

NPTEL : Introduction to Aerospace Propulsion (Aerospace Engineering)

Co-ordinators : Prof. Bhaskar Roy, Prof. A M Pradeep

Lecture 1 - Course Intro & Historical development of flights

Lecture 2 - Early development of aircraft propulsive devices

Lecture 3 - Development of Jet propulsion for aircraft

Lecture 4 - Introduction to thermodynamics, Scope and method, Basic concepts: system, surroundings, property, intensive and extensive, state, equilibrium and state postulate, process, path and cycle

Lecture 5 - Quasi-static processes, zeroth law of thermodynamics and temperature, concept of energy and its various forms, internal energy, enthalpy

Lecture 6 - Specific heats at constant pressure and volume Work and heat transfers

Lecture 7 - Tutorial

Lecture 8 - First law of thermodynamics for closed systems

Lecture 9 - First law of thermodynamics for open systems/flow processes

Lecture 10 - Second law of thermodynamics, heat engines, refrigerators and heat pumps, Kelvin-Planck and Clausius statement of second law of thermodynamics

Lecture 11 - Reversible and irreversible processes, concept of entropy

Lecture 12 - Increase of entropy principle, third law of thermodynamics, absolute entropy, perpetual motion machines

Lecture 13 - Tutorial

Lecture 14 - Carnot cycle, Carnot principle, thermodynamic temperature scale

Lecture 15 - Exergy, availability and second law efficiency

Lecture 16 - Tutorial

Lecture 17 - Gas and vapour power cycles, Otto cycle, Diesel cycle, Dual cycle

Lecture 18 - Rankine cycle, Brayton cycle, Stirling and Ericsson cycles

Lecture 19 - Thermodynamic property relations, Jacobean and Legendre transformations, Maxwell's equations

Lecture 20 - Tutorial

Lecture 21 - Properties of gas and vapour mixtures

Lecture 22 - One-dimensional compressible flows, isentropic flows

Lecture 23 - Flows with friction and heat transfer, normal and oblique shocks

Lecture 24 - Piston-prop engines: Otto cycles; Ideal and Real cycles

Lecture 25 - IC Engines for aircraft application

Lecture 26 - Performance parameters of IC engines

Lecture 27 - Supercharging of aircraft IC engines

Lecture 28 - Tutorial: IC Engines

Lecture 29 - Propeller fundamentals

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[Lecture 30 - Propeller aerodynamic theories - I](#)

[Lecture 31 - Propeller aerodynamic theories - II](#)

[Lecture 32 - Tutorial: Propellers](#)

[Lecture 33 - Ideal cycles for Jet engines](#)

[Lecture 34 - Ideal cycles for variants of jet engines](#)

[Lecture 35 - Tutorial](#)

[Lecture 36 - Fundamentals of Ramjets and Pulsejets](#)

[Lecture 37 - Fundamentals of Rocket engines](#)

[Lecture 38 - Fundamentals of Missile engines](#)

[Lecture 39 - Various space vehicles and their engines](#)

[Lecture 40 - Closure of the lecture series : recap](#)

NPTEL : Jet Aircraft Propulsion (Aerospace Engineering)

Co-ordinators : Prof. A M Pradeep, Prof. Bhaskar Roy

- Lecture 1 - Introduction & Development of Jet Aircraft Propulsion
- Lecture 2 - How the Aircraft Jet Engines make Thrust
- Lecture 3 - Jet Engine Basic Performance Parameters
- Lecture 4 - Turbojet, Reheat Turbojet and Multi-spool Engines
- Lecture 5 - Turbofan, Turbo-prop and Turboshaft engines
- Lecture 6 - Ideal and Real Brayton cycles
- Lecture 7 - Jet Engine Cycles for Aircraft propulsion
- Lecture 8 - Cycle components and component performances
- Lecture 9 - Tute-1
- Lecture 10 - Analysis of engine real cycles
- Lecture 11 - Tute-2
- Lecture 12 - Thermodynamics of Compressors
- Lecture 13 - Thermodynamics of Turbines
- Lecture 14 - Axial Compressors : two dimensional analytical model
- Lecture 15 - Cascade analysis; Loss and Blade performance estimation
- Lecture 16 - Free Vortex theory; Single-Multi-stage characteristics
- Lecture 17 - Tutes-3
- Lecture 18 - Elements of centrifugal compressor
- Lecture 19 - Centrifugal Compressor characteristics: Surging, Choking
- Lecture 20 - Axial flow turbines; Turbine Blade 2-D (cascade) analysis
- Lecture 21 - Multi-staging: Axial Turbine; Turbine Cooling Technology
- Lecture 22 - Radial Turbine Aerodynamics & Thermodynamics; Losses
- Lecture 23 - Tutes-4
- Lecture 24 - Types of combustion chambers: mechanism & parameters
- Lecture 25 - Pr. Loss, Combustion efficiency; Combustion intensity
- Lecture 26 - Practical combustion system ; Stability, Fuel injection
- Lecture 27 - Intakes for Powerplant: Transport / Military Aircraft
- Lecture 28 - Subsonic, Transonic, Supersonic Intake Designs
- Lecture 29 - Nozzle : fixed and variable geometry nozzles
- Lecture 30 - C-D nozzle and their uses
- Lecture 31 - Tute-5

[Lecture 32 - Engine Off Design Operations](#)

[Lecture 33 - Aircraft Engine component matching: Dimensional analysis](#)

[Lecture 34 - Engine component matching and Sizing](#)

[Lecture 35 - Installed Performance of Engine](#)

[Lecture 36 - Tute-6](#)

[Lecture 37 - Use of Ramjets and Pulsejets in Aircraft propulsion](#)

[Lecture 38 - Thermodynamic Cycle & Performance Parameters](#)

[Lecture 39 - Flow in Diffusers, Combustors and Nozzles](#)

[Lecture 40 - Performace and Design of Ramjet & Scramjet Engines](#)

[Lecture 41 - Tute-7](#)

[Lecture 42 - Future of Aircraft Propulsion](#)

- Lecture 1 - Introduction to Turbo machines Syllabus, References and Schedules
- Lecture 2 - Axial Flow Compressors and Fans : Introduction to Compressor Aerothermodynamics
- Lecture 3 - A two dimensional analytical model :Cascade
- Lecture 4 - 2D losses in Axial flow Compressor Stage : Primary losses
- Lecture 5 - Tutorial 1 : Two Dimensional Axial Flow Compressors
- Lecture 6 - 3D Flows in Blade Passages, Secondary Flows, Tip leakage Flow, Scrubbling
- Lecture 7 - Three Dimensional Flow Analysis : Radial Equilibrium Concept
- Lecture 8 - Classical Blade Design Laws : Free Vortex and other Laws
- Lecture 9 - Three Dimensional Flow Analysis in Axial Flow Compressor
- Lecture 10 - Tutorial 2 : Three Dimensional Axial Flow Compressors
- Lecture 11 - Axial Compressor Characteristics: Single stage, Multi stage and Multi spool Characteristics
- Lecture 12 - Instability in Axial Compressors
- Lecture 13 - Inlet Distortion and Rotating Stall, Control of Instability
- Lecture 14 - Transonic Compressors and Shock Structure Models, Transonic Compressor Characteristics
- Lecture 15 - Axial Flow Compressor Design, Inter Spool Duct
- Lecture 16 - Design of Compressor Blades, Aerofoil Design (Subsonic, Transonic, Supersonic Profiles)
- Lecture 17 - Design of Compressor Blade: 3D Blade Shapes of Rotors and Stators
- Lecture 18 - Noise Problem in Axial Compressors and Fans
- Lecture 19 - Axial Flow Turbines: Introduction to Turbines Aerothermodynamics
- Lecture 20 - Axial Flow Turbines: Turbine Blade 2D (Cascade) Analysis
- Lecture 21 - Axial Flow Turbines: Work done, Degree of Reaction, Losses and Efficiency
- Lecture 22 - Axial Flow Turbines: Blade and Axial Flow Passages, Exit Flow Matching with Nozzle
- Lecture 23 - Tutorial 3 : Axial Flow Turbines
- Lecture 24 - Multi staging and Multi spooling of Turbine
- Lecture 25 - 3D Flow in Turbine: 3D Flow Theories, Free Vortex Theories etc.
- Lecture 26 - Tutorial 4 : 3D Flows in Axial Flow Turbines
- Lecture 27 - Turbine Blade Cooling – Fundamentals of Heat Transfer, Blade Cooling Requirements
- Lecture 28 - Turbine Blade Cooling Technologies
- Lecture 29 - Turbine Blade Design: Turbine Profiles, Aerofoil Data and Profile Construction
- Lecture 30 - Turbine Blade Design: 3D Blade Shapes
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[Lecture 32 - Centrifugal Compressors: Characteristics, Stall, Surge Problems](#)

[Lecture 33 - Tutorial 5 : Centrifugal Compressors](#)

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[Lecture 40 - CFD for Turbomachinery: 2D and 3D Blade Generation and Analysis Using CFD](#)

Lecture 1 - Course Layout and Brief Introduction of Course Instructor

Lecture 2 - Introduction to International Standard Atmosphere (ISA)

Lecture 3 - Pressure, Temperature, Density and Viscosity Variation with Altitude in ISA

Lecture 4 - Other Standard Atmospheres

Lecture 5 - Aircraft Component Nomenclature - Wing and its Components

Lecture 6 - Aircraft Component Nomenclature - Fuselage and its Components

Lecture 7 - Aircraft Component Nomenclature - Tail Plane and its Components

Lecture 8 - Tutorial 1 - Aircraft Component Nomenclature

Lecture 9 - Essentials of Incompressible Flow - Part I

Lecture 10 - Essentials of Incompressible Flow - Part II

Lecture 11 - Bernoulli's Equation and Coanda Effect

Lecture 12 - Mach Number

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Lecture 14 - Viscous Flow and Reynolds Number

Lecture 15 - Introduction to Boundary Layer

Lecture 16 - Pressure Measurement

Lecture 17 - Air Speed Measurement - Pitot Static Tube

Lecture 18 - Air Speed Corrections

Lecture 19 - Altitude and ROC/ROD Measurement

Lecture 20 - Measurements in Compressible Flows

Lecture 21 - Non Pneumatic Instruments

Lecture 22 - Introduction to Aerofoils and Aerofoil Nomenclature

Lecture 23 - Aerofoils - A Visit to the Past

Lecture 24 - Thick Aerofoils

Lecture 25 - Low Reynolds Number Aerofoils

Lecture 26 - Lift Generation by Wings - Part I

Lecture 27 - Lift Generation by Wings - Part II

Lecture 28 - Coefficient of Lift and Coefficient of Pressure

Lecture 29 - Tutorial on Aerofoils

Lecture 30 - Critical Mach Number

Lecture 31 - Wave Drag

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[Lecture 57 - Tutorial on Stability and Control](#)

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[Lecture 66 - Flapping Wing Aerodynamics - Part I](#)

[Lecture 67 - Flapping Wing Aerodynamics - Part II](#)

Lecture 1 - What is Aircraft Design

Lecture 2 - Aircraft Design Process

Lecture 3 - Design Stages

Lecture 4 - Phases in Aircraft Design

Lecture 5 - The Design Spiral

Lecture 6 - Importance of Cost in Aircraft Design

Lecture 7 - Basic Laws of Aircraft Design

Lecture 8 - Requirements Capture

Lecture 9 - Quality Function Deployment

Lecture 10 - House of Quality Chart

Lecture 11 - Example of HoQ for HALE UAV

Lecture 12 - Illustration of HOQ-GA aircraft

Lecture 13 - Airliners

Lecture 14 - Key Issues in Design of Airliners

Lecture 15 - Design Considerations - Future Airliners

Lecture 16 - Supersonic Transport Aircraft

Lecture 17 - Airliner and Supersonic Aircraft, some additional concepts

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Lecture 19 - Design Considerations - GA Aircraft

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Lecture 24 - Wing Sweep

Lecture 25 - Canards and Flying Wing

Lecture 26 - Three Surface Aircraft

Lecture 27 - Winglets

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Lecture 29 - Few Novel Concepts_01

Lecture 30 - Aircraft Configuration Design - Closing Remarks

Lecture 31 - Choices in Aircraft Layout

- Lecture 32 - Wing Geometry Definitions
- Lecture 33 - Options for Wing layout
- Lecture 34 - Propulsion System Layout
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- Lecture 36 - Landing Gear Layout - Part 1
- Lecture 37 - Landing Gear Layout - Part 2
- Lecture 38 - Landing Gear of some Famous Aircraft
- Lecture 39 - Tutorial on OpenVSP
- Lecture 40 - Initial Sizing in Aircraft Design
- Lecture 41 - Estimation of Empty Weight Fraction
- Lecture 42 - Estimation of Mission Segment Weights
- Lecture 43 - Estimation of Fuel Weight Fractions
- Lecture 44 - Estimation of maximum L/D
- Lecture 45 - Estimation of engine parameters
- Lecture 46 - Estimation of Design gross weight
- Lecture 47 - Take-off weight build up
- Lecture 48 - Tutorial on Initial Sizing of Transport Aircraft
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- Lecture 51 - Component Buildup Method
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Lecture 13 - Constant (T/m) Solution

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Lecture 16 - Multi-stage Configuration Basics

Lecture 17 - Multi-stage Solution Basics

Lecture 18 - Multi-stage Problem Definition

Lecture 19 - Optimal Staging Strategy

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NPTEL : Aero elasticity (Aerospace Engineering)

Co-ordinators : Prof. C. Venkatesan

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NPTEL : Instability and Transition of Fluid Flows (Aerospace Engineering)

Co-ordinators : Prof. Tapan K. Sengupta

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NPTEL : Introduction to Propulsion (Aerospace Engineering)

Co-ordinators : Dr. D.P. Mishra

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Lecture 3 - Why do we need to look at Ancient Indian Science and Technology?

Lecture 4 - Glimpses of Ancient Indian Science and Technology

Lecture 5 - Brief Review of Ancient Indian Scriptures

Lecture 6 - Basic Principles of carrying out science and technology

Lecture 7 - Arrays of Physics, chemistry and Indoor games

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Lecture 17 - Ancient Indian Textile Technology

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Lecture 19 - Different types of Handlooms

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- Lecture 2 - Cruise Experiment (Theory)
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- Lecture 2 - Thermodynamic property, state, equilibrium and process
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- Lecture 4 - Macroscopic and microscopic forms of energy
- Lecture 5 - Different forms of work, energy transfer and sign convention
- Lecture 6 - First law of thermodynamics and energy balance
- Lecture 7 - Efficiency of mechanical and electrical devices
- Lecture 8 - Examples on basic concept and energy balance
- Lecture 9 - Phase change of a pure substance
- Lecture 10 - Property diagrams of pure substances
- Lecture 11 - Thermodynamic properties of a pure substance from a property table
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- Lecture 13 - Equations of state and compressibility chart
- Lecture 14 - Examples on properties of pure substances
- Lecture 15 - Quasi equilibrium, moving boundary work
- Lecture 16 - Polytropic process
- Lecture 17 - Energy analysis of closed system and unrestrained expansion
- Lecture 18 - Internal energy, enthalpy, and specific heats of ideal gas
- Lecture 19 - Internal energy, enthalpy, and specific heats of solids and liquids
- Lecture 20 - Examples on energy balance for closed systems and moving boundary work
- Lecture 21 - Conservation of mass and steady flow processes
- Lecture 22 - Flow work and energy of flowing fluid
- Lecture 23 - Energy balance for steady flow devices
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- Lecture 25 - Energy analysis of steady and unsteady flow devices
- Lecture 26 - Examples on mass and energy analysis of open systems
- Lecture 27 - Second law of thermodynamics, heat engine and cyclic devices
- Lecture 28 - COP of refrigerator and heat pump, second law statements
- Lecture 29 - Perpetual motion machines, reversible and irreversible processes, Carnot cycle
- Lecture 30 - Carnot principles, thermodynamic temperature scale, Carnot HE and HP
- Lecture 31 - Examples on second law of thermodynamics

Lecture 32 - Clausius inequality, application of second law

Lecture 33 - Entropy, increase in entropy principle, isentropic process

Lecture 34 - Change in entropy of solids, liquids and ideal gases

Lecture 35 - Reversible flow work, multistage compressor, efficiency of pump and compressors

Lecture 36 - Entropy balance in closed system and control volume

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Lecture 40 - Exergy transfer due to heat, mass and work, exergy destruction

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Lecture 28 - Take off: V_{stall} and High Lift Devices

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- Lecture 5 - Properties of liquid and solid fuels, various modes of combustion
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- Lecture 36 - Shock expansion theory; Flow through converging diverging nozzle
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NPTEL : Combustion (Aerospace Engineering)

Co-ordinators : Prof. S.R. Chakravarthy

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Lecture 3 - Sensible Enthalpy and Adiabatic Flame Temperature

Lecture 4 - Dissociation of Products, Role of Pressure

Lecture 5 - Numerical Calculation of Adiabatic Flame Temperature, Chemical Kinetics 1

Lecture 6 - Chemical Kinetics 2

Lecture 7 - Equilibrium Reactions, Global Kinetics, Order of Reaction

Lecture 8 - Reduced Chemistry, Steady State Approximation

Lecture 9 - Steady State Approximation, Partial Equilibrium Approximation

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Lecture 11 - Combining Chemical and Thermal Processes 1

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Lecture 2 - Basic aerodynamics

Lecture 3 - Equilibrium and stability

Lecture 4 - Static vs dynamic stability

Lecture 5 - Criterion for stability, Wing contribution

Lecture 6 - Horizontal tail contribution

Lecture 7 - Wing plus tail contribution

Lecture 8 - Static margin and CG limits

Lecture 9 - Fuselage contribution

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Lecture 11 - Power effects on neutral point

Lecture 12 - Elevator

Lecture 13 - Stick free stability, Most fwd CG location

Lecture 14 - Longitudinal stick force per 'g', Ground effect

Lecture 15 - Control requirement, Pull-up maneuver, Maneuver point

Lecture 16 - Elevator per 'g', Maneuver point

Lecture 17 - Example problems

Lecture 18 - Lateral-Directional Stability Derivatives, Fuselage/Vertical fin contribution

Lecture 19 - Roll stability, Wing sweep effect, Rudder

Lecture 20 - Dihedral effect, Various contributions

Lecture 21 - Power effects, Roll control, Aileron

Lecture 22 - Example problems

Lecture 23 - Derivation of Translational Motion Equations

Lecture 24 - Derivation of Angular Motion Equations

Lecture 25 - Description of various forces and moments

Lecture 26 - Nonlinearities and Associated Aircraft Behavior

Lecture 27 - Small perturbation method, Linearization of equations

Lecture 28 - Aerodynamic force and Moment Derivatives

Lecture 29 - Contribution of Aircraft components to Aerodynamic Derivatives

Lecture 30 - Linear Model and Aircraft Dynamics Modes

Lecture 31 - Short Period, Phugoid (Lanchester's formulation)

[Lecture 32 - Short period mode approximation](#)

[Lecture 33 - Flying and Handling Qualities, Cooper Harper Scale](#)

[Lecture 34 - Pure rolling motion, Pure yawing motion, Spiral approximation](#)

[Lecture 35 - Spiral, Roll, Dutch roll Mode approximations](#)

[Lecture 36 - Lateral directional Flying Qualities, Routh's Stability criterion](#)

[Lecture 37 - Stability in Steady Roll Maneuver](#)

[Lecture 38 - Wind Effect on Aircraft Pure Plunging Motion](#)

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NPTEL : Gas Dynamics (Aerospace Engineering)

Co-ordinators : Dr. T.M. Muruganandam

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NPTEL : Introduction to CFD (Aerospace Engineering)

Co-ordinators : Prof. M. Ramakrishna

- Lecture 1 - Introduction, Why and how we need computers
- Lecture 2 - Representing Arrays and functions on computers
- Lecture 3 - Representing functions - Box functions
- Lecture 4 - Representing functions - Polynomials and Hat functions
- Lecture 5 - Hat functions, Quadratic and Cubic representations
- Lecture 6 - Demo - Hat functions, Aliasing
- Lecture 7 - Representing Derivatives - finite differences
- Lecture 8 - Finite differences, Laplace equation
- Lecture 9 - Laplace equation - Jacobi iterations
- Lecture 10 - Laplace equation - Iteration matrices
- Lecture 11 - Laplace equation - convergence rate
- Lecture 12 - Laplace equation - convergence rate Continued
- Lecture 13 - Demo - representation error, Laplace equation
- Lecture 14 - Demo - Laplace equation, SOR
- Lecture 15 - Laplace equation - final, Linear Wave equation
- Lecture 16 - Linear wave equation - Closed form and numerical solution, stability analysis
- Lecture 17 - Generating a stable scheme and Boundary conditions
- Lecture 18 - Modified equation
- Lecture 19 - Effect of higher derivative terms on Wave equation
- Lecture 20 - Artificial dissipation, upwinding, generating schemes
- Lecture 21 - Demo - Modified equation, Wave equation
- Lecture 22 - Demo - Wave equation / Heat Equation
- Lecture 23 - Quasi-linear One-Dimensional. wave equation
- Lecture 24 - Shock speed, stability analysis, Derive Governing equations
- Lecture 25 - One-Dimensional Euler equations - Attempts to decouple
- Lecture 26 - Derive Eigenvectors, Writing Programs
- Lecture 27 - Applying Boundary conditions
- Lecture 28 - Implicit Boundary conditions
- Lecture 29 - Flux Vector Splitting, setup froms averaging
- Lecture 30 - Roes averaging
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Lecture 3 - Rotational Frame of Reference and Orbital Velocities

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Lecture 7 - Review of Rocket Principles: Propulsion Efficiency

Lecture 8 - Examples Illustrating Theory of Rocket Propulsion and Introduction to Nozzles

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Lecture 10 - Nozzle Shape

Lecture 11 - Area Ratio of Nozzles: Under Expansion and Over Expansion

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Lecture 14 - Unconventional Nozzles and Problems in Nozzles

Lecture 15 - Criterion for Choice of Chemical Propellants

Lecture 16 - Choice of Fuel-Rich Propellants

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Lecture 19 - Low energy liquid propellants and Hybrid propellants Chapter 5: Solid Propellant Rockets

Lecture 20 - Introduction to Solid Propellant Rockets

Lecture 21 - Burn Rate of Solid Propellants and Equilibrium Pressure in Solid Propellant Rockets

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Lecture 25 - Review of Solid Propellant Rockets

Lecture 26 - Feed Systems for Liquid Propellant Rockets

Lecture 27 - Feed System Cycles for Pump Fed Liquid Propellant Rockets

Lecture 28 - Analysis of Gas Generator and Staged combustion cycles and introduction to injectors

Lecture 29 - Injectors, Cooling of Chambers and Mixture Ratio Distribution

Lecture 30 - Efficiencies due to mixture ratio distribution and incomplete vaporization

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Lecture 20 - Dynamic Programming

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Lecture 22 - Transcription Method to Solve Optimal Control Problems

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- Lecture 13 - Aseptic equipment design
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- Lecture 19 - High pressure dialysis, ultrafiltration and reverse osmosis
- Lecture 20 - Nanofiltration, electrodialysis and membrane separation
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- Lecture 22 - Various types of driers for food process engineering
- Lecture 23 - Importance and applications of extrusion technology in food processing
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- Lecture 64 - Collective Management of resources

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Lecture 5 - Pest, causes for outbreaks and categories (Continued...)

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Lecture 7 - Principles of Pest Management and History

Lecture 8 - IPM, Definition and Concepts

Lecture 9 - Ecological Methods of Pest Management - Legal and Cultural

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Lecture 19 - Biological Control - Microbes: Entomopathogenic Nematodes

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Lecture 22 - Use of attractants and repellants in pest management

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Lecture 3 - Relationship between Food, Nutrition and Health 2

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Lecture 5 - Digestion, absorption and utilization of Nutrients 2

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Lecture 10 - Protein - health significance

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Lecture 17 - Fat Soluble Vitamins 3

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Lecture 29 - Food guide for selecting adequate diet, practical aspects of food selection

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NPTEL : NOC:Weather Forecast in Agriculture and Agro-advisory (WF) (Agriculture)

Co-ordinators : Dr. R. Nagarajan, Co Faculty, Dr.T.N.Balasubramanian (Rtd.), Instructor Incharge

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Lecture 3 - Basic aspects of Rainfall and their application in crop production

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Lecture 7 - Three weather codes and crop production

Lecture 8 - Crop production risks and their management

Lecture 9 - Weather sensitive crops, stages and farm operations

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Lecture 19 - Simple methods of verification of weather forecast with real event

Lecture 20 - Traditional knowledges on weather forecast and their validity

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Lecture 22 - Development and component of agro advisory for weather forecast

Lecture 23 - Development and component of agro advisory for weather forecast (Continued...)

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Lecture 5 - Architecture of a Phone

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Lecture 7 - What is WWW?

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Lecture 11 - Network Architectures - Part-1 (Introduction to Computer Networks)

Lecture 12 - Network Architectures - Part-2 (Overview of Network Architecture)

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Lecture 14 - Mobile Wireless Communications - Introduction (Module-1)

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Lecture 16 - Highlights Week 3

Lecture 17 - Adaptive and Responsive Websites

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Lecture 20 - Knowledge Representation Techniques

Lecture 21 - Expert Systems

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Lecture 24 - Speech Synthesis

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Lecture 18 - Flow through flat and parallel plates

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Lecture 20 - Problems and solution of falling film

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- Lecture 34 - Variable fluid flow - problems and solutions
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- Lecture 52 - Fluidization
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- Lecture 56 - Problem and solution
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Lecture 4 - Tractor, implement and soil force consideration for tillage implement design

Lecture 5 - Mechanics of rotavator or rotary tillers

Lecture 6 - Design of a tractor PTO operated rotavator

Lecture 7 - Tractor implement hitching systems

Lecture 8 - Mechanics of tractor implement hitch system and traction prediction models

Lecture 9 - Laboratory class on traction and tire testing

Lecture 10 - Combination tillage implements for efficient land preparation

Lecture 11 - LASER guided land leveller

Lecture 12 - Introduction of seeding operation

Lecture 13 - Types of seed metering devices and their operation

Lecture 14 - Types of fertilizer metering, furrow opening and soil covering devices

Lecture 15 - Equipment for seeding and planting

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Lecture 19 - GPS based automatic Variable rate fertilizer applicator

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Lecture 33 - Performance of weeding blades of a push-pull weeder

Lecture 34 - Advanced level machinery for inter and intra row weeding

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Lecture 36 - Design of manually operated weeding equipment

Lecture 37 - Plant protection equipment/machinery

Lecture 38 - Selection and design of plant protection equipment/machinery

Lecture 39 - Manually operated knapsack-cum-boom sprayer

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Lecture 41 - Testing and certification of spraying equipment

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Lecture 44 - Advanced level spraying equipment: Ultrasonic sensor based sprayer

Lecture 45 - Advanced level spraying equipment: Drone assisted variable rate chemical application system and electrostatic sprayer

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Lecture 47 - Machines for harvesting cereal crops, root and fruit crops

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Lecture 52 - Performance evaluation and testing of thresher

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Lecture 54 - Materials for construction of farm machinery

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Lecture 3 - Nutritional Value of the Nutrients

Lecture 4 - Best Way of Storage of Food Materials

Lecture 5 - Preservation Techniques

Lecture 6 - Temperature Quotient and Its Impact

Lecture 7 - Food Additives

Lecture 8 - Quality of Food

Lecture 9 - Quality of Food (Continued...)

Lecture 10 - Emerging Technology

Lecture 11 - Emerging Technology (Continued...)

Lecture 12 - Food Laws - Why?

Lecture 13 - Food Laws of India

Lecture 14 - Standards in India

Lecture 15 - Hygiene and Other Controls in India

Lecture 16 - Physico-Chemical Properties of Milk

Lecture 17 - Milk - What is it

Lecture 18 - Milk - How it looks?

Lecture 19 - Milk - Constituents

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Lecture 21 - Milk Fat

Lecture 22 - Milk Fat (Continued...)

Lecture 23 - Milk Fat (Continued...)

Lecture 24 - Milk Fat (Continued...)

Lecture 25 - Protein

Lecture 26 - Protein (Continued...)

Lecture 27 - Amino Acids

Lecture 28 - Amino Acids (Continued...)

Lecture 29 - Milk Protein

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Lecture 31 - Whey Protein

- Lecture 32 - Whey Protein (Continued...)
- Lecture 33 - Lactoferrin
- Lecture 34 - Carbohydrates in Milk
- Lecture 35 - Small Constituents of Milk
- Lecture 36 - Enzymes in Milk
- Lecture 37 - Chemical and Microbial Spoilage of Milk and Milk Products
- Lecture 38 - Extrinsic Factors for Microbial Growth
- Lecture 39 - Natural or Other Type of Spoilage
- Lecture 40 - Packaging
- Lecture 41 - Milk Pasteurization
- Lecture 42 - Thermal Death Time
- Lecture 43 - Pasteurization Effectiveness
- Lecture 44 - Milk Pasteurization and Homogenization
- Lecture 45 - Milk Pasteurization and Homogenization (Continued...)
- Lecture 46 - Milk Homogenization
- Lecture 47 - Milk Centrifugation
- Lecture 48 - Types of Available Milk
- Lecture 49 - Types of Available Milk in the Market
- Lecture 50 - New Technologies in Dairy Industries
- Lecture 51 - Cheese
- Lecture 52 - Cheddar Cheese
- Lecture 53 - Ice Cream
- Lecture 54 - Process of Ice Cream Preparation
- Lecture 55 - Ice Cream Lolies
- Lecture 56 - Over Run and Calculation for Preparing Ice Cream Mix
- Lecture 57 - Transportation of Ice Cream vis a vis Frozen Foods
- Lecture 58 - Packaging of Food Materials
- Lecture 59 - Modified Atmosphere Packaging
- Lecture 60 - Flow Chart for Manufacturing Some Dairy and Food Products

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- Lecture 2 - Organic Farming: Introduction and Status (Continued...)
- Lecture 3 - Organic Farming and its Components
- Lecture 4 - Organic Farming Concepts and Principles
- Lecture 5 - Organic Farming Concepts and Principles (Continued...)
- Lecture 6 - SWOT Analysis of Organic Farming
- Lecture 7 - Sustainable Agriculture
- Lecture 8 - Key Indicators of Sustainable Agriculture
- Lecture 9 - Organic Farming and Climate Change
- Lecture 10 - Organic Farming and Climate Change (Continued...)
- Lecture 11 - Principles of Compost Production
- Lecture 12 - Vermicompost Production Technology
- Lecture 13 - Vermicompost Production Technology (Continued...)
- Lecture 14 - Vermicompost Production Technology (Continued...)
- Lecture 15 - Enriched Vermicompost Production Technology
- Lecture 16 - Vermicompost Quality and Marketing
- Lecture 17 - Introduction to Pest and Disease Management
- Lecture 18 - Pest and Disease Management in Organic Farming
- Lecture 19 - Level C Pest and Disease Management
- Lecture 20 - Level C Pest and Disease Management (Continued...)
- Lecture 21 - Introduction to Organic Crop Management
- Lecture 22 - Introduction to Organic Crop Management (Continued...)
- Lecture 23 - Organic Vegetable Crop Management
- Lecture 24 - Organic Vegetable Crop Management (Cereals)
- Lecture 25 - Organic Vegetable Crop Management (Cereals) (Continued...)
- Lecture 26 - Organic Field Crop Management (Pulse and Oilseed Crop)
- Lecture 27 - Organic Plantation Crop Management
- Lecture 28 - Organic Meat Production
- Lecture 29 - Introduction on transition to organic crop production
- Lecture 30 - Crop planning and rotation design in organic system
- Lecture 31 - Crop planning and rotation design in organic system (Continued...)

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[Lecture 38 - Organic Certification Process](#)

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- Lecture 3 - Factors Affecting Quality During Processing and Storage
- Lecture 4 - Role of Water in Food and its Shelf Life
- Lecture 5 - Gelatinization and Retrogradation of Starch
- Lecture 6 - Browning Reactions
- Lecture 7 - Food Proteins
- Lecture 8 - Principles of Food Preservation
- Lecture 9 - Traditional Food Preservation Technologies - Part 1
- Lecture 10 - Traditional Food Preservation Technologies - Part 2
- Lecture 11 - High Pressure Processing of Food - Part 1
- Lecture 12 - High Pressure Processing of Food - Part 2
- Lecture 13 - Membrane Technology - Part 1
- Lecture 14 - Membrane Technology - Part 2
- Lecture 15 - Food Irradiation - Part 1
- Lecture 16 - Food Irradiation - Part 2
- Lecture 17 - Microwave Heating
- Lecture 18 - Radio Frequency Drying
- Lecture 19 - Super Critical Fluid Extraction - Part 1
- Lecture 20 - Super Critical Fluid Extraction - Part 2
- Lecture 21 - Freeze Drying - Part 1
- Lecture 22 - Freeze Drying - Part 2
- Lecture 23 - Food Extrusion Technology - Part 1
- Lecture 24 - Food Extrusion Technology - Part 2
- Lecture 25 - Textured Vegetable Protein (TVP)
- Lecture 26 - Aseptic Processing and Packaging
- Lecture 27 - Hurdle Technology
- Lecture 28 - Natural Antimicrobials
- Lecture 29 - Food Lipids: Nature and Occurrence
- Lecture 30 - Extraction of Oil - Part 1
- Lecture 31 - Extraction of Oil - Part 2

- Lecture 32 - Refining of Oil - Part 1
- Lecture 33 - Refining of Oil - Part 2
- Lecture 34 - Modified Fats
- Lecture 35 - Rancidity
- Lecture 36 - Natural Antioxidants
- Lecture 37 - Microencapsulation - Part 1
- Lecture 38 - Microencapsulation - Part 2
- Lecture 39 - Food nanotechnology
- Lecture 40 - Respiration and Ripening
- Lecture 41 - Modified Atmospheric Storage (MAP)
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- Lecture 43 - Edible coating technology
- Lecture 44 - Multiproduct CA/MA Storage Unit
- Lecture 45 - Grain Storage
- Lecture 46 - Ozonation of Food Grains
- Lecture 47 - Hyper Spectral Imaging for Quality Analysis of Food Grains
- Lecture 48 - Non-Destructive Methods for Analysis of Grain Quality
- Lecture 49 - Detection of Spoilage in Grains using Biosensors
- Lecture 50 - Food Fortification
- Lecture 51 - Iron Fortified Rice (IFR)
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- Lecture 53 - High Energy RTE Food Paste - Part 1
- Lecture 54 - High Energy RTE Food Paste - Part 2
- Lecture 55 - Functional Foods and Nutraceuticals
- Lecture 56 - Algae Based Health Foods
- Lecture 57 - Gluten Free Bread and Pasta
- Lecture 58 - Food Powder and Premixes
- Lecture 59 - GMP/GHP in Food Industry
- Lecture 60 - FCTL R&D and Course Summary

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Lecture 4 - Weathering and Soil Formation (Continued...)

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Lecture 7 - Soil Taxonomy and Classification (Continued...)

Lecture 8 - Soil Taxonomy and Classification (Continued...)

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Lecture 12 - Soil Porosity and Consistency

Lecture 13 - Soil Consistency and Soil Water

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Lecture 17 - Qualitative Description of Soil Wetness

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Lecture 21 - Silicate Clays

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- Lecture 3 - Preservation Techniques
- Lecture 4 - Fundamentals of Food Processing and Preservation (Continued...)
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- Lecture 6 - Fundamentals of Food Processing and Preservation why and how do food spoil
- Lecture 7 - One Dimensional Conduction Heat Transfer in Cartesian Coordinate
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- Lecture 9 - One Dimensional Steady State Heat Conduction
- Lecture 10 - One Dimensional Steady State Heat Conduction (Continued...)
- Lecture 11 - One Dimensional Heat Transfer Through Cylinders
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- Lecture 14 - One Dimensional Heat Transfer
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- Lecture 16 - Thermal contact Resistance and Finned Surface
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- Lecture 6 - Evapotranspiration
- Lecture 7 - Determination of Evapotranspiration
- Lecture 8 - Crop Coefficients and Crop Water Requirement
- Lecture 9 - Demonstration of Agro Metrological Instruments
- Lecture 10 - Demonstration of Lysimeter
- Lecture 11 - Tutorial 2 - Numerical Examples on Crop Water Requirement
- Lecture 12 - Irrigation Scheduling
- Lecture 13 - Soil and Plant Water Monitoring Instruments
- Lecture 14 - Measurement of Irrigation Water
- Lecture 15 - Irrigation Efficiency
- Lecture 16 - Tutorial 3 - Numerical Examples on Irrigation water Management
- Lecture 17 - Introduction of Water Lifts and Pumps
- Lecture 18 - Variable Displacement Pumps
- Lecture 19 - Irrigation Water Quality
- Lecture 20 - Tutorial 4 - Numerical Examples on Water Measurements and Pumps
- Lecture 21 - Irrigation methods
- Lecture 22 - Micro Irrigation System: Concept and Types
- Lecture 23 - Drip Irrigation: Introduction and Types
- Lecture 24 - Drip Irrigation: Design Considerations and System Layout
- Lecture 25 - Types and Selection of Emission Devices
- Lecture 26 - Hydraulics Drip Irrigation System Pipe Network
- Lecture 27 - Tutorial 5 - Numerical Example on Design of Drip Irrigation System
- Lecture 28 - Fertigation
- Lecture 29 - Fertigation Application Methods
- Lecture 30 - Drip Irrigation: Filtration System
- Lecture 31 - Tutorial 6 - Numerical Examples on Emission Devices and Fertigation

- Lecture 32 - Installation and Operation of Drip Irrigation System
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- Lecture 34 - Demonstration of Drip Irrigation Components and Evaluation of Drip Emitter
- Lecture 35 - Soil Water Movement under Drip Emitter
- Lecture 36 - Design and Development of Drip Emitter
- Lecture 37 - Tutorial 7- Numerical Examples on Drip Irrigation System
- Lecture 38 - Micro Sprinkler Irrigation System
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- Lecture 46 - Standards and Quality Assurance of MIS Components
- Lecture 47 - Standards and Quality Assurance of Sprinkler Irrigation System Components
- Lecture 48 - Solar Photovoltaic System for Irrigation - Part 1
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- Lecture 55 - Economic Analysis of Micro Irrigation System - Part 1
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- Lecture 59 - Precision Agriculture
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Lecture 5 - First Order Instruments

Lecture 6 - Second Order Instruments - I

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Lecture 8 - Food Instrumentation

Lecture 9 - Chromatography

Lecture 10 - Mass Spectrometry - I

Lecture 11 - Mass Spectrometry - II

Lecture 12 - Model Development

Lecture 13 - PID Controller Response Analysis

Lecture 14 - Block Diagram Representation of CSTR Systems

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Lecture 16 - Solved Examples on Controlled System

Lecture 17 - Complex Variables as Roots of Characteristic Equation

Lecture 18 - Routh Tests for Stability of Systems

Lecture 19 - Poles and Zeros of the OLTF

Lecture 20 - Plotting of Root Loci

Lecture 21 - Root Loci of PI Controlled Systems

Lecture 22 - Root Loci of PID Controlled Systems

Lecture 23 - First and Second Order Systems Responses

Lecture 24 - A Control Problem

Lecture 25 - PI/PD/PID Controllers and Worked Out Example 1

Lecture 26 - Linear Lag/Transportation Systems/First Order/Second Order Systems- Sinusoidal Input

Lecture 27 - PI/PD/PID Controllers

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Lecture 29 - Worked Out Example 2

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Lecture 27 - Use of ML for Portable Proximal Soil and Crop Sensors (Continued...)

Lecture 28 - Use of ML for Portable Proximal Soil and Crop Sensors (Continued...)

Lecture 29 - Use of ML for Portable Proximal Soil and Crop Sensors (Continued...)

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Lecture 4 - Propagation; Water budget

Lecture 5 - Conservation strategies

Lecture 6 - Transformation of open culture to closed high-tech technologies

Lecture 7 - Intensive farming in high-tech tanks

Lecture 8 - Re-circulatory system

Lecture 9 - Flow-through system

Lecture 10 - Raceway culture

Lecture 11 - Polyculture, IMTA

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Lecture 15 - Seaweed Culture; Pearl Culture

Lecture 16 - Introduction to freshwater prawn culture

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Lecture 19 - Introduction to crab culture

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Lecture 26 - Balanced diet

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Lecture 28 - Feed formulation: Linear Programming

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- Lecture 32 - Aeration
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- Lecture 38 - Bio-electrochemical system based wastewater treatment
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- Lecture 45 - Bio-floc Technology
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- Lecture 48 - Bioremediation
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- Lecture 50 - Eco-labelling
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- Lecture 53 - Fish by-products
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- Lecture 55 - Zero waste recycling
- Lecture 56 - Impact of Climate Change on aquaculture
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- Lecture 58 - Mitigation and adaptive strategies
- Lecture 59 - Mitigation and adaptive strategies (Continued...)
- Lecture 60 - Mitigation and adaptive strategies (Continued...)
- Lecture 61 - Opportunities in Aquaculture sectors for the entrepreneurs from the coastal regions

**NPTEL : NOC:Post Harvest Operations and Processing of Fruits, Vegetables, Spices and Plantation Crop Products
(Agriculture)**

Co-ordinators : Prof. Hari Niwas Mishra

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Lecture 2 - Fruits and Vegetables

Lecture 3 - Fruits and Vegetable (Part II : Respiration, Ripening and Senescence)

Lecture 4 - Indian Spices

Lecture 5 - Plantation Crops

Lecture 6 - Post Harvest Losses: Causes and Preventive Measures

Lecture 7 - Post Harvest Operations

Lecture 8 - Handling and Transportation

Lecture 9 - Supply Chain Management and Storage

Lecture 10 - Quality Assurance and Control (QA/QC)

Lecture 11 - Basics of Processing and Preservation

Lecture 12 - Processing by Removal of Water

Lecture 13 - Processing by Addition of Heat

Lecture 14 - Processing by Removal of Heat

Lecture 15 - Irradiation of Fruits, Vegetables and Spices

Lecture 16 - Cleaning and Washing

Lecture 17 - Sorting and Grading

Lecture 18 - Peeling, Coring, Slicing

Lecture 19 - Containers and Packaging Materials for Fresh Produce

Lecture 20 - Packaging Methods and Equipment

Lecture 21 - Minimal Processing

Lecture 22 - Hurdle Technology Concepts

Lecture 23 - Intermediate and High Moisture Fruit Products

Lecture 24 - Cut Fruits and Vegetables - Part I

Lecture 25 - Cut Fruits and Vegetables - Part II

Lecture 26 - Juice Extraction and Clarification

Lecture 27 - Concentrates and Pastes

Lecture 28 - Aseptic processing and packaging

Lecture 29 - RTS and RTD beverages

Lecture 30 - Quality and Safety Aspects

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NPTEL : NOC:Soil Fertility and Fertilizers (Agriculture)

Co-ordinators : Prof. Somsubhra Chakraborty

Lecture 1 - Importance of Soil Nutrient Management and Basic Soil-Plant Relationship

Lecture 2 - Importance of Soil Nutrient Management and Basic Soil-Plant Relationship (Continued...)

Lecture 3 - Importance of Soil Nutrient Management and Basic Soil-Plant Relationship (Continued...)

Lecture 4 - Importance of Soil Nutrient Management and Basic Soil-Plant Relationship (Continued...)

Lecture 5 - Importance of Soil Nutrient Management and Basic Soil-Plant Relationship (Continued...)

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Lecture 7 - Soil Nitrogen for Plant Nutrition (Continued...)

Lecture 8 - Soil Nitrogen for Plant Nutrition (Continued...)

Lecture 9 - Soil Nitrogen for Plant Nutrition (Continued...)

Lecture 10 - Soil Nitrogen For Plant Nutrition (Continued...)

Lecture 11 - Soil P and K for Plant Nutrition

Lecture 12 - Soil P and K for Plant Nutrition (Continued...)

Lecture 13 - Soil P and K for Plant Nutrition (Continued...)

Lecture 14 - Soil P and K for Plant Nutrition (Continued...)

Lecture 15 - Soil P and K for Plant Nutrition (Continued...)

Lecture 16 - Soil Secondary Nutrients and their role in Plant Nutrition

Lecture 17 - Soil Secondary Nutrients and their role in Plant Nutrition (Continued...)

Lecture 18 - Soil Secondary Nutrients and their role in Plant Nutrition (Continued...)

Lecture 19 - Soil Secondary Nutrients and their role in Plant Nutrition (Continued...)

Lecture 20 - Soil Secondary Nutrients and their role in Plant Nutrition (Continued...)

Lecture 21 - Soil Micronutrients and their role in Plant Nutrition

Lecture 22 - Soil Micronutrients and their role in Plant Nutrition (Continued...)

Lecture 23 - Soil Micronutrients and their role in Plant Nutrition (Continued...)

Lecture 24 - Soil Micronutrients and their role in Plant Nutrition (Continued...)

Lecture 25 - Soil Micronutrients and their role in Plant Nutrition (Continued...)

Lecture 26 - Soil Testing and Soil Fertility Evaluation Methods

Lecture 27 - Soil Testing and Soil Fertility Evaluation Methods (Continued...)

Lecture 28 - Soil Testing and Soil Fertility Evaluation Methods (Continued...)

Lecture 29 - Soil Testing and Soil Fertility Evaluation Methods (Continued...)

Lecture 30 - Soil Testing and Soil Fertility Evaluation Methods (Continued...)

Lecture 31 - Soil Health and Quality, Problem Soil, Land Capability Classification

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- [Lecture 34 - Soil Health and Quality, Problem Soil, Land Capability Classification \(Continued...\)](#)
- [Lecture 35 - Soil Health and Quality, Problem Soil, Land Capability Classification \(Continued...\)](#)
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- [Lecture 37 - Organic Manures, Manufacturing, Properties, and fate af N, P, K and Micronutrient \(Continued...\)](#)
- [Lecture 38 - Organic Manures, Manufacturing, Properties, and fate af N, P, K and Micronutrient \(Continued...\)](#)
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- [Lecture 59 - Agricultural Productivity and Environmental Quality \(Continued...\)](#)
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Lecture 1 - Introduction to Cooling

Lecture 2 - Why Cooling is required ?

Lecture 3 - Definitions

Lecture 4 - How to produce Safe Foods

Lecture 5 - How to produce Safe Foods ? (Continued...)

Lecture 6 - Cooling Load Calculation

Lecture 7 - Cooling Load Calculation (Continued...)

Lecture 8 - Cooling Load Calculation (Continued...)

Lecture 9 - Cooling Load Calculation (Continued...)

Lecture 10 - Basics of Thermodynamics

Lecture 11 - Basics of Thermodynamics (Continued...)

Lecture 12 - Basics of Thermodynamics (Continued...)

Lecture 13 - Basics of Thermodynamics (Continued...)

Lecture 14 - Basics of Thermodynamics (Continued...)

Lecture 15 - Basics of Thermodynamics (Continued...)

Lecture 16 - Basics of Thermodynamics (Continued...)

Lecture 17 - Basics of Thermodynamics (Continued...)

Lecture 18 - Psychrometrics

Lecture 19 - Psychrometrics (Continued...)

Lecture 20 - Psychrometrics (Continued...)

Lecture 21 - Psychrometrics (Continued...)

Lecture 22 - Psychrometrics (Continued...)

Lecture 23 - Psychrometrics (Continued...)

Lecture 24 - Psychrometrics (Continued...)

Lecture 25 - The Carnot Cycle

Lecture 26 - Carnot Cycle (Continued...)

Lecture 27 - Carnot Cycle (Continued...)

Lecture 28 - Carnot Cycle (Continued...)

Lecture 29 - Carnot Refrigeration Cycles

Lecture 30 - Carnot Refrigeration Cycles (Continued...)

Lecture 31 - Practical Difficulties with Carnot Cycle

- Lecture 32 - Dry Compression
- Lecture 33 - Problem Solving with Carnot System
- Lecture 34 - Pure Substance as Refrigerant
- Lecture 35 - Pure Substance as Refrigerant (Continued...)
- Lecture 36 - Gas as Refrigerant
- Lecture 37 - Gas as Refrigerant (Continued...)
- Lecture 38 - Gas as Refrigerant (Continued...)
- Lecture 39 - Basics of Refrigeration and Air Conditioning
- Lecture 40 - Basics of Refrigeration and Air Conditioning (Continued...)
- Lecture 41 - Selection of Condenser
- Lecture 42 - Compressor
- Lecture 43 - Reciprocating Compressor
- Lecture 44 - Reciprocating Compressor (Continued...)
- Lecture 45 - Reciprocating Compressor (Continued...)
- Lecture 46 - Centrifugal Compressor
- Lecture 47 - Rotary, Positive Displacement Type Compressors
- Lecture 48 - Condenser
- Lecture 49 - Condenser (Continued...)
- Lecture 50 - Evaporator and Expansion Device
- Lecture 51 - Freezing
- Lecture 52 - Crystallization in Freezing
- Lecture 53 - Freezing Curve
- Lecture 54 - Freezers
- Lecture 55 - Control Atmosphere Storage
- Lecture 56 - Use of Phase Change Materials (PCM)
- Lecture 57 - Cold Chain and Cold Storage
- Lecture 58 - Cold Storage
- Lecture 59 - Ice Cream
- Lecture 60 - Ice Cream (Continued...)

Lecture 1 - Concept of Traction and Traction Devices

Lecture 2 - Classification of wheels, Forces and moments acting on wheel

Lecture 3 - Tyre constructions and its specification

Lecture 4 - Tractive performance parameters

Lecture 5 - Tutorial 1

Lecture 6 - Mechanics of wheel and its tractive performance

Lecture 7 - Measurement of soil strength, cohesion and angle of internal friction

Lecture 8 - Measurement and characterization of terrain response

Lecture 9 - Characterization of shear stress and shear strength in different soil conditions

Lecture 10 - Tutorial 2 - Measurement of shear strength, modulus of sinkage and cone index

Lecture 11 - Rolling resistance of a rigid towed wheel

Lecture 12 - Rolling resistance of a pneumatic wheel

Lecture 13 - Motion resistance of a track

Lecture 14 - Tractive effort and slip of a powered rigid wheel

Lecture 15 - Tutorial 3 - Computation of rolling resistance of rigid wheel and pneumatic wheel

Lecture 16 - Tractive effort and slip of a track

Lecture 17 - Tractive effort and slip of a pneumatic wheel

Lecture 18 - Tractive performance prediction models - Wismer and Luth

Lecture 19 - Tractive performance prediction models - Brixius

Lecture 20 - Tutorial 4 - Tractive Performance Estimation Using Brixius Model

Lecture 21 - Effect of tyre parameters on tractive performance of tyre

Lecture 22 - Selection of tyre

Lecture 23 - Comparison of single tyre with dual tyres

Lecture 24 - Performance evaluation of a walking tractor fitted with track

Lecture 25 - Tutorial 5

Lecture 26 - Measurement of Cone Index

Lecture 27 - Pressure Sinkage Relationship in a Sandy Clay Loam Soil

Lecture 28 - Measurement of Theoretical Velocity, Actual Velocity and Slip for a Pneumatic Wheel

Lecture 29 - Measurement of Contact Area of a Pneumatic Tyre on a Hard Surface

Lecture 30 - Measurement of Tractice Efficiency

Lecture 31 - Performance comparison of track with wheel

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[Lecture 33 - Ballasting of Wheeled Tractors to achieve Maximum Power Output in Frictional-Cohesive soils](#)

[Lecture 34 - Optimum ballasting of a front wheel assisted tractor](#)

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[Lecture 37 - Lateral force developed by an unpowered tractor wheel](#)

[Lecture 38 - Steering of wheeled vehicles and steady state handling of front wheel steered vehicles](#)

[Lecture 39 - Classification of steady state handling characteristics and handling diagram](#)

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Lecture 1 - Oil and Fats Processing Industry - Current Status, Issues and Challenges

Lecture 2 - Plant Sources of Edible Oils and Fats

Lecture 3 - Composition, Nutrition and Health Values of Plant Oils

Lecture 4 - Animal Sources of Edible Oils and Fats

Lecture 5 - Composition, Nutrition and Health Values of Animal Fats and Oils

Lecture 6 - Lipids and Their Classification

Lecture 7 - Fatty acids and their types

Lecture 8 - Glycerides - Type, Structure and Function

Lecture 9 - Triglycerides - Function in Nutrition and Food Processing

Lecture 10 - Phospholipids and Sterols

Lecture 11 - Engineering Properties of Edible Oils

Lecture 12 - Chemical Properties of Edible Oils

Lecture 13 - Rancidity and Reversion

Lecture 14 - Oxidative Rancidity

Lecture 15 - Antioxidants in Edible Oil

Lecture 16 - Pre-Treatment Techniques

Lecture 17 - Physical Methods for Oil Extraction - Concept and Mechanism

Lecture 18 - Expression - Pressing

Lecture 19 - Screw Expelling

Lecture 20 - Recent Developments in Oil Expression Technology

Lecture 21 - Extraction principles and mechanisms

Lecture 22 - Factors affecting extraction process

Lecture 23 - Solvent Extraction Technology and Equipment

Lecture 24 - Miscella Distillation and Meal Desolventization

Lecture 25 - Novel techniques of oil extraction

Lecture 26 - Crude Oil Characteristics and Processing

Lecture 27 - Clarification and Degumming

Lecture 28 - Chemical Refining and Neutralization

Lecture 29 - Bleaching

Lecture 30 - Physical Refining and Deodorization

Lecture 31 - Hydrogenation

- Lecture 32 - Interesterification and Winterization
- Lecture 33 - Fractionation and Plasticization
- Lecture 34 - Margarine and Shortenings
- Lecture 35 - Trans-free modifications
- Lecture 36 - Animal fats
- Lecture 37 - Fish oil and Algal oil
- Lecture 38 - Dairy Cream
- Lecture 39 - Butter
- Lecture 40 - Ghee (Butter Oil)
- Lecture 41 - Characteristics and specifications
- Lecture 42 - Frying Technology
- Lecture 43 - Seed Oils
- Lecture 44 - Fruit and Nut Oils
- Lecture 45 - Rice Bran Oil
- Lecture 46 - Tree Nut Oils
- Lecture 47 - Tropical Exotic Oils and Butter
- Lecture 48 - Essential Oil
- Lecture 49 - Cocoa/Shea Butter and Structured Triacylglycerols
- Lecture 50 - Oil powder and liposomes
- Lecture 51 - Major by-Products, Their Composition and Uses
- Lecture 52 - By-Products Utilization - I
- Lecture 53 - By-Products Utilization - II
- Lecture 54 - Lecithin Production
- Lecture 55 - Biodiesel Production from Waste Cooking Oil
- Lecture 56 - Edible Oil Blending and Fortification
- Lecture 57 - Packaging materials and methods
- Lecture 58 - Handling and Storage
- Lecture 59 - Quality Analysis and Control
- Lecture 60 - Regulatory Requirements and Course summary

Lecture 1 - Introduction

Lecture 2 - Precipitation

Lecture 3 - Rainfall data analysis - I

Lecture 4 - Rainfall data analysis - II

Lecture 5 - Rainfall Frequency Analysis

Lecture 6 - Hydrological Abstractions

Lecture 7 - Evaporation

Lecture 8 - Evapotranspiration

Lecture 9 - Infiltration - I

Lecture 10 - Infiltration - II

Lecture 11 - Streamflow Processes

Lecture 12 - Streamflow Measurement - 1

Lecture 13 - Streamflow Measurement - 2

Lecture 14 - Streamflow Measurement - 3

Lecture 15 - Flow Duration Curve and Flow Mass Curve

Lecture 16 - Runoff

Lecture 17 - Estimation of Runoff

Lecture 18 - Estimation of Runoff - Rational Method

Lecture 19 - Estimation of Runoff - SCS-Curve Number Method

Lecture 20 - Numerical on Estimation of Runoff

Lecture 21 - Hydrograph - I

Lecture 22 - Hydrograph - II

Lecture 23 - Derivation of Unit Hydrograph - I

Lecture 24 - Derivation of Unit Hydrograph - II

Lecture 25 - Numerical on Hydrograph

Lecture 26 - Synthetic Unit Hydrograph - I

Lecture 27 - Synthetic Unit Hydrograph - II

Lecture 28 - IUH and Distribution Graph

Lecture 29 - Numerical on Synthetic UH, IUH and Distribution Graph - I

Lecture 30 - Numerical on Synthetic UH, IUH and Distribution Graph - II

Lecture 31 - Drainage Basin Characteristics

- Lecture 32 - Drainage Basin Geomorphology
- Lecture 33 - Morphometric analysis using RS and GIS
- Lecture 34 - Watershed Management - I
- Lecture 35 - Watershed Management - II
- Lecture 36 - Hydrological Modelling: Introduction and Protocol
- Lecture 37 - Hydrological Models: Classification
- Lecture 38 - Hydrological Model: Calibration, Validation and Evaluation
- Lecture 39 - Sensitivity Analysis and Machine Learning in Hydrology
- Lecture 40 - Machine Learning in Hydrology - II
- Lecture 41 - Floods
- Lecture 42 - Design Flood
- Lecture 43 - Flood Frequency Analysis
- Lecture 44 - Flood Control and Management
- Lecture 45 - Floodplain Zoning and Numerical on Floods
- Lecture 46 - Flood Routing: Introduction
- Lecture 47 - Hydrologic Reservoir Routing
- Lecture 48 - Hydrologic Channel Routing
- Lecture 49 - Hydraulic Channel Routing - Hydraulic routing
- Lecture 50 - Numerical on Flood Routing
- Lecture 51 - Drought: Introduction
- Lecture 52 - Classification of Drought
- Lecture 53 - Agricultural Drought - I
- Lecture 54 - Agricultural Drought - II
- Lecture 55 - Drought Management
- Lecture 56 - Hydrological Model Demonstration
- Lecture 57 - Miscellaneous Topics
- Lecture 58 - Objectives on Watershed Hydrology
- Lecture 59 - Objectives on Watershed Hydrology
- Lecture 60 - Solution of Numerical Problems in Assignments

Lecture 1 - Introduction to Water Quality

Lecture 2 - Classification of Major Water Pollutants

Lecture 3 - Emerging Concerns in Wastewater Treatment in Global Scenario

Lecture 4 - Environmental Legislation and Regulatory Standards

Lecture 5 - Commonly used terminologies and definitions

Lecture 6 - Collection and Preservation of Samples and the Measurement of pH, Acidity, Alkalinity

Lecture 7 - Measurement of DO and Solids in wastewater (TSS/VSS/TDS), Turbidity

Lecture 8 - Determination of BOD, COD and TOC

Lecture 9 - Modelling of BOD and its relation with COD and TOC

Lecture 10 - Determination of Nitrogen, Phosphorus and Microbial Counts

Lecture 11 - Wastewater Treatment Classification and Plant Analysis

Lecture 12 - Order of Reaction and Types of Reactors Used in Wastewater Treatment

Lecture 13 - Concept of Mass Balance

Lecture 14 - Overview of Sewage Treatment Plant

Lecture 15 - Self-Purification and its Factors

Lecture 16 - Screens

Lecture 17 - Grit Chamber and its Classification - I

Lecture 18 - Grit Chamber and its Classification - II and Skimming Tank

Lecture 19 - Theory of Sedimentation and Introduction to Primary Sedimentation Tank and its Types

Lecture 20 - PST: Performance factors affecting efficiency and design recommendations

Lecture 21 - Equalization

Lecture 22 - Neutralization, Dissolved Air Floatation

Lecture 23 - Coagulation

Lecture 24 - Flocculation

Lecture 25 - Pre-aeration and other advanced primary treatment units

Lecture 26 - Bacterial Metabolism and Their Use in Wastewater

Lecture 27 - Factors Affecting Bacterial Growth and Wastewater Treatment Using Bacteria

Lecture 28 - Role of enzymes and algae in biological wastewater treatment

Lecture 29 - Important nomenclature on aerobic treatment units

Lecture 30 - Types of aeration used in aerobic treatment units and Analysis of Gas Transfer

Lecture 31 - Activated Sludge Process: Description and Types

Lecture 32 - Bacterial growth kinetics in ASP: Biomass mass balance and substrate mass balance

Lecture 33 - Equalization Estimation of values of other operating parameters in ASP

Lecture 34 - Numericals on ASP

Lecture 35 - Sequencing Batch Reactor

Lecture 36 - Trickling Filter- Physical Overview, Types and Process Description

Lecture 37 - Aerated Lagoon, Fluidised Bed Bioreactor, Biological Active Filter

Lecture 38 - Aerated Lagoons, Fluidized Bed Bioreactors, Biological Active Filters

Lecture 39 - Rotating Biological Contactor and Hanging Sponge Reactor

Lecture 40 - Membrane Bioreactor (MBR)

Lecture 41 - Principles of Anaerobic process for wastewater treatment and Methane Production

Lecture 42 - Types of Anaerobic Treatment Systems

Lecture 43 - Factors Affecting Anaerobic Treatment Systems

Lecture 44 - Designs of Anaerobic Reactors: UASB reactor - I

Lecture 45 - Designs of Anaerobic Reactors: UASB reactor - II

Lecture 46 - Pond System, Components, Factors and Terminologies

Lecture 47 - Constructed Wetlands

Lecture 48 - Bio-electrochemical Systems: Types and Definition

Lecture 49 - Hybrid Bio-electrochemical Systems

Lecture 50 - Modular Designs for Smart Cities

Lecture 51 - Nitrification and Denitrification: Major factors

Lecture 52 - Systems used for Nitrification and Denitrification, Anammox Process

Lecture 53 - Biological Phosphorus Removal and Factors affecting it

Lecture 54 - Advanced Oxidation Processes

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Lecture 56 - Disinfection of Wastewater

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Lecture 58 - Life-Cycle Costing

Lecture 59 - Case studies

Lecture 60 - Future of Sustainable Wastewater Treatment Technologies

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Lecture 2 - Introduction to Food Packaging (Continued...)

Lecture 3 - Introduction to Food Packaging (Continued...)

Lecture 4 - Introduction to Food Packaging (Continued...)

Lecture 5 - Introduction to Food Packaging (Continued...)

Lecture 6 - Introduction to Food Packaging (Continued...)

Lecture 7 - Type of Packaging Materials (Paper)

Lecture 8 - Type of Packaging Materials (Paper) (Continued...)

Lecture 9 - Type of Packaging Materials (Paper) (Continued...)

Lecture 10 - Testing of Paper and Paperboard

Lecture 11 - Types of Packaging Materials (Glass)

Lecture 12 - Types of Packaging Materials (Glass) (Continued...)

Lecture 13 - Types of Packaging Materials (Glass) (Continued...)

Lecture 14 - Types of Packaging Materials (Glass) (Continued...)

Lecture 15 - Types of Packaging Materials (Plastic 1)

Lecture 16 - Types of Packaging Materials (Plastic 1) (Continued...)

Lecture 17 - Types of Packaging Materials (Plastic 1) (Continued...)

Lecture 18 - Types of Packaging Materials (Plastic 1) (Continued...)

Lecture 19 - Types of Packaging Materials (Plastic 2)

Lecture 20 - Types of Packaging Materials (Plastic 2) (Continued...)

Lecture 21 - Properties of Plastic Polymers

Lecture 22 - Properties of Plastic Polymers (Continued...)

Lecture 23 - Coating, Printing and Labeling of Plastic Films

Lecture 24 - Retort Pouches

Lecture 25 - Metals as a Packaging Material

Lecture 26 - Metals as a Packaging Material (Continued...)

Lecture 27 - Metals as a Packaging Material (Can Making Process)

Lecture 28 - Metals as a Packaging Material (can end making process)

Lecture 29 - Metals as a Packaging Material (Aluminium Container)

Lecture 30 - Metals as a Packaging Material (Corrosion of Metal Packaging)

Lecture 31 - Testing and Regulatory Aspects of Food Packaging

- Lecture 32 - Testing and Regulatory Aspects of Food Packaging (Continued...)
- Lecture 33 - Testing and Regulatory Aspects of Food Packaging (Continued...)
- Lecture 34 - Special Packaging Methods (form-fill-seal machine)
- Lecture 35 - Special Packaging Methods (controlled atmospheric packaging)
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- Lecture 41 - Packaging of Food Products (meat and poultry products) (Continued...)
- Lecture 42 - Packaging of Food Products (dairy and dairy based products)
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- Lecture 45 - Packaging of Food Products (fruits and vegetables)
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- Lecture 47 - Packaging of Food Products (cereals and flours)
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- Lecture 50 - Packaging of Food Products (beverages)
- Lecture 51 - Overview to Modern Food Packaging
- Lecture 52 - Challenges and Variations in Packaging Industries
- Lecture 53 - Recent Trends in Packaging Materials - Biodegradable
- Lecture 54 - Recent Trends in Packaging Materials - Edible
- Lecture 55 - Recycling and Disposal of Plastic Waste and Environmental Concern
- Lecture 56 - Packaging Processes and Machinery
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- Lecture 58 - Packaging Processes and Machinery (Continued...)
- Lecture 59 - Packaging Laws and Regulation
- Lecture 60 - FSSAI Regulations on Packaging and Labelling Requirements

Lecture 1 - Mendelian Genetics

Lecture 2 - Mendelian Genetics

Lecture 3 - Mendelian Genetics

Lecture 4 - Concept of Gene and Experiments on Plant Hybridization

Lecture 5 - Concept of Gene and Experiments on Plant Hybridization

Lecture 6 - Pureline Selection

Lecture 7 - Pedigree Method

Lecture 8 - Backcross Breeding

Lecture 9 - Back Cross Method (Recessive Gene Transfer)

Lecture 10 - Merits and Demerits of Backcross Breeding and Cytoplasm Transfer Through BB

Lecture 11 - Mass Selection

Lecture 12 - Modifications of Mass Selection

Lecture 13 - Recurrent Selection

Lecture 14 - Reciprocal Recurrent Selection

Lecture 15 - Heterosis and Inbreeding Depression

Lecture 16 - Degree of Inbreeding and Genetic Basis of Heterosis and Inbreeding Depression

Lecture 17 - Genetic Basis of Heterosis and Inbreeding Depression

Lecture 18 - Population Genetics - Part I

Lecture 19 - Population Genetics - Part II

Lecture 20 - Population Genetics - Part III

Lecture 21 - Polyploidy - Introduction

Lecture 22 - Autopolyploidy

Lecture 23 - Features and Limitations of Autopolyploids

Lecture 24 - Allopolyploidy

Lecture 25 - Introduction to Reverse Breeding

Lecture 26 - Applications of Reverse Breeding

Lecture 27 - Introduction to Markers

Lecture 28 - RFLP

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Lecture 31 - ISSR, SSR, CAPS

- Lecture 32 - Backcross breeding through molecular marker - Part I
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- Lecture 34 - Enzymatic tools used in Molecular Biology
- Lecture 35 - Vectors and Plasmids used in Molecular Biology
- Lecture 36 - Types of Vectors used in Plant Transformation and Selectable Marker Gene
- Lecture 37 - Scorable Marker Gene and Plant Tissue Culture
- Lecture 38 - Gene Cloning
- Lecture 39 - Promoters and Preparation of Over expression Construct
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- Lecture 41 - Unidirectional and Bidirectional Promoter, Numerical Question on Promoter Analysis
- Lecture 42 - Application of Plant Tissue Culture - Part I
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- Lecture 44 - Haploids and Artificial Seeds
- Lecture 45 - Gene Transfer Methods
- Lecture 46 - Agrobacterium Mediated Transformation in Tobacco and Rice
- Lecture 47 - PCR Screening
- Lecture 48 - Southern and Northern Blot
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- Lecture 50 - Microarray and Other Screening Methods
- Lecture 51 - Molecular Analysis of Transgenic Plants - I
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- Lecture 53 - Double Integration - Part I
- Lecture 54 - Double Integration - Part II
- Lecture 55 - Golden Rice, Bt Cotton, FLAVR SAVR
- Lecture 56 - Characterisation of OsGLP1 Gene from Rice - Part I
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- Lecture 58 - Seed Sterilisation and Transformation (Rice and Tobacco)

Lecture 1 - Overview

Lecture 2 - Introduction to Landscape

Lecture 3 - Categories and Materials in Landscape

Lecture 4 - Objective and Professional Scope of Landscape Design

Lecture 5 - Objective and Professional Scope of Landscape Design (Continued...)

Lecture 6 - Introduction to History of Landscape Design

Lecture 7 - Introduction to History of Landscape Design (Continued...)

Lecture 8 - Introduction to History of Landscape Design (Continued...)

Lecture 9 - Introduction to History of Landscape Design (Continued...)

Lecture 10 - Introduction to History of Landscape Design (Continued...)

Lecture 11 - Introduction to History of Landscape Design (Continued...)

Lecture 12 - Introduction to History of Landscape Design (Continued...)

Lecture 13

Lecture 14

Lecture 15

Lecture 16 - Behavioral Principle

Lecture 17 - Behavioral Principle (Continued...)

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Lecture 15 - EIA Law, Policy and Institutional Arrangements for EIA Systems - Part III - Air

Lecture 16 - EIA Law, Policy and Institutional arrangements for EIA Systems - Part IV - Water and Geology

Lecture 17 - EIA Law, Policy and Institutional Arrangements for EIA Systems - Part V - Ecology

Lecture 18 - EIA Law, Policy and Institutional Arrangements for EIA Systems - Part VI - Coastal Ecology and Geomorphology

Lecture 19 - EIA Law, Policy and Institutional arrangements for EIA Systems - Part VII - Noise

Lecture 20 - EIA Law, Policy and Institutional arrangements for EIA Systems - Part VIII - Ecosystem Services

Lecture 21 - EIA Law, Policy and Institutional Arrangements for EIA Systems - Part IX - Cultural Heritage and Health

Lecture 22 - EIA Law, Policy and Institutional Arrangements for EIA Systems - Part X

Lecture 23 - EIA Law, Policy and Institutional Arrangements for EIA Systems - Part XI

Lecture 24 - EIA Law, Policy and Institutional Arrangements for EIA Systems - Part XII

Lecture 25 - EIA Law, Policy and Institutional Arrangements for EIA Systems - Part XIII

Lecture 26 - EIA Process - Starting and Initial Stage

Lecture 27 - EIA Process - Impact Prediction

Lecture 28 - EIA Process - Impact Evaluation, Mitigation and Enhancement

Lecture 29 - EIA Process - Participation, Presentation and Review

Lecture 30 - EIA Process - Follow-Up (Monitoring and Auditing)

Lecture 31 - EIA Methods - Air Assessment - Part I

- Lecture 32 - EIA Methods - Air Assessment - Part II
- Lecture 33 - EIA Methods - Water Assessment
- Lecture 34 - EIA Methods - Soil, Land and Geology
- Lecture 35 - EIA Methods - Climate and Climate Change - Part I
- Lecture 36 - EIA Methods - Climate and Climate Change - Part II
- Lecture 37 - EIA Methods for Ecology (Definitions and Concepts)
- Lecture 38 - EIA Methods for Ecology (Baseline Study)
- Lecture 39 - EIA Methods for Ecology (Impact Prediction and Evaluation)
- Lecture 40 - EIA Methods - Ecosystem Services - Part I
- Lecture 41 - EIA Methods - Ecosystem Services - Part II
- Lecture 42 - EIA Methods - Coastal Ecology and Geomorphology - Part I
- Lecture 43 - EIA Methods - Coastal Ecology and Geomorphology - Part II
- Lecture 44 - EIA Methods - Noise
- Lecture 45 - EIA Methods - Transport
- Lecture 46 - EIA Methods - Landscape and Visuals
- Lecture 47 - EIA Methods - Cultural Heritage
- Lecture 48 - EIA Methods - Health
- Lecture 49 - EIA Methods - Socio-Economic Impacts (SIA) - Part I
- Lecture 50 - EIA Methods - Socio-Economic Impacts (SIA) - Part II
- Lecture 51 - EIA Methods - Land Acquisition, Resettlement and Livelihoods
- Lecture 52 - EIA Methods - Resource Efficiency
- Lecture 53 - EIA Methods - Risk and Risk Assessment
- Lecture 54 - EIA Methods - Cumulative Effects
- Lecture 55 - EIA - Environmental Management Plans
- Lecture 56 - EIA - Widening the scope: Strategic Environmental Assessment
- Lecture 57 - EIA - Reporting and Review of EIA Quality
- Lecture 58 - EIA Case Study - Mumbai Metro Line 3, Colaba - Bandra - SEEPZ
- Lecture 59 - EIA Case Study - Development of Water Aerodrome, Andaman and Nicobar - Part - I
- Lecture 60 - EIA Case Study - Development of Water Aerodrome, Andaman and Nicobar - Part - II

Lecture 1 - Introduction - Part 1

Lecture 2 - Introduction - Part 2

Lecture 3 - Pre-Independence - Part 1: Indo-Saracenic Architecture

Lecture 4 - Pre-Independence - Part 2: Colonial Architecture and Art Deco

Lecture 5 - Pre-Independence to Independence - Part 1

Lecture 6 - Pre-Independence to Independence - Part 2

Lecture 7 - Revivalism

Lecture 8 - The First Generation (1945-1970) - Part 1

Lecture 9 - The First Generation (1945-1970) - Part 2

Lecture 10 - The First Generation (1945-1970) - Part 3

Lecture 11 - The First Generation (1945-1970) - Part 4

Lecture 12 - The First Generation (1945-1970) - Part 5

Lecture 13 - The First Generation (1945-1970) - Part 6

Lecture 14 - Impact of Western Architects: Le Corbusier - Part 1

Lecture 15 - Impact of Western Architects: Le Corbusier - Part 2

Lecture 16 - Impact of Western Architects: Le Corbusier - Part 3

Lecture 17 - Impact of Western Architects: Le Corbusier - Part 4

Lecture 18 - Impact of Western Architects: Le Corbusier - Part 5

Lecture 19 - Impact of Western Architects: Le Corbusier - Part 6

Lecture 20 - Impact of Western Architects: Walter Gropius - Part 1

Lecture 21 - Impact of Western Architects: Walter Gropius - Part 2

Lecture 22 - Impact of Western Architects: Louis I Kahn - Part 1

Lecture 23 - Impact of Western Architects: Louis I Kahn - Part 2

Lecture 24 - Impact of Western Architects: Louis I Kahn - Part 3

Lecture 25 - Impact of Western Architects: Louis I Kahn - Part 4

Lecture 26 - Introduction to Critical Regionalism - Part 1

Lecture 27 - Introduction to Critical Regionalism - Part 2

Lecture 28 - Critical Regionalism in Indian Architecture - Part 1

Lecture 29 - Critical Regionalism in Indian Architecture - Part 2

Lecture 30 - Critical Regionalism in Indian Architecture - Part 3

Lecture 31 - Critical Regionalism in Indian Architecture - Part 4

[Lecture 32 - Critical Regionalism in Indian Architecture - Part 5](#)

[Lecture 33 - Structure: The Works of Mahendra Raj](#)

[Lecture 34 - Point-Blocks and High Rises - Part 1](#)

[Lecture 35 - Point-Blocks and High Rises - Part 2](#)

[Lecture 36 - Search for a new Architecture - Part 1](#)

[Lecture 37 - Search for a new Architecture - Part 2](#)

[Lecture 38 - Search for a new Architecture - Part 3](#)

[Lecture 39 - Search for a new Architecture - Part 4](#)

[Lecture 40 - Search for a new Architecture - Part 5](#)

Lecture 1 - Culture, Identity and Built Environment

Lecture 2 - Space and Meaning in Balinese Vernacular Architecture

Lecture 3 - Adobe Construction and Religious Structures

Lecture 4 - Social System, Beliefs and its Architecture

Lecture 5 - Anthropology of Shelter-Conclusion

Lecture 6 - Stone as a Vernacular Resource Material

Lecture 7 - Earth as Vernacular Resource Material

Lecture 8 - Bamboo as Vernacular Resource Material

Lecture 9 - Timber as Vernacular Resource Material

Lecture 10 - Advanced Material Adaptations: The conclusion

Lecture 11 - Cultural Geography and Vernacular Architecture

Lecture 12 - Cultural Geography and Small-scale Features in the Landscape

Lecture 13 - Acculturation in Architecture

Lecture 14 - Tradition and Transmission

Lecture 15 - Transformation in Vernacular Context

Lecture 16 - Disasters Vulnerability and Traditions

Lecture 17 - Learning Disaster Mitigation from the Vernacular

Lecture 18 - The Second Birth: Lessons from Disaster Recovery

Lecture 19 - Climate Change and Traditions

Lecture 20 - Yonmenkaigi (Four square table system) Method for Collaborative Knowledge Development

Lecture 1 - Introduction to Interaction Design

Lecture 2 - Components of Interaction Design

Lecture 3 - Interaction Design Process

Lecture 4 - Understanding User

Lecture 5 - Conceptual Design - Part 1

Lecture 6 - Conceptual Design - Part 2

Lecture 7 - Role of Cognition

Lecture 8 - Role of Social Interaction

Lecture 9 - Designing for Emotional Interaction

Lecture 10 - Interactive Interfaces

Lecture 11 - Data Gathering

Lecture 12 - Data Analysis

Lecture 13 - Discovering Requirements

Lecture 14 - User Personas and Scenarios

Lecture 15 - Design and Prototyping - Part 1

Lecture 16 - Design and Prototyping - Part 2

Lecture 17 - Visual Interface Design

Lecture 18 - Elements of User Interface

Lecture 19 - Affordances and UI Transformations

Lecture 20 - Component-Based Design Systems

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NPTEL : NOC:Understanding and Reducing Ghg Emissions - Focus on Scope 1 and 2 Emission Reduction through Building Design and Construction (Architecture)

Co-ordinators : Prof. Avlokita Agrawal

- Lecture 1 - Introduction, Sustainability, And Sustainable Development
- Lecture 2 - Sustainable Development And Sustainable Goals
- Lecture 3 - Sustainable Development Goals and Climate Change
- Lecture 4 - Climate Risk
- Lecture 5 - Impact of Development on Climate Natural Components
- Lecture 6 - UNFCCC
- Lecture 7 - Kyoto Protocol
- Lecture 8 - The Paris Agreement
- Lecture 9 - Green House Gases
- Lecture 10 - Carbon Footprint and Calculation
- Lecture 11 - The GHG Protocol
- Lecture 12 - ISO International Standards
- Lecture 13 - Identification and Determination of Scope 1,2 and 3 GHG Emissions
- Lecture 14 - Identification and Determination of Scope 1,2 and 3 GHG Emissions - Part II
- Lecture 15 - Identification and Determination of Scope 1,2 and 3 GHG Emissions - Part III
- Lecture 16 - India Specific GHG Programs - I
- Lecture 17 - India Specific GHG Programs - II
- Lecture 18 - Accounting Methods and Data Collection
- Lecture 19 - Tools for Calculation of GHG
- Lecture 20 - Understanding the Role of Buildings and Related Emissions
- Lecture 21 - Understanding Emissions of Airports
- Lecture 22 - Understanding Emissions of University Campuses
- Lecture 23 - Understanding Emissions of Fuel Supply Companies
- Lecture 24 - Understanding Emissions of IT Companies
- Lecture 25 - Understanding Emissions of Real Estate Companies
- Lecture 26 - Thermal Comfort in Building
- Lecture 27 - Passive Design Measures
- Lecture 28 - Advanced Passive Design Measures
- Lecture 29 - Natural and Mechanical Ventilation
- Lecture 30 - Daylighting and Lighting Design

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[Lecture 31 - Factors Affecting Material Selection in Building?](#)

[Lecture 32 - Material Selection for Emission Reduction](#)

[Lecture 33 - Reducing Emission from purchased Electricity](#)

[Lecture 34 - Strategies of Renovation and Retrofitting for Emission Reduction](#)

[Lecture 35 - Case studies of Various Efficient Building Design](#)

[Lecture 36 - Calculation of Emissions Reduction from HVAC System](#)

[Lecture 37 - Calculation of Emission Reduction from Fenestration](#)

[Lecture 38 - Calculation of Emission Reduction from Building Envelope](#)

[Lecture 39 - Calculation of Emission Reduction from Source of Energy](#)

[Lecture 40 - Course Summary](#)

Lecture 1 - Introduction

Lecture 2 - Types of Research

Lecture 3 - Qualitative vs. Quantitative Research

Lecture 4 - Research Methods vs Research Methodology

Lecture 5 - Issues and Challenges in Planning and Architectural Research

Lecture 6 - Research Process - I

Lecture 7 - Research Process - II

Lecture 8 - Research Process - III

Lecture 9 - Research Writing - I

Lecture 10 - Research Writing - II

Lecture 11 - Basics of Literature Review

Lecture 12 - Bibliometric Analysis

Lecture 13 - Systematic Literature Review

Lecture 14 - Meta Analysis

Lecture 15 - Referencing

Lecture 16 - Types of Data in Research

Lecture 17 - Measurement and Scaling Techniques - I

Lecture 18 - Measurement and Scaling Techniques - II

Lecture 19 - Types of Surveys - I

Lecture 20 - Types of Surveys - II

Lecture 21 - Determining the Sample Size

Lecture 22 - Sampling Techniques - I

Lecture 23 - Sampling Techniques - II

Lecture 24 - Sources of Data

Lecture 25 - Preparation of Survey Questionnaire

Lecture 26 - Methods of Data Collection - I

Lecture 27 - Methods of Data Collection - II

Lecture 28 - Methods of Data Collection - III

Lecture 29 - Ethics in Data Management and Use

Lecture 30 - Similarity vs. Plagiarism

Lecture 31 - Processing of Data and Database Management

[Lecture 32 - Interpreting Data](#)

[Lecture 33 - Descriptive Statistics](#)

[Lecture 34 - Representation of Data and Inferences - I](#)

[Lecture 35 - Representation of Data and Inferences - II](#)

[Lecture 36 - Hypothesis Testing](#)

[Lecture 37 - Parametric Tests](#)

[Lecture 38 - Non-parametric Tests](#)

[Lecture 39 - Quantitative Research Approach](#)

[Lecture 40 - Quantitative Research - Case Study - I](#)

[Lecture 41 - Quantitative Research - Case Study - II](#)

[Lecture 42 - Quantitative Research - Case Study - III](#)

[Lecture 43 - Quantitative Research - Case Study - IV](#)

[Lecture 44 - Quantitative Research - Case Study - V](#)

[Lecture 45 - Qualitative Research Approach](#)

[Lecture 46 - Qualitative Research - Case Study - I](#)

[Lecture 47 - Qualitative Research - Case Study - II](#)

[Lecture 48 - Qualitative Research - Case Study - III](#)

[Lecture 49 - Qualitative Research - Case Study - IV](#)

[Lecture 50 - Qualitative Research - Case Study - V](#)

[Lecture 51 - Mixed Method Research Approach](#)

[Lecture 52 - Mixed Method Research Approach - Case Study](#)

[Lecture 53 - Spatial Methods in Planning Research](#)

[Lecture 54 - Spatial Methods in Planning Research - Case Study](#)

[Lecture 55 - Research Methods for Behavioral Studies - The Basics](#)

[Lecture 56 - Simulation Based Studies in Planning and Architecture](#)

[Lecture 57 - Handling Big Data Research - The Basics](#)

[Lecture 58 - Role of AI in Architecture and Planning Studies - The Basics](#)

[Lecture 59 - Programming Language and Software for Research in Planning and Architecture](#)

[Lecture 60 - Emerging Research Potential in Planning and Architecture](#)

NPTEL : Introduction to Atmospheric Science (Atmospheric Science)

Co-ordinators : Prof. C. Balaji

Lecture 1 - Introduction

Lecture 2 - Atmosphere-A brief survey (Pressure, Temperature and Chemical composition)

Lecture 3 - Atmosphere-A brief survey (Continued...) (Vertical structure of the atmosphere)

Lecture 4 - Vertical structure of atmosphere (Continued...) and The Earth system - Oceans

Lecture 5 - The Earth system - Oceans (Continued...) and Marine biosphere

Lecture 6 - The Earth system - Hydrological cycle

Lecture 7 - The Earth system - Hydrological cycle (Continued...) and Carbon cycle

Lecture 8 - The Earth system - Carbon cycle (Continued...), and Carbon in the oceans Earth's crust

Lecture 9 - The Earth system - Carbon in the oceans Earth's crust

Lecture 10 - Atmospheric Thermodynamics- Introduction

Lecture 11 - The hydrostatic equation

Lecture 12 - Hypsometric equation and pressure at sea level

Lecture 13 - Basic Thermodynamics

Lecture 14 - Concept of air parcel and dry adiabatic lapse rate

Lecture 15 - Potential temperature

Lecture 16 - Skew-T ln-P chart

Lecture 17 - Problems using Skew-T ln-P chart

Lecture 18 - Problems using Skew-T ln-P chart (Continued...)

Lecture 19 - Problems using Skew-T ln-P chart (Continued...)

Lecture 20 - Lifting Condensation Level (LCL)

Lecture 21 - Lifting Condensation Level (LCL) (Continued...)

Lecture 22 - Saturated Adiabatic and Pseudo-adiabatic processes

Lecture 23 - Equivalent potential temperature and wet bulb potential temperature

Lecture 24 - Föhn's rule - Chinook winds

Lecture 25 - Problems on Chinook wind and static stability

Lecture 26 - Static stability-Brunt-Väisälä frequency

Lecture 27 - Conditional and convective instability

Lecture 28 - Static stability - Problems using radiosonde data and skew T ln P chart

Lecture 29 - The second law of thermodynamics – Clausius Clapeyron relation

Lecture 30 - Clausius Clapeyron relation (Continued...)

Lecture 31 - Atmospheric radiation – Radiation laws

[Lecture 32 - Planck's distribution and Inverse square law](#)

[Lecture 33 - Physics of scattering, emission and absorption](#)

[Lecture 34 - Physics of scattering, emission and absorption \(Continued...\)](#)

[Lecture 35 - Radiative Transfer Equation " Derivation](#)

[Lecture 36 - Radiative Transfer Equation \(Continued...\)](#)

[Lecture 37 - Radiative heating profiles of the atmosphere](#)

[Lecture 38 - Climate Dynamics " Introduction](#)

[Lecture 39 - Climate sensitivity and feedback](#)

[Lecture 40 - Climate change](#)

[Lecture 41 - Atmospheric dynamics](#)

Lecture 1 - Introduction

Lecture 2 - Blackbody radiation

Lecture 3 - Properties of real surfaces

Lecture 4 - Spectral and directional variations

Lecture 5 - Shape factor

Lecture 6 - Triangular enclosure

Lecture 7 - Evaluation of shape factors

Lecture 8 - Radiation in enclosures

Lecture 9 - Electrical analogy

Lecture 10 - Applications

Lecture 11 - Non-gray enclosures

Lecture 12 - Enclosure with Specular surfaces

Lecture 13 - Integral method for enclosures

Lecture 14 - Introduction to gas radiation

Lecture 15 - Plane parallel model

Lecture 16 - Diffusion approximation

Lecture 17 - Radiative equilibrium

Lecture 18 - Optically thick limit

Lecture 19 - Radiation spectroscopy

Lecture 20 - Isothermal gas emissivity

Lecture 21 - Band models

Lecture 22 - Total Emissivity method

Lecture 23 - Isothermal gas enclosures

Lecture 24 - Well-stirred furnace model

Lecture 25 - Gas radiation in complex enclosures

Lecture 26 - Interaction between radiation and other modes of heat transfer

Lecture 27 - Radiation heat transfer during flow over flat plate

Lecture 28 - Radiation and Climate

Lecture 29 - Radiative-convective equilibrium

Lecture 30 - Radiative equilibrium with scattering

Lecture 31 - Radiation measurement

[Lecture 32 - Radiation with internal heat source](#)

[Lecture 33 - Particle scattering](#)

[Lecture 34 - Scattering in the atmosphere](#)

[Lecture 35 - Non-isotropic scattering](#)

[Lecture 36 - Approximate methods in scattering : 1](#)

[Lecture 37 - Approximate methods in scattering : 2](#)

[Lecture 38 - Monte Carlo method](#)

NPTEL : The monsoon and its variability (Atmospheric Science)

Co-ordinators : Prof. Sulochana Gadgil

Lecture 1 - Preamble and Introduction to the Indian Monsoon

Lecture 2 - Nature of the variability of the Indian Monsoon

Lecture 3 - Monsoon variability through the eye in the sky, seasonal variation of the surface wind and pressure

Lecture 4 - Background about the atmosphere and rotating systems

Lecture 5 - Rainfall and clouds over the tropics

Lecture 6 - Organization of clouds over mesoscale, synoptic scale and planetary scales

Lecture 7 - The Indian monsoon: is it a gigantic land-sea breeze?

Lecture 8 - Monsoons and the seasonal variation of tropical circulation and rainfall

Lecture 9 - Evolution of the ideas about the basic system responsible for the Indian monsoon - Part 1

Lecture 10 - Evolution of the ideas about the basic system responsible for the Indian monsoon - Part 2

Lecture 11 - Tropical Convergence Zones and the Indian monsoon - Part 1

Lecture 12 - Tropical Convergence Zones and the Indian monsoon - Part 2

Lecture 13 - Variability of organized convection over the tropical oceans

Lecture 14 - Heat lows and the TCZ

Lecture 15 - Monsoonal regions of the world

Lecture 16 - Seasonal transitions - Part 1 : spring to summer transition

Lecture 17 - Seasonal transitions - Part 2 : spring to summer transition

Lecture 18 - Seasonal transitions - Part 3 : Advance and retreat of the summer monsoon

Lecture 19 - Climatic clusters of the Indian region

Lecture 20 - Active-weak spells and breaks in the monsoon - Part 1

Lecture 21 - Active-weak spells and breaks in the monsoon - Part 2

Lecture 22 - Intraseasonal variation and intraseasonal oscillations

Lecture 23 - The tropical oceans

Lecture 24 - El Nino Southern Oscillation (ENSO) - Part 1

Lecture 25 - El Nino Southern Oscillation (ENSO) - Part 2

Lecture 26 - El Nino Southern Oscillation (ENSO) - Part 3

Lecture 27 - El Nino Southern Oscillation (ENSO) - Part 4

Lecture 28 - El Nino Southern Oscillation (ENSO) - Part 5

Lecture 29 - El Nino Southern Oscillation (ENSO) - Part 6

Lecture 30 - Indian Ocean and the monsoon - Part 1

Lecture 31 - Indian Ocean and the monsoon - Part 2

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[Lecture 32 - Indian Ocean Dipole - Part 1](#)

[Lecture 33 - Indian Ocean Dipole - Part 2](#)

[Lecture 34 - Interannual variation of the Indian summer Monsoon rainfall: Links to events over the Pacific and Equatorial Indian Ocean](#)

[Lecture 35 - Monsoon Variability and Agriculture - Part 1](#)

[Lecture 36 - Monsoon Variability and Agriculture - Part 2](#)

[Lecture 37 - Monsoon Variability and Agriculture - Part 3](#)

[Lecture 38 - Monsoon Variability and Agriculture - Part 4](#)

[Lecture 39 - Indian Summer Monsoon, GDP and Agriculture](#)

[Lecture 40 - Monsoon Prediction - Part 1](#)

[Lecture 41 - Monsoon Prediction - Part 2](#)

[Lecture 42 - Concluding Remarks](#)

Lecture 1 - Preliminary Concepts

Lecture 2 - Vector Analysis

Lecture 3 - Analysis of Forces

Lecture 4 - Analysis of Equilibrium

Lecture 5 - Structural Mechanics - Part-1

Lecture 6 - Structural Mechanics - Part-2

Lecture 7 - Friction and its Applications - Part-1

Lecture 8 - Friction and its Applications - Part-2

Lecture 9 - Friction and its Applications - Part-3

Lecture 10 - Properties of Surfaces - Part-1

Lecture 11 - Properties of Surfaces - Part-2

Lecture 12 - Properties of Surfaces - Part-3

Lecture 13 - Moments and Products of Inertia

Lecture 14 - Methods of Virtual Work and Potential Energy - Part-1

Lecture 15 - Methods of Virtual Work and Potential Energy - Part-2

Lecture 16 - Stability of Equilibrium

Lecture 1 - Introduction

Lecture 2 - Motivation

Lecture 3 - Management

Lecture 4 - Work Ethics

Lecture 5 - Comparison Between Theories

Lecture 6 - Job Enrichment

Lecture 7 - Team Building and Participation

Lecture 8 - Other Leadership Styles

Lecture 9 - Empowerment

Lecture 10 - Barriers to Communication

Lecture 11 - Issues in Leadership

Lecture 12 - Participation Management and Team Working Part - 1

Lecture 13 - Participation Management and Team Working Part - 2

Lecture 14 - Participation Management and Team Working Part - 3

Lecture 15 - Participative Management and Team Working Part - 5

Lecture 16 - Organizations

Lecture 17 - Some Management Concepts - Part - 1

Lecture 18 - Some Management Concepts - Part - 2

Lecture 19 - Some Management Concepts - Part - 3

Lecture 20 - Diversity at Work Place and Management Issues

Lecture 21 - Industrial Relations and Conflict Management - Part - 1

Lecture 22 - Industrial Relations and Conflict Management - Part - 2

Lecture 23 - Selection and Training of Employees

Lecture 24 - Performance Management - Part - 1

Lecture 25 - Performance Management - Part - 2

Lecture 26 - Performance Management - Part - 3

Lecture 27 - Management Research: Some Methodological Issues-Part-2

Lecture 28 - Corporate Social Responsibilities

Lecture 29 - Women, Work and Organizations: Management Perspective - Part - 1

Lecture 30 - Women, Work and Organizations: Management Perspective - Part - 2

Lecture 31 - Selection, Recruitment and Training

[Lecture 32 - Management of Change in Organization](#)

[Lecture 33 - Organizational Development](#)

[Lecture 34 - Values, Ethics and Corporate Social Responsibilities - Part - 1](#)

[Lecture 35 - Values, Ethics and Corporate Social Responsibilities - Part - 2](#)

[Lecture 36 - Management: Now and Beyond - Part - 1](#)

[Lecture 37 - Management: Now and Beyond - Part - 2](#)

[Lecture 38 - Management: Now and Beyond - Part - 3](#)

[Lecture 39 - Conclusions](#)

Lecture 1 - Introduction

Lecture 2 - Internal Energy Enthalpy

Lecture 3 - Crystal Geometry

Lecture 4 - Crystal Geometry

Lecture 5 - Crystal Geometry

Lecture 6 - Crystal Structure

Lecture 7 - Close Packing of Spheres of Equal Size

Lecture 8 - Structure of Solid Materials

Lecture 9 - Non Crystalline Solids

Lecture 10 - Polymers (Continued)

Lecture 11 - Crystal Imperfections

Lecture 12 - Crystal Imperfections

Lecture 13 - Crystal Imperfections

Lecture 14 - Crystal Imperfections

Lecture 15 - Crystal Imperfections

Lecture 16 - Phase Diagrams

Lecture 17 - Phase Diagrams

Lecture 18 - Phase Diagrams

Lecture 19 - Diffusion in Solids

Lecture 20 - Diffusion in Solids

Lecture 21 - Phase Transformations

Lecture 22 - Phase Transformations

Lecture 23 - Phase Transformations

Lecture 24 - Transformations in Steels: Eutectoid Steel

Lecture 25 - Phase Transformations; Precipitation Hardening

Lecture 26 - Mechanical Behaviour of Materials

Lecture 27 - Plastic Deformation

Lecture 28 - Plastic Deformation

Lecture 29 - Plastic Deformation

Lecture 30 - Strengthening Mechanisms Creep

Lecture 31 - Fracture

[Lecture 32 - Conductors and Resistors](#)

[Lecture 33 - Conductors and Resistors](#)

[Lecture 34 - Superconductors](#)

[Lecture 35 - Superconductors](#)

[Lecture 36 - Semiconductors](#)

- Lecture 1 - Errors in Computation and Numerical Instability
- Lecture 2 - Solution of Nonlinear Algebraic Equations - Part 1
- Lecture 3 - Solution of Nonlinear Algebraic Equations - Part 2
- Lecture 4 - Solution of Nonlinear Algebraic Equations - Part 3
- Lecture 5 - Solution of Nonlinear Algebraic Equations - Part 4
- Lecture 6 - Solution of Nonlinear Algebraic Equations - Part 5
- Lecture 7 - Solution of Nonlinear Algebraic Equations - Part 6
- Lecture 8 - Solution of Nonlinear Algebraic Equations - Part 7
- Lecture 9 - Solution of Nonlinear Algebraic Equations - Part 8
- Lecture 10 - Solution of Nonlinear Algebraic Equations - Part 9
- Lecture 11 - Solution of a System of Linear Algebraic Equations - Part 1
- Lecture 12 - Solution of a System of Linear Algebraic Equations - Part 2
- Lecture 13 - Solution of a System of Linear Algebraic Equations - Part 3
- Lecture 14 - Solution of a System of Linear Algebraic Equations - Part 4
- Lecture 15 - Solution of a System of Linear Algebraic Equations - Part 5
- Lecture 16 - Solution of a System of Linear Algebraic Equations - Part 6
- Lecture 17 - Solution of a System of Linear Algebraic Equations - Part 7
- Lecture 18 - Solution of a System of Linear Algebraic Equations - Part 8
- Lecture 19 - Solution of a System of Linear Algebraic Equations - Part 9
- Lecture 20 - Solution of a System of Linear Algebraic Equations - Part 10
- Lecture 21 - Solution of a System of Linear Algebraic Equations - Part 11
- Lecture 22 - Solution of a System of Linear Algebraic Equations - Part 12
- Lecture 23 - Solution of a System of Linear Algebraic Equations - Part 13
- Lecture 24 - Solution of a System of Linear Algebraic Equations - Part 14
- Lecture 25 - Interpolation and Approximation - Part 1
- Lecture 26 - Interpolation and Approximation - Part 2
- Lecture 27 - Interpolation and Approximation - Part 3
- Lecture 28 - Interpolation and Approximation - Part 4
- Lecture 29 - Interpolation and Approximation - Part 5
- Lecture 30 - Interpolation and Approximation - Part 6
- Lecture 31 - Interpolation and Approximation - Part 7

[Lecture 32 - Interpolation and Approximation - Part 8](#)

[Lecture 33 - Interpolation and Approximation - Part 9](#)

[Lecture 34 - Numerical Differentiation and Integration - Part 1](#)

[Lecture 35 - Numerical Differentiation and Integration - Part 2](#)

[Lecture 36 - Numerical Differentiation and Integration - Part 3](#)

[Lecture 37 - Numerical Differentiation and Integration - Part 4](#)

[Lecture 38 - Numerical Differentiation and Integration - Part 5](#)

[Lecture 39 - Numerical Differentiation and Integration - Part 6](#)

[Lecture 40 - Numerical Differentiation and Integration - Part 7](#)

[Lecture 41 - Numerical Differentiation and Integration - Part 8](#)

Lecture 1 - Engineering Mechanics

Lecture 2 - Equilibrium - I

Lecture 3 - Equilibrium - II

Lecture 4 - Equilibrium - III

Lecture 5 - Plan Trusses - I

Lecture 6 - Plan Trusses - II

Lecture 7 - Friction

Lecture 8 - Properties of Surfaces - I

Lecture 9 - Properties of Surfaces - II

Lecture 10 - Properties of Surfaces - III

Lecture 11 - Method of Virtual Work

Lecture 12 - Motion of Particles Planar Polar Coordinates

Lecture 13 - Motion With Constraints

Lecture 14 - Motion of Particle With Friction

Lecture 15 - Motion of Particles With Drag

Lecture 16 - Momentum

Lecture 17 - Work and Energy - I

Lecture 18 - Work and Energy - II

Lecture 19 - Work and Energy - III

Lecture 20 - Work and Energy - IV

Lecture 21 - Rotational Motion - I

Lecture 22 - Rotational Motion - II

Lecture 23 - Rotational Motion - III

Lecture 24 - Rotational Motion - IV

Lecture 25 - Rotational Motion - V

Lecture 26 - Rotational Motion - VI

Lecture 27 - Simple Harmonic Motion - I

Lecture 28 - Simple Harmonic Motion - II

Lecture 29 - Simple Harmonic Motion - III

Lecture 30 - Motion in Uniformly Accelerating Frames

Lecture 31 - Motion In Rotating Frame

[Module - 1 lecture - 1](#)

[Module - 1 lecture - 2](#)

[Module - 1 lecture - 3](#)

[Module - 1 lecture - 4](#)

[Module - 2 lecture - 1](#)

[Module - 2 lecture - 2](#)

[Module - 2 lecture - 3](#)

[Module - 2 lecture - 4](#)

[Module - 2 lecture - 5](#)

[Module - 3 lecture - 1](#)

[Module - 3 lecture - 2](#)

[Module - 3 lecture - 3](#)

[Module - 3 lecture - 4](#)

[Module - 3 lecture - 5 \(Lecture Missing\)](#)

[Module - 3 lecture - 6](#)

[Module - 3 lecture - 7](#)

[Module - 3 lecture - 8](#)

[Module - 4 lecture - 1](#)

[Module - 4 lecture - 2](#)

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[Module - 4 lecture - 4](#)

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[Module - 4 lecture - 9](#)

[Module - 4 lecture - 10](#)

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[Module - 4 lecture - 12](#)

Lecture 1 - Real Number

Lecture 2 - Sequences I

Lecture 3 - Sequences II

Lecture 4 - Sequences III

Lecture 5 - Continuous Function

Lecture 6 - Properties of Continuous Function

Lecture 7 - Uniform Continuity

Lecture 8 - Differentiable Functions

Lecture 9 - Mean Value Theorem

Lecture 10 - Maxima - Minima

Lecture 11 - Taylor's Theorem

Lecture 12 - Curve Sketching

Lecture 13 - Infinite Series I

Lecture 14 - Infinite Series II

Lecture 15 - Tests of Convergence

Lecture 16 - Power Series

Lecture 17 - Riemann Integral

Lecture 18 - Riemann Integrable Functions

Lecture 19 - Applications of Riemann Integral

Lecture 20 - Length of a curve

Lecture 21 - Line Integrals

Lecture 22 - Functions of Several Variables

Lecture 23 - Differentiation

Lecture 24 - Derivatives

Lecture 25 - Mean Value Theorem

Lecture 26 - Maxima Minima

Lecture 27 - Method of Lagrange Multipliers

Lecture 28 - Multiple Integrals

Lecture 29 - Surface Integrals

Lecture 30 - Green's Theorem

Lecture 31 - Stokes Theorem

Lecture 32 - Gauss Divergence Theorem

Lecture 1 - Nature and Scope of HRM

Lecture 2 - Analysing and Designing Job - I

Lecture 3 - Analysing and Designing Job - II

Lecture 4 - Human Resource Planning - I

Lecture 5 - Human Resource Planning - II

Lecture 6 - Recruitment and Selection

Lecture 7 - Performance Evaluation and Appraisal - I

Lecture 8 - Performance Evaluation and Appraisal (Continued...)

Lecture 9 - Training and Development

Lecture 10 - Employee Welfare

Lecture 11 - Safety, Health, Environment

Lecture 12 - Industrial Relations

Lecture 13 - Total Quality Management

Lecture 14 - Organization Culture

Lecture 15 - Change Management - Part - I

Lecture 16 - Change Management - Part - II

Lecture 17 - Wage and Salary Administration

Lecture 18 - Career Planning - Part - I

Lecture 19 - Career Planning - Part - II

Lecture 20 - Contemporary Issues in HRM - I

Lecture 21 - Contemporary Issues in HRM - II

Lecture 22 - Contemporary Issues in HRM - III

Lecture 1 - Introduction to Leadership: Functions

Lecture 2 - Leadership Roles: Leaders Vs Managers: Theories

Lecture 3 - Leadership Styles: Effective Vs Successful Managers

Lecture 4 - Leadership Behaviour: Emergence: Leadership and Trust

Lecture 5 - Leadership Styles: Adaptation-Studies/Case: From Sindhi to Siddhi (Part-I)

Lecture 6 - Case: From Sindhi to Siddhi (Part-II) Transformation Leadership

Lecture 7 - Leadership Skills: Leadership and Management

Lecture 8 - Competencies and Skills of Leaders: Issues in Organizational Leadership

Lecture 9 - Case: The DVC Story-A First Person Account - Leadership in Action (Part-I)

Lecture 10 - Case: The DVC Story-A First Person Account- Leadership in Action (Part-II)

Lecture 11 - Case: Rai Bahadur Mohan Singh Oberoi (Part-I) Issues in Institution Building

Lecture 12 - Case: Rai Bahadur Mohan Singh Oberoi (Part-II)

Lecture 13 - Case: Self Regulation-The Key to Institution Building - Framework of Institution Building

Lecture 1 - Introduction - I

Lecture 2 - Introduction - II

Lecture 3 - Introduction - III

Lecture 4 - Concept of Information - I

Lecture 5 - Concept of Information - II

Lecture 6 - Decision Making Process

Lecture 7 - Impact of IS on Management - I

Lecture 8 - Impact of IS on Management - II

Lecture 9 - Hardware Software Overview - I

Lecture 10 - Hardware Software Overview - II

Lecture 11 - Knowledge Management

Lecture 12 - Learning Organization

Lecture 13 - Decision Analysis - I

Lecture 14 - Decision Analysis - II

Lecture 15 - Decision Analysis - III

Lecture 16 - Data Flow Diagrams - I

Lecture 17 - Data Flow Diagrams - II

Lecture 18 - Data Flow Diagrams - III

Lecture 19 - Data Flow Diagrams - IV

Lecture 20 - System Design - I

Lecture 21 - System Design - II

Lecture 22 - DBMS - I

Lecture 23 - DBMS - II

Lecture 24 - DBMS - III

Lecture 25 - DBMS - IV

Lecture 26 - DBMS - V

Lecture 27 - OOAD - I

Lecture 28 - OOAD - II

Lecture 29 - OOAD - III

Lecture 1 - Simple Harmonic Oscillators

Lecture 2 - Damped Oscillator - I

Lecture 3 - Damped Oscillator - II

Lecture 4 - Oscillator With External Forcing - I

Lecture 5 - Oscillator With External Forcing

Lecture 6 - Resonance

Lecture 7 - Coupled Oscillations

Lecture 8 - Sinusoidal Plane Waves - I

Lecture 9 - Electromagnetic waves - I

Lecture 10 - Electromagnetic Waves - II

Lecture 11 - The Vector Nature of Electromagnetic Waves

Lecture 12 - The Electromagnetic Spectrum

Lecture 13 - The Electromagnetic Spectrum - II

Lecture 14 - Interference - I

Lecture 15 - Interference - II

Lecture 16 - Interference - III

Lecture 17 - Interference - IV

Lecture 18 - Coherence

Lecture 19 - Coherence

Lecture 20 - Diffraction - I

Lecture 21 - Diffraction - II

Lecture 22 - Diffraction - III

Lecture 23 - Diffraction - IV

Lecture 24 - X-Ray Diffraction

Lecture 25 - Beats

Lecture 26 - The Wave Equation

Lecture 27 - Solving the Wave Equation

Lecture 28 - Waves

Lecture 29 - Standing Waves

Lecture 30 - Standing Waves

Lecture 31 - Polarization

[Lecture 32 - Compton Effect](#)

[Lecture 33 - Wave - Particle Duality](#)

[Lecture 34 - Wave - Particle Duality](#)

[Lecture 35 - Probability Amplitude](#)

[Lecture 36 - Probability](#)

[Lecture 37 - Schrodinger Wave Equation](#)

[Lecture 38 - Measurements](#)

[Lecture 39 - Particle in a Potential](#)

[Lecture 40 - Potential Well](#)

[Lecture 41 - Potential Well](#)

[Lecture 42 - Potential Well](#)

[Lecture 43 - Quantum Tunneling](#)

[Lecture 44 - Quantum Tunneling](#)

Lecture 1 - Strategy: Philosophy;Competition;Competitive Advantage - Part - I

Lecture 2 - Strategy: Philosophy;Competition;Competitive Advantage - Part - II

Lecture 3 - Case Study - Group Presentation on Case - I (Baddi's Solvent)

Lecture 4 - Case Study - Group Presentation on Case - II

Lecture 5 - Case Study - Group Presentation on Case - III

Lecture 6 - Case Study - Group Presentation on Case - IV Form

Lecture 7 - Strategy: Implementation in Organizations

Lecture 8 - Strategy: Design: Process: Managing Strategic Change

Lecture 9 - Case Study: The House of Tata

Lecture 10 - Case Study: The House of Tata

Lecture 11 - Group Presentation - II

Lecture 1 - Introduction to Basic Electronics

Lecture 2 - Electronic Devices 1

Lecture 3 - Electronics Devices II Resistor in series and parallel

Lecture 4 - Some Useful Laws in Basic Electronics

Lecture 5 - Some Useful Theorems in Basic Electronics

Lecture 6 - Semi Conductor Diodes

Lecture 7 - Applications of Diodes

Lecture 8 - Wave Shaping using Diodes

Lecture 9 - Zener Diode Characteristics

Lecture 10 - Transistors

Lecture 11 - Transistor Biasing - Common Emitter Circuits, Fixed Bias, Collector to base Bias

Lecture 12 - Transistor Biasing - Emitter Current Bias, Thermal Stability (RC Coupled Amplifier)

Lecture 13 - Basic Characteristic of an Amplifier - Simple Transistor model, Common emitter Amplifier

Lecture 14 - Hybrid Equivalent Circuit, H-Parameters

Lecture 15 - Circuit Analysis using H-Parameters

Lecture 16 - Frequency Response of Amplifiers

Lecture 17 - Frequency Analysis

Lecture 18 - Power Amplifiers

Lecture 19 - Differential Amplifiers Circuit

Lecture 20 - Integrated Chip

Lecture 21 - Typical Characteristic of Operation Amplifier

Lecture 22 - Four Types of Feed Back

Lecture 23 - Four Types of Feed Back

Lecture 24 - Mathematical Operations

Lecture 25 - Mathematical Operations

Lecture 26 - Mathematical Operations

Lecture 27 - Characteristics of Operation Amplifier

Lecture 28 - Characteristics of Operation Amplifier

Lecture 29 - Characteristics of Operation Amplifier

Lecture 30 - Inverter/Non-Inverter Circuits

Lecture 31 - Applications of Op Amps

[Lecture 32 - Non-Linear Op Amp circuits](#)

[Lecture 33 - Applications of Op Amps](#)

[Lecture 34 - Active Diode Circuits](#)

[Lecture 35 - Oscillators](#)

[Lecture 36 - Logarithmic and Anti-Logarithmic Amplifier](#)

[Lecture 37 - Filters](#)

[Lecture 38 - Unit Junction Transistor](#)

[Lecture 39 - Silicon Controlled Rectifier](#)

[Lecture 40 - Field Effect Transistor](#)

Lecture 1 - Introduction

Lecture 2 - Newtonian mechanics

Lecture 3 - Dynamics in phase space

Lecture 4 - Linear dynamical systems

Lecture 5 - Autonomous dynamical systems (Part 1)

Lecture 6 - Autonomous dynamical systems (Part 2)

Lecture 7 - Lagrangian formalism

Lecture 8 - Summary of classical electromagnetism

Lecture 9 - Charged particle in an electromagnetic field

Lecture 10 - Hamiltonian dynamics (Part 1)

Lecture 11 - Hamiltonian dynamics (Part 2)

Lecture 12 - Hamiltonian dynamics (Part 3)

Lecture 13 - Dynamical symmetry (Part 1)

Lecture 14 - Dynamical symmetry (Part 2)

Lecture 15 - Randomness in phase space; chaos

Lecture 16 - Discrete-time dynamics: maps (Part 1)

Lecture 17 - Discrete-time dynamics: maps (Part 2)

Lecture 18 - Problems and solutions (Part 1)

Lecture 19 - Problems and solutions (Part 2)

Lecture 20 - Classical statistical mechanics: Introduction

Lecture 21 - Some probability distributions; isolated system

Lecture 22 - The microcanonical ensemble

Lecture 23 - Thermodynamics

Lecture 24 - The canonical ensemble

Lecture 25 - Connection between statistical mechanics and thermodynamics

Lecture 26 - Probability distributions

Lecture 27 - Probability distributions (concl.). Phase transitions (Part 1)

Lecture 28 - Phase transitions (Part 2)

Lecture 29 - Phase transitions (Part 3)

Lecture 30 - Phase transitions (Part 4); misc. topics

Lecture 31 - Problems and solutions (Part 3)

[Lecture 32 - Continuous groups in physics \(Part 1\)](#)

[Lecture 33 - Continuous groups in physics \(Part 2\)](#)

[Lecture 34 - Continuous groups in physics \(Part 3\)](#)

[Lecture 35 - Noether's Theorem. Special Relativity \(Part 1\)](#)

[Lecture 36 - Special Relativity \(Part 2\)](#)

[Lecture 37 - Special Relativity \(Part 3\)](#)

[Lecture 38 - Special Relativity \(Part 4\)](#)

Lecture 1 - Introduction to Chemistry & Quantum Chemical Mechanics

Lecture 2 - Particle in a box (one and two dimensions)

Lecture 3 - Particle in a box (One and Two Dimensions) Continued

Lecture 4 - Harmonic Oscillator and Molecular Vibration

Lecture 5 - Harmonic Oscillator (Continued)

Lecture 6 - Hydrogen Atom - Radial Solution

Lecture 7 - Hydrogen Atom Part III Angular Solutions

Lecture 8 - Hydrogen Atom - Angular Solutions (Continued)

Lecture 9 - Hydrogen Atom - Angular Solutions (Continued)

Lecture 10 - Oppenheimer Approximation and Superposition

Lecture 1 - Programing Basics

Lecture 2 - Introduction to Pointers

Lecture 3 - Pointers And Arrays

Lecture 4 - External Functions and Argument Passing

Lecture 5 - Representation of Numbers

Lecture 6 - Numerical Error

Lecture 7 - Error Propagation and Stability

Lecture 8 - Polynomial Interpolation-1

Lecture 9 - Polynomial Interpolation-2

Lecture 10 - Error In Interpolation Polynomial

Lecture 11 - Polynomial Interpolation

Lecture 12 - Cubic Spline Interpolation

Lecture 13 - Data Fitting : Linear Fit

Lecture 14 - Data Fitting : Linear Fit

Lecture 15 - Data Fitting : Non Linear Fit

Lecture 16 - Matrix Elimination and Solution

Lecture 17 - Solution To Linear Equations

Lecture 18 - Matrix Elimination

Lecture 19 - Eigen Values of A Matrix

Lecture 20 - Eigen Values And Eigen Vectors

Lecture 21 - Solving NonLinear Equations

Lecture 22 - Solving NonLinear Equations Newton Raphson Method

Lecture 23 - Methods For Solving NonLinear Equations

Lecture 24 - System of NonLinear Equations

Lecture 25 - Numerical Derivations

Lecture 26 - High order Derivatives From Difference Formula

Lecture 27 - Numerical Integration - Basic Rules

Lecture 28 - Comparison of Different Basic Rules

Lecture 29 - Gaussian Rules

Lecture 30 - Comparison of Gaussian Rules

Lecture 31 - Solving Ordinary Differential Equations

[Lecture 32 - Solving ordinary differential equations](#)

[Lecture 33 - Adaptive step size Runge Kutta scheme](#)

[Lecture 34 - Partial Differential Equations](#)

[Lecture 35 - Explicit and Implicit Methods](#)

[Lecture 36 - The Crank - Nicholson Scheme For Two Spatial](#)

[Lecture 37 - Fourier Transforms](#)

[Lecture 38 - Fast Fourier Transforms](#)

Lecture 1 - Introduction to Quantum Physics;Heisenberg's uncertainty principle

Lecture 2 - Introduction to linear vector spaces

Lecture 3 - Characteristics of linear vector spaces

Lecture 4 - Functions in a linear vector space

Lecture 5 - Linear operations in a linear vector space and their eigenvalues

Lecture 6 - Classical Vs Quantum Mechanics

Lecture 7 - Quantum Physics

Lecture 8 - Quantum Physics

Lecture 9 - Quantum Physics

Lecture 10 - Quantum Physics

Lecture 11 - Quantum Physics

Lecture 12 - Quantum Physics

Lecture 13 - Quantum Physics

Lecture 14 - Quantum Physics

Lecture 15 - Quantum Physics

Lecture 16 - Quantum Physics

Lecture 17 - Quantum Physics

Lecture 18 - Quantum Physics

Lecture 19 - Quantum Physics

Lecture 20 - Quantum Physics

Lecture 21 - Quantum Physics

Lecture 22 - Quantum Physics

Lecture 23 - Quantum Physics

Lecture 24 - Quantum Physics

Lecture 25 - Quantum Physics

Lecture 26 - Quantum Physics

Lecture 27 - Quantum Physics

Lecture 28 - Quantum Physics

Lecture 29 - Quantum Physics

Lecture 30 - Quantum Physics

Lecture 31 - Quantum Physics

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : Engineering Physics I (Basic Courses (Semester 1 and 2))

Co-ordinators : Prof. Rajdeep Chatterjee, Prof. B.K. Patra, Prof. M.K. Srivastava, Prof. G.D. Verma

Lecture 1 - Introduction

Lecture 2 - Malus law & Superposition of ways

Lecture 3 - Double Refraction

Lecture 4 - Interference of polarized light

Lecture 5 - Optical Activity

Lecture 6 - Introduction

Lecture 7 - Stationary Waves & Reflection, Refraction and Diffraction

Lecture 8 - Ultrasonics

Lecture 9 - Acoustics of Buildings - Part I

Lecture 10 - Acoustics of Buildings - Part II

Lecture 11 - Interference of light Part-1

Lecture 12 - Interference of light Part-2

Lecture 13 - Interference of light Part-3

Lecture 14 - Interference by Division of Wave front

Lecture 15 - Interference by Division of Amplitude

Lecture 16 - Coherence and Application of Interference

Lecture 17 - Diffraction Part-1

Lecture 18 - Diffraction Part-2

Lecture 19 - Diffraction Part-3

Lecture 20 - Diffraction by a circular aperture

Lecture 21 - Kinetic theory of gases - Part-1

Lecture 22 - Kinetic theory of gases - Part-2

Lecture 23 - Maxwellian distribution law of velocity - Part-1

Lecture 24 - Maxwellian distribution law of velocity - Part-2

Lecture 25 - Maxwellian distribution law of velocity - Part-3

Lecture 26 - Vanderwaal's equation of states - Part-1

Lecture 27 - Vanderwaal's equation of states - Part-2

Lecture 28 - Vanderwaal's equation of states - Part-3

Lecture 29 - Fluid Mechanics - Part-1

Lecture 30 - Fluid Mechanics - Part-2

Lecture 31 - Introduction of special relativity

[Lecture 32 - Consequences of special relativity-1](#)

[Lecture 33 - Consequences of special relativity-2](#)

[Lecture 34 - Consequences of special relativity-3](#)

[Lecture 35 - Consequences of special relativity-4](#)

[Lecture 36 - Consequences of special relativity-5](#)

[Lecture 37 - Introduction](#)

[Lecture 38 - Image formation by lenses](#)

[Lecture 39 - Lens aberrations - Part I](#)

[Lecture 40 - Lens aberrations - Part II](#)

Lecture 1 - Complex Integration

Lecture 2 - Contour Integration

Lecture 3 - Cauchy's Integral Theorem

Lecture 4 - Cauchy's Integral Formula

Lecture 5 - Application of Cauchy Integral Formula

Lecture 6 - Zeros, Singularities and Poles

Lecture 7 - Residue Integration Method

Lecture 8 - Residue Theorem

Lecture 9 - Evaluation of Real Integrals

Lecture 10 - Evaluation of Real Improper Integrals-1

Lecture 11 - Evaluation of Real Improper Integrals-2

Lecture 12 - Evaluation of Real Improper Integrals-3

Lecture 13 - Evaluation of Real Improper Integrals-4

Lecture 14 - Evaluation of Real Integrals - Revision

Lecture 15 - Matrix Algebra Part - 1

Lecture 16 - Matrix Algebra Part - 2

Lecture 17 - Determinants Part - 1

Lecture 18 - Determinants Part - 2

Lecture 19 - Solution of System Equation

Lecture 20 - Linear Algebra Part - 1

Lecture 21 - Linear Algebra part - 2

Lecture 22 - Linear Algebra Part - 3

Lecture 23 - Linear Algebra Part - 4

Lecture 24 - Inner Product

Lecture 25 - Linear Transformation Part - 1

Lecture 26 - Linear Transformation Part - 2

Lecture 27 - Eigenvalues Eigenvectors Part - 1

Lecture 28 - Eigenvalues Eigenvectors Part - 2

Lecture 29 - Quadratic Forms

Lecture 30 - Diagonalization Part - 1

Lecture 31 - Diagonalization Part - 2

[Lecture 32 - Solution of System of Linear Equation](#)

[Lecture 33 - Functions of Complex Variables Part - 1](#)

[Lecture 34 - Functions of Complex Variables Part - 2](#)

[Lecture 35 - Taylor Series](#)

[Lecture 36 - Laurent Series](#)

[Lecture 37 - Rank of a Matrix](#)

[Lecture 38 - Complex Numbers Their Geometrical Representation](#)

Lecture 1 - Solution of ODE of First Order and First Degree

Lecture 2 - Linear Differential Equations of the First Order

Lecture 3 - Approximate Solution of An Initial Value

Lecture 4 - Series Solution of Homogeneous Linear I

Lecture 5 - Series Solution of Homogeneous Linear II

Lecture 6 - Bessel Functions and Their Properties

Lecture 7 - Bessel Functions And Their Properties (Continued..)

Lecture 8 - Laplace Transformation

Lecture 9 - Laplace Transformation (Continued..)

Lecture 10 - Applications Of Laplace Transformation

Lecture 11 - Applications Of Laplace Transformation (Continued..)

Lecture 12 - One Dimensional Wave Equation

Lecture 13 - One Dimensional Heat Equation

Lecture 14 - Introduction to Differential Equation

Lecture 15 - First Order Differential Equations and Their Geometric Interpretation

Lecture 16 - Differential Equations of First Order Higher Degree

Lecture 17 - Linear Differential Equation of Second Order-Part - 1

Lecture 18 - Linear Differential equation of Second Order-Part - 2

Lecture 19 - Euler-Cauchy Theorem

Lecture 20 - Higher Order Linear Differential Equations

Lecture 21 - Higher Order Non homogeneous Linear Equations

Lecture 22 - Boundary Value Problems

Lecture 23 - Sturm Liouville boundary Value Problem

Lecture 24 - Fourier Series-Part - 1

Lecture 25 - Fourier Series-Part - 2

Lecture 26 - Convergence of the Fourier Series

Lecture 27 - Fourier Integrals

Lecture 28 - Fourier Transforms

Lecture 29 - Partial Differential Equation

Lecture 30 - First Order Partial Differential Equation

Lecture 31 - Second Order Partial Differential Equations - I

[Lecture 32 - Second Order Partial Differential Equations - II](#)

[Lecture 33 - Solution of One Dimensional Wave Equation](#)

[Lecture 34 - Solution of Homogeneous Non Homogeneous Equations](#)

[Lecture 35 - Fourier Integral Transform Method for Heat Equation](#)

[Lecture 36 - Three Dimensional Laplace Equation](#)

[Lecture 37 - Solution of Dirichlet Problem](#)

[Lecture 38 - Numerical Method for Laplace Poisson equation](#)

[Lecture 39 - ADI Method for Laplace and Poisson Equation](#)

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : Concept of Management and Evolution of Management Thought (Basic Courses (Semester 1 and 2))

Co-ordinators : Prof. K.B. Akhilesh

Lecture 1 - Introduction - Concept of Management

Lecture 2 - Lecture 2

Lecture 3 - Management By Objectives

Lecture 4 - Organizing & Organization

Lecture 5 - Organizing - II

Lecture 6 - Coordinating

Lecture 7 - Communication - I

Lecture 8 - Communication - II

Lecture 9 - Leadership

Lecture 10 - Controlling

Lecture 11 - Motivation and Organization Culture

Lecture 12 - Japanese Management

Lecture 13 - Comparison of Japanese and American Management

Lecture 14 - Managerial Functions in International Business

Lecture 15 - Marketing Functions: Channels of Distribution

Lecture 16 - Management and Society

Lecture 17 - Social Responsibility and Ethics - II

Lecture 18 - Functions of Personnel Management

Lecture 19 - Manpower Planning

Lecture 20 - Selection - I

Lecture 21 - Selection - II

Lecture 22 - Performance Appraisal - I

Lecture 23 - Performance Appraisal - II

Lecture 24 - Training and Development - I

Lecture 25 - Training and Development - II

Lecture 26 - Job Design and Payment Systems - I

Lecture 27 - Job Design and Compensation Systems

Lecture 28 - Organizational Development - I

Lecture 29 - Organizational Development - II

Lecture 30 - Organization Theory - I

Lecture 31 - Organization Theory - II

[Lecture 32 - Group Dynamics - I](#)

[Lecture 33 - Group Dynamics - II](#)

[Lecture 34 - Group Dynamics - III](#)

[Lecture 35 - Conflict Management - I](#)

[Lecture 36 - Conflict Management - II](#)

[Lecture 37 - Managing Creativity and Innovation](#)

[Lecture 38 - Creativity and Managing Innovation Process - II](#)

[Lecture 39 - Stress Management - I](#)

[Lecture 40 - Stress Management - II](#)

Lecture 1 - Introduction

Lecture 2 - Graphs and functions - I

Lecture 3 - Graphs and functions - II

Lecture 4 - Functions and derivatives

Lecture 5 - Calculation of derivatives

Lecture 6 - Differentiation and its application in Biology - I

Lecture 7 - Differentiation and its application in Biology - II

Lecture 8 - Differentiation and its application in Biology - III

Lecture 9 - Differentiation and its application in Biology - IV

Lecture 10 - Integration - I

Lecture 11 - Integration - II

Lecture 12 - Differential equations - I

Lecture 13 - Differential equations - II

Lecture 14 - Vectors - I

Lecture 15 - Vectors - II

Lecture 16 - Vectors - III

Lecture 17 - Nernst equation

Lecture 18 - Diffusion - I : Diffusion equation

Lecture 19 - Diffusion - II : Mean-square displacement

Lecture 20 - Diffusion - III : Einstein's relation

Lecture 21 - Statistics : Mean and variance

Lecture 22 - Statistics : Distribution function

Lecture 23 - Understanding Normal distribution

Lecture 24 - Fitting a function to experimental data

Lecture 25 - Size of a flexible protein: Simplest model

Lecture 26 - Uniform and Poisson distributions; Knudsen's analysis

Lecture 27 - Fourier Series - I

Lecture 28 - Fourier Series - II

Lecture 29 - Fourier transform

Lecture 30 - Master equation: Polymerization dynamics, Molecular motor motion

Lecture 31 - Evolution: Simplest model

[Lecture 32 - Tutorial - I](#)

[Lecture 33 - Tutorial - II](#)

[Lecture 34 - Temperature, Energy and Entropy](#)

[Lecture 35 - Partition function, Free energy](#)

[Lecture 36 - Bending fluctuations of DNA and spring-like proteins](#)

[Lecture 37 - Force-extension and looping of DNA](#)

[Lecture 38 - Thermodynamics of protein organization along DNA](#)

[Lecture 39 - Learning mathematics with the help of a computer](#)

NPTEL : Proteomics: Principles and Techniques (Biotechnology)

Co-ordinators : Prof. Sanjeeva Srivastava

[Lecture 1](#)

[Lecture 2](#)

[Lecture 3](#)

[Lecture 4](#)

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[Lecture 40](#)

[Lecture 0 - Proteins and Gel-Based Proteomics; Course Introduction](#)

[Lecture 1 - Introduction to amino acids](#)

[Lecture 2 - Introduction to proteins](#)

[Lecture 3 - Protein folding & misfolding](#)

[Lecture 4 - Protein purification techniques](#)

[Lecture 5 - Introduction to proteomics](#)

[Lecture 6 - Systems biology and proteomics](#)

[Lecture 7 - Sample preparation and pre-analytical factors](#)

[Lecture 8 - Sample preparation: Pre-analytical factors \(Continued...\)](#)

[Lecture 9 - Sample preparation: Protein extraction and quantification](#)

[Lecture 10 - One-dimensional electrophoresis](#)

[Lecture 11 - 2-DE: Rehydration, IEF & Equilibration](#)

[Lecture 12 - 2-DE: Second dimension, staining & destaining](#)

[Lecture 13 - 2-DE: Gel analysis](#)

[Lecture 14 - 2-DE: Applications](#)

[Lecture 15 - 2-DE: Applications \(Continued...\) & Challenges](#)

[Lecture 16 - 2D-DIGE: Basics](#)

[Lecture 17 - 2D-DIGE: Data analysis](#)

[Lecture 18 - 2D-DIGE: Applications](#)

[Lecture 19 - Protein identification using MALDI-TOF/TOF](#)

[Lecture 20 - Proteomics experiment data analysis & challenges](#)

Lecture 0 - Introductory lecture

Lecture 1 - Introduction to proteomics

Lecture 2 - Proteomics and sample preparation

Lecture 3 - Bacterial protein extraction

Lecture 4 - In-gel digestion

Lecture 5 - Fundamentals of mass spectrometry

Lecture 6 - Chromatography technologies

Lecture 7 - Liquid chromatography

Lecture 8 - Mass spectrometry: Ionization sources

Lecture 9 - Mass spectrometry: Mass analyzers

Lecture 10 - MALDI sample preparation and analysis

Lecture 11 - Introduction to quantitative proteomics

Lecture 12 - Hybrid mass spectrometry configurations

Lecture 13 - SILAC: In Vivo labeling

Lecture 14 - iTRAQ: In Vitro labeling

Lecture 15 - TMT: In vitro labeling

Lecture 16 - Quantitative proteomics data analysis

Lecture 17 - Proteomics and Systems biology I

Lecture 18 - Proteomics & Systems biology II

Lecture 19 - Proteomics applications

Lecture 20 - Advances and challenges in proteomics

Lecture 1 - Introduction to Interactomics

Lecture 2 - An overview of label-free technologies

Lecture 3 - An overview of surface plasmon resonance (SPR)

Lecture 4 - An overview of surface plasmon resonance imaging (SPRi)

Lecture 5 - Basics of SPR: Surface chemistry

Lecture 6 - Basics of SPR: Experimental design

Lecture 7 - Protein immobilization for protein-protein interaction studies

Lecture 8 - Protein-protein interaction study: Binding analysis

Lecture 9 - Protein-protein interaction study: Kinetic analysis

Lecture 10 - Protein-small molecule interaction study: Immobilization and binding analysis

Lecture 11 - Protein-small molecule interaction study: Kinetic analysis

Lecture 12 - SPR: Interactive Session - I

Lecture 13 - SPR: Interactive Session - II

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- Lecture 9 - Atomic Force Microscopy (AFM)
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Co-ordinators : Prof. Sanjeeva Srivastava

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NPTEL : Animal Physiology (Biotechnology)

Co-ordinators : Prof. Mainak Das

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NPTEL : Bio electricity (Biotechnology)

Co-ordinators : Prof. Mainak Das

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Lecture 13 - On-chip cellular assay techniques - Part I

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Lecture 16 - Generation of diversity (GOD) of lymphocyte antigen receptors (Continued...)

Lecture 17 - Structural variation in immunoglobulin constant regions and isotype switching

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Lecture 15 - Reconstruction of Metabolic Networks

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Lecture 18 - Flux Variability Analysis (FVA) and Flux Coupling (FC)

Lecture 19 - Dynamic Flux Balance Analysis (DFBA) and Gene Deletion Algorithms

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NPTEL : NOC:Environmental Biotechnology (Biotechnology)

Co-ordinators : Prof. Pinaki Sar

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Lecture 10 - Data QC and Trimming

Lecture 11 - Hands-on: Setting up the system

Lecture 12 - Basic Shell Commands

Lecture 13 - Data Download and Exploration

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- Lecture 40 - DGE analysis results and visualizations
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- Lecture 43 - Functional Enrichment Analysis
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- Lecture 53 - Overlap-Layout-Consensus (OLC) approach
- Lecture 54 - de Bruijn Graph (DBG) based assembly
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- Lecture 56 - Applications of NGS in Epigenomics
- Lecture 57 - Detecting DNA Methylations
- Lecture 58 - Genome-wide Transcription Factor(TF) Binding Sites
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Lecture 7 - Patch Clamp Measurements

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Lecture 9 - Current injection: Synapses

Lecture 10 - Single Neuron Acitivity

Lecture 11 - Point and compartmental models of neurons

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- Lecture 42 - Biosynthesis of carotenoids and carotenoid cleavage products
- Lecture 43 - Metabolic engineering of carotenoid pathway
- Lecture 44 - Metabolic engineering of carotenoid pathway: Golden Rice Story
- Lecture 45 - Menthol story: Biosynthesis and pathway manipulation - I
- Lecture 46 - Menthol story: Biosynthesis and pathway manipulation - II
- Lecture 47 - Artemisinin, hyperforin and taxol - three promising candidates for biotechnological
- Lecture 48 - Phenolics: Origin via shikimate pathway
- Lecture 49 - Phenolics: Phenylpropanoids, benzenoids, coumarins, tannins
- Lecture 50 - Phenolics: Monolignols, lignins and lignans
- Lecture 51 - Phenolics: Metabolic engineering of monolignol pathways
- Lecture 52 - Phenolics: Biosynthesis of lignans and podophyllotoxin; Caffeic acid esters
- Lecture 53 - Phenolics: Flavonoids, Flavones, Isoflavonoids, Proanthocyanidins
- Lecture 54 - Phenolics: Biosynthesis of anthocyanins; Metabolic pathway engineering for enhance
- Lecture 55 - Phenolics: Metabolic engineering of anthocyanin pathways in flowers
- Lecture 56 - Phenolics: Alcohol acetyl transferses and volatile phenolics
- Lecture 57 - Phenolics: Biosynthesis of volatile benzenoids
- Lecture 58 - Phenolics: Biosynthesis of vanillin in plants
- Lecture 59 - Phenolics: Metabolic engineering for vanillin
- Lecture 60 - Phenolics: Biosynthesis of shikonin
- Lecture 61 - Phenolics: Metabolic engineering of shikonin pathway
- Lecture 62 - Molecular Pharming: Transplastomic plants
- Lecture 63 - Molecular Pharming: production of human somatotropin in tobacco

Lecture 1 - Introduction

Lecture 2 - Mass balance, Heat Balance, flow sheet

Lecture 3 - Costing

Lecture 4 - Costing (continued), Physical and chemical principles in Down stream

Lecture 5 - Problems in Mass balance, flow sheet

Lecture 6 - Cell Breakage

Lecture 7 - Cell breakage (Continued...)

Lecture 8 - Solid Liquid Separation

Lecture 9 - Solid Liquid Separation (Continued...)

Lecture 10 - Solid Liquid separation-problems

Lecture 11 - Pre-treatment and Filters

Lecture 12 - Adsorption

Lecture 13 - Adsorption

Lecture 14 - Adsorption

Lecture 15 - Adsorption

Lecture 16 - Liquid-Liquid Extraction

Lecture 17 - Liquid-Liquid Extraction

Lecture 18 - Liquid-Liquid Extraction

Lecture 19 - Liquid liquid extraction

Lecture 20 - Reversed micellar and aqueous two phase extraction

Lecture 21 - Membranes

Lecture 22 - Membranes

Lecture 23 - Membranes

Lecture 24 - Membranes

Lecture 25 - Precipitation

Lecture 26 - Chromatography

Lecture 27 - Chromatography

Lecture 28 - Chromatography

Lecture 29 - Chromatography

Lecture 30 - Chromatography

Lecture 31 - Chromatography

[Lecture 32 - Chromatography](#)

[Lecture 33 - Crystallisation](#)

[Lecture 34 - Drying](#)

[Lecture 35 - Drying and distillation](#)

[Lecture 36 - Future trends](#)

NPTEL : Thermodynamics (Biotechnology)

Co-ordinators : Prof. G.K. Suraishkumar

Lecture 1 - Introduction and Review

Lecture 2 - Need for Analysis Additional Thermodynamic Functions State and Path Variables

Lecture 3 - Equations for a Closed system Chemical Potential Concept Gibbs-Duhem Equation

Lecture 4 - Maxwell's relations

Lecture 5 - Inter-Relationships between Thermodynamic Variables

Lecture 6 - Some Useful Mathematical Manipulations

Lecture 7 - Thermodynamic Relations for a Closed System with 1 mole of a pure Substances

Lecture 8 - Maximum Work, Lost Work Review of Closed Systems

Lecture 9 - Open Systems

Lecture 10 - Equations of State - Virial Equations

Lecture 11 - Equations of State - Cubic Equations

Lecture 12 - Volume Estimation

Lecture 13 - Volume Estimation (Continued...) Generalized correlations

Lecture 14 - Generalized correlations (Continued...) Residual Properties

Lecture 15 - Residual Properties (Continued...)

Lecture 16 - Generalized Correlations and Residual Properties

Lecture 17 - Fugacity Coefficient Estimation

Lecture 18 - Review of Module 3

Lecture 19 - Learning Aspects Chemical Potential Formulations

Lecture 20 - Lewis and Randall rule partial Molar Properties

Lecture 21 - Partial Molar Property Estimation from Mixing Experiments

Lecture 22 - Partial Molar Property Estimation (Continued...) Excess Property

Lecture 23 - Activity Coefficient from Excess Property

Lecture 24 - Activity Coefficient from Excess Property (Continued...)

Lecture 25 - Activity Coefficient from Excess Property (Continued...) Models for Activity Coefficient in Binary Systems

Lecture 26 - Models for Activity Coefficient in Binary Systems (Continued...)

Lecture 27 - Review of Module 4

Lecture 28 - Criteria for Phase Equilibrium Phase Rule for Non-reacting Biosystems

Lecture 29 - Clausius - Clayperon Equation

Lecture 30 - Clausius - Clayperon Equation (Continued...) vapour-Liquid Equilibrium

Lecture 31 - Vapour-Liquid Equilibrium (Continued...) Estimation of Fugacity coefficient from Equilibrium P-V-T Data

[Lecture 32 - Liquid/Liquid and Solid/Liquid Equilibria](#)

[Lecture 33 - Review of Module 5](#)

[Lecture 34 - Criteria for Bio-reaction Equilibria](#)

[Lecture 35 - Phase rule for Reacting Biosystems Equilibrium constants](#)

[Lecture 36 - Effect of Temperature and Pressure on the Equilibrium constants](#)

[Lecture 37 - Reaction in Liquid or Solid Phases](#)

[Lecture 38 - Free energy Changes for some Bioreactions](#)

[Lecture 39 - Electrolytes](#)

[Lecture 40 - Course Review](#)

- Lecture 1 - Introduction
- Lecture 2 - Mass balance, Heat Balance, Flow sheet
- Lecture 3 - Costing
- Lecture 4 - Cell Breakage
- Lecture 5 - Solid Liquid Separation
- Lecture 6 - Pre-treatment and Filters/centrifuge
- Lecture 7 - Liquid-Liquid Extraction
- Lecture 8 - Liquid-Liquid extraction (Continued...)
- Lecture 9 - Adsorption
- Lecture 10 - Reversed micellar and aqueous two phase extraction
- Lecture 11 - Membranes
- Lecture 12 - Membranes (Continued...)
- Lecture 13 - Product stabilization, Drying, Lyophilisation
- Lecture 14 - Precipitation and crystallization
- Lecture 15 - Electrophoresis / SDS PAGE
- Lecture 16 - Chromatography
- Lecture 17 - Chromatography (Continued...1)
- Lecture 18 - Chromatography (Continued...2)
- Lecture 19 - Chromatography (Continued...3)
- Lecture 20 - Future trends, Other downstream operations/Summary of the course

Lecture 1 - Introduction

Lecture 2 - Experimental Design Strategy

Lecture 3 - Data types : Binomial distribution

Lecture 4 - Poisson Distribution

Lecture 5 - Normal Distribution

Lecture 6 - Standardized Normal Distribution / t-distribution

Lecture 7 - t-distribution/confidence interval

Lecture 8 - Statistical tests

Lecture 9 - t-Test

Lecture 10 - t-Tests

Lecture 11 - t-test

Lecture 12 - F-tests

Lecture 13 - F-tests

Lecture 14 - ANOVA

Lecture 15 - ANOVA

Lecture 16 - Anova

Lecture 17 - Anova

Lecture 18 - Anova

Lecture 19 - Anova

Lecture 20 - Anova

Lecture 21 - Normality test / Odds ratio

Lecture 22 - Chi square distribution

Lecture 23 - Chi square distribution / test

Lecture 24 - Chi square test

Lecture 25 - Chi square test and Weibull Distribution

Lecture 26 - Weibull Distribution

Lecture 27 - Weibull distribution.

Lecture 28 - Non-parametric test

Lecture 29 - Non parametric test/homogeneity of variance / beta distribution

Lecture 30 - Exponential / hypergeometric distributions

Lecture 31 - Hypergeometric / Log normal distribution

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[Lecture 33 - Factorial Design](#)

[Lecture 34 - Full factorial design](#)

[Lecture 35 - Fractional factorial design](#)

[Lecture 36 - Other designs](#)

[Lecture 37 - Second order designs](#)

[Lecture 38 - Second order design](#)

[Lecture 39 - Regression analysis](#)

[Lecture 40 - Control charts](#)

Lecture 1 - Introduction

Lecture 2 - Sterilization

Lecture 3 - Solution to PP 1.1

Lecture 4 - Some important concepts

Lecture 5 - Enzyme bioreactors, enzyme kinetics

Lecture 6 - Solution to PP 2.1

Lecture 7 - Inhibited enzyme kinetics

Lecture 8 - Solution to PP 2.2

Lecture 9 - Measurement principles and methods

Lecture 10 - Batch growth kinetics

Lecture 11 - Solution to PP 3.1

Lecture 12 - Bioreactor analysis: chemostat and fed-batch

Lecture 13 - Solution to PP 3.2

Lecture 14 - Bioreactor environment parameters

Lecture 15 - Bioreactor env. par. (DO)

Lecture 16 - Solution to PP 4.1

Lecture 17 - Shear stress, scale-up, scale-down

Lecture 18 - Cell view: stoichiometry; degree of reductance

Lecture 19 - Solution to PP 5.1

Lecture 20 - Culture status, metabolic flux analysis

Lecture 21 - Course summary

- Lecture 1 - Introduction to Biomaterials
- Lecture 2 - Background history
- Lecture 3 - History
- Lecture 4 - Properties - Mechanical and Physico-chemical
- Lecture 5 - Properties - Mechanical and Physico-chemical
- Lecture 6 - Mechanical properties
- Lecture 7 - Mechanical Properties (Continued...)
- Lecture 8 - Resorbability, biodegradation
- Lecture 9 - Resorbability, biodegradation (Continued...)
- Lecture 10 - Biofilm
- Lecture 11 - Biofilm (Continued...)
- Lecture 12 - Biofilm (Continued...)
- Lecture 13 - Biofilm (Continued...)
- Lecture 14 - Material characterization - Analytical instruments
- Lecture 15 - Analytical instruments
- Lecture 16 - Analytical instruments (Continued...)
- Lecture 17 - Analytical instruments (Continued...)
- Lecture 18 - Biological responses, compatibility, cytotoxicity
- Lecture 19 - Biological Responses
- Lecture 20 - Cell-biomaterial interaction
- Lecture 21 - Animal trials (in vivo)
- Lecture 22 - Animal trials
- Lecture 23 - Metals-types, classifications, applications
- Lecture 24 - Metals - properties
- Lecture 25 - Metals - properties (Continued...)
- Lecture 26 - Metals - properties (Continued...)
- Lecture 27 - Metals
- Lecture 28 - Polymers-types, classifications, applications
- Lecture 29 - Polymers
- Lecture 30 - Polymers (Continued...)
- Lecture 31 - Polymer blends

[Lecture 32 - Natural biopolymers](#)

[Lecture 33 - Natural biopolymers - \(Continued...\)](#)

[Lecture 34 - Biopolymers- proteins / hydrogels](#)

[Lecture 35 - Hydrogels](#)

[Lecture 36 - Experiments](#)

[Lecture 37 - surface modification-Demonstration](#)

[Lecture 38 - Ceramics](#)

[Lecture 39 - Cardiovascular and ocular biomaterials](#)

[Lecture 40 - Sterilisation/Device failure](#)

Lecture 1 - Concepts and importance of Bioinformatics

Lecture 2 - Complexities in biological systems

Lecture 3 - DNA sequence analysis

Lecture 4 - Sequence based parameters

Lecture 5 - Database

Lecture 6 - Database categories

Lecture 7 - Protein structure and function - I

Lecture 8 - Protein structure and function - II

Lecture 9 - Protein sequence databases - I

Lecture 10 - Protein sequence databases - II

Lecture 11 - Pairwise alignment - I

Lecture 12 - Pairwise alignment - II

Lecture 13 - Uniprot Demo

Lecture 14 - Sequence alignment - I

Lecture 15 - Sequence alignment - II

Lecture 16 - Sequence alignment: Online resources - I

Lecture 17 - Sequence alignment: Online resources - II

Lecture 18 - Conservation score - I

Lecture 19 - Conservation score - II

Lecture 20 - Blast Demo

Lecture 21 - Phylogenetic trees - I

Lecture 22 - Phylogenetic trees - II

Lecture 23 - Protein sequence analysis - I

Lecture 24 - Protein sequence analysis - II

Lecture 25 - Hydrophobicity profiles

Lecture 26 - Patterns and PSSM profiles

Lecture 27 - Construction of Non-redundant datasets - I

Lecture 28 - Non-redundant datasets - II

Lecture 29 - Protein secondary structure

Lecture 30 - Secondary structure prediction - I

Lecture 31 - Secondary structure prediction - II

[Lecture 32 - Secondary structure prediction - III](#)

[Lecture 33 - Protein tertiary structure - I](#)

[Lecture 34 - Protein tertiary structure - II](#)

[Lecture 35 - Protein structure analysis - I](#)

[Lecture 36 - Protein structure analysis - II](#)

[Lecture 37 - Protein structure analysis - III](#)

[Lecture 38 - Demo: PDB or Pymol or PDBParam](#)

[Lecture 39 - Protein structure analysis - IV](#)

[Lecture 40 - Protein structure prediction - I](#)

[Lecture 41 - Protein structure prediction - II](#)

[Lecture 42 - Protein stability - I](#)

[Lecture 43 - Protein stability - II](#)

[Lecture 44 - Demo: Homology Modelling](#)

[Lecture 45 - Stabilizing residues](#)

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[Lecture 47 - Stability of proteins upon mutations - I](#)

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[Lecture 49 - Demo: ProTherm](#)

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[Lecture 52 - Protein interactions - I](#)

[Lecture 53 - Protein interactions - II](#)

[Lecture 54 - Computer aided drug design - I](#)

[Lecture 55 - Computer aided drug design - II](#)

[Lecture 56 - Virtual screening - I](#)

[Lecture 57 - Virtual screening - II](#)

[Lecture 58 - QSAR - I](#)

[Lecture 59 - QSAR - II](#)

[Lecture 60 - Demo: Autodock](#)

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[Lecture 62 - awk programming - II](#)

[Lecture 63 - Development of algorithms - I](#)

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[Lecture 65 - Applications of bioinformatics - I](#)

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[Lecture 67 - Overview - I](#)

[Lecture 68 - Overview - II](#)

[Lecture 69 - Demo: Weka](#)

NPTEL : NOC:Demystifying the Brain (Biotechnology)

Co-ordinators : Dr. V Srinivasa Chakravarthy

- Lecture 1 - The Whole and Its Parts: A History of Ideas about Brain
- Lecture 2 - Understanding Brain's Shape - Segment 1 - Brain size and intelligence
- Lecture 3 - Understanding Brain's Shape - Segment 2 - Save Wire Principle
- Lecture 4 - Understanding Brain's Shape - Segment 3 - Brain Evolution
- Lecture 5 - Neurons and Neural Signaling: Outline
- Lecture 6 - Neural Signalling : Molecular and Cellular Basis
- Lecture 7 - Networks that Learn - Segment 1
- Lecture 8 - Multilayer Perceptrons Applications in Psychology and Neuroscience
- Lecture 9 - Organization of the Central Nervous System-Segment 1 - Cortex
- Lecture 10 - Organization of the Central Nervous System-Segment 2 - Subcortical Structures
- Lecture 11 - Maps in the Brain - Segment 1
- Lecture 12 - Maps in the Brain - Segment 2
- Lecture 13 - Emotions in the Brain - Segment 1
- Lecture 14 - Emotions in the Brain - Segment 2
- Lecture 15 - Memories and Holograms - Segment 1
- Lecture 16 - Memories and Holograms - Segment 2
- Lecture 17 - Consciousness - Segment 1
- Lecture 18 - Consciousness - Segment 2

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[Lecture 4 - Fundamentals of Mathematical Modelling](#)

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[Lecture 10 - Lab: MATLAB Basics](#)

[Lecture 11 - Lab: MATLAB Basics](#)

[Lecture 12 - Lab: MATLAB Basics](#)

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[Lecture 15 - Introduction to Network Biology](#)

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[Lecture 21 - Biological Networks](#)

[Lecture 22 - Network Perturbations](#)

[Lecture 23 - Community Detection](#)

[Lecture 24 - Network Motifs](#)

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[Lecture 26 - Lab: Cytoscape](#)

[Lecture 27 - Lab: Network Biology](#)

[Lecture 28 - Network Biology: Recap](#)

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[Lecture 36 - Introduction to Dynamic Modelling](#)

[Lecture 37 - Introduction to Dynamic Modelling](#)

[Lecture 38 - Lab: Solving ODEs in MATLAB](#)

[Lecture 39 - Lab: Example Biological Model](#)

[Lecture 40 - Parameter Estimation](#)

[Lecture 41 - Parameter Estimation](#)

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[Lecture 44 - Direct Search Methods](#)

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[Lecture 46 - Genetic Algorithms](#)

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[Lecture 96 - Robustness in Biological Systems: Trade-offs](#)

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Lecture 2 - Process Parameters and Variables

Lecture 3 - Fundamentals of Material Balances

Lecture 4 - Material Balance Calculations for Single Units Without Reactions - Part 1

Lecture 5 - Material Balance Calculations for Single Units Without Reactions - Part 2

Lecture 6 - Material Balance Calculations for Single Units Without Reactions - Part 3

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Lecture 8 - Material Balance Calculations for Multiple Units Without Reactions - Part 1

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Lecture 10 - Fundamentals of Reactive Processes

Lecture 11 - Material Balance Calculations For Single Units With A Single Reaction

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Lecture 13 - Material Balance Calculations for Single Units with Multiple Reactions - Part 1

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Lecture 18 - Material Balances on Reactive Processes - Tutorials

Lecture 19 - Combustion Reactions: An Introduction

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Lecture 21 - Biochemical Reactions: Enzyme Kinetics

Lecture 22 - Biochemical Reactions: Cell Growth

Lecture 23 - Recycle Without Reactions

Lecture 24 - Recycle with Reactions

Lecture 25 - Recycle: Tutorials

Lecture 26 - Bypass

Lecture 27 - Purge

Lecture 28 - Material Balance: A Review - Part 1

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[Lecture 43 - Energy Balances on Single-Phase Nonreactive Processes](#)

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[Lecture 46 - Estimating Latent Heats](#)

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Lecture 2 - Drug Discovery - Issues

Lecture 3 - Target and Lead Identification

Lecture 4 - Drug And Data bases

Lecture 5 - Drug Properties

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Lecture 7 - Drug Solubility

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Lecture 13 - Pgp efflux/Drug Likeness

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Lecture 15 - Molecular Modelling

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Lecture 21 - ODES and Numerical methods

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- Lecture 1 - Introduction to plant cell technology
- Lecture 2 - History of plant cell and tissue culture
- Lecture 3 - Anatomy of plant cells
- Lecture 4 - Plant tissues and functions
- Lecture 5 - Photosynthesis and Photorespiration
- Lecture 6 - In-vitro culture initiation
- Lecture 7 - Nutritional requirements of plant cells
- Lecture 8 - Organogenesis and Regeneration
- Lecture 9 - Somaclonal variation and Micropropagation
- Lecture 10 - Somatic embryogenesis and Protoplast culture
- Lecture 11 - Synthetic seeds, Cryopreservation and Freezing methods
- Lecture 12 - Secondary metabolism in plant cells - Part 1
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- Lecture 16 - Optimization strategies - Part 1
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- Lecture 20 - Biotransformation in plant cultures
- Lecture 21 - Immobilization of plant cells
- Lecture 22 - Genetic transformations in plant cells - Part 1
- Lecture 23 - Genetic transformations in plant cells - Part 2
- Lecture 24 - Genetic transformations in plant cells - Part 3
- Lecture 25 - Plant Cell Bioreactors - Part 1
- Lecture 26 - Plant Cell Bioreactors - Part 2
- Lecture 27 - Bioreactors for Hairy Root cultures
- Lecture 28 - Case study - Part 1
- Lecture 29 - Case study - Part 2

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Lecture 28 - snRNA, rRNA, miRNA, siRNA Processing, Export and Function: Introns and Link to Splicing

Lecture 29 - snRNA, rRNA, miRNA, siRNA Processing, Export and Function: RNA Helicases

Lecture 30 - snRNA, rRNA, miRNA, siRNA Processing, Export and Function: Nucleo Cytoplasmic Transport

Lecture 31 - snRNA, rRNA, miRNA, siRNA Processing, Export and Function: Nucleoporins and miRNAs

- Lecture 32 - snRNA, rRNA, miRNA, siRNA Processing, Export and Function: RNA Export Mechanisms
- Lecture 33 - snRNA, rRNA, miRNA, siRNA Processing, Export and Function: RNA Quality Control
- Lecture 34 - Mechanisms of RNA Decay and Non Coding RNAs: Decay Pathways
- Lecture 35 - Mechanisms of RNA Decay and Non Coding RNAs: The Exosomes
- Lecture 36 - Mechanisms of RNA Decay and Non Coding RNAs: mRNA Surveillance
- Lecture 37 - Mechanisms of RNA Decay and Non Coding RNAs: Mechanisms of RNA Decay
- Lecture 38 - Mechanisms of RNA Decay and Non Coding RNAs: Autoregulation of RNAs
- Lecture 39 - Mechanisms of RNA Decay and Non Coding RNAs: Introduction to Non-Coding RNAs
- Lecture 40 - Dosage Compensation and X-Inactivation: SRP and Different Modes of Compensation
- Lecture 41 - Dosage Compensation and X-Inactivation: Dosage Compensation of X
- Lecture 42 - Dosage Compensation and X-Inactivation: Omprinted vs Random X Inactivation
- Lecture 43 - Dosage Compensation and X-Inactivation: Molecular Basis of X-Inactivation
- Lecture 44 - Dosage Compensation and X-Inactivation: ES Cells and X-Inactivation
- Lecture 45 - Dosage Compensation, Xist and ncRNA in Imprinting: The Roles of YY1
- Lecture 46 - Dosage Compensation, Xist and ncRNA in Imprinting: shRNAs and Gene Expression
- Lecture 47 - Dosage Compensation, Xist and ncRNA in Imprinting: Mechanism of RNAi in Action
- Lecture 48 - Dosage Compensation, Xist and ncRNA in Imprinting: Genomic Imprinting in Action
- Lecture 49 - Dosage Compensation, Xist and ncRNA in Imprinting: Different ncRNAs and their Roles
- Lecture 50 - Dosage Compensation, Xist and ncRNA in Imprinting: lncRNA-Induced Cancer
- Lecture 51 - Dosage Compensation, Xist and ncRNA in Imprinting: Xist and Cancer
- Lecture 52 - Telomere, Telomerase and Impact on Genomes: The Importance of Telomeres
- Lecture 53 - Telomere, Telomerase and Impact on Genomes: Telomerase and Aging
- Lecture 54 - Telomere, Telomerase and Impact on Genomes: Telomere Length as Marker of Aging
- Lecture 55 - Telomere, Telomerase and Impact on Genomes: Telomeres and Cancer
- Lecture 56 - Telomere, Telomerase and Impact on Genomes: Cell Cycle Arrest
- Lecture 57 - Telomere, Telomerase and Impact on Genomes: Maintenance and Manipulation of Telomeres
- Lecture 58 - Epitranscriptome and Protein Synthesis: Important RNA Modifications
- Lecture 59 - Epitranscriptome and Protein Synthesis: Readers, Writes and Erasers
- Lecture 60 - Epitranscriptome and Protein Synthesis: Biological Implications of RNA Modifications
- Lecture 61 - Epitranscriptome and Protein Synthesis: Roles of RNAs in Translation
- Lecture 62 - Epitranscriptome and Protein Synthesis: Mechanism of Translation

Lecture 1 - Introduction to forces - Resolving forces, principle of transmissibility

Lecture 2 - Statics FBD and EOE

Lecture 3 - Example problems on FBD and EOE

Lecture 4 - Joints in human body

Lecture 5 - Machines and mechanical advantage

Lecture 6 - Levers and types of levers

Lecture 7 - Insertion point and torque

Lecture 8 - Practice problem - 1

Lecture 9 - Practice problem - 2

Lecture 10 - Key terminologies

Lecture 11 - Anatomical planes and axis

Lecture 12 - Sagittal plane movements

Lecture 13 - Coronal plane movements

Lecture 14 - Transverse plane movements

Lecture 15 - Muscles - Muscle fascicles

Lecture 16 - Muscle fibers- Pennation angle

Lecture 17 - More on pennation angle

Lecture 18 - Excitation contraction coupling

Lecture 19 - Sliding filament theory

Lecture 20 - Force length relationship

Lecture 21 - Shoulder joints and muscles

Lecture 22 - Shoulder problem - 1

Lecture 23 - Shoulder problem - 2

Lecture 24 - Elbow theory

Lecture 25 - Elbow problem - 1

Lecture 26 - Elbow problem - 2

Lecture 27 - Elbow problem - 3

Lecture 28 - Wrist theory

Lecture 29 - Finger theory

Lecture 30 - Finger muscles

Lecture 31 - Spine anatomy and movements

- Lecture 32 - Spine muscles
- Lecture 33 - Spine problem
- Lecture 34 - Hip anatomy and movements
- Lecture 35 - Hip muscles
- Lecture 36 - Hip problem
- Lecture 37 - Knee anatomy and movements
- Lecture 38 - Knee muscles
- Lecture 39 - Knee problem
- Lecture 40 - Ankle anatomy and movements
- Lecture 41 - Ankle muscles
- Lecture 42 - Ankle problem
- Lecture 43 - Grasping- reaching- chains
- Lecture 44 - D.O.F mobility, open/closed chain
- Lecture 45 - Forward kinematics and workspace
- Lecture 46 - 2R inverse kinematics
- Lecture 47 - 3R kinematics forward and inverse
- Lecture 48 - D-H parameters
- Lecture 49 - Velocity and jacobian
- Lecture 50 - 3R velocity
- Lecture 51 - Tissues and types of tissues
- Lecture 52 - Bone microstructure and cells
- Lecture 53 - Properties of bones
- Lecture 54 - Wolffs Law and Hookean behavior
- Lecture 55 - Elastic properties and stress strain relations
- Lecture 56 - Stress strain curve and mechanical properties of biological materials
- Lecture 57 - Bending of Bones
- Lecture 58 - Viscoelastic modelling
- Lecture 59 - Maxwell Model
- Lecture 60 - Voight Model
- Lecture 61 - Kelvin model
- Lecture 62 - Viscoelasticity in bones
- Lecture 63 - Tissues and its constituents
- Lecture 64 - Cartilages, ligaments and tendons

Lecture 65 - Stress strain relations in tendons

Lecture 66 - Tendon forces and factors affecting tendon property

Lecture 67 - Gliding resistance, tendon wrapping and friction forces

Lecture 68 - Enslaving - Intertendinous force transfer and motor units

Lecture 69 - Introduction to enslavement

Lecture 70 - Enslaving effects in finger force production - 1

Lecture 71 - Enslaving effects in finger force production - 2

Lecture 72 - Wrist posture and finger interdependence - 1

Lecture 73 - Wrist posture and finger interdependence - 2

Lecture 74 - Wrist posture and finger interdependence - 3

Lecture 75 - Measurement of orientation in 3D space - Devices

Lecture 76 - Rotation matrices in 2D and 3D

Lecture 77 - Animating using rotation matrices- Matlab Examples

Lecture 78 - Composite rotation matrix and relative orientations

Lecture 79 - Complex numbers and quaternions

Lecture 80 - Singularity, Gimbal Lock, Advantages and disadvantages of parameterization methods

Lecture 81 - Single finger kinematics measurement using IMU's

Lecture 82 - IMU based Full hand kinematics measurement system (HKMS)

Lecture 83 - Demonstration of the Hand Kinematics Measurement System (HKMS)

Lecture 84 - Introduction to Gait and running

NPTEL : Introduction to Synthetic Biology (Biotechnology)

Co-ordinators : Prof. Karthik Raman

Lecture 1 - Introduction to Synthetic Biology - Day 1 Part 1

Lecture 2 - Introduction to Synthetic Biology - Day 1 Part 2

Lecture 3 - Introduction to Synthetic Biology - Day 1 Part 3

Lecture 4 - Introduction to Synthetic Biology - Day 1 Part 4

Lecture 5 - Introduction to Synthetic Biology - Day 2 Part 1

Lecture 6 - Introduction to Synthetic Biology - Day 2 Part 2

Lecture 7 - Introduction to Synthetic Biology - Day 2 Part 3

Lecture 8 - Introduction to Synthetic Biology - Day 2 Part 4

Lecture 9 - Introduction to Synthetic Biology - Day 3 Part 1

Lecture 10 - Introduction to Synthetic Biology - Day 3 Part 2

Lecture 11 - Introduction to Synthetic Biology - Day 3 Part 3

Lecture 12 - Introduction to Synthetic Biology - Day 3 Part 4

Lecture 13 - Introduction to Synthetic Biology - Day 4 Part 1

Lecture 14 - Introduction to Synthetic Biology - Day 4 Part 2

Lecture 15 - Introduction to Synthetic Biology - Day 4 Part 3

Lecture 16 - Introduction to Synthetic Biology - Day 5 Part 1

Lecture 17 - Introduction to Synthetic Biology - Day 5 Part 2

Lecture 18 - Introduction to Synthetic Biology - Day 5 Part 3

Lecture 19 - Introduction to Synthetic Biology - Day 5 Part 4

Lecture 20 - Introduction to Synthetic Biology - Day 6 Part 1

Lecture 21 - Introduction to Synthetic Biology - Day 6 Part 2

Lecture 22 - Introduction to Synthetic Biology - Day 6 Part 3

Lecture 23 - Introduction to Synthetic Biology - Day 7 Part 1

Lecture 24 - Introduction to Synthetic Biology - Day 7 Part 2

Lecture 25 - Introduction to Synthetic Biology - Day 7 Part 3

Lecture 26 - Introduction to Synthetic Biology - Day 8 Part 1

Lecture 27 - Introduction to Synthetic Biology - Day 8 Part 2

Lecture 28 - Introduction to Synthetic Biology - Day 9 Part 1

Lecture 29 - Introduction to Synthetic Biology - Day 9 Part 2

Lecture 30 - Introduction to Synthetic Biology - Day 9 Part 3

Lecture 31 - Introduction to Synthetic Biology - Day 10 Part 1

[Lecture 32 - Introduction to Synthetic Biology - Day 10 Part 2](#)

[Lecture 33 - Introduction to Synthetic Biology - Day 10 Part 3](#)

Lecture 1 - Introduction to Different OMICS Approaches and their Applications

Lecture 2 - Genetic Information in Prokaryotic

Lecture 3 - Databases and Web Resources to Store and Access the Biological Data

Lecture 4 - First and Second Generation Sequencing Technologies

Lecture 5 - Long Read Sequencing and Linked Read Sequencing - Part 1

Lecture 6 - Long Read Sequencing and Linked Read Sequencing - Part 2

Lecture 7 - Sequence Formats and Databases for Genomic Analysis

Lecture 8 - Introduction to Linux

Lecture 9 - File Handling and Remote Connectivity in Linux

Lecture 10 - Running Linux Commands and Installation of Genomic Packages

Lecture 11 - Introduction to R and Applications in Genomic Analysis

Lecture 12 - Publicly Available Tools and Need for Workstations for Genomic Analysis

Lecture 13 - Overview of Genomic and Transcriptomic Analysis

Lecture 14 - Genomic and Transcriptomic Analysis of an Organism with Case Studies

Lecture 15 - How to Collect and Confirm Sample of the Species to be Sequenced and Transcriptome Sequencing Approaches

Lecture 16 - Estimating the Amount of Sequencing Coverage for a Genome and Hybrid Sequencing Approaches

Lecture 17 - Types of Reads, Quality Filtering, Estimating the Genome Complexity and Heterozygosity

Lecture 18 - Genome Assembly and its Completion Status, Assembly Algorithms

Lecture 19 - Commonly Used Assembly Tools

Lecture 20 - Linked-Read Sequencing and Processing

Lecture 21 - Long Reads Analysis and Assembly Workflow

Lecture 22 - De novo Assembly Using Genomic and Transcriptomic Reads

Lecture 23 - Merging Assemblies to Create Hybrid Assembly and Determining the Quality of Assembly

Lecture 24 - Chromosomal Level Assembly and Case Studies

Lecture 25 - Identification and Annotation of Repeats in Genomes

Lecture 26 - De novo Transcriptome Assembly and Making the Coding Gene Set

Lecture 27 - Prediction of tRNA, rRNA and miRNA in a Genome

Lecture 28 - Functional Annotation and Identification of Metabolic Pathways in a Genome

Lecture 29 - Comprehensive Functional Annotation of Predicted Genes in a Genome

Lecture 30 - Functional Annotation of Predicted Genes by Alternate Methods

Lecture 31 - Methods and Steps to Perform the Evolutionary Analysis of a Genome

[Lecture 32 - Methods for Taxonomic Classification and Phylogeny Econstruction and Analysis](#)

[Lecture 33 - Epigenetics, ChIp-seq, Transcriptome and Microarrays for Regulation of Expression](#)

[Lecture 34 - Single Cell Genomics, 10X Chromium Linked-reads and Illumina Sequencing, Single Cell Gene Expression](#)

[Lecture 35 - Application of Multiomics Approaches in Human Health and Diseases Such as Cancer, Diabetes, etc.](#)

[Lecture 36 - Prokaryotic Genome Sequencing and Assembly Approaches](#)

[Lecture 37 - Gene Prediction Approaches and Common Methods for Bacterial Gene Prediction](#)

[Lecture 38 - Common Methods for Annotation of a Bacterial Genome, t-RNA, rRNA, Operon Prediction and Annotation](#)

[Lecture 39 - Phylogenetic Analysis of Bacterial Genomes](#)

[Lecture 40 - Metabolic and Comparative Analysis](#)

[Lecture 41 - Microbiome and Metagenome, Human, Organismal and Environmental Microbiomes](#)

[Lecture 42 - Sequencing and Assembly of Metagenomes, Gene Prediction, Annotation, MAGs - Part 1](#)

[Lecture 43 - Sequencing and Assembly of Metagenomes, Gene Prediction, Annotation, MAGs - Part 2](#)

[Lecture 44 - Taxonomic Analysis Using Amplicon Sequence Variants, Statistical Analysis](#)

Lecture 1 - Introduction to Homeostasis

Lecture 2 - Mechanisms of Homeostasis - Part 1

Lecture 3 - Mechanisms of Homeostasis - Part 2

Lecture 4 - Physiology of muscle - Part 1

Lecture 5 - Physiology of muscle - Part 2

Lecture 6 - Molecular Mechanism of muscle contractility - Part 1

Lecture 7 - Molecular Mechanism of muscle contractility - Part 2

Lecture 8 - How does the heart muscle work? - Part 1

Lecture 9 - How does the heart muscle work? - Part 2

Lecture 10 - Cardiac system : From stimuli to rhythmic muscle contraction - Part 1

Lecture 11 - Cardiac system : From stimuli to rhythmic muscle contraction - Part 2

Lecture 12 - Cardiac system : From stimuli to rhythmic muscle contraction - Part 3

Lecture 13 - Cardiac system : From stimuli to rhythmic muscle contraction - Part 4

Lecture 14 - Rhythmicity of heart beat - Part 1

Lecture 15 - Rhythmicity of heart beat - Part 2

Lecture 16 - Hemodynamics

Lecture 17 - Hemodynamics and Regulation - Part 1

Lecture 18 - Hemodynamics and Regulation - Part 2

Lecture 19 - Hemodynamics and Regulation - Part 3

Lecture 20 - Hemodynamics and Regulation - Part 4

Lecture 21 - Hemodynamics and Regulation - Part 5

Lecture 22 - Hemodynamics and Regulation - Part 6

Lecture 23 - Lymphatic system

Lecture 24 - Excretory system : Kidney - Part 1

Lecture 25 - Excretory system : Kidney - Part 2

Lecture 26 - Excretory system : Kidney - Part 3

Lecture 27 - Kidney and RBC production

Lecture 28 - Excretory system : Nephron - Part 1

Lecture 29 - Excretory system : Nephron - Part 2

Lecture 30 - Excretory system : Nephron - Part 2.1

Lecture 31 - Excretory system : Nephron - Part 3

[Lecture 32 - Excretory system : Regulation of Osmolarity and counter-current mechanism - Part 1](#)

[Lecture 33 - Excretory system : Regulation of Osmolarity and counter-current mechanism - Part 2](#)

[Lecture 34 - Excretory system : Regulation of Osmolarity and counter-current mechanism - Part 3](#)

[Lecture 35 - Physiology and Introduction of Respiration - Part 1](#)

[Lecture 36 - Physiology and Introduction of Respiration - Part 2](#)

[Lecture 37 - Respiration - Part 1](#)

[Lecture 38 - Respiration - Part 2](#)

[Lecture 39 - Respiration - Part 3](#)

[Lecture 40 - Respiration - Part 4](#)

[Lecture 41 - Physiology of smooth muscles and digestive system - Part 1](#)

[Lecture 42 - Physiology of smooth muscles and digestive system - Part 2](#)

[Lecture 43 - Physiology of smooth muscles and digestive system - Part 3](#)

[Lecture 44 - Physiology of smooth muscles and digestive system - Part 4](#)

[Lecture 45 - Secretory functions of alimentary tract - Part 1](#)

[Lecture 46 - Secretory functions of alimentary tract - Part 2](#)

[Lecture 47 - Secretory functions of alimentary tract and Pancreas - Part 1](#)

[Lecture 48 - Secretory functions of alimentary tract and Pancreas - Part 2](#)

[Lecture 49 - Secretory functions of Pancreas and liver](#)

[Lecture 50 - Secretory functions of Liver and Gallbladder](#)

[Lecture 51 - Introduction to Endocrine system](#)

[Lecture 52 - Pituitary gland and growth hormone secretion - Part 1](#)

[Lecture 53 - Pituitary gland and growth hormone secretion - Part 2](#)

[Lecture 54 - Thyroid gland - Part 1](#)

[Lecture 55 - Thyroid gland - Part 2](#)

[Lecture 56 - Hormones of adrenal cortex - Part 1](#)

[Lecture 57 - Hormones of adrenal cortex - Part 2](#)

[Lecture 58 - Physiology of Glucocorticoids - Part 1](#)

[Lecture 59 - Physiology of Glucocorticoids - Part 2](#)

[Lecture 60 - Course Summary](#)

Lecture 1 - What is Biology ?

Lecture 2 - Pillars of Biology

Lecture 3 - Biology and the City

Lecture 4 - The Process of Science

Lecture 5 - A Tale of Forgotten Scientists - Part I

Lecture 6 - A Tale of Forgotten Scientists - Part II

Lecture 7 - Numbers and Scales in Biology - Part I

Lecture 8 - Numbers and Scales in Biology - Part II

Lecture 9 - Experimentation vs Theory_Discussion

Lecture 10 - How to Find Reliable Information ?

Lecture 11 - How to Read a Scientific Article ?

Lecture 12 - Biomolecules - Part I

Lecture 13 - Biomolecules - Part II

Lecture 14 - Central Dogma

Lecture 15 - Gene Regulation

Lecture 16 - Non-Coding RNA

Lecture 17 - Introduction to Cells

Lecture 18 - Our Favourite Cells - Part I

Lecture 19 - Our Favourite Cells - Part II

Lecture 20 - Cell Cycle

Lecture 21 - Cell Cycle Control

Lecture 22 - Cancer Biology (Guest Lecture) - Dr. Ramray Bhat (IISc)

Lecture 23 - Discussion on Cancer Biology - Dr. Ramray Bhat (IISc) and Dr. Divya Uma (Azim Premji University)

Lecture 24 - Genetics - I

Lecture 25 - Genetics - II

Lecture 26 - Genetics - III

Lecture 27 - Gene Mutations and Genetic Disorders (Guest Lecture) Dr. Antara Das, Azim Premji University

Lecture 28 - Studying Human Genetic Disorders using Transgenic Animals - Research talk (Guest Lecture)

Lecture 29 - Bead Microscopy (Guest Lecture) Dr. Procheta Mallik (ISPF and ThinkTac)

Lecture 30 - Molecular Biology Techniques

Lecture 31 - Bacterial DNA Isolation and PCR - Hands-on (Guest Lecture) Dr. Beena DB (Azim Premji University)

[Lecture 32 - BT Cotton - Part 1 \(Case study\)](#)

[Lecture 33 - Molecular Biology Techniques - BT Cotton - Part 2 \(Case study\)](#)

[Lecture 34 - Introduction to Evolution](#)

[Lecture 35 - Evidences of Evolution](#)

[Lecture 36 - Mechanism of Evolution](#)

[Lecture 37 - Misconceptions about Evolution - Discussion](#)

[Lecture 38 - Human Evolution](#)

[Lecture 39 - Species, Speciation and Biodiversity - I](#)

[Lecture 40 - Species, Speciation and Biodiversity - II](#)

[Lecture 41 - Measuring Biodiversity \(Tutorial\)](#)

[Lecture 42 - Speciation](#)

[Lecture 43 - Speciation \(Case studies\)](#)

[Lecture 44 - Introduction to Ecological Interactions - Part 1](#)

[Lecture 45 - Ecological Interactions - Part 2](#)

[Lecture 46 - Ecological Interactions - Part 3](#)

[Lecture 47 - Mutualism - Figs \(Case Study\)](#)

[Lecture 48 - Seed Dispersal \(Case study\)](#)

[Lecture 49 - Introduction to Public Health \(Guest Lecture\) Dr.Abha Rao \(Public Health Foundation of India\)](#)

[Lecture 50 - Public Health in India \(Guest Lecture\) Dr. Abha Rao \(Public Health Foundation of India\)](#)

[Lecture 51 - Discussion on Public Health - Dr. Abha Rao \(PHFI\) and Mr. Pratush Brahma \(University of Florida\)](#)

[Lecture 52 - Public Health - Rotavirus \(Case study\)](#)

[Lecture 53 - Public Health - Malaria \(Case study\) - Part 1](#)

[Lecture 54 - Public Health - Malaria \(Case study\) - Part 2](#)

[Lecture 55 - Biology and Climate Change - Part 1](#)

[Lecture 56 - Biology and Climate Change - Part 2](#)

[Lecture 57 - Biology and Climate Change - Part 3](#)

[Lecture 58 - Biodiversity Conservation \(Guest Lecture\) Dr. Krishnapriya Tamma \(Azim Premji University\)](#)

[Lecture 59 - Discussion on Biology and Society](#)

[Lecture 60 - Discussion on Art and Science](#)

[Lecture 61 - Biology and Society - Case study on Stray Dogs](#)

[Lecture 62 - Nature Relatedness](#)

[Lecture 63 - Course Wrap-Up](#)

- Lecture 1 - History of Neuroscience : Introduction - Part 1
- Lecture 2 - History of Neuroscience : Introduction - Part 2
- Lecture 3 - Factors that produce discoveries
- Lecture 4 - Importance of the 1950s in Neuroscience
- Lecture 5 - Advances in Molecular Biology (Genes to DNA)
- Lecture 6 - Discovery of the structure of the DNA
- Lecture 7 - How DNA works
- Lecture 8 - Molecular biology of the human brain
- Lecture 9 - Signaling molecule: The First growth Factor
- Lecture 10 - Nerve Growth Factor
- Lecture 11 - Organizing the Connections
- Lecture 12 - Axonal Transport
- Lecture 13 - Signaling molecules: The First Neurotransmitter in the brain
- Lecture 14 - The concept of Lock and Key
- Lecture 15 - The Soup vs Sparks Debate
- Lecture 16 - Intracellular Electrode, Neurotransmitter in the Brain, Dales Law
- Lecture 17 - Early evidence of Acetylcholine and Glutamate
- Lecture 18 - Early evidence of GABA and Serotonin
- Lecture 19 - Catecholamine and Hormones
- Lecture 20 - Second messengers and Hormones
- Lecture 21 - Pheromones
- Lecture 22 - Revolution in Cytology
- Lecture 23 - Synapse and the 'Neuronism vs Reticularism' debate
- Lecture 24 - Contributions by Rene Couteaux and George Koelle
- Lecture 25 - Chemical Synapse
- Lecture 26 - Synapse and the Neuromuscular Junction
- Lecture 27 - The Electrical Synapse and Myelin
- Lecture 28 - Physiology: The Action Potential - Part 1
- Lecture 29 - Recording nerve impulses and single action potentials
- Lecture 30 - Recording from nerve and plant cells
- Lecture 31 - Recording Local circuits, Hodgkin and Huxely contributions - Part 1

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

Lecture 32 - Hodgkin and Huxely model - Part 2 and Kenneth Cole Contributions

Lecture 33 - GHK equation and HH action potentials

Lecture 34 - First Electrophysiological Evidence for Synaptic Transmission

Lecture 35 - Bernard Katz

Lecture 36 - End-Plate Potential and Synaptic Quanta

Lecture 37 - Eccles and Spinal motor neuron

Lecture 38 - Invertebrate simple systems: Aplysia

Lecture 39 - Other studies of sensory responses

Lecture 40 - Legacy of Golgi and Ramo`n y Cajal

Lecture 41 - Dynamic polarization of Neuron

Lecture 42 - Modern Research

Lecture 43 - Synaptic Integration and Action Potential Initiation

Lecture 44 - Active properties of dendrites

Lecture 45 - Dendritic dominance

Lecture 46 - Dendritic spines

Lecture 47 - Rethinking the concept of Neuron Doctrine

Lecture 48 - Muscle spindles

Lecture 49 - Spinal cord pathways

Lecture 50 - Retinal Processing

Lecture 51 - Keffler Hartline

Lecture 52 - Stephen Kuffler and Horace Barlow

Lecture 53 - Expansion of the Reflex concept

Lecture 54 - Central Pptern genrators

Lecture 55 - The cortical column

Lecture 56 - Vernon Mountcastle

Lecture 57 - Central Visual Processing

Lecture 58 - Central Visual Processing and Feature Detectors

Lecture 59 - Intracellular recordings from the brain - Part 1

Lecture 60 - Intracellular recordings from the brain - Part 2

Lecture 61 - Two motor systems

Lecture 62 - Auditory cortex and The pattern theory of olfaction

Lecture 63 - Arousal and Reticular activating system

Lecture 64 - Sleep and Rapid Eye Movements

- Lecture 65 - Operant Conditioning by brain stimulation
- Lecture 66 - Hypothalamus and Feeding Behavior
- Lecture 67 - Brain as a gland
- Lecture 68 - Hypothalamic-Neurohypophyseal System
- Lecture 69 - Hypothalamic-Adenohypophyseal System
- Lecture 70 - Founding Modern Neuroanatomy
- Lecture 71 - Psychology and Ethology
- Lecture 72 - Karl Lashley
- Lecture 73 - Donald Hebb
- Lecture 74 - Limbic system- Limbic Lobe and Papez Circuit
- Lecture 75 - Limbic system-Kluver-Bucy Syndrome
- Lecture 76 - The Limbic system and Amygdala
- Lecture 77 - The Hippocampus and Patient H.M
- Lecture 78 - Brenda Milner
- Lecture 79 - Neurology: Foundations of Brain Imaging
- Lecture 80 - The Neurological unit of the Boston City Hospital
- Lecture 81 - Derek Denny-Brown, Raymond Adams and C. Miller Fisher
- Lecture 82 - Montreal Neurological Institute
- Lecture 83 - Cerebral Circulation
- Lecture 84 - Spreading depression of Leo and Migraine
- Lecture 85 - The Eradication of Polio
- Lecture 86 - Origin of Neurosurgery
- Lecture 87 - Harvey Cushing
- Lecture 88 - Pituitary Surgery
- Lecture 89 - Stereotaxy
- Lecture 90 - Epilepsy
- Lecture 91 - Psychosurgery
- Lecture 92 - Antipsychotic Drugs
- Lecture 93 - Reserpine
- Lecture 94 - Monoamine Oxidase Inhibitors
- Lecture 95 - Lithium
- Lecture 96 - Benzodiazepines
- Lecture 97 - Stress

Lecture 1 - Introduction to Genomics - 1

Lecture 2 - Introduction to Genomics - 2

Lecture 3 - Advent of NGS

Lecture 4 - Genome Assembly: Few Concepts and Terminology

Lecture 5 - Genome Assembly Approaches

Lecture 6 - Pyrosequencing

Lecture 7 - Reversible Chain Termination Based Sequencing

Lecture 8 - Ph Sequencing

Lecture 9 - Sequencing by Ligation (Solid)

Lecture 10 - Sequencing by Ligation (Complete Genomics)

Lecture 11 - Other Short-Read Sequencing Technologies - Part 1

Lecture 12 - Other Short-Read Sequencing Technologies - Part 2

Lecture 13 - Long-Read Sequencing

Lecture 14 - Single Molecule Long-Read Sequencing

Lecture 15 - The Omics Data Avalanche

Lecture 16 - Evolutionary Biology and Genomics

Lecture 17 - Ancient Genomics

Lecture 18 - Whole-Genome Duplication

Lecture 19 - Tests of Selection

Lecture 20 - Genomics in Experimental Evolution

Lecture 21 - Making Sense of Genomic Sequences

Lecture 22 - Transcriptomics: New Tools Leading to Deeper Insights

Lecture 23 - Single Cell Transcriptomics and Beyond

Lecture 24 - Proteomics: A Brief Introduction

Lecture 25 - Protein Quantification

Lecture 26 - Introduction to Linux for Omics

Lecture 27 - The Linux Command Line Interface

Lecture 28 - Using the CLI-1: NCBI Datasets

Lecture 29 - Using the CLI-2: Short Read Archive Toolkit

Lecture 30 - UCSC and IGV genome browsers

Lecture 31 - Mega Omics Projects

[Lecture 32 - Genotype-Tissue Expression \(GTEx\)](#)

[Lecture 33 - Encyclopedia of DNA Element \(ENCODE\)](#)

[Lecture 34 - The Cancer Genome Atlas \(TCGA\)](#)

[Lecture 35 - Eukaryotic Genome Sequencing Consortia](#)

[Lecture 36 - The Postomics Era](#)

[Lecture 37 - RNA-Seq Differential Expression Analysis](#)

[Lecture 38 - Gene Loss and its Consequences](#)

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Lecture 2 - Statistics - Introduction

Lecture 3 - Statistics: Definition and Terminology - Part I

Lecture 4 - Statistics: Definition and Terminology - Part II

Lecture 5 - Data: Primary vs Secondary

Lecture 6 - Data: Quantitative vs Qualitative

Lecture 7 - Data: Presentation

Lecture 8 - Data: Static vs Dynamic

Lecture 9 - Data: Box Plot and Spider Graphs

Lecture 10 - Data: Summarising Data

Lecture 11 - Probability: Event and Sample space

Lecture 12 - Probability: Mutually exclusive and Independent Events

Lecture 13 - Probability: Random Variables

Lecture 14 - Probability: Expectation of Random Variable

Lecture 15 - Probability: Variance of Random Variable

Lecture 16 - Probability Distribution: Binomial, Poisson, Bernoulli

Lecture 17 - Probability Distribution: Normal Distribution

Lecture 18 - Central Limit Theorem: Statement

Lecture 19 - Central Limit Theorem: Illustration

Lecture 20 - Confidence Interval

Lecture 21 - Determining Sample Size

Lecture 22 - Hypothesis Test: Introduction

Lecture 23 - Hypothesis Test: Example

Lecture 24 - Hypothesis: P value

Lecture 25 - Hypothesis: Type 2 error

Lecture 26 - Hypothesis: Chi square Distribution - Part 1

Lecture 27 - Hypothesis: Chi square Distribution - Part 2

Lecture 28 - Hypothesis: Probability Plots

Lecture 29 - Hypothesis: Contingency Table Test

Lecture 30 - Multivariate Hypothesis: Two Sample Test

Lecture 31 - Multivariate Hypothesis: Paired T test

- Lecture 32 - Multivariate Hypothesis: Paired vs Unpaired Testing
- Lecture 33 - Multivariate Hypothesis: Two population variances
- Lecture 34 - Multivariate Hypothesis: Multiple Random Variables - Part 1
- Lecture 35 - Multivariate Hypothesis: Multiple Random Variables - Part 2
- Lecture 36 - Multivariate Hypothesis: Covariance and Correlation
- Lecture 37 - One Way ANOVA: Motivation and Assumptions
- Lecture 38 - One Way ANOVA: Fixed and Random effects Model
- Lecture 39 - One Way ANOVA: Derivation and Confidence Interval
- Lecture 40 - One Way ANOVA: Confidence Interval
- Lecture 41 - One Way ANOVA: Unbalanced Experiment and Residuals
- Lecture 42 - One Way ANOVA: Interpretation of Results
- Lecture 43 - Statistical Modeling: Introduction
- Lecture 44 - Statistical Modeling: Linear Regression Derivation
- Lecture 45 - Statistical Modeling: Linear Regression - Assumption and Residuals
- Lecture 46 - Statistical Modeling: Multi Linear Regression
- Lecture 47 - Statistical Modeling: Logistic Regression
- Lecture 48 - Statistical Modeling: Cross Entropy Loss
- Lecture 49 - Statistical Modeling: Gradient Descent
- Lecture 50 - Statistical Modeling: One Way Anova via Linear Regression
- Lecture 51 - Design Of Experiments: Randomised Complete Block Design - Part 1
- Lecture 52 - Design Of Experiments: Randomised Complete Block Design - Part 2
- Lecture 53 - RCBD: Math Formulation and Derivation
- Lecture 54 - RCBD: Necessity and Application
- Lecture 55 - Latin Square: Introduction
- Lecture 56 - Latin Square: Math and Formulation
- Lecture 57 - Graeco - Latin Square
- Lecture 58 - Interaction Among Variables
- Lecture 59 - Two-Way ANOVA: Introduction - Part 1
- Lecture 60 - Two-Way ANOVA: Introduction - Part 2
- Lecture 61 - Two-Way ANOVA: Math and Formulation
- Lecture 62 - Factorial Design: 2^2 Experiments
- Lecture 63 - Factorial Design: 2^k Experiments - Part 1
- Lecture 64 - Factorial Design: 2^k Experiments - Part 2

[Lecture 65 - Factorial Design: Blocking](#)

[Lecture 66 - Introduction to Python Programming for Biomedical Engineers](#)

Lecture 1 - Basic concepts in microscopy - 1

Lecture 2 - Basic concepts in microscopy - 2

Lecture 3 - Dark-field and phase contrast microscopy

Lecture 4 - Differential interference contrast and polarization

Lecture 5 - Fluorescence and confocal microscopy

Lecture 6 - Transmission electron microscopy

Lecture 7 - Transmission electron microscopy cont. and scanning electron microscopy

Lecture 8 - Basic concepts - 1

Lecture 9 - Basic concepts - 2

Lecture 10 - GM counting and Scintillation counting

Lecture 11 - Scintillation counting continued

Lecture 12 - Autoradiography and RIA

Lecture 13 - Safety aspects and applications

Lecture 14 - Introduction and Basic concepts in chromatography - 1

Lecture 15 - Basic concepts in chromatography - 2

Lecture 16 - Low-pressure liquid chromatography (LPLC) and high performance liquid chromatography (HPLC)

Lecture 17 - Ion-exchange chromatography

Lecture 18 - Gel-filtration chromatography

Lecture 19 - Affinity chromatography

Lecture 20 - Gas-liquid chromatography

Lecture 21 - Basic concepts in electrophoresis

Lecture 22 - Horizontal and vertical gel electrophoresis

Lecture 23 - Native gel electrophoresis and SDS-PAGE

Lecture 24 - Isoelectric focusing (IEF), 2-D gel electrophoresis and protein detection methods

Lecture 25 - Electrophoresis of nucleic acids

Lecture 26 - Immunoelectrophoresis and capillary electrophoresis

Lecture 27 - Introduction and Basic Concepts - 1

Lecture 28 - Basic concepts - 2

Lecture 29 - Types of centrifuges and analytical ultracentrifugation method

Lecture 30 - Separation methods in preparative ultracentrifuges

Lecture 31 - Types of rotors

[Lecture 32 - Types of rotors cont. and care of rotors](#)

[Lecture 33 - Introduction and basic concepts](#)

[Lecture 34 - UV-Visible spectroscopy](#)

[Lecture 35 - Infrared and fluorescence spectroscopy](#)

[Lecture 36 - Circular dichroism \(CD\) spectroscopy](#)

[Lecture 37 - Nuclear magnetic resonance \(NMR\) spectroscopy and X-ray crystallography](#)

[Lecture 38 - Atomic spectroscopy and mass spectrometry](#)

[Lecture 39 - Polymerase chain reaction\(PCR\)](#)

[Lecture 40 - DNA sequencing methods](#)

[Lecture 41 - Enzyme linked immunosorbent assay \(ELISA\)](#)

Lecture 1 - Introduction to Nano

Lecture 2 - Nano-Biomimicry

Lecture 3 - Synthesis of nanomaterials by Physical and Chemical Methods

Lecture 4 - Synthesis of nanomaterials by Biological Methods

Lecture 5 - Characterisation of Nanomaterials

Lecture 6 - DNA Nanotechnology

Lecture 7 - Protein and Glyco Nanotechnology

Lecture 8 - Lipid Nanotechnology

Lecture 9 - Bio-Nanomachines

Lecture 10 - Carbon nanotubes and Its Bio-Applications

Lecture 11 - Nanomaterials for Cancer Diagnosis

Lecture 12 - Nanomaterials for Cancer therapy

Lecture 13 - Nanotechnology in Tissue Engineering

Lecture 14 - Nano artificial cells

Lecture 15 - Nanotechnology in Organ Printing

Lecture 16 - Nanotechnology in Point-of-Care Diagnostics

Lecture 17 - Nano-Pharmacology and Drug Targeting

Lecture 18 - Cellular uptake mechanisms of nanomaterials

Lecture 19 - In vitro Methods to study antibacterial and anticancer properties of nanomaterials

Lecture 20 - Nanotoxicology

- Lecture 1 - Life Cycle of an Angiosperm
- Lecture 2 - Characteristics of Plant Growth and Development - I
- Lecture 3 - Characteristics of Plant Growth and Development - II
- Lecture 4 - Molecular Genetics of Plant Development - I
- Lecture 5 - Molecular Genetics of Plant Development - II
- Lecture 6 - Molecular Genetics of Plant Development - III
- Lecture 7 - Molecular Genetics of Plant Development - IV
- Lecture 8 - Molecular Genetics of Plant Development (Continued...) - I
- Lecture 9 - Molecular Genetics of Plant Development (Continued...) - II
- Lecture 10 - Molecular Genetics of Plant Development (Continued...) - III
- Lecture 11 - Root Development
- Lecture 12 - Root Development (Continued...)
- Lecture 13 - Root Development (Vascular Development)
- Lecture 14 - Root Branching: Lateral Root Development
- Lecture 15 - Shoot Development: SAM Maintenance
- Lecture 16 - Shoot Development: Organogenesis
- Lecture 17 - Shoot Development: Leaf Development
- Lecture 18 - Shoot Development: Flowering
- Lecture 19 - Cell-Cell Communication During Plant Development
- Lecture 20 - Techniques Used in Lab

Lecture 1 - Introduction: Why to Study Structural Biology

Lecture 2 - Introduction to Biological Macromolecules

Lecture 3 - Introduction: Decoding Biological Macromolecules

Lecture 4 - Introduction: Genome Sequencing

Lecture 5 - Introduction: Post Genomic Era

Lecture 6 - Amino acids and their properties

Lecture 7 - Protein: Protein Chemistry, Chirality, Peptide bond and Levels of protein structures

Lecture 8 - Protein: Dihedral angles, Peptide bond and Ramachandran Plot

Lecture 9 - Protein: Super Secondary Structures, Motif, Domains, Non-covalent interactions

Lecture 10 - Protein: Folding of Protein, Thermodynamics and Kinetics of protein folding, Characterization of Proteins

Lecture 11 - Introduction to Structural Biology Techniques - Part I

Lecture 12 - Introduction to Structural Biology Techniques - Part II

Lecture 13 - X-ray Crystallography: Crystallization - Part I

Lecture 14 - X-ray Crystallography: Crystallization - Part II

Lecture 15 - X-ray Crystallography: Crystal Mounting

Lecture 16 - X-ray Crystallography: Production of X-ray and its properties

Lecture 17 - X-ray Crystallography: Journey to 3D land

Lecture 18 - X-ray Crystallography: Crystal Symmetry

Lecture 19 - X-ray Crystallography: Instrumentation in X-ray Crystallography

Lecture 20 - X-ray Crystallography: Data collection and processing

Lecture 21 - X-ray Crystallography: Data Analysis - Part I

Lecture 22 - X-ray Crystallography: Data Analysis - Part II

Lecture 23 - X-ray Crystallography: Phase Problem - Part I

Lecture 24 - X-ray Crystallography: Phase Problem - Part II

Lecture 25 - X-ray Crystallography: Refinement and Structure deposition to PDB

Lecture 26 - Introduction to Spectroscopy and NMR

Lecture 27 - Basic Principles of NMR and Instrumentation

Lecture 28 - NMR Sample Preparation and Chemical Shift related concepts

Lecture 29 - Factors effecting NMR Spectra (1D and 2D)

Lecture 30 - 2D and 3D NMR Spectroscopy focusing on protein structure

Lecture 31 - Introduction to Spectroscopy

Lecture 32 - UV-Vis and CD spectroscopy

Lecture 33 - Fluorescence Spectroscopy and Green Fluorescence Protein (GFP)

Lecture 34 - Infrared and Raman Spectroscopy for protein

Lecture 35 - Raman Spectroscopy, Raman Microscopy and Raman Crystallography for studying protein

Lecture 36 - Introduction to Microscopy

Lecture 37 - Functioning details of Cryo Electron Microscopy (Cryo EM)

Lecture 38 - Cryo Electron Microscopy: Data Collection and Analysis

Lecture 39 - A concise story of advancement Cryo-EM

Lecture 40 - Protein Data Bank

Lecture 41 - History of Molecular Visualizations of Biological Macromolecules

Lecture 42 - Description of structure related files (.pdb, .mmCIF, .mtz, etc.)

Lecture 43 - Demonstration of COOT

Lecture 44 - 3D visualization using Pymol

Lecture 45 - Demonstration of Pymol

Lecture 46 - Why we need MD Simulation

Lecture 47 - Molecular Dynamic Simulation Process - Part I

Lecture 48 - Molecular Dynamic Simulation Process - Part II

Lecture 49 - Molecular Dynamic Simulation Process - Part III

Lecture 50 - Application of Molecular Dynamic Simulation

Lecture 51 - What, How and Which of Protein Engineering

Lecture 52 - How to make logical Protein Engineering: Process of Rational design

Lecture 53 - Success story of Rational Protein designing: Focusing on De Novo Process

Lecture 54 - Designing Protein by mimicking nature: Process of Directed Evolution

Lecture 55 - Achievement, Challenges, and Future direction in the field of Protein Engineering

Lecture 56 - Introduction to Structure Based Drug Discovery (SBDD)

Lecture 57 - Rational Drug Discovery

Lecture 58 - Docking Based Virtual Screening: Progress, Challenges and Future perspective

Lecture 59 - What makes a small molecule an ideal drug: Developing in silico ADMETox Model

Lecture 60 - Structure Based Drug Discovery: Case study and Conclusion

Lecture 1 - Introduction to Learning and Memory - I : Historical perspective

Lecture 2 - Introduction to Learning and Memory - II : Classification

Lecture 3 - Associative Learning I : Rules of Associative learning

Lecture 4 - Associative learning II : Garcia and Koelling's Experiment, Kamin's Blocking Experiment

Lecture 5 - Introduction to the Rescorla Wagner Model

Lecture 6 - Application of Rescorla Wagner Model - I

Lecture 7 - Application of Rescorla Wagner Model - II

Lecture 8 - Application of Rescorla Wagner Model - III

Lecture 9 - Application of Rescorla Wagner Model - IV

Lecture 10 - Limitations of Rescorla Wagner Model

Lecture 11 - Introduction of Reinforcement Learning - I : Thorndike's view, Tolman's views, Skinner Box

Lecture 12 - Introduction of Reinforcement Learning - II : Classification, Thorndike's view, Tolman's views, Skinner Box (Continued...)

Lecture 13 - Introduction of Reinforcement Learning - III : Understanding scheduling of reinforcers in operant conditioning

Lecture 14 - Sign Tracking vs Goal Oriented/Tracking; Linking complex behaviors to simple molecules

Lecture 15 - Sign Tracking vs Goal Oriented; Learning Linking complex behaviors to simple molecules - II

Lecture 16 - Memory in Molecular Terms - I : Protein synthesis in memory consolidation

Lecture 17 - Memory in Molecular Terms - II : Long term potentiation

Lecture 18 - Memory in Molecular Terms - III : Properties of a memory molecule

Lecture 19 - Memory in Molecular Terms - IV : Remote memory and its characteristics

Lecture 20 - Memory in Molecular Terms - V : Selective labelling of memory encoding neurons and their manipulation

Lecture 1 - Drug Delivery Introduction and Pharmacokinetics

Lecture 2 - Pharmacokinetics (Continued...)

Lecture 3 - Pro-drugs and Polymers Introduction

Lecture 4 - Polymers - Synthesis

Lecture 5 - Polymers - Properties

Lecture 6 - Biomedical Polymers

Lecture 7 - Biodegradable Polymers and Polymer Drug Conjugates - I

Lecture 8 - Polymer Drug Conjugates - II

Lecture 9 - Research Paper Discussion and Diffusion Controlled Systems

Lecture 10 - Controlled Release: Reservoir System - I

Lecture 11 - Controlled Release: Reservoir Systems and Non-erodible Systems

Lecture 12 - Controlled Release: Non-erodible Systems and Erodible systems

Lecture 13 - Math Exercise

Lecture 14 - Hydrogels - I

Lecture 15 - Hydrogels - II

Lecture 16 - Hydrogels - III

Lecture 17 - Hydrogels - IV

Lecture 18 - Nano and Micro-particles - I

Lecture 19 - Nano and Micro-particles - II

Lecture 20 - Nano and Micro-particles - III

Lecture 21 - Nano and Micro-particles - IV

Lecture 22 - Nano and Micro-particles - V

Lecture 23 - Nano and Micro-particles - VI

Lecture 24 - Nano and Micro-particles - VII

Lecture 25 - Protein Adsorption - I

Lecture 26 - Protein Adsorption - II

Lecture 27 - Protein Adsorption - III

Lecture 28 - Tissue Engineering - I

Lecture 29 - Tissue Engineering - II

Lecture 30 - Tissue Engineering - III

Lecture 31 - Drug Delivery in Tissue Engineering - I

- Lecture 32 - Drug Delivery in Tissue Engineering - II
- Lecture 33 - Implant Associated Infections - I
- Lecture 34 - Implant Associated Infections - II
- Lecture 35 - Route Specific Delivery: Oral Route - I
- Lecture 36 - Route Specific Delivery: Oral Route - II
- Lecture 37 - Route Specific Delivery: Oral and Subcutaneous Route
- Lecture 38 - Route Specific Delivery: Intramuscular, Transdermal - I
- Lecture 39 - Route Specific Delivery: Transdermal - II
- Lecture 40 - Route Specific Delivery: Transdermal and Inhalation Route
- Lecture 41 - Route Specific Delivery: Inhalation - II, Buccal and Rectal Administration
- Lecture 42 - Research Paper Discussion: Dry Powder Particle Delivery
- Lecture 43 - Route Specific Delivery: Intra-articular and Intravenous Administration
- Lecture 44 - Intravenous Administration: Approved Nanocarriers and Immune System
- Lecture 45 - Immune System - II
- Lecture 46 - Complement System and Blood Clotting
- Lecture 47 - Blood Clotting and Hemocompatibility of Materials; Adaptive Immune Response
- Lecture 48 - Adaptive Immune Response and Vaccine
- Lecture 49 - Vaccines
- Lecture 50 - Vaccines and Immuno-isolated Cell Therapy
- Lecture 51 - Immuno-isolated Cell Therapy
- Lecture 52 - Immuno-isolated Cell and Gene Therapy
- Lecture 53 - Gene Delivery: Vectors
- Lecture 54 - Gene Delivery: Polymers
- Lecture 55 - Genes as Vaccines
- Lecture 56 - Vaccines: Gene Delivery and Other Variants
- Lecture 57 - Cancer Vaccines
- Lecture 58 - Cancer Vaccine: Immunotherapy
- Lecture 59 - Responsive Delivery Systems - I
- Lecture 60 - Responsive Delivery Systems - II
- Lecture 61 - Targeted Drug Delivery System
- Lecture 62 - Targeted Drug Delivery System: Research Paper Discussion
- Lecture 63 - Nanotoxicology and Translation Pathways

Lecture 1 - Introduction

Lecture 2 - Substrate

Lecture 3 - Substrate (Continued...)

Lecture 4 - Introduction to cleanroom

Lecture 5 - Contamination and surface cleaning

Lecture 6 - Advanced cleaning techniques

Lecture 7 - Defects

Lecture 8 - Diffusion

Lecture 9 - Diffusion - Advanced Concepts

Lecture 10 - Ion Implantation

Lecture 11 - Ion Implantation (Continued...)

Lecture 12 - Native Films

Lecture 13 - Native Films: Advanced Concepts

Lecture 14 - Native Films: Defects at Si/SiO₂ interface

Lecture 15 - Methods and Some Definitions

Lecture 16 - Chemical Vapor Deposition: Basics

Lecture 17 - Chemical Vapor Deposition: Precursor Transport

Lecture 18 - Chemical Vapor Deposition: Types of CVD Equipment

Lecture 19 - Chemical Vapor Deposition: Nucleation and Growth

Lecture 20 - Chemical Vapor Deposition: Other Details

Lecture 21 - Atomic Layer Deposition

Lecture 22 - Atomic Layer Deposition (Continued...)

Lecture 23 - Physical Vapor Deposition: Basics

Lecture 24 - Physical Vapor Deposition: Evaporation

Lecture 25 - Physical Vapor Deposition: Sputtering

Lecture 26 - Metallization: Contact resistance

Lecture 27 - Metallization: Electromigration and Epilogue

Lecture 28 - Pattern Transfer Basics

Lecture 29 - Optical lithography basics: resist process - 1

Lecture 30 - Optical lithography basics: resist process - 2

Lecture 31 - Optical Lithography: Contact and Proximity printing

- Lecture 32 - Optical Lithography: Stepper and Scanner
- Lecture 33 - Projection Lithography: Image formation basics
- Lecture 34 - Projection Lithography: Image formation in photoresist
- Lecture 35 - Optical lithography: Surface Reflection
- Lecture 36 - Optical Lithography: Mask Technology
- Lecture 37 - Lithography process technology glossary
- Lecture 38 - Optical Lithography: Resolution enhancement
- Lecture 39 - Electron beam lithography: Basics
- Lecture 40 - Electron beam lithography: Resist process
- Lecture 41 - Emerging lithography techniques
- Lecture 42 - Etching Figures of Merit
- Lecture 43 - Wet etching Basics
- Lecture 44 - Wet Etching Recipes
- Lecture 45 - Wet Etching Recipes
- Lecture 46 - Dry etch: Plasma Basics
- Lecture 47 - Dry etch: Plasma etching basics
- Lecture 48 - Dry etch: Plasma tool configuration
- Lecture 49 - Dry etch: Etch mechanism
- Lecture 50 - Dry etch: Etch chemistry
- Lecture 51 - Chemical Mechanical Polishing (CMP): Basics
- Lecture 52 - Chemical Mechanical Polishing (CMP): Tool and process
- Lecture 53 - Design for Manufacturability - 1
- Lecture 54 - Design for Manufacturability - 2
- Lecture 55 - Design for Manufacturability: Case study
- Lecture 56 - Process integration
- Lecture 57 - PV integration
- Lecture 58 - CMOS integration
- Lecture 59 - Lab demo: Silicon Nitride cantilever fabrication - 1
- Lecture 60 - Lab demo: Silicon Nitride cantilever fabrication - 2
- Lecture 61 - CMOS process for photonics application

**NPTEL : NOC:Optical Spectroscopy and Microscopy: Fundamentals of Optical Measurements and Instrumentation
(Biotechnology)**

Co-ordinators : Prof. Balaji Jayaprakash

- Lecture 1 - Optical Focus and Localisation of Light
- Lecture 2 - Relating Photon's Momentum to Spot Size
- Lecture 3 - Shortest Pulse of Light: How fast can we shutter the light?
- Lecture 4 - Behaviour of light through polarizers: Introduction
- Lecture 5 - Nature of Light: Introduction to Photo Multiplier Tubes
- Lecture 6 - Revisiting Polarisation Through Ket Vectors
- Lecture 7 - Light through Polarisers: Detailed Description - I
- Lecture 8 - Light through Polarisers: Detailed Description - II
- Lecture 9 - Time Dependent Perturbation Theory (TDPT): Overview
- Lecture 10 - TDPT in Steps-1: Unperturbed and Perturbed Hamiltonian
- Lecture 11 - TDPT in Steps-2: Introducing the switch and first approximation
- Lecture 12 - TDPT in Steps-3: Finding the co-efficients
- Lecture 13 - Fermi's Golden Rule
- Lecture 14 - Beer Lambert's Law from TDPT
- Lecture 15 - Einstein's Phenomenology
- Lecture 16 - Einstein's Coefficients, Fluorescence and Lifetime
- Lecture 17 - Fock States and Photonic Treatment of Light
- Lecture 18 - Operators in Fock State Space
- Lecture 19 - Light Matter Interaction and Rudimentary Feynman Diagrams
- Lecture 20 - Emergence of Spontaneous and Stimulated Emission Processes
- Lecture 21
- Lecture 22
- Lecture 23
- Lecture 24
- Lecture 25
- Lecture 26 - Introduction to LASER
- Lecture 27 - LASER population dynamics
- Lecture 28 - LASER population dynamics - Part- 2
- Lecture 29 - Real world LASER and characteristics of LASER emission
- Lecture 30 - Temporal and Spatial Coherence

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

- Lecture 31 - Transverse and Longitudinal modes of LASER
- Lecture 32 - Pulsed LASER
- Lecture 33 - Q-switching in detail
- Lecture 34 - Q-switching in detail - Part 2
- Lecture 35 - Basics of mode locking
- Lecture 36 - Basics of mode locking - Part 2
- Lecture 37 - Pulse compression
- Lecture 38 - Real world system (Mode lock Part-2)
- Lecture 39 - TEM mode
- Lecture 40 - Alignment basics
- Lecture 41 - Non-Linear Optics
- Lecture 42 - Confocal Detection
- Lecture 43 - Interference Filters
- Lecture 44 - Laser Scanning System - 1
- Lecture 45 - Laser Scanning System - 2
- Lecture 46 - Alignment of Moving Beams
- Lecture 47 - Decoding an Objective Lens - 1
- Lecture 48 - Decoding an Objective Lens - 2
- Lecture 49 - Designing Lens Systems
- Lecture 50 - Astigmatism and Field Curvature
- Lecture 51 - Intro to Lab Session
- Lecture 52 - Optics in LAB: Aligning light through an optical fiber - 1
- Lecture 53 - Optics in Lab: Telescope
- Lecture 54 - Kinematic Mounts
- Lecture 55 - Alignment with out iris
- Lecture 56 - Fluorescence Spectrometer - 1
- Lecture 57 - Fluorescence Spectrometer - 2
- Lecture 58 - Ti:Sapphire Laser and Two Photon Fluorescence

Lecture 1 - Introduction to Cell Biology, Cell components, organization and processes - Part I

Lecture 2 - Introduction to Cell Biology, Cell components, organization and processes - Part II

Lecture 3 - DNA: The genetic material - Part I

Lecture 4 - DNA: The genetic material - Part II

Lecture 5 - Regulation of the cell cycle - Part I

Lecture 6 - Regulation of the cell cycle - Part II

Lecture 7 - Checkpoints: The DNA damage and DNA replication checkpoints

Lecture 8 - The Ubiquitin Proteasome system

Lecture 9 - S-phase: Regulation of entry into S-phase and DNA Replication

Lecture 10 - DNA replication - Part I

Lecture 11 - DNA Replication - Part II

Lecture 12 - DNA Replication - Part III

Lecture 13 - DNA Replication - Part IV

Lecture 14 - Mitosis - Part I

Lecture 15 - Cytokinesis

Lecture 16 - Aging and Senescence

Lecture 17 - Apoptosis - Part I

Lecture 18 - Apoptosis - Part II

Lecture 19 - Meiosis - Part I

Lecture 20 - Meiosis - Part II

Lecture 21 - Nuclear organization

Lecture 22 - SMC proteins and chromosome organization - Real-Time imaging of DNA loop-extrusion by SMC complexes

Lecture 23 - The cohesin complex and its functions - The mysterious biological function of chromosome loops

Lecture 24 - Chromatin organization

Lecture 25 - SMC proteins and chromosome organization - Introduction

Lecture 26 - Meiosis - Part III

Lecture 27 - Mitosis - Part II

Lecture 28 - Cell diversity and properties of specialized cells-Budding yeast as a model system

Lecture 29 - The Plant Cell

Lecture 30 - Stem cells - Part I Intro-SL

Lecture 31 - Stem cells - Part II

[Lecture 32 - Nerve cells](#)

[Lecture 33 - The Cancer Cell](#)

Lecture 1 - Course Introduction - I

Lecture 2 - Course Introduction - II

Lecture 3 - Neuro anatomy for Neurosurgery

Lecture 4 - Neural Implant Fabrication: PVD - I

Lecture 5 - Neural Implant Fabrication: PVD - II

Lecture 6 - Rodent Neuroanatomy

Lecture 7 - Basics of BCI and Signal Processing

Lecture 8 - Neural Implant Fabrication: Sputtering and CVD

Lecture 9 - Principles of Stereotactic Rodent MicroNeurosurgery

Lecture 10 - Neural Signal Processing: Demonstrations

Lecture 11 - Neural Implant Fabrication: Photolithography - I

Lecture 12 - Neural Implant Fabrication: Photolithography - II

Lecture 13 - Craniotomy and Stereotactic Implantation Surgeries

Lecture 14 - Lithography Numericals

Lecture 15 - IDE Patterning

Lecture 16 - Etching

Lecture 17 - Introduction to Cleanroom and Gowning

Lecture 18 - E-Beam Evaporation Demonstration

Lecture 19 - Craniotomy and Cranial Window Surgeries

Lecture 20 - Flexible MEA: Introduction and Process Flow

Lecture 21 - Flexible MEA: EIB, Characterization and Analyses

Lecture 22 - Stereotactic Implantation Surgeries

Lecture 23 - Sputtering Demonstration

Lecture 24 - 3D Printing - Part I

Lecture 25 - Bioresorbable Microelectrode Array-based System

Lecture 26 - Fundamentals of Spinal Neuroanatomy

Lecture 27 - 3D Printing - Part II

Lecture 28 - Neural Implant - Microneedle

Lecture 29 - Spinal Cord Structure, and Circuits

Lecture 30 - Surgical Steps in Spinal Surgeries

Lecture 31 - 3D Printing - Part III

- [Lecture 32 - 3D Printing - Demonstration](#)
- [Lecture 33 - Wet Etching Demonstration](#)
- [Lecture 34 - Neural Implants for Parkinson's Disease](#)
- [Lecture 35 - Spinal micro neuro Surgery](#)
- [Lecture 36 - Anesthesia in Rodents](#)
- [Lecture 37 - Physiological Monitoring in Rodents](#)
- [Lecture 38 - Lithography Demonstration](#)
- [Lecture 39 - Electronic System Development for Neural Engineering - I](#)
- [Lecture 40 - Anesthesia Administration Equipments and Vital Monitoring](#)
- [Lecture 41 - Standard Safety Practices](#)
- [Lecture 42 - Euthanasia](#)
- [Lecture 43 - Euthanasia in Rodents](#)
- [Lecture 44 - Electronic System Development for Neural Engineering - II](#)
- [Lecture 45 - Rodent Brain and Spinal Cord Harvest](#)
- [Lecture 46 - Rodent Behavioural Setups](#)
- [Lecture 47 - Study Plan for Behavioural Setups: Stroke Model](#)
- [Lecture 48 - PCB Design Demonstration for Neural Systems](#)
- [Lecture 49 - Electronic Systems for Brain Stimulation - I](#)
- [Lecture 50 - Behavioural Tasks in Rodent Models - I](#)
- [Lecture 51 - Behavioural Tasks in Rodent Models - II](#)
- [Lecture 52 - Behavioural Setup for Rodents: Parkinsonism Model - I](#)
- [Lecture 53 - Behavioural Setup for Rodents: Parkinsonism Model - II](#)
- [Lecture 54 - Electronic Systems for Brain Stimulation - II](#)
- [Lecture 55 - Course Concluding Remarks](#)

Lecture 1 - Course Overview - I

Lecture 2 - Course Overview - II

Lecture 3 - Design Equations - I

Lecture 4 - Design Equations - Illustrative Examples

Lecture 5 - Design Equations - II : Plug Flow Recycle Reactors

Lecture 6 - Illustrative Examples : 1) Plug Flow Recycle 2) Multiple reactions - I

Lecture 7 - Illustrative Examples : 1) Recycle Reactor with Condenser 2) CSTR with Recycle

Lecture 8 - Multiple Reactions - II

Lecture 9 - Modelling Multiple Reactions in Soil Environment - III

Lecture 10 - Semi Continuous Reactor Operation

Lecture 11 - Catalyst Deactivation - I

Lecture 12 - Catalyst Deactivation - II

Lecture 13 - Illustrative Example : 1) Determination of deactivation Parameters 2) Design for Deactivating Catalyst

Lecture 14 - Energy Balance - I

Lecture 15 - Energy Balance - II

Lecture 16 - Reacting Fluids as Energy Carrier

Lecture 17 - Illustrative Example : Energy Balance in Stirred Vessels

Lecture 18 - Energy Balance - III : Design for Constant T Operation

Lecture 19 - Energy Balance - IV : Temperature Effects on Rate & Equilibria

Lecture 20 - Energy Balance - V : Stability Analysis of Exothermic Stirred Tank

Lecture 21 - Illustrative Example : Stability of Exothermic Stirred Tank

Lecture 22 - Energy Balance - VI : 1) Tubular Reactor Heated/Cooled from Wall 2) Transient Behavior of CSTR

Lecture 23 - Illustrative Example : 1) Plug Flow with Heat Effects 2) Multiple Reactions

Lecture 24 - Illustrative Example : 1) Further Considerations in Energy Balance 2) Multiple Reactions

Lecture 25 - Illustrative Example : 1) Hot Spot as Design Basis 2) Design for Instantaneous Reactions

Lecture 26 - Residence Time Distribution Methods

Lecture 27 - Residence Time Distribution Models

Lecture 28 - Shrinking core Gas-Solid reactions Model

Lecture 29 - Shrinking core Ash Diffusion Model & Combination of Resistances

Lecture 30 - 1) Gas Solid Reactions Temperature Effects on Rate & Equilibria 2) Introduction to Population Balance - I

Lecture 31 - Illustrative Example : Temperature Effects on Rate & Equilibria

[Lecture 32 - Population Balance Modelling - II](#)

[Lecture 33 - Population Balance Modelling - III](#)

[Lecture 34 - Illustrative Examples : Population Balance Models](#)

[Lecture 35 - Introduction to Environmental Reactions](#)

[Lecture 36 - Reaction Engineering Examples in Biochemical & Environmental Engineering](#)

[Lecture 37 - Illustrative Examples : 1\) Biomethanation 2\) Alcohol via Fermentation 3\) Natural Selection](#)

[Lecture 38 - Illustrative Examples : 1\) Enzyme Reaction 2\) Microbial Reaction 3\) Waste Treatment](#)

[Lecture 39 - Oxygen Sag Analysis in Rivers](#)

[Lecture 40 - Illustrative Examples : 1\) Oxygen Sag Analysis 2\) Population Balance Modelling of Forest 3\) Sponge Iron Process](#)

[Lecture 41 - Illustrative Example : Gas- Solid Reaction RTD Models Reaction Network](#)

NPTEL : Advanced Process Control (Chemical Engineering)

Co-ordinators : Prof. Sachin C. Patwardhan

Lecture 1 - Introduction and Motivation

Lecture 2 - Linearization of Mechanistic Models

Lecture 3 - Linearization of Mechanistic Models (Continued...)

Lecture 4 - Introduction to z-transforms and Development of Grey-box models

Lecture 5 - Introduction to Stability Analysis and Development of Output Error Models

Lecture 6 - Introduction to Stochastic Processes

Lecture 7 - Introduction to Stochastic Processes (Continued...)

Lecture 8 - Development of ARX models

Lecture 9 - Statistical Properties of ARX models and Development of ARMAX models

Lecture 10 - Development of ARMAX models (Continued...) and Issues in Model Development

Lecture 11 - Model Structure Selection and Issues in Model Development (Continued...)

Lecture 12 - Issues in Model Development (Continued...) and State Realizations of Transfer Function Models

Lecture 13 - Stability Analysis of Discrete Time Systems

Lecture 14 - Lyapunov Functions and Interaction Analysis and Multi-loop Control

Lecture 15 - Interaction Analysis and Multi-loop Control (Continued...)

Lecture 16 - Multivariable Decoupling Control and Soft Sensing and State Estimation

Lecture 17 - Development of Luenberger Observer

Lecture 18 - Development of Luenberger Observer (Continued...) and Introduction to Kalman Filtering

Lecture 19 - Kalman Filtering

Lecture 20 - Kalman Filtering (Continued...)

Lecture 21 - Kalman Filtering (Continued...)

Lecture 22 - Pole Placement State Feedback Control Design and Introduction to Linear Quadratic Gaussian (LQG) Control

Lecture 23 - Linear Quadratic Gaussian (LQG) Regulator Design

Lecture 24 - Linear Quadratic Gaussian (LQG) Controller Design

Lecture 25 - Model Predictive Control (MPC)

Lecture 26 - Model Predictive Control (Continued...)

Lecture 1 - Introduction to catalysts and catalysis

Lecture 2 - Steps in catalytic reaction: adsorption, desorption and reaction

Lecture 3 - Derivation of the rate equation

Lecture 4 - Heterogenous data analysis for reactor design - I

Lecture 5 - Heterogenous data analysis for reactor design - II

Lecture 6 - Catalyst deactivation and accounting for it in design - I

Lecture 7 - Catalyst deactivation and accounting for it in design - II

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Co-ordinators : Prof. Ganesh A. Viswanathan

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NPTEL : Heterogeneous Catalysis and Catalytic Processes (Chemical Engineering)

Co-ordinators : Dr. K.K. Pant

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[Lecture 39](#)

[Lecture 40](#)

NPTEL : Interfacial Engineering (Chemical Engineering)

Co-ordinators : Prof. A.N. Bhaskarwar

Lecture 1 - General Introduction Definitions

Lecture 2 - General Introduction, Definitions, Surface Tension

Lecture 3 - Surface Tension Free Energies and Adsorption

Lecture 4 - Properties over Curved Surfaces

Lecture 5 - Total Surface Energy

Lecture 6 - Interfacial Tension Entropy, Cohesion, Adhesion

Lecture 7 - Cohesion, Adhesion and Spreading

Lecture 8 - Spreading from Liquids and Solids

Lecture 9 - Spreading, Interfacial Tensions, Surface Tensions

Lecture 10 - Spreading, Contact Angles Free Energies

Lecture 11 - Spreading/Contact Angles Rough Surfaces, Free Energies

Lecture 12 - Spreading/Contact Angles Work of Adhesion, De-wetting

Lecture 13 - Work of Adhesion, Surface and Interfacial Tensions

Lecture 14 - Surface and Interfacial Tensions: Drop Weight and Wilhelmy Plate Methods

Lecture 15 - Surface and Interfacial Tensions: Wilhelmy Plate, Pendant Drop and Maximum Bubble Pressure Methods

Lecture 16 - Wetting Balance Method Spreading Coefficient Work of Adhesion Sessile Drop Method, Positive S

Lecture 17 - Indirect and Direct Methods for Positive S, Adhesion Energies Interfacial Potentials

Lecture 18 - Surface and Interfacial Potentials Distribution and Contact Potentials

Lecture 19 - Diffusion Potential Surface and Interfacial Potentials Components of Contact Potential

Lecture 20 - Electrically Charged Monolayers Gouy Theory

Lecture 21 - Equations of State, Cohesion Repulsion, Limiting Area

Lecture 22 - Condensed and Liquid Expanded Monolayers Phase Transformations

Lecture 23 - Films of Polymers Molecular Weight, Surface Viscosity Drag, Canal Method

Lecture 24 - Canal Method Joly's Semi-Empirical Correction Rotational Torsional Surface Viscometer Compressional Moduli

Lecture 25 - Magnitudes of Surface Compressional Moduli Surface Waves and Ripples

Lecture 26 - Surface waves and Ripples, Velocity Effect of Surface Tension and Surface Compressional Modulus Rates of adsorption and absorption Damping

Lecture 27 - Surface waves and ripples, velocity effect of surface tension and surface compressional modulus damping for clean and contaminated, surfaces, fiber from monolayers

Lecture 28 - Shear Elastic Moduli, Yield Stress Fibres from MLs, Surface Reactions

Lecture 29 - Surface Reactions, Comparison with Bulk-Phase Reactions Steric Factors, Inhibition

Lecture 30 - Hydrolyses of Esters by Alkali Acid or Enzyme Photochemical Reactions in Monolayers Polymerization in MLs,

Lactonization

Lecture 31 - Catalytic Effects Reactions in Emulsions Complex Formation

Lecture 32 - Complex Formation Penetration into Monolayers Thermodynamics of Penetration Adsorption from Vapour Phase Mass Transfer

Lecture 33 - Introductory Concepts Resistances and their Magnitudes Evaporation and its Retardation

Lecture 34 - Evaporation and its Retardation Resistances and their Analysis Diffusional Resistance in Gas Phase

Lecture 35 - Resistances in Liquid Phase and Interface and Their Importance Some Effects and Applications, Theory

Lecture 36 - Surface Instability Theories of Mass Transfer Experiments on static and Dynamic Systems

Lecture 37 - Colloids, Aerosols, Emulsions Foams, Coagulation Smoluchowski's Theory

[Lecture 1 \(1\)](#)

[Lecture 2 \(1A\)](#)

[Lecture 3 \(2\)](#)

[Lecture 4 \(2A\)](#)

[Lecture 5 \(3\)](#)

[Lecture 6 \(3A\)](#)

[Lecture 7 \(4\)](#)

[Lecture 8 \(4A\)](#)

[Lecture 9 \(5\)](#)

[Lecture 10 \(5A\)](#)

[Lecture 11 \(6\)](#)

[Lecture 12 \(6A\)](#)

[Lecture 13 \(7\)](#)

[Lecture 14 \(7A\)](#)

[Lecture 15 \(8\)](#)

[Lecture 16 \(8A\)](#)

[Lecture 17 \(8B\)](#)

[Lecture 18 \(9\)](#)

[Lecture 19 \(9A\)](#)

[Lecture 20 \(10\)](#)

[Lecture 21 \(10A\)](#)

[Lecture 22 \(10B\)](#)

[Lecture 23 \(11\)](#)

[Lecture 24 \(12\)](#)

[Lecture 25 \(12A\)](#)

[Lecture 26 \(12B\)](#)

[Lecture 27 \(13\)](#)

[Lecture 28 \(13A\)](#)

[Lecture 29 \(14\)](#)

[Lecture 30 \(14A\)](#)

[Lecture 31 \(15\)](#)

[Lecture 32 \(15A\)](#)

[Lecture 33 \(16\)](#)

[Lecture 34 \(16A\)](#)

[Lecture 35 \(17\)](#)

[Lecture 36 \(17A\)](#)

[Lecture 37 \(18\)](#)

[Lecture 38 \(18A\)](#)

[Lecture 39 \(19\)](#)

[Lecture 40 \(19A\)](#)

[Lecture 41 \(20\)](#)

[Lecture 42 \(20A\)](#)

[Lecture 43 \(20B\)](#)

[Lecture 44 \(21\)](#)

[Lecture 45 \(21A\)](#)

[Lecture 46 \(22\)](#)

[Lecture 47 \(22A\)](#)

[Lecture 48 \(23\)](#)

[Lecture 49 \(23A\)](#)

[Lecture 50 \(24\)](#)

[Lecture 51 \(24A\)](#)

[Lecture 52 \(25\)](#)

[Lecture 53 \(25A\)](#)

[Lecture 54 \(26\)](#)

[Lecture 55 \(26A\)](#)

[Lecture 56 \(25\)](#)

[Lecture 57 \(27\)](#)

[Lecture 58 \(28\)](#)

[Lecture 59 \(28A\)](#)

[Lecture 60 \(29\)](#)

[Lecture 61 \(29A\)](#)

[Lecture 62 \(30\)](#)

[Lecture 63 \(30A\)](#)

[Lecture 64 \(31\)](#)

Lecture 1 - Flowsheet Synthesis - I

Lecture 2 - Flowsheet Synthesis - II

Lecture 3 - Mass Balance - I

Lecture 4 - Mass Balance - II

Lecture 5 - Mass and Energy Balance of Complete Flowsheet

Lecture 6 - Equipment Sizing and Costing

Lecture 7 - Economic Evaluation

Lecture 8 - Design of Batch Plants

Lecture 9 - Simulations for Process Flowsheet

Lecture 10 - Optimization Methods used for Designing

Lecture 11 - Heat Exchanger Network Design - 1

Lecture 12 - Heat Exchanger Network Design - 2

Lecture 13 - Geometric Methods for Reactor Network Synthesis

Lecture 14 - Optimization Methods for Process Design - 1

Lecture 15 - Optimization Methods for Process Design - 2

Lecture 16 - Quantifying Sustainability for Design

Lecture 17 - Process Network Analysis and Footprint Assessment

Lecture 18 - Energy, Exergy and Emergy

Lecture 19 - Ecosystems in Sustainability Assessment

NPTEL : Heat Transfer (Chemical Engineering)

Co-ordinators : Prof. A.K. Ghoshal

- Lecture 1 - Introduction to heat transfer
- Lecture 2 - General heat conduction equation
- Lecture 3 - One dimensional steady state conduction in rectangular coordinate
- Lecture 4 - One dimensional steady state conduction in cylindrical and spherical coordinate
- Lecture 5 - Critical and optimum insulation
- Lecture 6 - Extended surface heat transfer - 1
- Lecture 7 - Extended surface heat transfer - 2
- Lecture 8 - Analysis of lumped parameter model
- Lecture 9 - Transient heat flow in semi infinite solid
- Lecture 10 - Infinite body subjected to sudden convective
- Lecture 11 - Graphical solutions of unsteady state heat conduction problem
- Lecture 12 - Dimensional analysis for forced convection
- Lecture 13 - Dimensional analysis for free convection
- Lecture 14 - Heat transfer co-relations for laminar and internal flows
- Lecture 15 - Heat transfer co-relations for turbulent and internal flows
- Lecture 16 - Co-relation for turbulent and external flows
- Lecture 17 - Heat transfer co-relations for flow across tube banks
- Lecture 18 - Momentum and heat transfer analogies
- Lecture 19 - Boundary layer heat transfer
- Lecture 20 - Boundary layer equations
- Lecture 21 - Approximate analysis in boundary layer
- Lecture 22 - Theoretical concepts of natural / free convection heat transfer
- Lecture 23 - Empirical relations for free convection heat transfer
- Lecture 24 - Condensation heat transfer over vertical plate
- Lecture 25 - Condensation heat transfer for various conditions and geometries
- Lecture 26 - Fundamentals of boiling heat transfer
- Lecture 27 - Boiling heat transfer co-relations
- Lecture 28 - Classification of heat exchangers
- Lecture 29 - Various types of shell and tube heat exchangers
- Lecture 30 - Various types of compact heat exchangers
- Lecture 31 - Effectiveness-NTU, method of heat exchanger analysis

[Lecture 32 - Design of double pipe heat exchanger](#)

[Lecture 33 - Design of shell and tube heat exchanger](#)

[Lecture 34 - Introduction to evaporation and evaporators](#)

[Lecture 35 - Evaporation principles and evaporator performance](#)

[Lecture 36 - Evaporator calculations](#)

[Lecture 37 - Introduction to radiation heat transfer](#)

[Lecture 38 - Radiation intensity and radiation view factor](#)

[Lecture 39 - Radiation heat exchange](#)

[Lecture 40 - Radiation shield and gas radiation](#)

NPTEL : Mass Transfer Operations I (Chemical Engineering)

Co-ordinators : Dr. B. Mandal

- Lecture 1 - Introduction to Mass Transfer
- Lecture 2 - Molecular Diffusion
- Lecture 3 - Fick's Law of Diffusion
- Lecture 4 - Steady state molecular diffusion in fluids - Part I
- Lecture 5 - Steady state molecular diffusion in fluids - Part II
- Lecture 6 - Diffusion coefficient: Measurement and Prediction - Part I
- Lecture 7 - Diffusion Coefficient: Measurement and Prediction - Part II
- Lecture 8 - Multicomponent Diffusion and Diffusivity in Solids
- Lecture 9 - Concept of Mass Transfer Coefficient
- Lecture 10 - Dimensionless Groups and Co-relations for Convective
- Lecture 11 - Mass Transfer co-efficient in Laminar Flow Condition
- Lecture 12 - Boundary Layer Theory and Film Theory in Mass Transfer
- Lecture 13 - Mass Transfer Coefficients in Turbulent Flow
- Lecture 14 - Interphase Mass Transfer and Mass Transfer Theories - Part I
- Lecture 15 - Interphase Mass Transfer and Mass Transfer Theories - Part II
- Lecture 16 - Interphase Mass Transfer and Mass Transfer Theories - Part III
- Lecture 17 - Agitated and Sparged Vessels
- Lecture 18 - Tray Column - Part I
- Lecture 19 - Tray Column - Part II
- Lecture 20 - Packed Tower
- Lecture 21 - Introduction to Absorption and Solvent selection
- Lecture 22 - Packed Tower Design - Part I
- Lecture 23 - Packed Tower Design - Part II
- Lecture 24 - Packed Tower Design - Part III
- Lecture 25 - Mass Transfer Coefficients Correlation and HETP Concept
- Lecture 26 - Tray Tower Design and Introduction to Multicomponent System
- Lecture 27 - Introduction to Distillation and Phase diagrams
- Lecture 28 - Azeotropes and Enthalpy Concentration Diagrams
- Lecture 29 - Flash Distillation
- Lecture 30 - Batch and Steam Distillation
- Lecture 31 - Fractional Distillation

[Lecture 32 - Fractional Distillation: McCabe Thiele Method](#)

[Lecture 33 - Fractional Distillation: Minimum Reflux and Pinch Point](#)

[Lecture 34 - Fractional Distillation: Subcooled Reflux ,Tray Efficiency and Use of Open Steam](#)

[Lecture 35 - Fractional Distillation: Multiple Feeds and Side Stream](#)

[Lecture 36 - Multistage Batch Distillation with Reflux](#)

[Lecture 37 - Fractional Distillation: Ponchan and Savarit Method](#)

[Lecture 38 - Ponchan and Savarit Method and Packed Tower Distillation](#)

[Lecture 39 - Multicomponent Distillation](#)

Lecture 1 - General Introduction to the Course and Syllabus

Lecture 2 - Hierarchical Approach to Process Design - I

Lecture 3 - Hierarchical Approach to Process Design - Examples

Lecture 4 - Input Information and Design Aspects of Batch vs. Continuous Process

Lecture 5 - Input / Output Structure of Flowsheet - Part I

Lecture 6 - Input / Output Structure of Flowsheet - Part II

Lecture 7 - Input / Output Structure of Flowsheet - Part III and Recycle Structure of Flowsheet - Part I

Lecture 8 - Recycle Structure of Flowsheet - Part II

Lecture 9 - Recycle Structure of Flowsheet - Part III

Lecture 10 - Recycle Structure of Flowsheet - Part IV and Tutorial - Part I

Lecture 11 - Tutorial - Part II

Lecture 12 - Tutorial - Part III

Lecture 13 - Algorithm and Basic Principles of Reactor Design

Lecture 14 - Reactor Non-ideality, Residence Time Distribution (RTD) and Types of Chemical Reactions & Catalysts

Lecture 15 - Types of Reactors and Selection Criteria

Lecture 16 - Tutorial on Reactor Design and Cost Estimation

Lecture 17 - General Introduction (Types of Separation Processes and Criteria for Selection of the Processes)

Lecture 18 - Guidelines for Design of Separation Systems

Lecture 19 - Design of Distillation Columns - Part I (Sequencing of Columns, Energy Integration / Thermal Coupling of the Columns)

Lecture 20 - Design of Distillation Columns - Part II (Plate and Packed Towers, Number of Plates, Diameter and Height of the Column)

Lecture 21 - Tutorial - Part I (Design of Absorption Column)

Lecture 22 - Tutorial - Part II (Design of Distillation Column)

Lecture 23 - Concepts and Basic Principles of Energy (or Heat) Integration - Part 1 (Composite Curves and T_{min})

Lecture 24 - Concepts and Basic Principles of Heat Integration - Part 2 (Problem Table Algorithm and Identification of Energy Targets)

Lecture 25 - Identification of Area and Cost Targets

Lecture 26 - Pinch Technology for Heat Exchanger Network Design

Lecture 27 - Tutorial - I (Composite Curves, Problem Table Algorithm and Enthalpy Intervals)

Lecture 28 - Tutorial - II (Heat Exchanger Network Synthesis Using Pinch Technology)

Lecture 29 - Selection of Process, Design of Flowsheet and Materials Balance

Lecture 30 - Energy Balance, Process Alternatives and Design of the Absorber

Lecture 31 - Rules of Thumb & Their Limitations and Tutorial

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[Lecture 32 - General Concepts & Principles and Cost Allocation Procedure](#)

[Lecture 33 - Lumped Cost Diagram and Cost Allocation Diagram \(Case Study of Hydro-dealkylation Process\)](#)

[Lecture 34 - Assessment of Process Alternatives with Cost Allocation Diagram \(Case Study of Hydrodealkylation Process\)](#)

[Lecture 35 - Tutorial on Lumped Cost Diagram and Cost Allocation Diagram](#)

[Lecture 36 - Introduction to Chemical Projects and Their Economic Aspects](#)

[Lecture 37 - Selection of the Process and Project Site - Part I](#)

[Lecture 38 - Selection of the Process and Project Site - Part II](#)

[Lecture 39 - Project Cost Estimation - Part I](#)

[Lecture 40 - Project Cost Estimation - Part II](#)

[Lecture 41 - Simplified Cost Model and Depreciation](#)

[Lecture 42 - Time Value of Money](#)

[Lecture 43 - Measures of Profitability and Project Evaluation - Part I](#)

[Lecture 44 - Measures of Profitability and Project Evaluation - Part II](#)

[Lecture 45 - Tutorial on Project Economics - Part I](#)

[Lecture 46 - Tutorial on Project Economics - Part II](#)

Lecture 1 - Introduction

Lecture 2 - Particle properties

Lecture 3 - Particle / Powder Classifications

Lecture 4 - Minimum Fluidization Velocity: Fluid-solid System

Lecture 5 - Minimum Fluidization Velocity: Liquid-solid and gas-liquid-solid System

Lecture 6 - Flow regime and its map: Gas-solid Fluidization

Lecture 7 - Flow regime and its map: Liquid-solid and Gas-liquid-solid Fluidization

Lecture 8 - Frictional pressure drop in fluidized bed-fluid-solid system

Lecture 9 - Frictional pressure drop in fluidized Bed-Gas-liquid-solid system

Lecture 10 - Analysis of Frictional Pressure Drop in Fluidized Bed By Different Models

Lecture 11 - Gas Distribution Through Distributor

Lecture 12 - Calculation of gas pumping power consumption in fluidized bed

Lecture 13 - Bubbling Fluidization Part 1: Bubble Characteristics

Lecture 14 - Bubbling Fluidization Part 2: Bubble Characteristics (Continued...)

Lecture 15 - Bubbling Fluidization Part 3: Bubble coalescence in three-phase fluidization

Lecture 16 - Bubbling Fluidization Part 4: Bubble breakup in three-phase fluidization

Lecture 17 - Bubbling Fluidization Part 5: Gas and solid movements at bubble

Lecture 18 - Bubbling Fluidization Part 6: Slugging Bed

Lecture 19 - Entrainment Characteristics (Part 1) : Entrainment Characteristics

Lecture 20 - Entrainment Characteristics (Part 2) : Fast fluidization condition

Lecture 21 - Entrainment Characteristics (Part 2) : Elutriation Characteristics

Lecture 22 - Entrainment Characteristics (Part 2) : Attrition in Fluidized Bed (Part 1)

Lecture 23 - Attrition in Fluidized Bed (Part 2)

Lecture 24 - Solid movement, mixing: Gas-fluidized Bed

Lecture 25 - Solid segregation: Gas-fluidized bed

Lecture 26 - Solid mixing and segregation: Liquid-solid fluidized bed

Lecture 27 - Gas Dispersion and Interchange

Lecture 28 - Mass transfer in fluidized Bed-Gas-solid system

Lecture 29 - Mass transfer in fluidized Bed-Gas-liquid-solid system (Continued...)

Lecture 30 - Heat transfer Characteristics

Lecture 31 - Fluidized bed reactor design and its performance

[Lecture 1 - An Introduction](#)

[Lecture 2 - Fluid Mechanics: A Review](#)

[Lecture 3 - Solid Mechanics: A Review](#)

[Lecture 4 - Rheology of blood](#)

[Lecture 5 - Blood morphology](#)

[Lecture 6 - Blood flow in a channel](#)

[Lecture 7 - Viscometers and Rheometers](#)

[Lecture 8 - Viscoelasticity](#)

[Lecture 9 - Flow Bifurcation](#)

[Lecture 10 - Pulsatile Flow 1](#)

[Lecture 11 - Pulsatile Flow 2](#)

[Lecture 12 - Flow in Elastic Tubes](#)

Lecture 1 - An Introduction

Lecture 2 - Interface and Surface Tension

Lecture 3 - Flow Regimes 1

Lecture 4 - Flow Regimes 2

Lecture 5 - Taylor Flow 1

Lecture 6 - Taylor Flow 2

Lecture 7 - Computational Techniques

Lecture 8 - Bubble and Droplet Generation

Lecture 9 - Interface and Surface tension 2

Lecture 10 - Void Fraction and Pressure Drop

Lecture 11 - Liquid-Liquid Flow: Flow Regimes

Lecture 12 - Ideal annular Flow

Lecture 13 - Taylor Flow : Heat transfer 1

Lecture 14 - Taylor Flow : Heat transfer 2

Lecture 15 - Taylor Flow : Meat Transfer 1

Lecture 16 - Taylor Flow : Meat Transfer 2

Lecture 17 - Flow boiling in microchannels

Lecture 18 - Flow boiling in microchannels (Continued...)

Lecture 19 - Flow Measurement Techniques

Lecture 20 - Particle image Velocimetry

Lecture 21 - Inertial Microfluidics

Lecture 22 - Microfluidic applications

Lecture 23 - Microfluidic applications (Continued...)

Lecture 24 - Concluding Remarks

Lecture 1 - Introduction to Multiphase flow Measurement Techniques

Lecture 2 - Invasive and Non-invasive Techniques

Lecture 3 - Hot Wire Anemometry

Lecture 4 - Optical Fiber Probe

Lecture 5 - Laser Doppler Anemometry (LDA)

Lecture 6 - LDA Post Processing and Particle Image Velocimetry (PIV)

Lecture 7 - PIV and Positron Emission Particle Tracking

Lecture 8 - Radioactive Particle Tracking - I

Lecture 9 - Radioactive Particle Tracking - II

Lecture 10 - Capacitance Probe, Optical Fiber Probe and ECT

Lecture 11 - Gamma-ray and X-ray Tomography, MRI

Lecture 12 - Summary

Lecture 1 - Multiphase flow introduction

Lecture 2 - Fundamental definitions and terminology used in Multiphase - I

Lecture 3 - Fundamental definitions and terminology used in Multiphase - II

Lecture 4 - Flow Regime Map for Gas-Liquid System

Lecture 5 - Flow Regime Map for Fluid-Solid System

Lecture 6 - Pneumatic Conveying

Lecture 7 - Momentum Equation through Reynolds Transport Theorem

Lecture 8 - Lockhart Martinelli Correlation

Lecture 9 - Pressure Drop Calculation for Homogeneous Flow

Lecture 10 - Pressure Drop Calculation for Separated and Annular Flow Regime

Lecture 11 - Lagrangian Tracking of Single Particle Under Different Forces

Lecture 12 - Multiphase Interactions: Drag Force

Lecture 13 - Multiphase Interactions: Multi-particle Drag, Virtual Mass Force, Basset Force and Lift Force

Lecture 14 - Introduction to Multiphase Flow Modeling

Lecture 15 - Algebraic Slip Method and Euler-Euler Method

Lecture 16 - KTGF and Euler-Lagrangian Model

Lecture 17 - Measurement Techniques: Velocity Measurement

Lecture 18 - Measurement Techniques: Phase Fraction Measurement

Lecture 19 - Bubble Column

Lecture 20 - Packed Bed Reactor

Lecture 21 - Fluidized Bed Reactor

Lecture 22 - Summary

Lecture 1 - Introduction to Polymers

Lecture 2 - Ideal Chain Models

Lecture 3 - Ideal and Real Chains

Lecture 4 - Thermodynamics of Polymer Solutions - I

Lecture 5 - Thermodynamics of Polymer Solutions - II

Lecture 6 - Thermodynamics of Polymer Solutions - III

Lecture 7 - Phase Behaviour of Polymer Solutions and Blends

Lecture 8 - Phase Behaviour of Polymer Blends and Copolymers

Lecture 9 - Determination of Polymer Molar Mass: Osmometry

Lecture 10 - Determination of Polymer Molar Mass: Static Light Scattering - I

Lecture 11 - Determination of Polymer Molar Mass: Static Light Scattering - II

Lecture 12 - Determination of Polymer Molar Mass: Viscometry and GPC

Lecture 13 - Branching: Hyperbranched Polymers

Lecture 14 - Branching, Network Formation and Gelation

Lecture 15 - Gelation and Swelling of Network Polymers

Lecture 16 - Amorphous State of Polymers

Lecture 17 - Crystalline State of Polymers

Lecture 18 - Mechanical Properties of Polymers

Lecture 19 - Viscoelasticity: Mechanical Models

Lecture 20 - Viscoelasticity, Dynamic Mechanical Analysis and Rheology

Lecture 21 - Rubber Elasticity

Lecture 22 - Unentangled Polymer Dynamics

Lecture 23 - Entangled Polymer Dynamics

Lecture 24 - Review

- Lecture 1 - Introduction to Natural Gas - I
- Lecture 2 - Introduction to Natural Gas - II
- Lecture 3 - Introduction to Natural Gas - III
- Lecture 4 - Wellbore Performance Relationship (WPR)
- Lecture 5 - Choke Performance Relationship (CPR)
- Lecture 6 - Nodal Analysis
- Lecture 7 - Inflow Performance Relationship (IPR) - I
- Lecture 8 - Inflow Performance Relationship (IPR) - II
- Lecture 9 - Gas Well Testing
- Lecture 10 - Wellbore Performance Relationship (WPR)
- Lecture 11 - Choke Performance Relationship (CPR)
- Lecture 12 - Nodal Analysis
- Lecture 13 - Natural Gas Separation - I
- Lecture 14 - Natural Gas Separation - II
- Lecture 15 - Dehydration of Natural Gas
- Lecture 16 - Sweetening of Natural Gas
- Lecture 17 - Compressor Design
- Lecture 18 - Measurement of Natural Gas
- Lecture 19 - Transportation of Natural Gas - I
- Lecture 20 - Transportation of Natural Gas - II
- Lecture 21 - Unconventional production of Natural Gas
- Lecture 22 - Review: Concluding Remarks

Lecture 1 - Introduction

Lecture 2 - First law for closed systems

Lecture 3 - First law for open systems

Lecture 4 - Simple processes

Lecture 5 - Processes involving liquids and ideal gases

Lecture 6 - Temperature dependency of C_p in an ideal gas

Lecture 7 - Efficiency of Heat engines and Statement of Second Law

Lecture 8 - Entropy

Lecture 9 - Lost Work

Lecture 10 - Maxwell's Relations

Lecture 11 - Thermodynamic Diagrams

Lecture 12 - Thermodynamic Tables, Residual Properties

Lecture 13 - Virial Equation of State

Lecture 14 - Residual property relations from EoS

Lecture 15 - Cubic Equation of State

Lecture 16 - Cubic Equation of State

Lecture 17 - Thermodynamic Tables

Lecture 18 - Correlations for Liquids

Lecture 19 - Process Involving Phase Changes

Lecture 20 - Chemical potential

Lecture 21 - Partial molar properties

Lecture 22 - Examples

Lecture 23 - Ideal Solutions

Lecture 24 - Excess Properties

Lecture 25 - Fugacity

Lecture 26 - Calculation of Fugacity using EoS - Part 1

Lecture 27 - Calculation of Fugacity using EoS - Part 2

Lecture 28 - Calculation of Fugacity in Mixtures using Cubic EoS

Lecture 29 - Fugacity in Liquids, Activity Coefficient

Lecture 30 - Models for Excess Gibbs free energy - Part 1

Lecture 31 - Models for Excess Gibbs free energy - Part 2

[Lecture 32 - Vapor Liquid Equilibrium - Part 1](#)

[Lecture 33 - Vapor Liquid Equilibrium - Part 2](#)

[Lecture 34 - Azeotropes](#)

[Lecture 35 - Gamma/Phi Formulation](#)

[Lecture 36 - LLE](#)

[Lecture 37 - VLLE](#)

[Lecture 38 - Enthalpy changes upon reaction](#)

[Lecture 39 - Reaction coordinate](#)

[Lecture 40 - Equilibrium constant](#)

[Lecture 41 - Examples](#)

[Lecture 42 - Conclusion](#)

Lecture 1 - Introduction and Overview of Mass Transfer Operation

Lecture 2 - Molecular and Eddy Diffusion, Diffusion Velocities and Fluxes

Lecture 3 - Fick's First and Second Law

Lecture 4 - Steady State Molecular Diffusion in fluids under stagnant and laminar flow conditions

Lecture 5 - Diffusion through variable cross-sectional area

Lecture 6 - Gas Phase Diffusion Coefficient measurement

Lecture 7 - Gas Phase Diffusion Coefficient prediction and liquid phase diffusion coefficient measurement and prediction

Lecture 8 - Multicomponent diffusion and diffusivity in solids

Lecture 9 - Mass transfer coefficient concept and classifications

Lecture 10 - Dimensionless groups and correlations for convective mass transfer coefficients

Lecture 11 - Mass transfer coefficient in laminar flow

Lecture 12 - Boundary Layer Theory and mass transfer coefficients in turbulent flow

Lecture 13 - Mass transfer theories

Lecture 14 - Interphase mass transfer

Lecture 15 - Interphase mass transfer and material balance for operating line

Lecture 16 - Number of ideal stages in counter current operation: graphical and algebraic methods

Lecture 17 - Introduction, classification, Sparged and agitated vessels design

Lecture 18 - Gas dispersed: Tray tower

Lecture 19 - Sieve Tray

Lecture 20 - Liquid dispersed: Venture scrubber, wetted wall column, Packed tower

Lecture 21 - Introduction to absorption, Equilibrium in gas-liquid system, and minimum liquid rate

Lecture 22 - Design of packed column absorber based on the Individual Mass Transfer Coefficient

Lecture 23 - Design of packed column absorber based on the Overall Mass Transfer Coefficient

Lecture 24 - Height Equivalent to a Theoretical Plate (HETP), Design of packed column absorber for dilute and concentrated gases

Lecture 25 - Absorption in plate column: Method of McCabe and Thiele-graphical determination of ideal trays and Introduction to multicomponent absorption

Lecture 26 - Introduction to distillation, binary equilibrium diagrams and concept of relative volatility

Lecture 27 - Distillation in non-ideal systems and concept of enthalpy-concentration diagram

Lecture 28 - Flash distillation

Lecture 29 - Batch and steam distillation

Lecture 30 - Continuous multistate fractionation

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[Lecture 31 - Number of trays by McCabe and Thiele for distillation](#)

[Lecture 32 - Pinch Points and minimum reflux](#)

[Lecture 33 - Reflux below its bubble point: Sub-cooled reflux and use of open steam](#)

[Lecture 34 - Multiple feeds, multiple product withdrawal or side streams](#)

[Lecture 35 - Multistage batch distillation with reflux](#)

[Lecture 36 - The Ponchon-Savarit method](#)

[Lecture 37 - The Ponchon-Savarit method](#)

[Lecture 38 - Packed Distillation](#)

[Lecture 39 - Introduction to multicomponent distillation and multicomponent flash distillation](#)

[Lecture 40 - Minimum stages and minimum reflux in multicomponent distillation](#)

[Lecture 41 - Multicomponent batch distillation](#)

Lecture 1 - Introduction and Basic Concepts

Lecture 2 - Classification of Non-Newtonian Fluids

Lecture 3 - Mathematical Models for Non-Newtonian Fluids

Lecture 4 - Viscoelastic Non-Newtonian Fluids

Lecture 5 - Capillary Viscometers: Sources of Errors and Correction Methods

Lecture 6 - Rotational Viscometers

Lecture 7 - Capillary Viscometers - Errors and Corrections II

Lecture 8 - Equation of Change for Non-Isothermal Systems

Lecture 9 - Rotational Viscometers - II

Lecture 10 - Rotational Viscometers - III

Lecture 11 - Transition from Laminar to Turbulent Flow in Pipes for GNF

Lecture 12 - Equations of Change for Isothermal Systems

Lecture 13 - Equations of Change for Non-Isothermal Systems

Lecture 14 - Power-law Fluids Flow in Concentric Annulus

Lecture 15 - Power-law and Ellis Model Fluids Flow Through Pipes

Lecture 16 - Bingham Plastic Fluids Flow through Pipes

Lecture 17 - Herschel Bulkley Fluids Flow through Pipes

Lecture 18 - Transition and Turbulent Flow of GNF in Pipes - I

Lecture 19 - Transition and Turbulent Flow of GNF in Pipes - II

Lecture 20 - Laminar flow of GNFs between Parallel Plates and along Inclined Surface

Lecture 21 - Laminar flow of GNFs along Inclined Surface and Concentric Annulus

Lecture 22 - Flow of Non-Newtonian Fluids through Packed Beds

Lecture 23 - Dispersion in Packed Beds: Non-Newtonian Effects

Lecture 24 - Liquid-Solid Fluidization by Power-law Liquids

Lecture 25 - Free Convection between Two Vertical Plates

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- Lecture 21 - Various models and applications: design aspects
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- Lecture 7 - Composite membranes: Interfacial polymerization, dip-coating, plasma polymerization
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- Lecture 2 - Basic Unit Processes and Unit Operations of OCT
- Lecture 3 - Introduction to Chemical Plant Design
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- Lecture 5 - Vegetable Oils and Processing
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- Lecture 7 - Soaps and Glycerine Manufacture
- Lecture 8 - Detergents Manufacture
- Lecture 9 - Carbohydrates Industry - Sugar
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- Lecture 18 - Petroleum Industry
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- Lecture 24 - Chemicals from C2 Compounds
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Lecture 3 - Particle size and Its distribution in mixture

Lecture 4 - Mechanism of Size Reduction

Lecture 5 - General Machines for Size Reduction

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Lecture 11 - Terminal velocity of single particle

Lecture 12 - Multiple particle Interaction/Sedimentation: Hindered settling velocity

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Lecture 14 - General expressions for flow through packed beds-Ergun Equation

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- Lecture 2 - Postulates and Boltzmann Distribution
- Lecture 3 - Properties of Canonical Partition Function
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- Lecture 5 - Thermodynamic Properties of Ideal Monoatomic Gases
- Lecture 6 - Monoatomic Gases and Gibbs Entropy Equation
- Lecture 7 - Energy Fluctuations for Monoatomic Gases
- Lecture 8 - Partition Function for Diatomic Gases
- Lecture 9 - Vibrational Partition Function
- Lecture 10 - Partition Function for Ideal Polyatomic Gas
- Lecture 11 - Normal Mode Analysis
- Lecture 12 - Illustrations
- Lecture 13 - Non-reacting Ideal Gas Mixture
- Lecture 14 - Chemically Reacting Gas Mixture
- Lecture 15 - Degree of Ionization of Gas Molecules
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- Lecture 17 - Microcanonical and Grand Canonical Ensemble
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NPTEL : Fluid Mechanics (Chemical Engineering)

Co-ordinators : Dr. V. Shankar

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NPTEL : Mass Transfer II (Chemical Engineering)

Co-ordinators : Prof. Nishith Verma

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- Lecture 9 - RGA and dynamic decoupling
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- Lecture 13 - Temperature inferential distillation control
- Lecture 14 - Considerations in temperature inferential control
- Lecture 15 - Control of Complex Column Configurations
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- Lecture 19 - Control of reactors
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- Lecture 21 - CSTR heat management
- Lecture 22 - Heat Exchangers and Miscellaneous Systems
- Lecture 23 - Degrees of freedom analysis
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Lecture 20 - General discussion on fugacity

Lecture 21 - Ideal Gas Mixture - Part 1

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- Lecture 32 - Probability and Multiplicity
- Lecture 33 - Multiplicity and maximising the multiplicity
- Lecture 34 - Introduction to statistical mechanics
- Lecture 35 - Partition function for independent particles
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- Lecture 37 - Models of Molecular Pair Potentials
- Lecture 38 - Molecular Theory of Corresponding States
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- Lecture 40 - Models for Electrolyte Systems
- Lecture 41 - Membrane Osmometry
- Lecture 42 - Fugacity of liquid mixture - 1
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- Lecture 44 - Models for fugacity of liquid mixtures - 1
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- Lecture 46 - Examples of Fugacity of liquids
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- Lecture 48 - Theories of Solution - I
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- Lecture 8 - Biochemistry & Thermodynamics of Enzymes
- Lecture 9 - Enzyme Kinetics : Michealis-Menten Kinetics
- Lecture 10 - Regulation of Enzyme Activity : Inhibition
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- Lecture 13 - Immobilized Enzymes
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- Lecture 19 - TCA Cycle
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- Lecture 21 - Pentose Phosphate Pathways Glycogenesis & Glycogenolysis
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- Lecture 23 - Microbial Growth : Phases and Models
- Lecture 24 - Effect of Mass Transfer on Microbial & Fungal Growth
- Lecture 25 - Effect of Multiple Substrates and Inhibition on Microbial Growth
- Lecture 26 - Design of Bioreactors
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NPTEL : Multiphase Flow (Chemical Engineering)

Co-ordinators : Prof. P.K. Das, Prof. Gargi Das

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Lecture 2 - Estimation of Flow Patterns

Lecture 3 - Estimation of Flow Patterns (Continued...)

Lecture 4 - Flow Pattern Maps Fascinating Taylor Bubbles

Lecture 5 - Definitions and Common Terminologies

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Lecture 7 - Simple Analytical Models

Lecture 8 - The Homogeneous Flow Theory

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Lecture 18 - Separated Flow Model (Continued...)

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Lecture 21 - Separated Flow Model - Condition of Choking (Continued...)

Lecture 22 - Separated Flow Model - Estimation of Frictional Pressure Drop and Void Fraction

Lecture 23 - Separated Flow Model - Estimation of Frictional Pressure Drop and Void Fraction (Continued...)

Lecture 24 - Separated Flow Model - Estimation of Frictional Pressure Drop and Void Fraction (Continued...)

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Lecture 26 - Analysis of Specific Flow Regimes

Lecture 27 - Analysis of Specific Flow Regimes (Continued...)

Lecture 28 - Analysis of Specific Flow Regimes - Slug Flow (Continued...)

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NPTEL : Novel Separation Processes (Chemical Engineering)

Co-ordinators : Prof. S. De

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Lecture 2 - Identification of Novel Separation Processes

Lecture 3 - Membrane Separation Processes

Lecture 4 - Membrane Separation Processes (Continued...1)

Lecture 5 - Membrane Separation Processes (Continued...2)

Lecture 6 - Membrane Separation Processes (Continued...3)

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Lecture 8 - Membrane Separation Processes (Continued...5)

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Lecture 6 - Dynamic Behavior of Chemical Processes

Lecture 7 - Dynamic Behavior of Chemical Processes (Continued...1)

Lecture 8 - Dynamic Behavior of Chemical Processes (Continued...2)

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Lecture 7 - Phase plane analysis of linear autonomous second order systems

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Lecture 9 - Analysis of a free spring-mass system

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Lecture 12 - Similarity solution for non-autonomous higher order dynamics

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NPTEL : NOC:Metallocene and Metal-Carbene based Organometallic Compounds as Industrially Important Advanced Polyolefin Catalysts (Chemical Engineering)

Co-ordinators : Prof. Sanjib K. Patra

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Lecture 4 - Polyethylene and Polypropylene: Chemical structure and properties (Continued...)

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Lecture 6 - Common polymerization protocol and mechanism (Continued...)

Lecture 7 - Common polymerization protocol and mechanism: Controlled Polymerization

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Lecture 9 - Transition metal/Organometallic complexes: Unique reactions

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Lecture 11 - Metallocene compounds: Structure and Bonding (Continued...)

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Lecture 15 - General Synthetic Strategies for Metallocenes (Parallel and Bent)

Lecture 16 - Properties and Unique Reactivities of parallel and bent Metallocenes

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Lecture 20 - Olefin polymerization by Zeigler Natta Catalyst: Important features

Lecture 21 - Coordination polymerization of olefin by Metallocene Catalysts: A new avenue in polyolefin catalysts

Lecture 22 - Coordination polymerization of olefin by Metallocene Catalysts: A new avenue in polyolefin catalysts (Continued...)

Lecture 23 - Symmetry of metallocene and Stereoregularity in polyolefin

Lecture 24 - Symmetry of metallocene and Stereoregularity in polyolefin (Continued...)

Lecture 25 - Metallocene to Post-metallocene catalysts for olefin polymerization

Lecture 26 - Metallocene to Post-metallocene catalysts for olefin polymerization (Continued...)

Lecture 27 - Polymerization strategy for industrial preparation of LLDPE

Lecture 28 - Polymerization strategy for industrial preparation of LLDPE (Continued...)

Lecture 29 - Metallocene and Post-metallocene Catalysts: Homogeneous to Heterogeneous and Lab to Industry

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Lecture 31 - Depolymerization of synthetic polymers: Role of organometallic and metallocene based catalysts

Lecture 32 - Depolymerization of synthetic polymers: Role of organometallic and metallocene based catalysts

Lecture 33 - Metal-carbene complexes as versatile catalysts for multiple useful reactions: A short introduction

Lecture 34 - Metal-carbene complexes as versatile catalysts for multiple useful reactions: A short introduction (Continued...)

Lecture 35 - Bonding and Electronic properties in Metal-carbene complexes

Lecture 36 - General synthetic protocol of Metal-carbene complexes

Lecture 37 - N-Heterocyclic carbene (NHC) complex: Bonding and General synthetic protocol

Lecture 38 - Alkene metathesis by metal-carbene catalysts and its mechanism

Lecture 39 - Utility of metal-carbene catalysts in alkene polymerization

Lecture 40 - Industrially important polymers by ROMP: Recent development and scope; Overall summary of this course

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- Lecture 4 - Kinematics - 4
- Lecture 5 - Kinematics - 5 - Shear Stress
- Lecture 6 - Kinematics - 6 and Conservation Equation - 1
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- Lecture 8 - Conservation Equation - 3 - Conservation of Momentum
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Lecture 2 - Introduction of Structure-Property-Process Correlation of Polymer, Elastomer and Composite - 1

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Lecture 12 - Identification by Chemical Techniques, Implication of National and International Standards alongwith Practical Demonstration (Continued...)

Lecture 13 - Identification by Chemical Techniques, Implication of National and International Standards alongwith Practical Demonstration (Continued...)

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Lecture 15 - Identification by Chemical Techniques, Implication of National and International Standards alongwith Practical Demonstration (Continued...)

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Lecture 17 - Introduction of UV-Vis and infrared spectroscopy for polymers, elastomers and composites (Continued...)

Lecture 18 - Introduction of UV-Vis and infrared spectroscopy for polymers, elastomers and composites (Continued...)

Lecture 19 - Introduction of UV-Vis and infrared spectroscopy for polymers, elastomers and composites (Continued...)

Lecture 20 - Introduction of UV-Vis and infrared spectroscopy for polymers, elastomers and composites (Continued...)

Lecture 21 - Application of infrared spectroscopy for blends, modification of polymers, compatibilizaion, coupling etc.

Lecture 22 - Application of infrared spectroscopy for blends, modification of polymers, compatibilizaion, coupling etc.

Lecture 23 - Application of infrared spectroscopy for blends, modification of polymers, compatibilizaion, coupling etc.

Lecture 24 - Practical demonstration on UV-Visible spectroscopy

Lecture 25 - Practical demonstration on FTIR spectroscopy and Sulphur analyzer

Lecture 26 - Introduction to Photoacoustic spectroscopy (PA), Raman spectroscopy, Atomic absorption spectroscopy and Electron spin response (ESR) spectroscopy

Lecture 27 - Introduction to Photoacoustic spectroscopy (PA), Raman spectroscopy, Atomic absorption spectroscopy and Electron spin response (ESR) spectroscopy (Continued...)

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Lecture 28 - Introduction to Photoacoustic spectroscopy (PA), Raman spectroscopy, Atomic absorption spectroscopy and Electron spin response (ESR) spectroscopy (Continued...)

Lecture 29 - Introduction to Photoacoustic spectroscopy (PA), Raman spectroscopy, Atomic absorption spectroscopy and Electron spin response (ESR) spectroscopy (Continued...)

Lecture 30 - Introduction to Photoacoustic spectroscopy (PA), Raman spectroscopy, Atomic absorption spectroscopy and Electron spin response (ESR) spectroscopy (Continued...)

Lecture 31 - NMR Spectroscopy- principles and fundamentals. Application of NMR in polymer, elastomer and composites

Lecture 32 - NMR Spectroscopy- principles and fundamentals. Application of NMR in polymer, elastomer and composites (Continued...)

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Lecture 35 - NMR Spectroscopy- principles and fundamentals. Application of NMR in polymer, elastomer and composites (Continued...)

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Lecture 37 - Thermal analysis techniques and application in polymer, elastomer and composites (Continued...)

Lecture 38 - Thermal analysis techniques and application in polymer, elastomer and composites (Continued...)

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Lecture 41 - XRD, XPS and XRF. Principles, Fundamentals and Application in Polymer, Elastomer and Composites (Continued...)

Lecture 42 - XRD, XPS and XRF. Principles, Fundamentals and Application in Polymer, Elastomer and Composites (Continued...)

Lecture 43 - XRD, XPS and XRF. Principles, Fundamentals and Application in Polymer, Elastomer and Composites (Continued...)

Lecture 44 - XRD, XPS and XRF. Principles, Fundamentals and Application in Polymer, Elastomer and Composites (Continued...)

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Lecture 46 - Introduction to microscopy (Optical, AFM) with special reference to electron microscopy (SEM, FESEM and HRTEM) (Continued...)

Lecture 47 - Introduction to microscopy (Optical, AFM) with special reference to electron microscopy (SEM, FESEM and HRTEM) (Continued...)

Lecture 48 - Introduction to microscopy (Optical, AFM) with special reference to electron microscopy (SEM, FESEM and HRTEM) (Continued...)

Lecture 49 - Introduction to microscopy (Optical, AFM) with special reference to electron microscopy (SEM, FESEM and HRTEM) (Continued...)

Lecture 50 - Applications of microscopy in polymers, elastomers and composites

Lecture 51 - Applications of microscopy in polymers, elastomers and composites (Continued...)

Lecture 52 - Practical demonstration on optical microscopy

Lecture 53 - Practical demonstration on atomic force microscopy (AFM)

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Lecture 55 - Chromatography, DETA, Quantification from Rate Dependent Methods, Reverse Engineering and Recent Advances

Lecture 56 - Chromatography, DETA, Quantification from Rate Dependent Methods, Reverse Engineering and Recent Advances (Continued...)

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[Lecture 57 - Chromatography, DETA, Quantification from Rate Dependent Methods, Reverse Engineering and Recent Advances \(Continued...\)](#)

[Lecture 58 - Chromatography, DETA, Quantification from Rate Dependent Methods, Reverse Engineering and Recent Advances \(Continued...\)](#)

[Lecture 59 - Chromatography, DETA, Quantification from Rate Dependent Methods, Reverse Engineering and Recent Advances \(Continued...\)](#)

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Lecture 12 - LAB 1 - Analysis of Frictional Losses in Pipe Flows Theory and Solution Strategy

Lecture 13 - LAB 1 - Analysis of Frictional Losses in Pipe Flows Solution of the Problem under ...

Lecture 14 - LAB 1 - Analysis of Frictional Losses in Pipe Flows Solution of the Problem under ...

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Lecture 29 - LAB 4 - Analysis of Cooling of a Solid Body in a Reservoir Solution of the Problem ...

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- Lecture 54 - LAB 9 - Process economics and optimisation Solution of the problem (Continued...)
- Lecture 55 - LAB 9 - Process economics and optimisation Solution of the problem and analysis of ...
- Lecture 56 - LAB 10 - Regression and curve - fitting of data Problem definition and analysis
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Lecture 9 - Ostwald Viscometer, Brookfield Viscometer, Falling Piston Viscometers

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NPTEL : NOC:Momentum Transfer in Fluids (Chemical Engineering)

Co-ordinators : Prof. Somenath Ganguly, Prof. Sunando DasGupta

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Lecture 24 - Fixed Bed Design: Adams-Bohart and Other Models

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Lecture 2 - Illustration of the CFD approach through a worked out example

Lecture 3 - Eulerian approach, Conservation Equation, Derivation of Mass Conservation Equation and Statement of the momentum conservation equation

Lecture 4 - Forces acting on a control volume; Stress tensor; Derivation of the momentum conservation equation ; Closure problem; Deformation of a fluid element in fluid flow

Lecture 5 - Kinematics of deformation in fluid flow; Stress vs strain rate relation; Derivation of the Navier-Stokes equations

Lecture 6 - Equations governing flow of incompressible flow; Initial and boundary conditions; Wellposedness of a fluid flow problem

Lecture 7 - Equations for some simple cases; Generic scalar transport equation form of the governing equations; Outline of the approach to the solution of the N-S equations.

Lecture 8 - cut out the first 30s; Spatial discretization of a simple flow domain; Taylor's series expansion and the basis of finite difference approximation of a derivative; Central and one-sided difference approximations; Order of accuracy of finite difference ap

Lecture 9 - Finite difference approximation of pth order of accuracy for qth order derivative; cross -derivatives; Examples of high order accurate formulae for several derivatives

Lecture 10 - One -sided high order accurate approximations; Explicit and implicit formulations for the time derivatives

Lecture 11 - Numerical solution of the unsteady advection equation using different finite difference approximations

Lecture 12 - Need for analysis of a discretization scheme; Concepts of consistency, stability and convergence and the equivalence theorem of Lax ; Analysis for consistency

Lecture 13 - Statement of the stability problem; von Neumann stability analysis of the first order wave equation

Lecture 14 - Consistency and stability analysis of the unsteady diffusion equation; Analysis for two- and three -dimensional cases; Stability of implicit schemes

Lecture 15 - Interpretation of the stability condition; Stability analysis of the generic scalar equation and the concept of upwinding ; Diffusive and dissipative errors in numerical solution; Introduction to the concept of TVD schemes

Lecture 16 - Template for the generic scalar transport equation and its extension to the solution of Navier-Stokes equations for a compressible flow.

Lecture 17 - Illustration of application of the template using the MacCormack scheme for a three-dimensional compressible flow

Lecture 18 - Stability limits of MacCormack scheme; Limitations in extending compressible flow schemes to incompressible flows ; Difficulty of evaluation of pressure in incompressible flows and listing of various approaches

Lecture 19 - Artificial compressibility method and the streamfunction-vorticity method for the solution of NS equations and their limitations

Lecture 20 - Pressure equation method for the solution of NS equations

Lecture 21 - Pressure-correction approach to the solution of NS equations on a staggered grid; SIMPLE and its family of methods

Lecture 22 - Need for efficient solution of linear algebraic equations; Classification of approaches for the solution of linear algebraic equations.

Lecture 23 - Direct methods for linear algebraic equations; Gaussian elimination method

Lecture 24 - Gauss-Jordan method; LU decomposition method; TDMA and Thomas algorithm

Lecture 25 - Basic iterative methods for linear algebraic equations: Description of point -Jacobi, Gauss-Seidel and SOR methods

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Lecture 26 - Convergence analysis of basic iterative schemes; Diagonal dominance condition for convergence; Influence of source terms on the diagonal dominance condition; Rate of convergence

Lecture 27 - Application to the Laplace equation

Lecture 28 - Advanced iterative methods: Alternating Direction Implicit Method; Operator splitting

Lecture 29 - Advanced iterative methods; Strongly Implicit Procedure; Conjugate gradient method; Multigrid method

Lecture 30 - Illustration of the Multigrid method for the Laplace equation

Lecture 31 - Overview of the approach of numerical solution of NS equations for simple domains; Introduction to complexity arising from physics and geometry

Lecture 32 - Derivation of the energy conservation equation

Lecture 33 - Derivation of the species conservation equation; dealing with chemical reactions

Lecture 34 - Turbulence; Characteristics of turbulent flow; Dealing with fluctuations and the concept of time-averaging

Lecture 35 - Derivation of the Reynolds -averaged Navier -Stokes equations; identification of the closure problem of turbulence; Boussinesq hypothesis and eddy viscosity

Lecture 36 - Reynolds stresses in turbulent flow; Time and length scales of turbulence; Energy cascade; Mixing length model for eddy viscosity

Lecture 37 - One-equation model for turbulent flow

Lecture 38 - Two -equation model for turbulent flow; Numerical calculation of turbulent reacting flows

Lecture 39 - Calculation of near-wall region in turbulent flow; wall function approach; near-wall turbulence models

Lecture 40 - Need for special methods for dealing with irregular flow geometry; Outline of the Body-fitted grid approach ; Coordinate transformation to a general, 3-D curvilinear system

Lecture 41 - Transformation of the governing equations; Illustration for the Laplace equation; Appearance and significance of cross - derivative terms; Concepts of structured and unstructured grids.

Lecture 42 - Finite volume method for complicated flow domain; Illustration for the case of flow through a duct of triangular cross - section.

Lecture 43 - Finite volume method for the general case

Lecture 44 - Generation of a structured grid for irregular flow domain; Algebraic methods; Elliptic grid generation method

Lecture 45 - Unstructured grid generation; Domain nodalization; Advancing front method for triangulation

Lecture 46 - Delaunay triangulation method for unstructured grid generation

Lecture 47 - Co -located grid approach for irregular geometries; Pressure correction equation for a co -located structured grid; Pressure correction equation for a co-located unstructured grid.

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Lecture 22 - Stability of distributed systems (PDEs): reaction diffusion example

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Lecture 12 - A review of Fourier transforms - Lecture 3.5 (Properties of Fourier transforms)

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Lecture 14 - A review of Fourier transforms - MATLAB demo of Fourier transform and periodogram

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NPTEL : System Identification (Chemical Engineering)

Co-ordinators : Dr. Arun K.Tangirala

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- Lecture 88 - Fisher's information and properties of estimators 5
- Lecture 89 - Fisher's information and properties of estimators 6
- Lecture 90 - Fisher's information and properties of estimators 7
- Lecture 91 - Fisher's information and properties of estimators 8
- Lecture 92 - Fisher's information and properties of estimators 9
- Lecture 93 - Fisher's information and properties of estimators 10
- Lecture 94 - Fisher's information and properties of estimators 11
- Lecture 95 - Fisher's information and properties of estimators 12
- Lecture 96 - Fisher's information and properties of estimators 13
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[Lecture 111 - State-Space/Subspace identification 1](#)

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[Lecture 118 - State-Space/Subspace identification 8](#)

[Lecture 119 - Input for Identification](#)

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Lecture 1 - Introduction

Lecture 2 - Fluid Statics

Lecture 3 - Newton Law of Viscosity

Lecture 4 - Equation of Continuity Differential

Lecture 5 - Equation of Linear Momentum - 1

Lecture 6 - Equation of Linear Momentum - 2

Lecture 7 - Bernoulli's Equation

Lecture 8 - Solution of Navier Stokes - 1

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Lecture 10 - Introduction to cylindrical coordinate systems

Lecture 11 - Continuity equation in cylindrical coordinates

Lecture 12 - Solution of Navier Stokes in the Cylindrical co-ordinate system - 1

Lecture 13 - Solution of Navier Stokes in the Cylindrical co-ordinate system - 2

Lecture 14 - Circular poiseuille flow

Lecture 15 - Shear Stress Distribution

Lecture 16 - Flow between two concentric cylinder

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Lecture 18 - Viscosity and Momentum Transfer

Lecture 19 - Device For Measuring Fluid Viscosity

Lecture 20 - Fluid Properties And its Behaviour

Lecture 21 - Tutorial 4

Lecture 22 - Choice of Scaling Parameter

Lecture 23 - Non Dimensional analysis

Lecture 24 - Non-dimensional analysis - 2

Lecture 25 - Non-dimensional analysis - 3 (Buckingham Pi Theorem)

Lecture 26 - Non-dimensional analysis - 4 (Trinity test)

Lecture 27 - Non-dimensional analysis - 5 (Concept of similarity)

Lecture 28 - Characterization Of Particles - 1

Lecture 29 - Characterization Of Particles - 2

Lecture 30 - Motion of a Particle in a fluid

Lecture 31 - Brownian motion and electrophoresis

- Lecture 32 - Sedimentation and Separation
- Lecture 33 - Settling velocity - Stoke's regime and Newton's regime
- Lecture 34 - Applications of settling - I
- Lecture 35 - Applications of settling - II
- Lecture 36 - Colloidal aggregates - Introduction
- Lecture 37 - Settling of colloidal aggregates
- Lecture 38 - Tutorial 5
- Lecture 39 - Settling of colloidal aggregates - free settling
- Lecture 40 - Settling in Multiple Particles System
- Lecture 41 - Flow Through Packed Bed
- Lecture 42 - Pressure Drop Through Packed Bed
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- Lecture 44 - Pressure Drop Through Packed bed Continue
- Lecture 45 - Fluidized Bed - 1
- Lecture 46 - Fluidized Bed - 2
- Lecture 47 - Filtration - 1
- Lecture 48 - Filtration - 2
- Lecture 49 - Tutorial 7
- Lecture 50 - Laminar and Turbulent Flows - 1
- Lecture 51 - Laminar and Turbulent Flows - 2
- Lecture 52 - Laminar and Turbulent Flows - 3
- Lecture 53 - Turbulent Stress and Turbulent Shear Layer
- Lecture 54 - Turbulent Flow near a wall and in a pipe
- Lecture 55 - Effect of rough Walls
- Lecture 56 - Roughness in Turbulent Pipe Flow
- Lecture 57 - Pipes of non-circular cross section
- Lecture 58 - Minor Losses, Sudden Expansion and Contraction
- Lecture 59 - Friction Losses in Sudden Expansion
- Lecture 60 - Tutorial 8
- Lecture 61 - Momentum and Kinetic Energy Correction Factor
- Lecture 62 - pressure drop in pipes which connected in series
- Lecture 63 - Pressure Drop in Pipes Which Connected in Parallel
- Lecture 64 - Pressure Drop in Pipes Which Connected at Junction

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[Lecture 66 - Boundary Layer - Momentum Integral Analysis - 1](#)

[Lecture 67 - Boundary Layer - Momentum Integral Analysis - 2](#)

[Lecture 68 - Boundary Layer - Differential Approach](#)

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[Lecture 70 - Tutorial 9](#)

- Lecture 1 - Measurement and Prediction - Part 1
- Lecture 2 - Measurement and Prediction - Part 2
- Lecture 3 - Overview of Transport Phenomena
- Lecture 4 - Scope of Course
- Lecture 5 - Continuum Hypothesis
- Lecture 6 - Lagrangian and Eulerian Descriptions - Part 1
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- Lecture 8 - Substantial Derivative - Part 1
- Lecture 9 - Substantial Derivative - Part 2
- Lecture 10 - Substantial Derivative Example - 1
- Lecture 11 - Substantial Derivative Example - 2
- Lecture 12 - Visualization of Flow Patterns: Streamline, Pathline
- Lecture 13 - Visualization of Flow Patterns: Streakline
- Lecture 14 - Streamline, Pathline: Steady Flow Example
- Lecture 15 - Streamline, Pathline, Streakline: Unsteady Flow Example
- Lecture 16 - System and Control Volume
- Lecture 17 - Reynolds transport theorem : Introduction
- Lecture 18 - Reynolds transport theorem : Simplified form
- Lecture 19 - Reynolds transport theorem : General form - Part 1
- Lecture 20 - Reynolds transport theorem : General form - Part 2
- Lecture 21 - Integral and differential balances
- Lecture 22 - Integral total mass balance
- Lecture 23 - Integral total mass balance : Simplification
- Lecture 24 - Integral total mass balance : Examples
- Lecture 25 - Differential total mass balance - Part 1
- Lecture 26 - Differential total mass balance - Part 2
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- Lecture 29 - Integral linear momentum balance - Part 1
- Lecture 30 - Integral linear momentum balance - Part 2
- Lecture 31 - Integral linear momentum balance : Examples - Part 1

- Lecture 32 - Integral linear momentum balance : Examples - Part 2
- Lecture 33 - Integral linear momentum balance : Examples - Part 3
- Lecture 34 - Differential linear momentum balance : Introduction
- Lecture 35 - Differential linear momentum balance : Transient, convection and body force terms
- Lecture 36 - Stress vector - Part 1
- Lecture 37 - Stress vector - Part 2
- Lecture 38 - Stress tensor - Part 1
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- Lecture 40 - Cauchy's formula
- Lecture 41 - Components of Stress Vector : Example
- Lecture 42 - Properties of stress tensor - Part 1
- Lecture 43 - Properties of stress tensor - Part 2
- Lecture 44 - Total stress tensor for fluids
- Lecture 45 - Comparison of solids and fluids
- Lecture 46 - Fluids at rest
- Lecture 47 - Differential linear momentum balance : Surface force terms
- Lecture 48 - Differential linear momentum balance : All terms
- Lecture 49 - Convective momentum flux tensor
- Lecture 50 - Differential linear momentum balance : Closure problem
- Lecture 51 - Normal Strain and Shear Strain - Part 1
- Lecture 52 - Normal Strain and Shear Strain - Part 2
- Lecture 53 - Displacement Field and Displacement Gradient - Part 1
- Lecture 54 - Displacement Field and Displacement Gradient - Part 2
- Lecture 55 - Strain Displacement Gradient Relation : Example
- Lecture 56 - Strain Displacement Gradient Relation : Normal and shear strain
- Lecture 57 - Strain Displacement Gradient Relation : Rotation and volumetric strain
- Lecture 58 - Strain Displacement Gradient Relation : Examples
- Lecture 59 - Displacement Gradient Tensor
- Lecture 60 - Components of Total Displacement - Part 1
- Lecture 61 - Components of Total Displacement - Part 2
- Lecture 62 - Strain Tensor and Rotation Tensor - Part 1
- Lecture 63 - Components of Total Displacement : Example
- Lecture 64 - Normal and Shear Strain Rate

- Lecture 65 - Strain Rate Velocity Gradient Relation
- Lecture 66 - Volumetric Strain Rate
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- Lecture 68 - Strain Rate : Example 1
- Lecture 69 - Strain Rate : Example 2
- Lecture 70 - Stress Strain Relation : Introduction
- Lecture 71 - Material Properties
- Lecture 72 - Hooke's Law - Strain-stress Relation
- Lecture 73 - Relation Between Material Properties
- Lecture 74 - Hooke's Law - Stress-strain Relation
- Lecture 75 - Hooke's Law : Examples
- Lecture 76 - Stress Strain Rate Relation : Introduction
- Lecture 77 - Newton's Law of Viscosity : 1D Form
- Lecture 78 - Newton's Law of Viscosity : 3D Form
- Lecture 79 - Navier Stokes Equation
- Lecture 80 - Fluid at Rest : Pressure Distribution
- Lecture 81 - Hydrostatic Pressure Distribution in Liquid
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- Lecture 84 - Flow Regimes : Laminar and Turbulent flow
- Lecture 85 - Euler Equation
- Lecture 86 - Bernoulli Equation : Inviscid Flow
- Lecture 87 - Bernoulli Equation : Example 1
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- Lecture 90 - Planar Couette Flow - Governing Equations
- Lecture 91 - Planar Couette Flow - Velocity and Pressure Distribution
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- Lecture 93 - Planar Poiseuille Flow : Governing Equations
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- Lecture 97 - Viscous Stress vs. Molecular Momentum Flux - Part 1

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- [Lecture 99 - Linear Momentum Balance : Fluid Mechanics vs. Momentum Transport - Part 1](#)
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- [Lecture 101 - Viscous Stress vs. Molecular Momentum Flux - Part 3](#)
- [Lecture 102 - Integral Energy Balance - Part 1](#)
- [Lecture 103 - Integral Energy Balance - Part 2](#)
- [Lecture 104 - Simplification of Integral Energy Balance](#)
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- [Lecture 116 - Non Isothermal Planar Couette Flow](#)

Lecture 1 - Introduction

Lecture 2 - Chemicals of Concern

Lecture 3 - Water Quality Screening Parameters

Lecture 4 - Water Quality Parameters

Lecture 5 - Air quality parameters; Sustainability

Lecture 6 - PM - Particulate Matter

Lecture 7 - Physical/Chemical properties of interest

Lecture 8 - Partition Constants

Lecture 9 - Soil-air partition constants

Lecture 10 - Application/Example of Equilibrium Partitioning

Lecture 11 - Introduction to Environmental Monitoring and Sampling

Lecture 12 - Environmental Sampling

Lecture 13 - Environmental Analysis: Quality Control - Part 1

Lecture 14 - Environmental Analysis: Quality Control - Part 2

Lecture 15 - Environmental Analysis of Organics in Water

Lecture 16 - Environmental Analysis: Quality Control - Part 3

Lecture 17 - Tutorial

Lecture 18 - Tutorial (Continued...)

Lecture 19 - Analysis Methods - Introduction and Water Quality Parameters

Lecture 20 - Analysis Methods - Water Quality Parameters

Lecture 21 - Analysis Methods - Review of Standard Methods

Lecture 22 - Analysis Methods - Organics in water

Lecture 23 - Analysis Methods - Overall Methodology for Organics

Lecture 24 - Analysis Methods - Chromatography Fundamentals

Lecture 25 - Analysis Methods - Gas Chromatography

Lecture 26 - Analysis Methods - Gas Chromatography (Mass Spectrometry)

Lecture 27 - Analysis Methods - Liquid Chromatography

Lecture 28 - Monitoring methods for Air - PM - Part 1

Lecture 29 - Monitoring methods for Air - PM - Part 2

Lecture 30 - Monitoring methods for Air - Vapor - Part 1

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- [Lecture 32 - Monitoring methods for Air - Vapor - Part 3](#)
- [Lecture 33 - Monitoring and Measurement of Microorganisms](#)
- [Lecture 34 - Transport of Pollutants - Introduction](#)
- [Lecture 35 - Transport of Pollutants - Box Models in Water](#)
- [Lecture 36 - Transport of Pollutants - Box Models in Air](#)
- [Lecture 37 - Transport of Pollutants - Dispersion](#)
- [Lecture 38 - Transport of Pollutants - Gaussian Dispersion Model](#)
- [Lecture 39 - Dispersion Model - Parameters - Part 1](#)
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- [Lecture 41 - Gaussian Dispersion Model](#)
- [Lecture 42 - Gaussian Dispersion Model - Example, Additional topics](#)
- [Lecture 43 - Regulatory Models](#)
- [Lecture 44 - Introduction to Interphase Mass Transfer](#)
- [Lecture 45 - Interphase mass transfer - Application to Environmental Interfaces](#)
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- [Lecture 47 - Interphase mass transfer - Boundary Layer and Mass Transfer Coefficient](#)
- [Lecture 48 - Interphase mass transfer - Individual and Overall Mass Transfer Coefficients](#)
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- [Lecture 50 - Estimation of the Mass Transfer Coefficients](#)
- [Lecture 51 - Air-Water Exchange](#)
- [Lecture 52 - Evaporation from different surfaces](#)
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- [Lecture 54 - Application of Interphase mass transfer](#)
- [Lecture 55 - Contamination of Sediments](#)
- [Lecture 56 - Release from Sediments](#)
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- [Lecture 58 - Other mechanisms of chemical release from sediments - Part 1](#)
- [Lecture 59 - Other mechanisms of chemical release from sediments - Part 2](#)
- [Lecture 60 - Soil - Air Transfer](#)
- [Lecture 61 - Remediation of contaminated sediments - Application of transport models](#)

NPTEL : Synthetic and Natural Supramolecular Architectures: An Approach Towards Molecular Technology (Chemical Engineering)

Co-ordinators : Prof. Chebrolu Pulla Rao

Lecture 1 - Impetus

Lecture 2 - Introduction to Supramolecular Science and Technology

Lecture 3 - Introduction to Supramolecular Science and Technology

Lecture 4 - A quickwalk - through the Supramolecular Architectures

Lecture 5 - A quickwalk - through the Supramolecular Architectures

Lecture 6 - A quickwalk - through the Supramolecular Architectures

Lecture 7 - Weak intermolecular forces : What, Where, When and How?

Lecture 8 - Weak intermolecular forces : What, Where, When and How?

Lecture 9 - Weak intermolecular forces : What, Where, When and How?

Lecture 10 - Weak intermolecular forces : What, Where, When and How?

Lecture 11 - Weak intermolecular forces : What, Where, When and How?

Lecture 12 - Weak intermolecular forces : What, Where, When and How?

Lecture 13 - Chemistry concepts of Immediate relevance - Part 1

Lecture 14 - Chemistry concepts of Immediate relevance - Part 2

Lecture 15 - Chemistry concepts of Immediate relevance - Part 3

Lecture 16 - Chemistry concepts of Immediate relevance - Part 4

Lecture 17 - Chemistry concepts of Immediate relevance - Part 5

Lecture 18 - Chemistry concepts of Immediate relevance - Part 6

Lecture 19 - Chemistry concepts of Immediate relevance - Part 7

Lecture 20 - Molecular recognition - Part 1

Lecture 21 - Molecular recognition - Part 2

Lecture 22 - Molecular recognition - Part 3

Lecture 23 - Molecular recognition - Part 4

Lecture 24 - Molecular recognition - Part 5

Lecture 25 - Molecular recognition - Part 6

Lecture 26 - Molecular recognition - Part 7

Lecture 27 - Molecular recognition - Part 8

Lecture 28 - Molecular recognition - Part 9

Lecture 29 - Molecular recognition - Part 10

Lecture 30 - Property driven functions of Supramolecular assembly

[Lecture 31](#)

[Lecture 32](#)

[Lecture 33 - Metal coordinated architectures](#)

[Lecture 34 - Engineering Supramolecular devices : Sensors,Switches,Devices and Molecules - Part 1](#)

[Lecture 35 - Engineering Supramolecular devices : Sensors,Switches,Devices and Molecules - Part 2](#)

[Lecture 36 - Engineering Supramolecular devices : Sensors,Switches,Devices and Molecules - Part 3](#)

[Lecture 37 - Engineering Supramolecular devices : Sensors,Switches,Devices and Molecules - Part 4](#)

[Lecture 38 - Engineering Supramolecular devices : Sensors,Switches,Devices and Molecules - Part 5](#)

[Lecture 39 - Engineering Supramolecular devices : Sensors,Switches,Devices and Molecules - Part 6](#)

[Lecture 40 - From molecules to machines : A glimpse at the travel](#)

- Lecture 1 - Introduction to oil and gas
- Lecture 2 - Drilling and Completion
- Lecture 3 - Well completion
- Lecture 4 - Oil and gas production systems
- Lecture 5 - Pumps, compressors and flow through pipes
- Lecture 6 - Reservoir fluid
- Lecture 7 - Fluid properties and Phase diagram - Part 1
- Lecture 8 - Fluid properties and Phase diagram - Part 2
- Lecture 9 - Nodal analysis
- Lecture 10 - Reservoir deliverability - Single phase flow
- Lecture 11 - Reservoir deliverability - Two phase flow
- Lecture 12 - Flow over a flat surface or flow through pipe - Part 1
- Lecture 13 - Flow over a flat surface or flow through pipe - Part 2
- Lecture 14 - Single-Phase, Multi-Phase-Emulsion
- Lecture 15 - Emulsification and demulsification
- Lecture 16 - Single and Multi Phase flow-flow regimes
- Lecture 17 - Multi phase flow-flow models
- Lecture 18 - Choke Performance
- Lecture 19 - Pump classifications
- Lecture 20 - Classification of artificial lifts - Part 1
- Lecture 21 - Classification of artificial lifts - Part 2
- Lecture 22 - Sucker rod pump (SRP) - Part 1
- Lecture 23 - Sucker rod pump (SRP) - Part 2
- Lecture 24 - Sucker rod pump (SRP) - Part 3
- Lecture 25 - Sucker rod pump (SRP) - Part 4
- Lecture 26 - Sucker rod pump (SRP) - Part 5
- Lecture 27 - Sucker rod pump (SRP) - Part 6
- Lecture 28 - SRP-Pump performance analysis - Part 1
- Lecture 29 - SRP-Pump performance analysis - Part 2
- Lecture 30 - SRP-Pump performance analysis - Part 3
- Lecture 31 - Introduction to progressive cavity pump

- [Lecture 32 - Progressive cavity Pump - Part 1](#)
- [Lecture 33 - Progressive cavity Pump - Part 2](#)
- [Lecture 34 - Progressive cavity Pump - Part 3](#)
- [Lecture 35 - Progressive cavity Pump - Part 4](#)
- [Lecture 36 - Progressive cavity Pump - Part 5](#)
- [Lecture 37 - Electric submersible pump - Part 1](#)
- [Lecture 38 - Electric submersible pump - Part 2](#)
- [Lecture 39 - Electric submersible pump - Part 3](#)
- [Lecture 40 - ESP- basic electrical systems - Part 1](#)
- [Lecture 41 - ESP- basic electrical systems - Part 2](#)
- [Lecture 42 - ESP- basic electrical systems - Part 3](#)
- [Lecture 43 - ESP- numerical problems - Part 1](#)
- [Lecture 44 - ESP- numerical problems - Part 2](#)
- [Lecture 45 - ESP- numerical problems - Part 3](#)
- [Lecture 46 - ESP- numerical problems - Part 1](#)
- [Lecture 47 - ESP- numerical problems - Part 2](#)
- [Lecture 48 - Gas lift basics - Part 1](#)
- [Lecture 49 - Gas lift basics - Part 2](#)
- [Lecture 50 - Gas lift valves and installartion - Part 1](#)
- [Lecture 51 - Gas lift valves and installartion - Part 2](#)
- [Lecture 52 - Plunger lift and design](#)
- [Lecture 53 - Hydraulic jet pump fundamentals - Part 1](#)
- [Lecture 54 - Hydraulic jet pump fundamentals - Part 2](#)
- [Lecture 55 - Hydraulic engine pumps and design - Part 1](#)
- [Lecture 56 - Hydraulic engine pumps and design - Part 2](#)
- [Lecture 57 - Surface pump units for jet pump - Part 1](#)
- [Lecture 58 - Surface pump units for jet pump - Part 2](#)
- [Lecture 59 - Surface pump units for jet pump - Part 3](#)
- [Lecture 60 - Surface compressor for gas lift - Part 1](#)
- [Lecture 61 - Surface compressor for gas lift - Part 2](#)
- [Lecture 62 - Surface compressor for gas lift - Part 3](#)

Lecture 1 - Introduction to Chemical process Industries

Lecture 2 - Raw material for Organic Chemical Industries

Lecture 3 - Unit processes and unit operations in organic chemical Industries

Lecture 4 - Coal and coal as chemicals feed stock

Lecture 5 - Coal carbonization and Coke oven plant

Lecture 6 - Gasification of Coal,Petrocoke and Biomass

Lecture 7 - Introduction to Pulp and paper Industry, Raw material for paper industry and Technological development

Lecture 8 - Pulping and Bleaching

Lecture 9 - Recovery of Chemicals

Lecture 10 - Stock preparation and paper making

Lecture 11 - Introduction to Soap and detergent, Soap making and Recovery of Glycerine

Lecture 12 - Synthetic detergent and Linear alkyl benzene

Lecture 13 - Sugar and Fermentation industry

Lecture 14 - Ethanol as Biofuel and Chemical feed stock

Lecture 15 - Introduction : Status of Petroleum refinery, Crude oil and Natural gas origin, occurrence, exploration, drilling and processing, Fuel norms

Lecture 16 - Evaluation of Crude oil,Petroleum Products and Petrochemicals

Lecture 17 - Crude oil Distillation

Lecture 18 - Thermal Cracking: Visbreaking and Delayed Coking

Lecture 19 - Catalytic cracking: Fluid Catalytic cracking and Hydro cracking

Lecture 20 - Catalytic reforming

Lecture 21 - Alkylation, Isomerisation and Polymerisation

Lecture 22 - Desulphurisation Processes and Recovery of Sulphur

Lecture 23 - Profile of petrochemical Industry and its structure

Lecture 24 - Naphtha and gas cracking for production of olefins

Lecture 25 - Recovery of chemicals from FCC and steam cracking

Lecture 26 - Synthesis gas and its derivatives: Hydrogen, CO, Methanol, Formaldehyde

Lecture 27 - Ethylene derivatives: Ethylene Oxide, Ethylene glycol, Ethylene dichloride and Vinyl chloride

Lecture 28 - Propylene, Propylene oxide and Isopropanol

Lecture 29 - Aromatics Production

Lecture 30 - Aromatics product profile, Ethyl benzene & Styrene, Cumene and phenol, Bisphenol, Aniline

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Lecture 31 - Introduction to polymer, Elastomer and Synthetic Fibre, Polymerisation

Lecture 32 - Polymers: Polyolefins, Polyethylene, Polypropylene Polystyrene

Lecture 33 - Polyvinylchloride, polycarbonate, thermoset resin: phenolformaldehyde, uriaformaldehyde and melamineformaldehyde

Lecture 34 - Elastomers: Styrene butadiene Rubber(SBR), Poly butadiene, Nitrile rubber

Lecture 35 - Polymides or Nylons(PA)

Lecture 36 - DMT and Terephtalic Acid, Polyester, PET resin, PTB resin

Lecture 37 - Acrylic Fibre, Modified Acrylic Fibre, Acrylonitrile, Acrolein, Propylene Finber, Polyurethane

Lecture 38 - Viscose Rayon and Acetate rayon

Lecture 39 - Pesticide

Lecture 40 - Dye and Intermediates

NPTEL : Process Integration (Chemical Engineering)

Co-ordinators : Dr. B. Mohanty

- Lecture 1 - Process integration, methods and area of application
- Lecture 2 - Fundamental concepts related to heat integration - Part 1
- Lecture 3 - Fundamental concepts related to heat integration - Part 2
- Lecture 4 - Data extraction
- Lecture 5 - Hot composite curves
- Lecture 6 - Cold composite curves
- Lecture 7 - Hot and cold composite curves and the pinch
- Lecture 8 - Threshold problems
- Lecture 9 - Energy targeting procedure
- Lecture 10 - Problem Table Algorithm - Part 1
- Lecture 11 - Grand composite curve
- Lecture 12 - Problem Table Algorithm - Part 2
- Lecture 13 - Number of units target
- Lecture 14 - Shell targeting - Part 1
- Lecture 15 - Area targeting - Part 1
- Lecture 16 - Area targeting - Part 2
- Lecture 17 - Coast targeting - Part 1
- Lecture 18 - Coast targeting - Part 2
- Lecture 19 - Supertargeting- optimization of $\hat{I}^* t \text{ min}$
- Lecture 20 - Global & stream specific $\hat{I}^* t \text{ min}$ and its relevance
- Lecture 21 - Topology Trap
- Lecture 22 - Rules for Pinch Design Method (PDM) - Part 1
- Lecture 23 - Rules for Pinch Design Method (PDM) - Part 2
- Lecture 24 - Application of PDM for MER Hen Synthesis
- Lecture 25 - Design for threshold problems
- Lecture 26 - Design for single pinch problems
- Lecture 27 - Design for multi pinch problems
- Lecture 28 - HEN optimization
- Lecture 29 - Remaining problem analysis
- Lecture 30 - Driving Force Plot
- Lecture 31 - Low Temperature process Design - Part 1

[Lecture 32 - Low Temperature process Design - Part 2](#)

[Lecture 33 - Integration of Gas turbine with process - Part 1](#)

[Lecture 34 - Integration of Gas turbine with process - Part 2](#)

[Lecture 35 - Placement and Integration of Distillation Column](#)

[Lecture 36 - Heat Integration of evaporators](#)

[Lecture 37 - Integration of heat pump](#)

[Lecture 38 - Placement of Heat Engine, Heat pump and Reactors](#)

[Lecture 39 - Integration of Furnace](#)

[Lecture 40 - Problem solving using HINT Software - Part 1](#)

[Lecture 41 - Problem solving using HINT Software - Part 2](#)

[Lecture 42 - Problem solving using HINT Software - Part 3](#)

[Lecture 43 - Problem solving using HINT Software - Part 4](#)

NPTEL : Mechanical Operations (Chemical Engineering)

Co-ordinators : Prof. Shabina Khanam

Lecture 1 - Introduction

Lecture 2 - Characterization of a single particle - 1

Lecture 3 - Characterization of a single particle - 2

Lecture 4 - Characterization of collection of particles - 1

Lecture 5 - Characterization of collection of particles - 2

Lecture 6 - Fine grain size distribution

Lecture 7 - Effectiveness of screen - 1

Lecture 8 - Effectiveness of screen - 2

Lecture 9 - Industrial screening equipment

Lecture 10 - Size reduction

Lecture 11 - Laws of comminution

Lecture 12 - Examples of Laws of comminution - 1

Lecture 13 - Examples of Laws of comminution - 2

Lecture 14 - Size reduction equipment - 1

Lecture 15 - Size reduction equipment - 2

Lecture 16 - Particle dynamics - 1

Lecture 17 - Particle dynamics - 2

Lecture 18 - Particle dynamics-Examples

Lecture 19 - Classification and Jigging - 1

Lecture 20 - Classification and Jigging - 2

Lecture 1 - Introduction - 1

Lecture 2 - Introduction - 2

Lecture 3 - Characterization of wastes - 1

Lecture 4 - Characterization of wastes - 2

Lecture 5 - Characterization of wastes - 3

Lecture 6 - Tutorial on Chatacterization of wastes

Lecture 7 - Energy production from wastes through incineration - 1

Lecture 8 - Energy production from wastes through incineration - 2

Lecture 9 - Tutorial on incineration

Lecture 10 - Energy production from wastes through gasification - 1

Lecture 11 - Energy production from wastes through gasification - 2

Lecture 12 - Syngas utilization - 1

Lecture 13 - Syngas utilization - 2

Lecture 14 - Energy production from wastes through pyrolysis - 1

Lecture 15 - Energy production from wastes through pyrolysis - 2

Lecture 16 - Tutorial on gasification

Lecture 17 - Tutorial on Pyrolysis

Lecture 18 - Densification of solids - 1

Lecture 19 - Densification of solids - 2

Lecture 20 - Efficiency improvement of power plant - 1

Lecture 21 - Efficiency improvement of power plant - 2

Lecture 22 - Energy production from waste plastics - 1

Lecture 23 - Energy production from waste plastics - 2

Lecture 24 - Gas clean up - 1

Lecture 25 - Gas clean up - 2

Lecture 26 - Energy production from organic wastes through anaerobic digestion - 1

Lecture 27 - Energy production from organic wastes through anaerobic digestion - 2

Lecture 28 - Design of anaerobic digester

Lecture 29 - Introduction to Microbial fuel cells

Lecture 30 - Energy production from organic wastes through fermentation - 1

Lecture 31 - Energy production from organic wastes through fermentation - 2

[Lecture 32 - Tutorial on anaerobic digestion](#)

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- Lecture 2 - Classification of polymers, Types of polymerization, Average molecular weights and polydispersity
- Lecture 3 - Motivation to study polymer physics
- Lecture 4 - Random Walk Models of Single Chain I: end-to-end distance of a polymer chain, freely jointed chain, drunkard walk
- Lecture 5 - Random Walk Models of Single Chain II: general random walk on a lattice
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- Lecture 8 - Models of semiflexible chains (Kratky Porod Model) - Part II
- Lecture 9 - Probability density of an ideal chain - Part I
- Lecture 10 - Probability density of an ideal chain - Part II
- Lecture 11 - Entropic Elasticity, Bead-Spring Model, Simulations of random walk models
- Lecture 12 - Derivation of Diffusion equation, Einstein notation
- Lecture 13 - Definition of Radius of gyration
- Lecture 14 - Radius of gyration for an ideal chain, concept of ideality
- Lecture 15 - Nonbonded interactions, hydrophobic and hydrophilic behaviour
- Lecture 16 - Definition of excluded volume; good, bad, and theta solvent
- Lecture 17 - Virial expansion, Flory theory for good solvent
- Lecture 18 - Flory theory for bad solvent, self-similarity and fractal nature of polymers
- Lecture 19 - Derivation of fractal dimension, concentration regimes and overlap concentration
- Lecture 20 - Size, shape, and structure. Gyration tensor and measures of asphericity.
- Lecture 21 - Order-disorder transition
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- Lecture 23 - Structure of polymer chain, Introduction to Monte Carlo simulations of polymer chains
- Lecture 24 - Monte Carlo algorithm: Detailed Balance, Metropolis algorithm
- Lecture 25 - Practical aspects of Monte Carlo simulation
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- Lecture 50 - Jaipur Terminal Fire, India: October 29, 2009
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- Lecture 41 - Radical Chain Polymerization Redox Initiation
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- Lecture 51 - Emulsion Polymerization Nucleation, Morphology and Reactor Types - I
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- Lecture 53 - Emulsion Polymerization PSD and Implementation of the Process - I
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Lecture 3 - Probability and probability distributions

Lecture 4 - Probability distributions and thermodynamic equilibrium

Lecture 5 - Energy distribution in molecular systems

Lecture 6 - First and second law of thermodynamics

Lecture 7 - Reversible and irreversible processes; third law of thermodynamics; legendre transformation; thermodynamic functions for one component system

Lecture 8 - Thermodynamic functions for multi-component systems; chemical potential; why do we minimize thermodynamic functions?

Lecture 9 - Extensive and intensive variables; gibbs duhem relation; euler theorem; maxwell relations

Lecture 10 - Discrete and continuous probabilities; stirling approximation

Lecture 11 - Binomial distribution approaches Gaussian distribution for large n; definition of drunkard walk

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Lecture 13 - Energy distribution in molecular system revisited; introduction to thermodynamic ensembles

Lecture 14 - Canonical ensemble: most probable distribution, partition function

Lecture 15 - Definition of temperature; third law of thermodynamics

Lecture 16 - Canonical ensemble: Helmholtz free energy, averages and fluctuations, specific heat, deriving ideal gas law

Lecture 17 - Partition function of a dense gas; grand canonical ensemble: partition function, most probable distribution

Lecture 18 - Computing properties in grand canonical ensemble

Lecture 19 - Isothermal isobaric ensemble

Lecture 20 - Summary of thermodynamic ensembles; partition function of an ideal gas

Lecture 21 - Mixing and phase separation, phase equilibrium of a multiphase multicomponent system, Gibbs phase rule

Lecture 22 - Pure component phase diagram; solution thermodynamics: Helmholtz free energy density

Lecture 23 - Characterizing mixing and phase separation using Helmholtz free energy density

Lecture 24 - Common tangent construction, definition of binodal, spinodal, and critical point

Lecture 25 - Osmotic pressure and chemical potential

Lecture 26 - Lattice model of liquid solutions - I

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Lecture 28 - Lattice model of liquid solutions - III

Lecture 29 - Critical review of Lattice model, theoretical basis of molecular dynamics simulation

Lecture 30 - Theoretical basis of molecular dynamics simulation

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Lecture 31 - Interaction energy and force field

Lecture 32 - Liouville theorem; theoretical basis of Monte Carlo simulation

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Lecture 46 - Numerical implementation of MD; thermostat and barostat

Lecture 47 - MD simulations - efficiency and parallelization, sampling and averaging, analysis of simulation trajectories

Lecture 48 - MD simulations - analysis of simulation trajectories (continued), Case Studies - I

Lecture 49 - MD simulations - Case Studies - II

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Lecture 52 - Extension of canonical ensemble Monte Carlo to other ensembles (Continued...)

Lecture 53 - Monte Carlo in Gibbs ensemble and semi-grand canonical ensemble, thermodynamic integration

Lecture 54 - Thermodynamic integration (continued); Widom's particle insertion; overlapping distribution method

Lecture 55 - Multiple histogram method; umbrella sampling; thermodynamic cycle; potential of mean force; pulling simulations; metadynamics; tackling time scale issues

Lecture 56 - Tackling time scale issues (continued); nonequilibrium molecular dynamics; mesoscale simulations: Langevin dynamics and Brownian dynamics, kinetic Monte Carlo simulations; dissipative particle dynamics

Lecture 57 - Multiparticle collision dynamics; lattice Boltzmann method; coarse-graining

Lecture 58 - Case studies

Lecture 59 - Simulations of chemical reactions using Kinetic Monte Carlo simulations

Lecture 60 - Reactive force fields; Ab initio molecular dynamics and other advanced methods; molecular simulations in chemical engineering; concluding remarks

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Lecture 5 - Practice problems related to power cycle and fuel analysis

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- Lecture 32 - Air Filtration and Pneumatic Conveying
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- Lecture 45 - Types and Components of Cooling Tower
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Lecture 13 - Correlations for drag coefficient

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NPTEL : NOC:Computational Chemistry and Classical Molecular Dynamics (Chemistry and Biochemistry)

Co-ordinators : Prof. B.L. Tembe

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- Lecture 6 - Programming Techniques 4 - Arrays and matrices
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- Lecture 8 - Programming Techniques 5 - Formats, Functions and Subroutines
- Lecture 9 - Programming Techniques 6 - Functions and Subroutines, arranging numbers in as ascending order
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- Lecture 11 - Numerical Methods. Analysis of errors
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Lecture 8 - Coordination Theory

Lecture 9 - Werner's Coordination Theory

Lecture 10 - Early Bonding Concepts

Lecture 11 - Valence Bond Theory (VBT) - 1

Lecture 12 - Valence Bond Theory (VBT) - 2

Lecture 13 - Background To Crystal Field Theory (CFT)

Lecture 14 - Crystal Field Theory (CFT) Jahn-Teller Theorem

Lecture 15 - Crystal Field Theory (CFT) - 1

Lecture 16 - Crystal Field Theory (CFT) - 2

Lecture 17 - Ligand Field Theory (LFT) - 1

Lecture 18 - Ligand Field Theory (LFT) - 2

Lecture 19 - Ligand Field Theory (LFT) - 3

Lecture 20 - Ligand Field Theory (LFT) - 4

Lecture 21 - 18 Electron Rule

Lecture 22 - 18 Electron Rule

Lecture 23 - Metal-Metal Multiple Bonds

Lecture 24 - Metal-Metal Multiple Bonds [Quadruple and Quintuple Bonding]

Lecture 25 - Preparation of metal Complexes

Lecture 26 - Preparation of metal Complexes

Lecture 27 - Classification of ligands by donor atoms

Lecture 28 - Classification of ligands by donor atoms - Hydrogen

Lecture 29 - Classification of ligands by donor atoms - Carbon - 1

Lecture 30 - Classification of ligands by donor atoms - Carbon - 2

Lecture 31 - Classification of ligands by donor atoms - Carbon - 3

- Lecture 32 - Classification of ligands by donor atoms - Carbon - 4
- Lecture 33 - Classification of ligands by donor atoms - Nitrogen - 1
- Lecture 34 - Classification of ligands by donor atoms - Nitrogen - 2
- Lecture 35 - Classification of ligands by donor atoms - Nitrogen - 3
- Lecture 36 - Classification of ligands by donor atoms - Oxygen, Phosphorus
- Lecture 37 - Classification of ligands by donor atoms - Phosphorus - 1
- Lecture 38 - Classification of ligands by donor atoms - Phosphorus - 2
- Lecture 39 - Classification of ligands by donor atoms - Phosphorus - 3
- Lecture 40 - Classification of ligands by donor atoms - Halogens
- Lecture 41 - Oxidative addition and reductive elimination reactions - 1
- Lecture 42 - Oxidative addition and reductive elimination reactions - 2
- Lecture 43 - Oxidative addition and reductive elimination reactions - 3
- Lecture 44 - Oxidative addition and reductive elimination reactions - 4
- Lecture 45 - Inorganic Reaction Mechanisms
- Lecture 46 - Inorganic Reaction Mechanisms Square planar complexes
- Lecture 47 - Trans-Effect
- Lecture 48 - Substitution Reactions in Square Planar Complexes, Trans-Effect
- Lecture 49 - Substitution Reactions in Octahedral Complexes
- Lecture 50 - Substitution Reactions in Octahedral Complexes; Stereochemistry of Products
- Lecture 51 - Electron-Transfer Processes
- Lecture 52 - Electron-Transfer Processes
- Lecture 53 - Methods of Characterization UV-Visible Spectroscopy
- Lecture 54 - Methods of Characterization UV-Visible Spectroscopy
- Lecture 55 - UV-Visible Spectroscopy
- Lecture 56 - UV-Visible Spectroscopy
- Lecture 57 - NMR Spectroscopy
- Lecture 58 - NMR Spectroscopy
- Lecture 59 - NMR and IR Spectroscopy
- Lecture 60 - Summary and Conclusion

Lecture 1 - Radioactivity

Lecture 2 - Radioactive decay

Lecture 3 - Radioactive decay chain

Lecture 4 - Radioactive equilibria

Lecture 5 - Nuclear structure and stability

Lecture 6 - Nuclear force and nuclear properties

Lecture 7 - Liquid drop model

Lecture 8 - Applications of Liquid drop model

Lecture 9 - Nuclear Shell model

Lecture 10

Lecture 11 - Alpha decay

Lecture 12 - Beta decay

Lecture 13 - Gamma decay

Lecture 14 - Interaction of radiations with matter

Lecture 15 - Interaction of fast electrons with matter

Lecture 16 - Interaction of electromagnetic radiations with matter

Lecture 17 - Principles of radiation detectors

Lecture 18 - Gas filled detectors

Lecture 19 - Scintillator detectors

Lecture 20 - Semiconductor detectors

Lecture 21

Lecture 22

Lecture 23

Lecture 24

Lecture 25

Lecture 26 - Compound nucleus reactions

Lecture 27 - Nuclear fission

Lecture 28 - Nuclear fusion

Lecture 29 - Production of radioisotopes using neutrons

Lecture 30 - Radioisotope production using charged particles

Lecture 31 - Radiochemical practices

Lecture 32 - Radioanalytical techniques and applications

Lecture 33 - Nuclear analytical techniques

Lecture 34 - Applications of neutron activation analysis

Lecture 35 - Ion beam analysis

Lecture 36 - Nuclear reaction analysis and particle induced gamma emission

Lecture 37 - Nuclear Probes: Positron annihilation spectroscopy

Lecture 38 - Perturbed angular correlation

Lecture 39 - Radioisotope applications in healthcare

Lecture 40 - Radioisotope applications in Industry, agriculture and food technology

Lecture 41 - History of actinides

Lecture 42 - Actinide concept

Lecture 43 - Actinide ionic species in water

Lecture 44 - Actinide hydration and Hydrolysis

Lecture 45 - pH-pE concept

Lecture 46 - Ln/An absorption spectroscopy - I

Lecture 47 - Ln/An absorption spectroscopy - II

Lecture 48 - Ln/An emission spectroscopy - I

Lecture 49 - Ln/An emission spectroscopy - II

Lecture 50 - Solution chemistry Actinides

Lecture 51 - Complexation of actinides - I

Lecture 52 - Complexation of actinides - II

Lecture 53 - Solvent extraction of actinides - I

Lecture 54 - Solvent extraction of actinides - II

Lecture 55 - Actinide partitioning

Lecture 56 - Analytical chemistry of actinides

Lecture 57 - Transactinides

Lecture 58 - Fast radiochemical separations

Lecture 59 - Actinides in the environment

Lecture 60 - Actinides sorption and migration

Lecture 1 - General introduction to Statistical Thermodynamics

Lecture 2 - Configuration and Weights

Lecture 3 - Configuration and Weights (Continued...)

Lecture 4 - Boltzmann Distribution

Lecture 5 - The Molecular Partition Function

Lecture 6 - The Molecular Partition Function of a uniform ladder of energy levels

Lecture 7 - The partition function for a particle of mass m free to move in a 1D container

Lecture 8 - The partition function for a particle of mass m free to move in a 3D container

Lecture 9 - Numerical Problems Set-I (based on partition function)

Lecture 10 - Numerical Problems Set-II

Lecture 11 - The Internal Energy

Lecture 12 - Obtaining expression for beta

Lecture 13 - The Statistical Entropy

Lecture 14 - Connecting partition function with entropy

Lecture 15 - Solving numerical problems based on Internal energy and Entropy

Lecture 16 - Solving numerical problems based on Internal energy and Entropy

Lecture 17 - Negative Temperature

Lecture 18 - Further discussion on q (Partition function), U (Internal energy) and S (Entropy)

Lecture 19 - The Canonical Partition Function

Lecture 20 - Relating Canonical Partition Function Internal Energy and Entropy

Lecture 21 - Recovering molecular partition function q from canonical partition function Q

Lecture 22 - Entropy of a monatomic gas

Lecture 23 - Further discussion on entropy of a monatomic gas - I

Lecture 24 - Further discussion on entropy of a monatomic gas - II

Lecture 25 - The Thermodynamic Functions (Pressure)

Lecture 26 - The Thermodynamic Functions (Enthalpy)

Lecture 27 - The Thermodynamic Functions (The Gibbs Energy)

Lecture 28 - The Thermodynamic Functions (The Molecular Partition Function)

Lecture 29 - The Rotational Contribution to Molecular Partition Function

Lecture 30 - The Rotational Contribution to Molecular Partition Function (Nonlinear Rotor)

Lecture 31 - The Rotational Contribution to Molecular Partition Function

[Lecture 32 - Rotational Partition Function](#)

[Lecture 33 - Vibrational Partition Function - I](#)

[Lecture 34 - Vibrational Partition Function - II](#)

[Lecture 35 - Vibrational Partition Function - Applications](#)

[Lecture 36 - Electronic Partition Function](#)

[Lecture 37 - Mean Energies](#)

[Lecture 38 - Mean Energies \(Continued...\)](#)

[Lecture 39 - Heat Capacity](#)

[Lecture 40 - Heat Capacity \(Continued...\)](#)

[Lecture 41 - Mean Energies \(Applications\)](#)

[Lecture 42 - Problem Solving](#)

[Lecture 43 - Residual Entropy](#)

[Lecture 44 - Residual Entropy \(Continued...\)](#)

[Lecture 45 - Relation between equilibrium constant \$K\$ and partition function \$q\$](#)

[Lecture 46 - Relation between equilibrium constant \$K\$ and partition function \$q\$ \(Continued...\)](#)

[Lecture 47 - Relation between equilibrium constant \$K\$ and partition function \$q\$ \(Applications-1\)](#)

[Lecture 48 - Relation between equilibrium constant \$K\$ and partition function \$q\$ \(Applications-2\)](#)

[Lecture 49 - Contributions to equilibrium constant](#)

[Lecture 50 - Contributions to equilibrium constant \(Continued...\)](#)

[Lecture 51 - Contributions to equilibrium constant \(Continued...\) and Problems Solving](#)

[Lecture 52 - Problem Solving](#)

[Lecture 53 - Problem Solving \(Continued...\)](#)

[Lecture 54 - Equations of state](#)

[Lecture 55 - Bose-Einstein Statistics](#)

[Lecture 56 - Problem Solving](#)

[Lecture 57 - FERMI-DIRAC Statistics](#)

[Lecture 58 - Radial Distribution Function](#)

[Lecture 59 - Recap - 1](#)

[Lecture 60 - Recap - 2](#)

- Lecture 1 - Various Analytical Techniques and their applications
- Lecture 2 - Introduction to ^1H NMR Spectroscopy
- Lecture 3 - NMR signals and magnetic shielding
- Lecture 4 - Introduction to the concept of Chemical Shifts in NMR spectra
- Lecture 5 - Chemical Shifts for different type of protons
- Lecture 6 - N+1 Rule and Pascal's Triangle
- Lecture 7 - Coupling constants for different types of molecules
- Lecture 8 - Second Order Coupling
- Lecture 9 - Introduction to ^{13}C NMR Spectroscopy
- Lecture 10 - Introduction to ^{31}P NMR Spectroscopy
- Lecture 11 - Chemical Shift Range in ^{31}P NMR Spectroscopy
- Lecture 12 - Examples explaining Multinuclear NMR Spectroscopy - 1
- Lecture 13 - Examples explaining Multinuclear NMR Spectroscopy - 2
- Lecture 14 - Examples explaining Multinuclear NMR Spectroscopy - 3
- Lecture 15 - Examples explaining Multinuclear NMR Spectroscopy - 4
- Lecture 16 - Examples explaining Multinuclear NMR Spectroscopy - 5
- Lecture 17 - Monitoring reaction through ^{31}P NMR Spectroscopy
- Lecture 18 - ^{19}F , ^{14}N and ^{15}N NMR Spectroscopy
- Lecture 19 - ^6Li and ^7Li NMR Spectroscopy
- Lecture 20 - ^{11}B , ^{10}B and ^{199}Hg NMR Spectroscopy
- Lecture 21 - Introduction to UV Spectroscopy
- Lecture 22 - Types of Electronic Transitions and Woodward-Fieser Rules
- Lecture 23 - Spin Orbit Coupling and Term Symbols
- Lecture 24 - Ground State Term Symbol
- Lecture 25 - Calculating microstates for different electronic configuration
- Lecture 26 - Selection Rule of Electronic Transition
- Lecture 27 - Orgel Level Diagrams
- Lecture 28 - Racah Parameters and Tanabe-Sugano Diagrams
- Lecture 29 - Introduction to IR Spectroscopy - 1
- Lecture 30 - Introduction to IR Spectroscopy - 2
- Lecture 31 - Interpretation of IR Spectra

- Lecture 32 - IR stretching frequencies for various functional groups
- Lecture 33 - Hook's Law - Numericals
- Lecture 34 - IR Spectra of carbonyl compounds - 1
- Lecture 35 - IR Spectra of carbonyl compounds - 2
- Lecture 36 - Numerical Problems related to IR Spectroscopy - 1
- Lecture 37 - Numerical Problems related to IR Spectroscopy - 2
- Lecture 38 - Introduction to Mass Spectrometry
- Lecture 39 - Isotope Peaks in Mass Spectrometry
- Lecture 40 - Hydrogen deficiency Index
- Lecture 41 - EI Mass Spectra of various molecules - 1
- Lecture 42 - EI Mass Spectra of various molecules - 2
- Lecture 43 - EI Mass Spectra of various molecules - 3
- Lecture 44 - Types of Mass Spectrometry
- Lecture 45 - Introduction to EPR Spectroscopy - 1
- Lecture 46 - Introduction to EPR Spectroscopy - 2
- Lecture 47 - Hyperfine Interactions
- Lecture 48 - Examples of Hyperfine Interactions
- Lecture 49 - Introduction to Mössbauer Spectroscopy (Mössbauer)
- Lecture 50 - More discussion, problems and solutions (Mössbauer)
- Lecture 51 - Problems and Solutions - 1
- Lecture 52 - Problems and Solutions - 2
- Lecture 53 - Problems and Solutions - 3
- Lecture 54 - Problems and Solutions - 4
- Lecture 55 - Problems and Solutions - 5
- Lecture 56 - Rule of Thirteen and Nitrogen Rule
- Lecture 57 - Problems and Solutions - 6
- Lecture 58 - Problems and Solutions - 7
- Lecture 59 - Problems and Solutions - 8
- Lecture 60 - Summary and conclusion

- Lecture 1 - Failure of classical mechanics
- Lecture 2 - Postulates of quantum mechanics
- Lecture 3 - Postulate 5 and 6
- Lecture 4 - Overview of exactly solvable system
- Lecture 5 - Introduction to many electron problem
- Lecture 6 - Non-interacting and interacting quantum particles
- Lecture 7 - Spin orbital concept
- Lecture 8 - Slater determinant introduction
- Lecture 9 - Form of exact wave function for interacting particles
- Lecture 10 - A brief introduction to Configuration Interaction (CI)
- Lecture 11 - Variational method and Rayleigh-Ritz variation
- Lecture 12 - Linear variation method
- Lecture 13 - Hartree-Fock theory introduction
- Lecture 14 - Slater rules for matrix elements
- Lecture 15 - Spin integrated for closed shell determinant
- Lecture 16 - Examples of spin integrated determinants
- Lecture 17 - Introduction to Lagrange variation
- Lecture 18 - General lagrange variation
- Lecture 19 - Lagrange variation to minimize the the Hartree-Fock energy
- Lecture 20 - Non-canonical HF equation
- Lecture 21 - Interpretation of coulomb and exchange terms
- Lecture 22 - Unitary transformation of non-canonical HF equation
- Lecture 23 - Canonical Hartree-Fock equation
- Lecture 24 - Koopmans' approximation for IP
- Lecture 25 - Koopmans' approximation for EA
- Lecture 26 - Spin integrated Hartree-Fock for closed shell system (RHF)
- Lecture 27 - Molecular Hartree-Fock introduction
- Lecture 28 - Hartree-Fock Roothaan Hall equation
- Lecture 29 - Symmetry of two electron integrals
- Lecture 30 - HF Roothaan equation in terms of atomic orbitals
- Lecture 31 - Koopmans' IP for molecules

Lecture 32 - Koopmans' EA for molecules

Lecture 33 - Roothaan equation in orthonormalized basis

Lecture 34 - Review of Hartree-Fock theory

Lecture 35 - Charge density, Bond order and Population analysis

Lecture 36 - Dipole Moment

Lecture 37 - Introduction to basis set

Lecture 38 - Dunning and Pople basis set

Lecture 39 - Polarization and diffuse function

Lecture 40 - Brillouin's theorem and Slater's rule type-2

Lecture 41 - Slater rule type-2

Lecture 42 - Spin adapted determinant

Lecture 43 - Dissociation of Hydrogen molecule problem

Lecture 44 - Inadequacies of restricted Hartree-Fock theory

Lecture 45 - Hartree-Fock perturbation theory and correlation correction

Lecture 46 - Hartree-Fock perturbation theory (Continued...)

Lecture 47 - Introduction of 2nd order perturbation theory

Lecture 48 - Intermediate normalization and an expression for the Correlation energy

Lecture 49 - Slater rule -3 and derivation of 2-nd order perturbation energy

Lecture 50 - Physical insight of pair correlation theory

Lecture 51 - Introduction to configuration interaction (CI)

Lecture 52 - Determine the parameter of CI

Lecture 53 - Construction of CIS hamiltonian matrix

Lecture 54 - Importance of doubly excited determinants in correlation contribution

Lecture 55 - Intermediate normalization and an expression for the Correlation energy

Lecture 56 - CI equation in terms of Normal-Ordered hamiltonian

Lecture 57 - Doubly excited CI function (D-CI)

Lecture 58 - Matrix structure of CISD (singly and doubly excited CI)

Lecture 59 - Some illustrative example

Lecture 60 - Effects of singly excited determinant in the calculation

Lecture 61 - D-CI for non-interacting hydrogen molecules

Lecture 62 - Size consistency problem in truncated CI

Lecture 63 - N-dependence of D-CI correlation energy

Lecture 64 - problem of truncating CI

[Lecture 65 - Introduction of second quantization operator in quantum mechanics](#)

[Lecture 66 - Creation and annihilation operator and their properties](#)

[Lecture 67 - Operators in second quantization](#)

[Lecture 68 - Some basic examples related with second quantization operator](#)

[Lecture 69 - Hole-Particle formalism](#)

[Lecture 70 - Hugenholtz rule for diagrammatic construction of MP perturbation theory](#)

[Lecture 71 - Linked cluster diagram](#)

[Lecture 72 - Energy expression for higher order Moller-Plasset perturbation theory](#)

[Lecture 73 - Diagrammatic representation of MP3 energy and some practice problem](#)

[Lecture 74 - Overview of the some other correlation calculation method](#)

[Lecture 75 - A brief introduction to Coupled cluster theory](#)

Lecture 1 - A Course on Bio-physical Chemistry

Lecture 2 - Protein Structure

Lecture 3 - Secondary Structure of Proteins

Lecture 4 - Secondary Structure of Proteins (Continued...)

Lecture 5 - Tertiary Structure

Lecture 6 - Forces in Protein Folding

Lecture 7 - Forces in Protein Folding (Continued...)

Lecture 8 - Electrostatics (Continued...)

Lecture 9 - Intermolecular Interactions

Lecture 10 - Dipole-Dipole Interaction

Lecture 11 - Electrostatics (Continued...)

Lecture 12 - Hydrophobic Effect

Lecture 13 - Hydrophobic Effect (Continued...)

Lecture 14 - Hydrogen Bonding

Lecture 15 - Protein Stability Curves

Lecture 16 - Thermodynamics of Protein Unfolding

Lecture 17 - Thermodynamics of Protein Unfolding (Continued...)

Lecture 18 - Mechanism of Chemical Denaturation

Lecture 19 - Pressure Induced Denaturation (The P-T Diagram)

Lecture 20 - Protein Folding Pathways and Energy Landscapes

Lecture 21 - Diffusion

Lecture 22 - Diffusion (Continued...)

Lecture 23 - Diffusion (Continued...)

Lecture 24 - Langevin Equation and Brownian Motion

Lecture 25 - Langevin Equation and Brownian Motion (Continued...)

Lecture 26 - Langevin Equation and Brownian Motion (Continued...)

Lecture 27 - Protein Folding : Mechanisms and Kinetics

Lecture 28 - Protein Folding : Mechanisms and Kinetics (Continued...)

Lecture 29 - Protein Folding : Mechanisms and Kinetics (Continued...)

Lecture 30 - Protein Folding : The Chevron-Plot

Lecture 31 - Protein Folding Kinetics : Rapid Mixing and Relaxation Techniques

[Lecture 32 - Protein Folding Kinetics : Rapid Mixing and Relaxation Techniques \(Continued...\)](#)

[Lecture 33 - Protein Folding Kinetics : Rapid Mixing and Relaxation Techniques \(Continued...\)](#)

[Lecture 34 - Protein Folding Kinetics : Rapid Mixing and Relaxation Techniques \(Continued...\)](#)

[Lecture 35 - Experimental Tools](#)

[Lecture 36 - Spectroscopy : The Franck Condon Principle](#)

[Lecture 37 - Spectroscopy : The Franck Condon Principle \(Continued...\)](#)

[Lecture 38 - Electronic Spectroscopy Absorption and Fluorescence](#)

[Lecture 39 - Fluorescence](#)

[Lecture 40 - Fluorescence Quenching](#)

[Lecture 41 - Infrared Spectroscopy of Proteins](#)

[Lecture 42 - Infrared Spectroscopy of Proteins \(Continued...\)](#)

Lecture 1 - Introduction to Spectroscopy - I

Lecture 2 - Introduction to Spectroscopy - II

Lecture 3 - Introduction to Spectroscopy - III

Lecture 4 - Introduction to Spectroscopy - IV

Lecture 5 - Introduction to Spectroscopy - V

Lecture 6 - Introduction to Spectroscopy - VI

Lecture 7 - Rotational, rotational Raman Spectroscopy theory and Application - I

Lecture 8 - Rotational, rotational Raman Spectroscopy theory and Application - II

Lecture 9 - Vibrational Spectroscopy Theory and Application - I

Lecture 10 - Vibrational, Rotational-Vibrational, Raman Spectroscopy - II

Lecture 11 - Vibrational, Rotational-Vibrational, Raman Spectroscopy - III

Lecture 12 - Problems on Rotational, Vibrational and Raman Spectroscopy

Lecture 13 - Atomic Spectroscopy - I

Lecture 14 - Atomic Spectroscopy - II

Lecture 15 - Atomic Spectroscopy - III

Lecture 16 - Atomic Spectroscopy - IV

Lecture 17 - Atomic and Molecular Spectroscopy

Lecture 18 - Electronic Spectra of Diatomic Molecules and UV-Vis Spectroscopy

Lecture 19 - UV-Visible Spectroscopy of Conjugated Molecules

Lecture 20 - UV-Vis Spectroscopy and its Applications - I

Lecture 21 - UV-Vis Spectroscopy and its Applications - II

Lecture 22 - UV-Vis and Fluorescence Spectroscopy

Lecture 23 - Fluorescence Spectroscopy (Continued...)

Lecture 24 - Application of Fluorescence Spectroscopy

Lecture 25 - Application of Steady-State Fluorescence

Lecture 26 - Time- resolved Fluorescence Spectroscopy

Lecture 27 - Microscopy

Lecture 28 - Contrast in Microscopy, Fluorescence Microscopy

Lecture 29 - Fluorescence Microscopy and Application

Lecture 30 - Principle of NMR

Lecture 31 - NMR data processing and Chemical shift

[Lecture 32 - Structure Informations from NMR](#)

[Lecture 33 - Structure Calculation and 2D-NMR Spectroscopy](#)

[Lecture 34 - Mass Spectroscopy](#)

Lecture 1 - Introduction, Stability, Phase Space and Invariant Sets - 1

Lecture 2 - Introduction, Stability, Phase Space and Invariant Sets - 2

Lecture 3 - Introduction, Stability, Phase Space and Invariant Sets - 3

Lecture 4 - Maps and Flows. Simple Examples of Dynamics Systems - 1

Lecture 5 - Maps and Flows. Simple Examples of Dynamics Systems - 2

Lecture 6 - Logistic map. Simple Examples of Bifurcations

Lecture 7 - Bifurcation Diagrams. Period 3 Implies Chaos. Characterizing Chaos

Lecture 8 - Characterizing The Period-Doubling Route to Chaos

Lecture 9 - Lyapunov Exponents; Invariant measures

Lecture 10 - Intermittency. Crises

Lecture 11 - Fractals

Lecture 12 - Chaos in Flows. The Lorenz and Rossler Systems

Lecture 13 - The Baker and Horseshoe Maps

Lecture 14 - Hamiltonian Chaos - 1

Lecture 15 - Hamiltonian Chaos - 2

Lecture 1 - Aldol Reaction

Lecture 2 - Perkin, Claisen and Thorpe Reactions

Lecture 3 - Reaction of Enolates

Lecture 4 - Mannich Reaction

Lecture 5 - Reaction of Alkenes and Carbonyl Compounds

Lecture 6 - Friedel-Crafts and Prins Reactions

Lecture 7 - Grignard Reagents

Lecture 8 - Organolithium Reagents

Lecture 9 - Organocopper, Organozinc and Organomercury Reagents

Lecture 10 - Ritter Reaction and Gabriel Synthesis

Lecture 11 - Reactions of imines and enamines, synthesis of alkaloids and amino acids

Lecture 12 - Reactions of electrophilic and nucleophilic nitrogens, synthesis of amino acids and peptides

Lecture 13 - Principles, effect of substituents and carbon-carbon bond formation

Lecture 14 - Formylation/acylation and related reactions

Lecture 15 - Nitration, Sulfonation and other reactions

Lecture 16 - Principle, Substitution mechanism and reactions of Benzyne

Lecture 17 - Schiemann Reaction, Ullmann reaction and Stephens-Castro coupling

Lecture 18 - Ziegler Alkylation, Chichibabin Reaction, Von Richter Rearrangement, Smiles Rearrangement, Bamberger Rearrangement and Bucherer Reaction

Lecture 19 - Preparation, properties and reactions

Lecture 20 - Coupling reactions, Japp-Klingemann reaction and Tiffeneau-Demjanov rearrangement

Lecture 21 - Applications of diazonium salts

Lecture 22 - Wagner-Meerwein rearrangement, Pinacol rearrangement, Benzilic acid rearrangement and Arndt-Eistert synthesis

Lecture 23 - Rearrangement of halogen, oxygen, sulfur and nitrogen containing centre

Lecture 24 - Rearrangement to electron-Rich carbon

Lecture 25 - Reactivity and several reactions

Lecture 26 - Reactions of sulfur and silicon containing reagents

Lecture 27 - Preparation and reactions of organoborane and organotin reagents

Lecture 28 - Formation of carbon-carbon and carbon-halogen bonds

Lecture 29 - Cu, Mn, Sm, and Sn Based Reactions, Acyloin Condensation

Lecture 30 - C-N, C-O bond formation and decarboxylation

- Lecture 1 - Chromium Based Reagents for Oxidation
- Lecture 2 - Non-metal based Reagents for Oxidation
- Lecture 3 - Organic Peroxides
- Lecture 4 - Oxidation Mediated by DDQ, CAN and SeO₂
- Lecture 5 - Oxidation Mediated by Mn and Ag
- Lecture 6 - Oxidation by Ru, Hypervalent Iodine, Al and Na based Reagents
- Lecture 7 - Na and Li Metal based Reduction
- Lecture 8 - Hydride based Reduction
- Lecture 9 - Hydrogenation
- Lecture 10 - Al, Zn and Li Based Reagents for Reduction
- Lecture 11 - Reduction With Boranes, Diimide and Trialkylsilanes
- Lecture 12 - Li Based Reagents in Organic Synthesis
- Lecture 13 - Mg and Na Based Reagents in Organic Synthesis
- Lecture 14 - B Based Reagents in Organic Synthesis
- Lecture 15 - B and Al Based Reagents in Organic Synthesis
- Lecture 16 - S Based Reagents in Organic Synthesis
- Lecture 17 - P Based Reagents in Organic Synthesis
- Lecture 18 - Si and Pb Based Reagents in Organic Synthesis
- Lecture 19 - Sn and Bi Based Reagents in Organic Synthesis
- Lecture 20 - Ti Based Reagents in Organic Synthesis
- Lecture 21 - Ru Based Reagents in Organic Synthesis
- Lecture 22 - Pd Based Reagents in Organic Synthesis
- Lecture 23 - Cu Based Reagents in Organic Synthesis
- Lecture 24 - Cr and Mn Based Reagents in Organic Synthesis
- Lecture 25 - Zn and Hg Based Reagents in Organic Synthesis
- Lecture 26 - Au Based Reagents in Organic Synthesis
- Lecture 27 - Fe and Co Based Reagents in Organic Synthesis
- Lecture 28 - Ag and Rh Based Reagents in Organic Synthesis
- Lecture 29 - Ni, Pt and Ir Based Reagents in Organic Synthesis
- Lecture 30 - Introduction to Lanthanides and Sm Based Reagents
- Lecture 31 - Samarium(II) Iodide Based Reagents in Organic Synthesis

Lecture 32 - Sm and Yb Based Reagents in Organic Synthesis

- Lecture 1 - Concepts of heat and work; First Law of Thermodynamics
- Lecture 2 - Concepts of enthalpy and heat capacity
- Lecture 3 - Introduction to entropy
- Lecture 4 - Calculation of entropy for various processes
- Lecture 5 - Gibbs and Helmholtz free energy
- Lecture 6 - Introduction to chemical potential
- Lecture 7 - Clapeyron equation and phase transition; concept of fugacity
- Lecture 8 - Calculation of fugacity; free energy of mixing
- Lecture 9 - Partial molar quantities; excess thermodynamic quantities
- Lecture 10 - Concept of activity and activity coefficients; Debye-Huckel limiting law
- Lecture 11 - Phase Diagram of one component systems
- Lecture 12 - Phase Diagram of two component systems
- Lecture 13 - Phase Diagram of three component system; one dimensional random walk
- Lecture 14 - Macroscopic and microscopic states; Boltzmann distribution; Canonical partition function
- Lecture 15 - Calculation of different thermodynamical quantities using canonical partition function
- Lecture 16 - Introduction to molecular partition function
- Lecture 17 - Translational, electronic and nuclear partition function
- Lecture 18 - Rotational partition function
- Lecture 19 - Vibrational partition function; Introduction to grand canonical ensemble
- Lecture 20 - Grand canonical distribution; Introduction to microcanonical ensemble
- Lecture 21 - Problems on classical thermodynamics - 1
- Lecture 22 - Problems on classical thermodynamics - 2
- Lecture 23 - Problems on statistical thermodynamics - 1
- Lecture 24 - Problems on statistical thermodynamics - 2
- Lecture 25 - Problems on statistical thermodynamics - 3
- Lecture 26 - Fermi-Dirac and Bose-Einstein statistics
- Lecture 27 - Ideal Fermi gas
- Lecture 28 - Ideal Bose gas; Introduction to Bose-Einstein condensation
- Lecture 29 - Bose-Einstein condensations
- Lecture 30 - Nuclear spin statistics; Ortho- and para-hydrogens
- Lecture 31 - Specific Heats of solids

[Lecture 32 - Problems on statistical thermodynamics - 4](#)

[Lecture 33 - Advance problems - 1](#)

[Lecture 34 - Advance Problems - 2](#)

[Lecture 35 - Advance Problems - 3](#)

[Lecture 36 - Advance Problems - 4](#)

[Lecture 37 - Advance Problems - 5](#)

Lecture 1 - Importance of Biomolecules

Lecture 2 - DNA double helix: Chemical parameters

Lecture 3 - DNA and Proteins

Lecture 4 - Amino acids and Proteins

Lecture 5 - Protein 3D structures, folding and denaturation

Lecture 6 - Chemical synthesis pyrimidine nucleobases

Lecture 7 - Chemical synthesis purine nucleobases, Prebiotic chemistry

Lecture 8 - Synthesis of nucleosides

Lecture 9 - Solid phase DNA synthesis

Lecture 10 - Chemistry and Biology of DNA Replication

Lecture 11 - Chemistry of Polymerase Chain Reaction

Lecture 12 - Major components and steps involved in Polymerase chain reaction

Lecture 13 - DNA sequencing: Sanger's di-deoxy method

Lecture 14 - DNA sequencing: Maxam- Gilbert method

Lecture 15 - Numerical Problem-1

Lecture 16 - Sugar Chemistry

Lecture 17 - Chemistry behind DNA damage and mutation

Lecture 18 - Chemistry behind DNA damage and mutation

Lecture 19 - DNA repair

Lecture 20 - Transcription - The transfer of genetic information from DNA to mRNA

Lecture 21 - Translation - The transfer of genetic information from mRNA to protein I

Lecture 22 - Translation - The transfer of genetic information from mRNA to protein II

Lecture 23 - Role of Ribosome in protein synthesis and the concept of codon

Lecture 24 - Protein sequencing using Sanger's and Edman's degradation methods

Lecture 25 - Mass spectroscopy and other sequencing methods for large proteins

Lecture 26 - Solution phase peptide synthesis: mechanism and end protection

Lecture 27 - Peptide coupling agents, Solid phase synthesis, peptide based therapeutics

Lecture 28 - Spectroscopic techniques

Lecture 29 - Spectroscopic techniques - II and Purification technique-I of biomolecules

Lecture 30 - Purification techniques - II and Characteriation techniques of biomolecules

Lecture 31 - Molecular probes: PNA and LNA-I

[Lecture 32 - Molecular Probes: PNA and LNA-II](#)

[Lecture 33 - Carbohydrate chemistry - I: Introduction and Synthesis](#)

[Lecture 34 - Carbohydrate chemistry - II: Polysaccharides and its nanoparticles](#)

[Lecture 35 - Carbohydrate chemistry - III: Synthesis of nanoparticles; Recap of all modules](#)

NPTEL : Chemistry of Materials (Chemistry and Biochemistry)

Co-ordinators : Prof. S. Sundar Manoharan

Lecture 1 - Introduction to Materials Chemistry

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Co-ordinators : Prof. D.R. Mal

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[Lecture 34 - Enzyme Kinetics - I](#)

[Lecture 35 - Enzyme Kinetics - II](#)

[Lecture 36 - Enzyme Kinetics \(by using enzyme from apple juice\)](#)

[Lecture 37 - Enzyme Kinetics \(by using enzyme from apple juice\) \(Continued...\)](#)

[Lecture 38 - Isolation and Characterization of DNA Part - I](#)

[Lecture 39 - Isolation and Characterization of DNA Part - II](#)

[Lecture 40 - Bacterial Culture for Plasmid DNA Isolation](#)

[Lecture 41 - Isolation of Plasmid DNA](#)

[Lecture 42 - Isolation and Characterization of DNA Summary](#)

[Lecture 43 - Basics of rDNA Technology Part - I](#)

[Lecture 44 - Basics of rDNA Technology Part - II](#)

[Lecture 45 - Cloning : Polymerase Chain Reaction, Restriction Enzyme Digestion and Ligation](#)

[Lecture 46 - DNA Transformation](#)

[Lecture 47 - Protein-Ligand Interaction](#)

[Lecture 48 - Protein-Ligand Interaction \(Continued...\)](#)

[Lecture 49 - Interaction study of HSA protein with Curcumin and Gallic acid using UV-Vis spectroscopy](#)

[Lecture 50 - Interaction study of HSA protein with Curcumin and Gallic acid using UV-Vis spectroscopy \(Continued...\)](#)

[Lecture 51 - Analysis of the Structure of Protein ligand complex](#)

[Lecture 52 - Immunoassay Techniques](#)

[Lecture 53 - Western Blotting Technique](#)

Lecture 1 - Introduction

Lecture 2 - Importance of chemical industry, chemicals from materials

Lecture 3 - Bulk and commodity chemicals

Lecture 4 - Fine and speciality chemicals

Lecture 5 - Water

Lecture 6 - Hydrogen

Lecture 7 - Inorganic peroxide compounds

Lecture 8 - Nitrogen compounds

Lecture 9 - Chloramine and Hydroxylamine

Lecture 10 - Nitric acid, Ostwald process and uses

Lecture 11 - Phosphorus and its components

Lecture 12 - Phosphoric acid salts

Lecture 13 - Tetrapotassium diphosphate preparation

Lecture 14 - Hydroxy apatite

Lecture 15 - P₄S₁₀ and phosphide preparation

Lecture 16 - Sulfur and copper (I) phosphide

Lecture 17 - Sulfur compounds and sulfur from H₂S and SO₂

Lecture 18 - Sulfuric acid, catalyst and S₂Cl₂, applications

Lecture 19 - Sulfur dichloride, thionyl chloride

Lecture 20 - Thiosulfates and dithionite

Lecture 21 - Sodium hydroxyl methanesulfinate and hydrogen sulfide

Lecture 22 - Halogen and halogen compounds

Lecture 23 - Fluorine and inorganic fluorides

Lecture 24 - Hydrogen fluoride and aluminum fluoride

Lecture 25 - Cryolite and other industrially important fluoride salts

Lecture 26 - Electrochemical fluorination, sulfonyl fluorides

Lecture 27 - Chloralkali electrolysis

Lecture 28 - Ion conduction membrane in electrolysis

Lecture 29 - Hydrochloric acid manufacture

Lecture 30 - Bromine and bromine compounds

Lecture 31 - Hydrogen bromide and alkali bromates

Lecture 32 - Iodine and iodine compounds

Lecture 33 - Mineral fertilizers

Lecture 34 - Nitrogen fertilizer and Urea

Lecture 35 - Potassium fertilizer

Lecture 36 - Metals and their compounds: Lithium

Lecture 37 - Sodium and its compounds

Lecture 38 - Potassium and its compounds

Lecture 39 - Magnesium and its compounds

Lecture 40 - Calcium and its compounds

Lecture 41 - Barium and its compounds

Lecture 42 - Chromium and its compounds

Lecture 43 - Manganese and its industrially important compounds

Lecture 44 - Silicon and its compounds

Lecture 45 - Organosilicon compounds, organoalkoxysilanes

Lecture 46 - Organomercapto silanes and silicones

Lecture 47 - Silicone rubber

Lecture 48 - Inorganic solids: glass

Lecture 49 - Zeolites

Lecture 50 - Inorganic Fibres: asbestos, textile glass and optical fibres

Lecture 51 - Glass fibre production and construction materials

Lecture 52 - Ceramics and its manufacturing processes

Lecture 53 - Specialty ceramic products

Lecture 54 - Ferrites and porcelain enamel

Lecture 55 - Layers of enamelling

Lecture 56 - Carbon modifications: Glassy carbon, foamed carbon, carbon black

Lecture 57 - Activated carbon

Lecture 58 - Metallic hard materials: Carbides, borides, silicides

Lecture 59 - Fillers and inorganic pigments

Lecture 60 - Oxide pigments, luminescent pigments, corrosion protection pigments, magnetic pigments

[Lecture 1 - Introduction](#)

[Lecture 2 - Structure and Geometry of Carbenes](#)

[Lecture 3 - Structure and Geometry of Carbenes \(Continued...\)](#)

[Lecture 4 - Generation of Carbene](#)

[Lecture 5 - Generation of Carbene \(Continued...\)](#)

[Lecture 6 - Generation of Carbene \(Continued...\)](#)

[Lecture 7 - Reaction of Carbene](#)

[Lecture 8 - Reaction of Carbene \(Continued...\)](#)

[Lecture 9 - Reaction of Carbene \(Continued...\)](#)

[Lecture 10 - Reaction of Carbene \(Continued...\)](#)

[Lecture 11 - Reaction of Carbene \(Continued...\)](#)

[Lecture 12 - Reaction of Carbene \(Continued...\)](#)

[Lecture 13 - Reaction of Carbene \(Continued...\)](#)

[Lecture 14 - Reaction of Carbene \(Continued...\)](#)

[Lecture 15 - Reaction of Carbene \(Continued...\)](#)

[Lecture 16 - Nitrene](#)

[Lecture 17 - Nitrene \(Continued...\)](#)

[Lecture 18 - Reaction of Nitrene](#)

[Lecture 19 - Reaction of Nitrene \(Continued...\)](#)

[Lecture 20 - Reaction of Nitrene \(Continued...\)](#)

Lecture 1 - A brief introduction to Molecules of Life: Structure of Amino acids and their various charged forms

Lecture 2 - Biological Macromolecules and Small molecules: Importance and functions

Lecture 3 - Amino Acids: The building block of proteins

Lecture 4 - Amino acids: separation and detection, Electrophoresis and Ninhydrin reaction

Lecture 5 - Method of determination of Amino acid sequence: primary structure of polypeptide/protein

Lecture 6 - Selective peptide bond cleavage: Enzymatic and Non-enzymatic methods

Lecture 7 - Peptide synthesis: Protecting groups for amine and carboxyl functionality

Lecture 8 - Peptide synthesis (Continued...) Protection, coupling and deprotection method

Lecture 9 - Recent development of coupling agents; Merrifield's method of solid phase peptide synthesis

Lecture 10 - Hierarchical structure of proteins: Secondary, tertiary and quaternary structure

Lecture 11 - Ramachandran plot and protein purification techniques

Lecture 12 - Protein purification techniques (Continued...)

Lecture 13 - Introduction to Enzymes and its kinetics

Lecture 14 - Enzyme catalysed reactions and introduction to catalytic activity of proteases

Lecture 15 - Enzyme Kinetics (Continued...)

Lecture 16 - Concept of Enzyme Inhibition

Lecture 17 - Concept of Enzyme Inhibition (Continued...)

Lecture 18 - Problems on Enzyme Kinetics and Enzyme Inhibition

Lecture 19 - Synthetic Biology

Lecture 20 - Synthetic Biology (Continued...)

Lecture 21 - Synthetic Biology (Continued...)

Lecture 22 - Nucleic Acid

Lecture 23 - Nucleic Acid (Continued...)

Lecture 24 - DNA sequencing method

Lecture 25 - DNA sequencing method (Continued...)

Lecture 26 - DNA sequencing method (Continued...)

Lecture 27 - Synthesis of oligonucleotide

Lecture 28 - Central dogma: DNA replication, transcription and translation

Lecture 29 - Central dogma: DNA replication, transcription and translation (Continued...)

Lecture 30 - Central dogma: DNA replication, transcription and translation (Continued...)

Lecture 31 - Central dogma: DNA replication, transcription and translation (Continued...)

[Lecture 32 - Central dogma: DNA replication, transcription and translation \(Continued...\)](#)

[Lecture 33 - Molecular Biology](#)

[Lecture 34 - Molecular Biology \(Continued...\)](#)

[Lecture 35 - Chemistry of cofactors/coenzymes](#)

[Lecture 36 - Chemistry of cofactors/coenzymes \(Continued...\)](#)

[Lecture 37 - Chemistry of cofactors/coenzymes \(Continued...\)](#)

[Lecture 38 - Chemistry of cofactors/coenzymes \(Continued...\)](#)

[Lecture 39 - Chemistry of cofactors/coenzymes \(Continued...\)](#)

[Lecture 40 - Chemistry of cofactors/coenzymes \(Continued...\)](#)

[Lecture 41 - Introduction to Drug Discovery Process](#)

[Lecture 42 - Fundamental Principles of Drug Development Process](#)

[Lecture 43 - Combinatorial chemistry](#)

[Lecture 44 - Neurotransmitters](#)

[Lecture 45 - Catechol amine based and GABA neurotransmitters](#)

[Lecture 46 - Hypertension: humoral mechanism and renin/angiotensin system](#)

[Lecture 47 - Inhibitor design of angiotensin converting enzyme](#)

[Lecture 48 - Antimicrobial drugs](#)

[Lecture 49 - Chemistry of penicillins](#)

[Lecture 50 - Resistance to beta-lactam antibiotics](#)

[Lecture 51 - Mechanistic studies of beta-lactamase](#)

[Lecture 52 - Non beta-lactam antibiotics](#)

[Lecture 53 - Mechanistic enzymology of Isopenicillin N synthase](#)

[Lecture 54 - Polyketide Biosynthesis](#)

[Lecture 55 - Biosynthesis of macrolide polyketides and introduction to virus](#)

[Lecture 56 - Anti-viral drugs](#)

[Lecture 57 - Cancer and Chemotherapy](#)

[Lecture 58 - Anti-cancer drugs \(Continued...\)](#)

[Lecture 59 - Aromatase inhibition and Anti-ulcer drugs](#)

[Lecture 60 - Cholesterol lowering agents](#)

[Lecture 61 - Cholesterol Biosynthesis](#)

[Lecture 62 - Pharmacokinetics and pharmacodynamics](#)

[Lecture 63 - QSAR principles](#)

Lecture 1 - Importance of Polymer Science and Brief Historical background

Lecture 2 - Definitions/Terminologies, Classifications

Lecture 3 - Classifications, Nomenclature

Lecture 4 - Classification by Polymerization Mechanism, Nomenclature

Lecture 5 - Molecular Weight, Big Picture of Polymer Science, Common Polymers

Lecture 6 - Examples of Step Polymers, Linear Step Polymerization

Lecture 7 - Linear Step Polymerization: MW Control, MW Distribution, Kinetics

Lecture 8 - Linear Step Polymerization: Kinetics (Continued...), Equilibrium Consideration, General Requirements for Achieving High MW; Non-linear Step Polymerization

Lecture 9 - Linear Step Polymerization: Summary - General Requirement, Non-Linear Step Polymerization

Lecture 10 - Types of Chain polymerization, Mechanism and Kinetics of Radical Chain Polymerization

Lecture 11 - Kinetics of Radical Chain Polymerization (Continued...), Various Types of Initiators

Lecture 12 - Thermal Initiation (Continued...), Molecular Weight and Kinetic Chain Length, Other Types of Radical Initiators, Transfer Reactions

Lecture 13 - Transfer Reactions, Effect of Temperature on Rate and MW, MW Distribution, ceiling Temperature

Lecture 14 - Energetics and Thermodynamics of Chain Polymerization, MW Distribution, Common Polymers

Lecture 15 - Thermodynamics of Chain Polymerization, MW Distribution, Common Polymers

Lecture 16 - Process Conditions, Emulsion Polymerization

Lecture 17 - Emulsion Polymerization (Continued...), Common Polymers by Radical Chain Polymerization, RDRP

Lecture 18 - Reversible - Deactivation Radical Polymerizations (RDRP)

Lecture 19 - RAFT Polymerization (Continued...), Ionic Polymerization

Lecture 20 - Polymer Stereochemistry and Zeigler - Natta Coordination Polymerization

Lecture 21 - Ring Opening Polymerization, Copolymers

Lecture 22 - Copolymerization (Continued...)

Lecture 23 - Polymers in Solution : Flory - Huggins Theory

Lecture 24 - Polymers in Solution : Application of Flory - Huggins Theory

Lecture 25 - Polymers in Solution : Solubility Parameter, Polymer Phase Separation and Fractionation

Lecture 26 - Polymers Chain Dimensions

Lecture 27 - Frictional Properties of Polymer Molecules in Dilute Solution, Determination of Polymer MW (Overview)

Lecture 28 - Membrane Osmometry, End Group Analysis, Dilute Solution Viscometry

Lecture 29 - Dilute Solution Viscometry, Light Scattering Techniques for MW

Lecture 30 - Gel Permeation Chromatography

[Lecture 31 - Light Scattering Techniques for MW and Size Measurements \(Continued...\)](#)

[Lecture 32 - Mass Spectroscopy of Polymers](#)

[Lecture 33 - Polymer Processing](#)

[Lecture 34 - Mechanical Properties, Amorphous State](#)

[Lecture 35 - Thermal Properties: Amorphous State](#)

[Lecture 36 - Thermal Properties: Crystalline State](#)

[Lecture 37 - Thermal Properties: Factors Influencing \$T_m\$, Determination of \$T_g\$ and \$T_m\$, Other Thermal Properties](#)

[Lecture 38 - Thermomechanical Properties, Viscoelasticity](#)

[Lecture 39 - Thermomechanical Properties, Viscoelasticity \(Continued...\)](#)

[Lecture 40 - Optical, Electrical, Barrier Properties; Chemical Resistance and Weathering of Polymers](#)

[Lecture 41 - Polymer Additives](#)

[Lecture 42 - Polymer Blends, Concluding Remarks](#)

NPTEL : NOC:Structure, Stereochemistry and Reactivity of Organic Compounds and Intermediates: A Problem Solving Approach (Chemistry and Biochemistry)

Co-ordinators : Prof. A. Basak

Lecture 1 - Introduction to structure and stereochemistry of organic molecules: salient features of symmetry elements; Role of principal axis, sigma plane, centre of symmetry, and alternating axis of symmetry in deciding chirality

Lecture 2 - Introduction to point group notation, classification, symmetry number and order

Lecture 3 - Examples of various point group notations, chiral and achiral point groups, examples of various point groups

Lecture 4 - Solving problems on point groups (C_n , C_{nv} , C_{nh} , D_{nd})

Lecture 5 - Conformational Analysis of Perhydrophenanthrene

Lecture 6 - Concept Clearing Session on Achiral Point Groups

Lecture 7 - Axial, Planar and Helical Chirality, assignment of absolute configuration to such molecules

Lecture 8 - Concept of pseudoasymmetry; Reflection variance/invariance problem; methods of nomenclature system

Lecture 9 - Conformational analysis of bicyclic systems: the Decalins

Lecture 10 - Conformational analysis of Perhydrophenanthrene

Lecture 11 - Conformational analysis of Perhydroanthracene

Lecture 12 - Revisiting conformational analysis of Perhydrophenanthrene

Lecture 13 - Revisiting conformational analysis of Perhydroanthracene

Lecture 14 - Introduction to Linear Polarized light and interaction with chiral materials; Circular Birefringence, Circular Dichroism

Lecture 15 - ORD, CD and Cotton Effect (CE); Empirical rule to determine the sign of CE, 2-axial haloketone rule

Lecture 16 - Octant rule: application to substituted cyclohexanone and decalone system

Lecture 17 - Application of Octant rule to tricyclic system; drawing of octant projection

Lecture 18 - Application of Octant rule to steroidal ketones; drawing of octant projection

Lecture 19 - Stereoelectronic effects on conformation and reactivity

Lecture 20 - Examples of anomeric effect and Stereoelectronic effect

Lecture 21 - Baldwin rules

Lecture 22 - Cyclization in enolic systems

Lecture 23 - Problem solving on Baldwin rules

Lecture 24 - Reactive Functionalities: Chemistry of Alkynes

Lecture 25 - Reactive Functionalities: Chemistry of Alkynes (Continued...), arynes and enediynes

Lecture 26 - Reactive Functionalities: Ene-diyne (Continued...), allenes and Ketenes

Lecture 27 - Beta - Lactam Synthesis

Lecture 28 - Chemistry of radicals

Lecture 29 - Reactivity of radicals: Frontier orbital approach.

Lecture 30 - Radical mediated C-C bond formation

[Lecture 31 - Radical mediated C-C bond formation \(Continued...\)](#).

[Lecture 32 - Radical mediated decarboxylation and deoxygenation](#)

[Lecture 33 - Dynamic Stereochemistry: Conformationally rigid and mobile systems](#)

[Lecture 34 - Dynamic Stereochemistry: Conformational analysis of elimination and addition](#)

[Lecture 35 - Dynamic Stereochemistry: Stereoselectivity in carbonyl reduction](#)

[Lecture 36 - Dynamic Stereochemistry: Reactivity of unsaturated carbonyl and enolate systems](#)

[Lecture 37 - Dynamic Stereochemistry: Enolate as nucleophile](#)

[Lecture 38 - Dynamic Stereochemistry: stereochemical issues in cyclohexenone reduction and alpha-electrophilic substitution in carbonyls](#)

[Lecture 39 - Dynamic Stereochemistry: Asymmetric aldol reactions](#)

[Lecture 40 - Dynamic Stereochemistry: Asymmetric aldol reaction \(Continued...\)](#)

Lecture 1 - Review of Quantum Chemistry

Lecture 2 - Postulates of Quantum Mechanics - I

Lecture 3 - Postulates of Quantum Mechanics - II

Lecture 4 - Exactly Solvable Models - I

Lecture 5 - Exactly Solvable Models - II

Lecture 6 - Exactly Solvable Models - II (Continued...)

Lecture 7 - Variational Principle - I

Lecture 8 - Variational Principle - II

Lecture 9 - Variational Method: Applications - I

Lecture 10 - Linear Variational Method

Lecture 11 - Applications of Linear Variational Method

Lecture 12 - Variational Method in Chemical Bonding - I

Lecture 13 - Variational Method in Chemical Bonding - II

Lecture 14 - Variational Method in Chemical Bonding - III

Lecture 15 - Molecular Orbital Treatment of Polyatomics

Lecture 16 - Molecular Orbital Treatment of Polyatomics

Lecture 17 - Perturbation Theory

Lecture 18 - Examples of Perturbation Theory - I

Lecture 19 - Examples of Perturbation Theory - II

Lecture 20 - Molecular Response to Electric Field - I

Lecture 21 - Molecular Response to Electric Field - II

Lecture 22 - Degenerate Perturbation Theory

Lecture 23 - Excited States of He Atom - I

Lecture 24 - Excited States of He Atom - II

Lecture 25 - Slater Determinants - I

Lecture 26 - Slater Determinants - II

Lecture 27 - Energy Expectation Value with Slater Determinants - I

Lecture 28 - Energy Expectation Value with Slater Determinants - II

Lecture 29 - Self-Consistent Field Method

Lecture 30 - Canonical HF Equations

Lecture 31 - Hartree-Fock Energy

[Lecture 32 - Hartree-Fock-Roothan Equations](#)

[Lecture 33 - The Density Matrix](#)

[Lecture 34 - Evaluation of Molecular Properties](#)

[Lecture 35 - Basis Sets - I](#)

[Lecture 36 - Basis Sets - II](#)

[Lecture 37 - Electron Correlation and Post HF Methods](#)

[Lecture 38 - Time-Dependent Perturbation Theory - I](#)

[Lecture 39 - Time-Dependent Perturbation Theory - II](#)

[Lecture 40 - Slowly Switched Constant Perturbation](#)

[Lecture 41 - Oscillating Perturbation](#)

[Lecture 42 - Einstein's Coefficients](#)

Lecture 1 - Metal Ions In Biological Systems

Lecture 2 - Metallobiosite structures

Lecture 3 - Biomolecular structure and molecular biology component

Lecture 4 - Structures of nucleic acids

Lecture 5 - Coordination Chemistry in action

Lecture 6 - Coordination of peptide building blocks

Lecture 7 - Occurrence and availability

Lecture 8 - Potential ligands of different types

Lecture 9 - Metal ion insertion

Lecture 10 - Organic cofactors and siderophores

Lecture 11 - Introduction

Lecture 12 - CD and Raman spectroscopy

Lecture 13 - EPR

Lecture 14 - NMR and X-ray

Lecture 15 - Electrochemical methods

Lecture 16 - Metal ion assimilation

Lecture 17 - Transport of metal ions in bacteria and plants

Lecture 18 - Transport of metal ions in fungi and mammals

Lecture 19 - Homeostasis in bacteria and plants

Lecture 20 - Homeostasis in fungi and mammals

Lecture 21 - Transport across membranes

Lecture 22 - Ion channels and ion pumps

Lecture 23 - (K⁺) channels

Lecture 24 - (Na⁺) channels

Lecture 25 - (Na⁺)-(K⁺) ATPase

Lecture 26 - (Mg²⁺) dependent enzymes and kinases

Lecture 27 - Phosphatases and enolases

Lecture 28 - Photoreception and enzymes

Lecture 29 - (Ca²⁺) transporting, binding and sensor proteins

Lecture 30 - Cell signaling by (Ca²⁺) binding and sensing

Lecture 31 - Functions of iron ions and iron ion proteins

- Lecture 32 - Heme proteins for (O₂) transport and storage
- Lecture 33 - Activators of (O₂) and electron transport proteins
- Lecture 34 - Iron-sulfur proteins
- Lecture 35 - Mononuclear and dinuclear non-heme enzymes
- Lecture 36 - Oxygen transport and SOD activity
- Lecture 37 - Type 1 blue copper proteins
- Lecture 38 - Type 2 non-blue copper proteins
- Lecture 39 - Type 3 dinuclear copper proteins
- Lecture 40 - Multicopper and mixed-copper enzymes
- Lecture 41 - Coordination chemistry and function of zinc ions
- Lecture 42 - Carbonic anhydrase and lyases
- Lecture 43 - Carboxypeptidase and metalloproteinases
- Lecture 44 - Alcohol dehydrogenase and Beta-lactamase
- Lecture 45 - Redox catalysis by manganese ions
- Lecture 46 - Redox catalysis by manganese ions
- Lecture 47 - Catalysis by manganese and cobalt ions
- Lecture 48 - Cobalt ion dependent proteins and enzymes
- Lecture 49 - Nickel proteins and enzymes
- Lecture 50 - More nickel ion bearing enzymes
- Lecture 51 - Carbon, hydrogen and oxygen
- Lecture 52 - Nitrogen and Silicon
- Lecture 53 - Phosphorus
- Lecture 54 - Sulfur and Selenium
- Lecture 55 - Chlorine and Iodine
- Lecture 56 - Brain and blood-brain barrier (BBB)
- Lecture 57 - Zinc and copper ions
- Lecture 58 - Iron ions
- Lecture 59 - Metal ion based drugs and metalloterapeutics
- Lecture 60 - Chemotherapy, radiotherapy and contrast agents

- Lecture 1 - Enolate generation, structure of enolates and related topic - I
- Lecture 2 - Enolate generation, structure of enolates and related topic - II
- Lecture 3 - Enolate generation, structure of enolates and related topic - III
- Lecture 4 - Different mode of asymmetric induction in enolate alkylation
- Lecture 5 - Revisit again, Different mode of asymmetric induction in enolate alkylation
- Lecture 6 - Substrate directed stereocontrol in acyclic and cyclic system
- Lecture 7 - Substrate directed enolate alkylation in bicyclic system
- Lecture 8 - Seebach's SRS principle and related systems - I
- Lecture 9 - Seebach's SRS principle and related systems - II
- Lecture 10 - Seebach's SRS principle and related systems - III
- Lecture 11 - Evans oxazolidinone and related systems - I
- Lecture 12 - Evans oxazolidinone and related systems - II
- Lecture 13 - Evans oxazolidinone and related systems - III
- Lecture 14 - Evans oxazolidinone and related systems - IV
- Lecture 15 - Evans oxazolidinone and related systems - V
- Lecture 16 - Helmchen's auxiliary, Oppolzer's sultam based auxiliary
- Lecture 17 - Camphor based N-acyloxazolidinones as chiral auxiliary
- Lecture 18 - Myer's ephedrine, Chiral Weinreb amide equivalents and related systems
- Lecture 19 - Myer's ephedrine and related systems
- Lecture 20 - Chiral Weinreb amide equivalents and related systems
- Lecture 21 - Meyer's oxazoline based alkylation - I
- Lecture 22 - Meyer's oxazoline based alkylation - II
- Lecture 23 - Meyer's bicyclic lactam based enolate alkylation
- Lecture 24 - Meyer's bicyclic lactam based alkylation
- Lecture 25 - Meyer's bicyclic lactams, Gleason's bicyclic thioglycolate lactam based systems
- Lecture 26 - Few problem solving from Meyer's oxazoline/bicyclic lactam based alkylation
- Lecture 27 - Schollkopf's bis-lactim ether and related systems; Auxiliary induced chiral relay
- Lecture 28 - Chiral relay systems in amino acid derived enolate alkylation
- Lecture 29 - Williams oxazinone, Yamada's chiral glycine enolate and related system
- Lecture 30 - Tricycloiminolactone as chiral glycine equivalents
- Lecture 31 - Najera's auxiliary, Davies diketopiperazine and related system

Lecture 32 - Ender's RAMP/SAMP, Coltart's cyclic carbamate hydrazone, Ellman's sulfinamide and related

Lecture 33 - Ender's RAMP/SAMP based systems

Lecture 34 - Ender's RAMP/SAMP based systems

Lecture 35 - Ender's RAMP/SAMP, Coltart's cyclic carbamate hydrazone, Ellman's sulfinamide

Lecture 36 - Coltart's cyclic carbamate hydrazone and its exploration

Lecture 37 - Memory of chirality in enolate alkylation

Lecture 38 - Organocatalytic methods for enolate alkylation (SOMO activation)

Lecture 39 - Enantioselective alkylation with chiral PTC

Lecture 40 - Overall analysis of the entire discussion

Lecture 1 - Bioenergetics: Understanding the significance in Biological Systems

Lecture 2 - Regulation of Enzyme Activity

Lecture 3 - Digestion and Absorption of Carbohydrates

Lecture 4 - Glycolysis, alcohol and lactic acid fermentation

Lecture 5 - Biochemistry of TCA Cycle (I)

Lecture 6 - TCA Cycle (II) - Regulation and special characteristics

Lecture 7 - Neoglucogenesis

Lecture 8 - Regulation of Glycolysis and Neoglucogenesis - I

Lecture 9 - Regulation of Glycolysis and Neoglucogenesis - II Cori Cycle, Rapoport Leubering

Lecture 10 - Hexose Monophosphate Shunt : Steps and Phases

Lecture 11 - Hexose Monophosphate Shunt : Regulation and Significance

Lecture 12 - Glycogen Metabolism - I

Lecture 13 - Glycogen Metabolism - II

Lecture 14 - Glycogen Metabolism - III

Lecture 15 - Glycogen Metabolism - IV

Lecture 16 - Galactose Metabolism and Associated Disorders

Lecture 17 - Fructose Metabolism and Associated Disorders

Lecture 18 - Regulation of Blood Glucose

Lecture 19 - Diabetes Mellitus and Metabolic Alterations

Lecture 20 - Digestion and absorption of Lipid

Lecture 21 - Lipoprotein Metabolism - I

Lecture 22 - Lipoprotein Metabolism - II

Lecture 23 - Lipoprotein metabolism - III

Lecture 24 - Fatty acid catabolism (Oxidation of Fatty acids) - I

Lecture 25 - Fatty acid catabolism (Oxidation of Fatty acids) - II

Lecture 26 - Fatty acid catabolism (Oxidation of Fatty acids) - III

Lecture 27 - Metabolism of Ketone Bodies

Lecture 28 - Biosynthesis of Fatty acid and its regulation

Lecture 29 - Biosynthesis of triacylglycerol, phosphoglycerides and sphingolipids

Lecture 30 - Cholesterol Metabolism

Lecture 31 - Digestion and absorption of Protein

Lecture 32 - Transformation of Amino acids

Lecture 33 - Metabolism of Ammonia and ammonia toxicity

Lecture 34 - Urea cycle - Steps, Significance and Energetics

Lecture 35 - Urea Cycle - Regulation and Enzyme Deficiency Disorders

Lecture 36 - Metabolism of Phenylalanine and Associated Disorders

Lecture 37 - Tyrosine Metabolism - I

Lecture 38 - Tyrosine Metabolism - II (Catecholamines)

Lecture 39 - Tyrosine Metabolism - III

Lecture 40 - Tryptophan Metabolism

Lecture 41 - Metabolism of Sulphur containing Amino acids (Methionine and Cysteine)

Lecture 42 - Metabolism of Glycine and its disorders

Lecture 43 - Metabolism of Serine, Threonine and Alanine

Lecture 44 - Branched chain amino acid metabolism and their disorders

Lecture 45 - Metabolism of Histidine, Proline, Arginine and Lysine

Lecture 46 - Heme Metabolism - I (Heme Synthesis and Regulation)

Lecture 47 - Heme Metabolism - II (Disorders of Heme Synthesis - Porphyrrias)

Lecture 48 - Heme Metabolism - III (Heme Degradation, Transport and Bilirubin Metabolism)

Lecture 49 - Disorders of Bilirubin Metabolism

Lecture 50 - Nucleotide Metabolism - I (Purine Metabolism)

Lecture 51 - Nucleotide Metabolism - II (Disorders of Purine Metabolism)

Lecture 52 - Nucleotide Metabolism - III (Pyrimidine Metabolism and Disorders)

Lecture 53 - Inborn errors of Metabolism

Lecture 54 - Integration of Metabolism - I (Cellular and Organ level integration)

Lecture 55 - Integration of Metabolism - II (Starve feed cycle)

Lecture 56 - Integration of Metabolism - III (Metabolic Control Analysis)

Lecture 57 - Obesity, Metabolic Syndrome and Role of Adipokines

Lecture 58 - Fatty Liver and alcohol metabolism

Lecture 59 - Energy metabolism and Nutritional disorders, Protein Energy Malnutrition and Dietary

Lecture 60 - Metabolism in Cancer Cells

Lecture 1 - Introduction

Lecture 2 - System, Equilibrium States

Lecture 3 - Mathematical foundation - Exact differentials

Lecture 4 - Mathematical foundation - Inexact differentials

Lecture 5 - First law - Introduction to Internal energy

Lecture 6 - First law - Heat and work

Lecture 7 - First law - Pressure-volume work

Lecture 8 - First law - Internal energy revisited

Lecture 9 - First Law - Enthalpy

Lecture 10 - First law - Estimation of change in internal energy and enthalpy

Lecture 11 - Second law - Introduction

Lecture 12 - Second law - Carnot engine and entropy

Lecture 13 - Entropy and Third law

Lecture 14 - Entropy and Spontaneity in isolated systems

Lecture 15 - Spontaneity and equilibrium - Thermodynamic potentials

Lecture 16 - Spontaneity and equilibrium - Non-isolated systems

Lecture 17 - Thermodynamic potentials and Maxwell's relations

Lecture 18 - Application of Maxwell's relations

Lecture 19 - Thermodynamic response functions

Lecture 20 - Using Maxwell's relations to solve numerical problems

Lecture 21 - Fundamental Equation of Chemical Thermodynamics

Lecture 22 - Open systems and chemical potential

Lecture 23 - Chemical potential in one and many component ideal gas

Lecture 24 - Gibbs-Duhem relation and thermodynamics of ideal gas mixture

Lecture 25 - Numerical applications of Gibbs-Duhem relation

Lecture 26 - Phase equilibrium - Part 1

Lecture 27 - Phase equilibrium - Part 2

Lecture 28 - Phase equilibrium - Part 3

Lecture 29 - Phase equilibrium - Part 4

Lecture 30 - Numerical problems in phase equilibrium

Lecture 31 - Simple non-reactive mixtures - Part 1

- Lecture 32 - Simple non-reactive mixtures - Part 2
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Lecture 17 - Nomenclature for coupled spins

Lecture 18 - Energy levels of two and three coupled spins

Lecture 19 - Analysis of ^1H NMR spectra - I

Lecture 20 - Analysis of ^1H NMR spectra - II

Lecture 21 - Analysis of ^1H NMR spectra - III

Lecture 22 - Coupling of ^1H with other nuclei - I

Lecture 23 - Coupling of ^1H with other nuclei - II

Lecture 24 - ^{13}C -NMR - I

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Lecture 26 - ^{13}C -NMR - III

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[Lecture 48 - 2D INADEQUATE](#)

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[Lecture 58 - 1D NOE, 1D TOCSY](#)

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NPTEL : Advanced Geotechnical Engineering (Civil Engineering)

Co-ordinators : Dr. B.V.S. Viswanadham

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Lecture 1 - Introduction

Lecture 2 - Degrees of Freedom, SDOF System, Types of Vibrations

Lecture 3 - SDOF System, Types of Vibrations, Free Vibration

Lecture 4 - Problems on Torsional Motion

Lecture 5 - Damped Free Vibrations

Lecture 6 - Damped Free Vibrations, Definition of Critical Damping and problems

Lecture 7 - Decay of Motion

Lecture 8 - Forced Vibrations, Dynamic Magnification Factor

Lecture 9 - Maxwells Diagram of DMF, Discussion on Phase

Lecture 10 - Transmissibility Ratio, Response to Arbitrary, Step and Pulse Excitations

Lecture 11 - Response to Arbitrary, Step and Pulse Excitations, Response to Impact Load

Lecture 12 - Vibration Isolation, Vibrations Measuring Instruments

Lecture 13 - Solutions of Quiz Questions, Multi-Degree of Freedom (MDOF) Systems

Lecture 14 - (MDOF) System : Equation of Motion, Longitudinal Waves in an Infinitely long rod

Lecture 15 - 3 Dimensional Wave Propagation, Waves in semi-infinite media, Rayleigh Wave

Lecture 16 - Love Wave, Waves in layered medium, 3D case-Inclined wave, Earthquake Waves

Lecture 17 - Earthquake Waves; P-waves, S-waves, 3 circle method, Estimation of Earthquake Epicentre

Lecture 18 - Stresses in Soil Element, Field Tests, Seismic Reflection Test

Lecture 19 - Seismic Refraction Test, SASW Test, Laboratory & Model Tests

Lecture 20 - Centrifuge Tests Stress Strain Behavior of Cyclically Loaded Soils

Lecture 21 - Estimation of G_{max} , Modulus Reduction Curves, Variation of Damping Ratio, Cyclic Plate load Test

Lecture 22 - Liquefaction, Preliminary scening, Simplified Procedure for Liquefaction

Lecture 23 - Cyclic Stress Ratio, Evaluation of CRR, Correction Factors, Corrections for SPT

Lecture 24 - Becker Penetrometer Test (BPT), Cone Penetrometer Test (CPT), SPT v BPT, SASW Test

Lecture 25 - Types of Machine Foundations, Methods of Analysis, Design of Machine Foundations as per IS:2974 (Part-1)-1969

Lecture 26 - Tschebotarioff's

Lecture 27 - Problem on Tschebotarioff's method contd., Mass-Spring-Dashpot (MSD) Model

Lecture 28 - MSD Model- Yawing mode of Vibration, Use of MSD model for analysis

Lecture 29 - Problems on Use of MSD Model for Analysis, Rocking mode of Vibrations

Lecture 30 - Torsional Mode/Yawing Mode, Constant Force type excitation, EHS Theory

Lecture 31 - EHS Theory, Vibrational Control

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[Lecture 34 - Liquefaction mitigation methods,Vibro Compaction,Densification Techniques](#)

[Lecture 35 - Soil Improvement methods,Dynamic Compaction,Reinforcement Techniques](#)

[Lecture 36 - Force-based Analysis,Dynamic analysis using MSD model](#)

[Lecture 37 - Behaviour of Subgrade Soil below Rail Track](#)

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NPTEL : Structural Dynamics (Civil Engineering)

Co-ordinators : Dr. P. Banerji

Lecture 1 - Introduction

Lecture 2 - Inverse Power Method

Lecture 3 - Dynamics of SDOF Structure

Lecture 4 - SDOF Response to Harmonic Loads

Lecture 5 - Response of SDOF Structure to Harmonic Loading

Lecture 6 - Response to Harmonic Loading

Lecture 7 - Response to Harmonic Loading (Continue...)

Lecture 8 - Transmissibility & Base Isolation

Lecture 9 - Dynamic Characteristics & Periodic Loading

Lecture 10 - Pulse Loading

Lecture 11 - Pulse Load Response Characteristics & Impulse Loading

Lecture 12 - Frequency Domain Response Analysis

Lecture 13 - Methods of Analysis for General Loading

Lecture 14 - Numerical Analysis of Response of Single Degree of Freedom Structure & Time Domain Approaches

Lecture 15 - Response Analysis of Single Degree of Freedom System for Earthquake Loads

Lecture 16 - Earthquake Response Analysis for Single Degree of Freedom Structures

Lecture 17 - Generalized Single Degree of Freedom Systems Equations of Motions

Lecture 18 - Generalized Single Degree of Freedom Systems Equations of Motions

Lecture 19 - Generalized Single Degree of Freedom Systems Equations of Motions

Lecture 20 - Generalized Single Degree of Freedom Systems Equations of Motion & Free Vibrations

Lecture 21 - Equations of Motion for Multi Degree of Freedom Structures

Lecture 22 - Equations of Motion for Multi Degree of Freedom Systems

Lecture 23 - Multi Degree of Freedom Structure Equations of Motions

Lecture 24 - Multi Degree of Freedom Structure Equations of Motions & Free Vibration

Lecture 25 - Free Vibration for Multi Degree of Freedom Structures

Lecture 26 - Free Vibration for Multi Degree of Freedom Structures

Lecture 27 - Practical Free Vibration Analysis

Lecture 28 - Dynamic Response of Multi Degree of Freedom Systems

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Lecture 30 - Damping for Multi Degree of Freedom Structures

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[Lecture 33 - Dynamic Analysis of Buildings](#)

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NPTEL : Watershed Management (Civil Engineering)

Co-ordinators : Dr. T.I. Eldho

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Lecture 2 - Watershed Management & Stakeholder Analysis

Lecture 3 - Watershed Management Policies

Lecture 4 - Sustainable Watershed Management

Lecture 5 - Agricultural Practices & Watershed Management

Lecture 6 - Soil Erosion & Conservation

Lecture 7 - Watershed Management in Arid Regions & Strategic Planning

Lecture 8 - Integrated Water Resources Management

Lecture 9 - Conjunctive Use of Water Resources

Lecture 10 - Rainwater Harvesting System

Lecture 11 - Rainwater Harvesting & Roof Catchment System

Lecture 12 - Watershed Characteristics

Lecture 13 - Watershed Delineation & Modeling

Lecture 14 - Hydrologic Processes

Lecture 15 - Watershed Modeling

Lecture 16 - Hydrologic Modeling

Lecture 17 - Numerical Watershed Modeling

Lecture 18 - Subsurface & Groundwater Flows

Lecture 19 - Social & Community Aspects of Watershed Management

Lecture 20 - Socio-economy, Private Sector Participation & Gender Issues

Lecture 21 - Integrated Development, Water Legislation & Implementation Issues

Lecture 22 - GIS & Applications in Watershed Management

Lecture 23 - Remote Sensing & Applications in Watershed Management

Lecture 24 - Decision Support Systems & Applications in Watershed Management

Lecture 25 - Integrated Watershed Modeling Using Numerical Methods, GIS & Remote Sensing

Lecture 26 - Applications of Knowledge Based Models in Watershed Management

Lecture 27 - Surface Water Quality & Pollution Issues

Lecture 28 - Groundwater Pollution Problems & Transport Processes

Lecture 29 - Water Quality Modeling

Lecture 30 - Environmental Guidelines for Water Quality Management

Lecture 31 - Storm Water Management

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Lecture 2 - Fundamental Concepts of Fluid Flow & Fluid Statics

Lecture 3 - Fluid Statics

Lecture 4 - Fluid Statics

Lecture 5 - Fluid Statics

Lecture 6 - Kinematics of Fluid Flow

Lecture 7 - Kinematics of Fluid Flow

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Lecture 9 - Kinematics of Fluid Flow

Lecture 10 - Kinematics of Fluid Flow

Lecture 11 - Kinematics & Dynamics of Fluid Flow

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Lecture 27 - Navier-Stokes Equations and Applications

Lecture 28 - Navier-Stokes Equations and Applications

Lecture 29 - Navier-Stokes Equations and Applications

Lecture 30 - Boundary Layer Theory and Applications

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NPTEL : Soil Mechanics (Civil Engineering)

Co-ordinators : Dr. B.V.S. Viswanadham

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Lecture 9 - Soil Mechanics

Lecture 10 - Soil Mechanics

Lecture 11 - Compaction of Soils - I

Lecture 12 - Soil Mechanics

Lecture 13 - Soil Mechanics

Lecture 14 - Compaction of Soils - IV

Lecture 15 - Compaction of Soils - V

Lecture 16 - Compaction of Soils - VI

Lecture 17 - Effective Stress - I

Lecture 18 - Effective Stress - II

Lecture 19 - Effective Stress - III

Lecture 20 - Flow of water through soils - I

Lecture 21 - Flow of water through soils - II

Lecture 22 - Flow of water through soils - III

Lecture 23 - Flow of water through soils - IV

Lecture 24 - Flow of water through soils - V

Lecture 25 - Flow of water through soils - VI

Lecture 26 - Flow of water through soils - VII

Lecture 27 - Flow of water through soils - VIII

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NPTEL : Structural Analysis II (Civil Engineering)

Co-ordinators : Dr. P. Banerji

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NPTEL : Geotechnical Earthquake Engineering (Civil Engineering)

Co-ordinators : Dr. Deepankar Choudhury

Lecture 1 - Introduction to Geotechnical Earthquake Engineering - Part I

Lecture 2 - Introduction to Geotechnical Earthquake Engineering - Part II

Lecture 3 - Basics of Vibration Theory

Lecture 4 - Engineering Seismology - Part - I

Lecture 5 - Engineering Seismology - Part - II

Lecture 6 - Engineering Seismology - Part - III

Lecture 7 - Engineering Seismology - Part - IV

Lecture 8 - Engineering Seismology - Part - V

Lecture 9 - Engineering Seismology - Part - VI

Lecture 10 - Strong Ground Motion - Part I

Lecture 11 - Strong Ground Motion - Part II

Lecture 12 - Strong Ground Motion - Part III

Lecture 13 - Strong Ground Motion - Part IV

Lecture 14 - Strong Ground Motion - Part V

Lecture 15 - Strong Ground Motion - Part VI

Lecture 16 - Strong Ground Motion - Part VII

Lecture 17 - Wave Propagation - Part I

Lecture 18 - Wave Propagation - Part II

Lecture 19 - Wave Propagation - Part III

Lecture 20 - Wave Propagation - Part IV

Lecture 21 - Dynamic Soil Properties - Part I

Lecture 22 - Dynamic Soil Properties - Part II

Lecture 23 - Seismic Hazard Analysis - Part I

Lecture 24 - Seismic Hazard Analysis - Part II

Lecture 25 - Seismic Hazard Analysis - Part III

Lecture 26 - Seismic Hazard Analysis - Part IV

Lecture 27 - Seismic Hazard Analysis - Part V

Lecture 28 - Seismic Hazard Analysis - Part VI

Lecture 29 - Seismic Hazard Analysis - Part VII

Lecture 30 - Seismic Hazard Analysis - Part VIII

Lecture 31 - Site Response Analysis - Part I

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[Lecture 33 - Site Response Analysis - Part III](#)

[Lecture 34 - Seismic Analysis and Design of Various Geotechnical Structures - Part I](#)

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Lecture 1 - Introduction

Lecture 2 - Introduction to Reinforced Earth

Lecture 3 - Introduction to Reinforced Earth

Lecture 4 - Introduction to Reinforced Earth

Lecture 5 - Introduction to Reinforced Earth

Lecture 6 - An Overview of Geosynthetics - Part I

Lecture 7 - An Overview of Geosynthetics - Part II

Lecture 8 - An Overview of Geosynthetics - Part III

Lecture 9 - An Overview of Geosynthetics

Lecture 10 - Geosynthetic Properties and Test Methods

Lecture 11 - Geosynthetic Properties and Test Methods

Lecture 12 - Geosynthetic Properties and Test Methods

Lecture 13 - Geosynthetic Properties and Test Methods

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Lecture 15 - Geosynthetic in Filtration, Drainage and Erosion Control

Lecture 16 - Geosynthetic in Filtration, Drainage and Erosion Control

Lecture 17 - Geosynthetic in Filtration, Drainage and Erosion Control

Lecture 18 - Geosynthetic in Filtration, Drainage and Erosion Control

Lecture 19 - Geosynthetic in Filtration, Drainage and Erosion Control

Lecture 20 - Geosynthetic in pavements

Lecture 21 - Geosynthetic in pavements

Lecture 22 - Geosynthetic in pavements

Lecture 23 - Geosynthetic in pavements

Lecture 24 - Geosynthetic in pavements

Lecture 25 - Geosynthetic in pavements

Lecture 26 - Geosynthetics for Reinforced Soil Retaining Walls

Lecture 27 - Geosynthetics for Reinforced Soil Retaining Walls

Lecture 28 - Geosynthetics for Reinforced Soil Retaining Walls

Lecture 29 - Geosynthetics for Reinforced Soil Retaining Walls

Lecture 30 - Geosynthetics for Reinforced Soil Retaining Walls

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[Lecture 36 - Geosynthetic for Steep Slopes](#)

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[Lecture 40 - Geosynthetic for Embankments on Soft Foundations](#)

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Lecture 1 - Introduction

Lecture 2 - Types of Geosynthetics

Lecture 3 - Functions

Lecture 4 - Tests for Physical Properties and tensile strength of geosynthetics

Lecture 5 - Tensile Modulus

Lecture 6 - Drop Cone Test

Lecture 7 - Puncture Resistance Test

Lecture 8 - Puncture Resistance Test and Burst Strength Test

Lecture 9 - Grab Tensile Test

Lecture 10 - Grab Tensile Test and Triaxial Test

Lecture 11 - Triaxial and Pullout Test

Lecture 12 - Pullout Test

Lecture 13 - Sewn Seam Strength, Permittivity and Transmissivity

Lecture 14 - Hydraulic Properties and abrasion Test of geosynthetics

Lecture 15 - Endurance properties of Geosynthetics

Lecture 16 - Density, Water Absorption and Compressive Properties tests of Geofabric

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Lecture 19 - Tensile and Shear Properties of Geofabric

Lecture 20 - Shear and Flexural Properties of Geofabric

Lecture 21 - Flexural Properties and Flammability Test of Geofabric

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Lecture 2 - Overview - 2

Lecture 3 - Overview - 3

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Lecture 5 - Recent Trends in civil engineering

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Lecture 7 - Civil Engineering and Soil Mechanics

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Lecture 9 - Recent Trends in Soil mechanics

Lecture 10 - Soil contamination

Lecture 11 - Soil Improvement and wastes

Lecture 12 - Contaminant transport in soils

Lecture 13 - Soil- water- Environment Interaction

Lecture 14 - Basic concepts of analysis

Lecture 15 - Particle Energy Field Theory

Lecture 16 - Waste and types

Lecture 17 - Municipal and Industrial solid waste

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Lecture 20 - Introduction to Characterization of waste

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Lecture 22 - Geomaterial characterization - 2 (Morphological and physical characterization)

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Lecture 28 - Geomaterial characterization - 8 (Pore solution studies - I)

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[Lecture 55 - RS and OSM for mapping rural infrastructures: Adding data, crops and water bodies](#)

[Lecture 56 - RS and GIS application for Rural Development: Monitoring and Evaluation](#)

[Lecture 57 - RS and GIS application for Rural Development: Monitoring and Evaluation using NDVI and NDWI](#)

[Lecture 58 - RS and GIS application for Rural Development: Water Quality Assessment](#)

[Lecture 59 - RS and GIS application for Rural Development: Indicators and Dashboards](#)

[Lecture 60 - RS and GIS for Rural Development - Summary, Wrap and Ways Forward](#)

Lecture 1 - Doming and Diapirism

Lecture 2 - Isostasy - I

Lecture 3 - Isostasy - II

Lecture 4 - Ghyben-Herzberg law, Hydrostatic and Deviatoric stresses and strains

Lecture 5 - Resolution of stress as vectors

Lecture 6 - Addition and resolution of Stress (& Force) - I

Lecture 7 - Addition and resolution of Stress (& Force) - II

Lecture 8 - Addition and resolution of Stress (& Force) - III

Lecture 9 - Addition and resolution of Stress (& Force) - IV

Lecture 10 - Principle of centrifuge analogue modeling

Lecture 11 - Stress Issue: Mohr circle - I

Lecture 12 - Stress Issue: Mohr circle - II

Lecture 13 - Stress Issue: Mohr circle - III

Lecture 14 - Stress Issue: Mohr circle - IV

Lecture 15 - Strain parameters: Definitions and Calculations - I

Lecture 16 - Finding out areas of irregular geometries

Lecture 17 - Elementary strain analysis - I

Lecture 18 - Elementary strain analysis - II

Lecture 19 - Stress and strain behaviour of rocks - I

Lecture 20 - Stress and strain behaviour of rocks - II

Lecture 21 - Stress and strain behaviour of rocks - III

Lecture 22 - Ductile simple shear zone kinematics - I

Lecture 23 - Ductile simple shear zone kinematics - II

Lecture 24 - Ductile simple shear zone kinematics - III

Lecture 25 - Ductile simple shear zone kinematics - IV

Lecture 26 - Ductile simple shear zone kinematics - V

Lecture 27 - Ductile simple shear zone kinematics - VI

Lecture 28 - Ductile simple shear zone kinematics - VII

Lecture 29 - Ductile simple shear zone kinematics - VIII

Lecture 30 - Ductile pure shear zone kinematics

Lecture 31 - Ductile pure shear zone kinematics and Taylor-Couette flow

Lecture 32 - Taylor-Couette flow

Lecture 33 - Introduction to Second-Rank Tensors - I

Lecture 34 - Introduction to Second-Rank Tensors - II

Lecture 35 - Second-Rank Tensors and Stress Issues - I

Lecture 36 - Second-Rank Tensors and Stress Issues - II

Lecture 37 - Second-Rank Tensors and Stress Issues - III

Lecture 38 - Cauchy Stress Tetrahedron

Lecture 39 - Stress Invariants

Lecture 40 - Stress and strain invariants, Hooke law for isotropic materials

Lecture 41 - Hooke's law - II

Lecture 42 - Triaxial stress applied on materials with thermal effects

Lecture 43 - How stress can alter permeability, double dot product and applications

Lecture 44 - Deviatoric stress and strain, deformation gradient and Jacobian matrix

Lecture 45 - General definition of 3D strain, application of Jacobian matrix

Lecture 46 - Application of Jacobian matrix, nonhomogeneous deformation

Lecture 47 - Rotation and translation - changes in coordinates

Lecture 48 - Principles of 1g analogue modeling - I

Lecture 49 - Principles of 1g analogue modeling - II

Lecture 50 - Principles of 1g analogue modeling - III

Lecture 51 - Anderson's theory of faulting

Lecture 52 - Stereoplot of principal stress axes - I

Lecture 53 - Stereoplot of principal stress axes - II

Lecture 54 - Stereoplot of principal stress axes - III

Lecture 55 - Deduction of principal stress axes orientation from fault data

Lecture 56 - Elementary stress problems dealing with stereonet - I

Lecture 57 - Elementary stress problems dealing with stereonet - II

Lecture 58 - Poroelasticity - I

Lecture 59 - Poroelasticity - II, stereonet problem

Lecture 60 - Poroelasticity - III

NPTEL : Concrete Technology (Civil Engineering)

Co-ordinators : Dr. B. Bhattacharjee

Lecture 1 - Production and Composition

Lecture 2 - Structure and Hydration

Lecture 3 - Structure and Hydration

Lecture 4 - Properties and Tests

Lecture 5 - Types and Use

Lecture 6 - Aggregates (Size, Shape)

Lecture 7 - Packing, FM, SM

Lecture 8 - Properties

Lecture 9 - Chemical Admixtures

Lecture 10 - Chemical Admixtures

Lecture 11 - Mineral Admixtures

Lecture 12 - Mineral Admixtures

Lecture 13 - Mineral Admixtures

Lecture 14 - Mix Proportioning of Concrete: General Principles

Lecture 15 - Mix design of Concrete: General and IS Method

Lecture 16 - Mix Design of Concrete: Is Example and British (DOE) Method

Lecture 17 - Mix Design of concrete: ACI 211 Method

Lecture 18 - Mix Design of concrete: Packing Density, Rheology

Lecture 19 - Batching and Mixing of concrete: General Principles

Lecture 20 - RMC and Transporting Concrete

Lecture 21 - Workability and Pumping of Concrete

Lecture 22 - Compaction and Curing Concrete

Lecture 23 - Strength of Concrete: Factors Affecting

Lecture 24 - Strength of Concrete: Aggregate Contribution

Lecture 25 - Strength of Concrete: Factors Affecting Test Results

Lecture 26 - Mechanical Properties of Concrete: Elastic Modulus, Poisson's Ratio, Fatigue, Impact

Lecture 27 - Creep of Concrete

Lecture 28 - Creep and Shrinkage of Concrete

Lecture 29 - Shrinkage of Concrete

Lecture 30 - Shrinkage of Concrete

Lecture 31 - Fundamental Concepts, Degradation Process, Attacks

[Lecture 32 - Frost Action and Rebar Corrosion](#)

[Lecture 33 - Carbonation and Chloride Affect](#)

[Lecture 34 - Rebar Corrosion](#)

[Lecture 35 - Rebar Corrosion and General Strategy](#)

[Lecture 36 - High Strength Concrete](#)

[Lecture 37 - High Strength Matrics and SCC](#)

[Lecture 38 - Self Compacting Concrete](#)

[Lecture 39 - Fiber Concrete](#)

[Lecture 40 - Fiber and Roller Compacted Concrete](#)

[Lecture 41 - Special Concrete and Sustainability](#)

NPTEL : Seismic Analysis of Structures (Civil Engineering)

Co-ordinators : Dr. T.K. Datta, Dr. Ashok Gupta

[Lecture 1 - Seismology](#)

[Lecture 2 - Seismology \(Continued...\)](#)

[Lecture 3 - Seismology \(Continued...\)](#)

[Lecture 4 - Seismology \(Continued...\)](#)

[Lecture 5 - Seismic Inputs](#)

[Lecture 6 - Seismic Inputs \(Continued...\)](#)

[Lecture 7 - Seismic Inputs \(Continued...\)](#)

[Lecture 8 - Seismic Inputs \(Continued...\)](#)

[Lecture 9 - Response Analysis for Specified Ground Motion](#)

[Lecture 10 - Response Analysis for Specified Ground Motion \(Continued...\)](#)

[Lecture 11 - Response Analysis for Specified Ground Motion \(Continued...\)](#)

[Lecture 12 - Response Analysis for Specified Ground Motion \(Continued...\)](#)

[Lecture 13 - Response Analysis for Specified Ground Motion \(Continued...\)](#)

[Lecture 14 - Response Analysis for Specified Ground Motion \(Continued...\)](#)

[Lecture 15 - Frequency Domain Spectral Analysis](#)

[Lecture 16 - Frequency Domain Spectral Analysis.](#)

[Lecture 17 - Frequency Domain Spectral Analysis \(Continued...\)](#)

[Lecture 18 - Frequency Domain Spectral Analysis \(Continued...\)](#)

[Lecture 19 - Frequency Domain Spectral Analysis \(Continued...\)](#)

[Lecture 20 - Response Spectrum Method of Analysis](#)

[Lecture 21 - Response Spectrum Method of Analysis.](#)

[Lecture 22 - Response Spectrum Method of Analysis \(Continued...\)](#)

[Lecture 23 - Response Spectrum Method of Analysis \(Continued...\)](#)

[Lecture 24 - Response Spectrum Method of Analysis \(Continued...\)](#)

[Lecture 25 - Inelastic Seismic Response of Structures](#)

[Lecture 26 - Inelastic Seismic Response of Structures \(Continued...\)](#)

[Lecture 27 - Inelastic Seismic Response of Structures \(Continued...\)](#)

[Lecture 28 - Inelastic Seismic Response of Structures \(Continued...\)](#)

[Lecture 29 - Inelastic Seismic Response of Structures \(Continued...\)](#)

[Lecture 30 - Inelastic Seismic Response of Structures \(Continued...\)](#)

Lecture 1 - Functions Of Buildings

Lecture 2 - Role Of Material In Construction

Lecture 3 - Concrete:Material

Lecture 4 - Concrete Production (Continued...)

Lecture 5 - Concrete Production (Continued...)

Lecture 6 - Concrete:Production Pumping, Placing

Lecture 7 - Concrete:Production Curing

Lecture 8 - Cement: Hydration

Lecture 9 - Cement and Cementitious Material

Lecture 10 - Fresh Concrete

Lecture 11 - Fresh Concrete : Role of Mix Parameters

Lecture 12 - Fresh Concrete : Role of Admixtures

Lecture 13 - Fresh Concrete : Segregation Bleeding

Lecture 14 - Strength of Concrete - I

Lecture 15 - Strength of Concrete - II

Lecture 16 - Strength of Concrete - III

Lecture 17 - Mechanical Properties of Concrete - I

Lecture 18 - Mechanical Properties of Concrete - II

Lecture 19 - Strength of Concrete : Non Destructive

Lecture 20 - Durability of Concrete - I

Lecture 21 - Durability of Concrete - II

Lecture 22 - Durability of Concrete - III

Lecture 23 - Cement Aggregate and Water Selection

Lecture 24 - Mix Design of Concrete

Lecture 25 - Mix Design Of concrete IS Method

Lecture 26 - Mix Design Of Concrete: British

Lecture 27 - Masonry : Materials

Lecture 28 - Masonry : Walls

Lecture 29 - Masonry : Walls; Resistance - I

Lecture 30 - Masonry : Walls; Resistance - II

Lecture 31 - Walls : Functional Performances

[Lecture 32 - Walls : Defects and Durability](#)

[Lecture 33 - Metals Fundamentals](#)

[Lecture 34 - Metals and Iron Systems](#)

[Lecture 35 - Steel : Uses in Construction](#)

[Lecture 36 - Steel : Uses in Rebar](#)

[Lecture 37 - Polymer in Construction](#)

[Lecture 38 - Polymer in Construction : Uses](#)

[Lecture 39 - Glass and Timber : Glass](#)

[Lecture 40 - Glass and Timber : Timber](#)

[Lecture 41 - Roof and Floor Construction](#)

NPTEL : Water Management (Civil Engineering)

Co-ordinators : Dr. A.K. Gosain

- Lecture 1 - Introduction to Irrigation Water Management
- Lecture 2 - Soil - Water - Plant Relationships
- Lecture 3 - Soil - Water - Plant Relationships (Continued...)
- Lecture 4 - Soil - Water - Plant Relationships (Continued...)
- Lecture 5 - Soil - Water - Plant Relationships (Continued...)
- Lecture 6 - Soil - Water - Plant Relationships (Continued...) and Infiltration
- Lecture 7 - Crop Water Requirements
- Lecture 8 - Crop Water Requirements (Continued...)
- Lecture 9 - Crop Water Requirements (Continued...)
- Lecture 10 - Crop Water Requirements (Continued...)
- Lecture 11 - Crop Water Requirements (Continued...)
- Lecture 12 - Crop Water Requirements (Continued...)
- Lecture 13 - Crop Water Requirements (continued...)
- Lecture 14 - Irrigation Efficiencies - Part I
- Lecture 15 - Irrigation Efficiencies - Part II and Irrigation Methods and their Suitability
- Lecture 16 - Irrigation Methods - III
- Lecture 17 - Irrigation Methods - IV
- Lecture 18 - Irrigation Methods - V
- Lecture 19 - Irrigation Methods - VI
- Lecture 20 - Irrigation Methods and their Suitability
- Lecture 21 - Border Irrigation System - I
- Lecture 22 - Border Irrigation System - II
- Lecture 23 - Border Irrigation System - III
- Lecture 24 - Border Irrigation System - IV
- Lecture 25 - Furrow Irrigation System - I
- Lecture 26 - Furrow Irrigation System - II
- Lecture 27 - Furrow Irrigation System - III
- Lecture 28 - Furrow Irrigation System - IV
- Lecture 29 - Sprinkler Irrigation System - I
- Lecture 30 - Sprinkler Irrigation System - II
- Lecture 31 - Sprinkler Irrigation System - III

[Lecture 32 - Sprinkler Irrigation System - IV](#)

[Lecture 33 - Sprinkler Irrigation System - V](#)

[Lecture 34 - Sprinkler Irrigation System - VI](#)

[Lecture 35 - Sprinkler Irrigation System - VII](#)

[Lecture 36 - Sprinkler Irrigation System - VIII](#)

[Lecture 37 - Drip Irrigation System - I](#)

[Lecture 38 - Drip Irrigation System - II](#)

[Lecture 39 - Drip Irrigation System - III](#)

[Lecture 40 - Drip Irrigation System - IV](#)

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NPTEL : NOC:Geoenvironmental Engineering (Environmental Geotechnology) Landfills, Slurry Ponds and Contaminated Sites (Civil Engineering)

Co-ordinators : Prof. Manoj Datta

Lecture 1 - Introduction to Geoenvironmental Engineering

Lecture 2 - Sources and Impact of Contamination

Lecture 3 - Waste-Soil Interaction

Lecture 4 - Solid Waste Generation and Disposal

Lecture 5 - Waste Minimization by Integrated Solid Waste Management (ISWM)

Lecture 6 - Integrated Solid Waste Management (ISWM) - Case Studies

Lecture 7 - Principles of Landfilling

Lecture 8 - Planning of Landfills - Part 1

Lecture 9 - Planning of Landfills - Part 2

Lecture 10 - Liners for Landfills - Part 1

Lecture 11 - Liners for Landfills - Part 2

Lecture 12 - Liners for Landfills - Part 3

Lecture 13 - Liners for Landfills - Part 4

Lecture 14 - Covers for Landfills - Part 1

Lecture 15 - Covers for Landfills - Part 2

Lecture 16 - Generation and Control of Leachate

Lecture 17 - Generation and Control of Landfill Gas

Lecture 18 - Stability of Slopes - Part 1

Lecture 19 - Stability of Slopes - Part 2

Lecture 20 - Stability of Slopes - Part 3

Lecture 21 - (Lecture Missing)

Lecture 22 - Some Solved Examples

Lecture 23 - Subsurface Monitoring Around Landfills - Part 1

Lecture 24 - Subsurface Monitoring Around Landfills - Part 2

Lecture 25 - Cost of Geotechnical Components of Landfills

Lecture 26 - Construction and Operation of Landfills

Lecture 27 - Site Selection for Landfills

Lecture 28 - Closure, Rehabilitation and Expansion of MSW Landfills

Lecture 29 - Control and Remedial Measures at Contaminated Sites - Part 1

Lecture 30 - Control and Remedial Measures at Contaminated Sites - Part 2

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[Lecture 31 - Slurry Disposal on Land](#)

[Lecture 32 - Disposal of Slurry Waste in Ponds and Impoundments and Dry Waste in Mounds](#)

[Lecture 33 - Geotechnical Properties of Coal Ash and Mine Tailings - Part 1](#)

[Lecture 34 - Geotechnical Properties of Coal Ash and Mine Tailings - Part 2](#)

[Lecture 35 - Planning and Design of Slurry Ponds](#)

[Lecture 36 - Stability of Incrementally Raised Embankments - Part 1](#)

[Lecture 37 - Stability of Incrementally Raised Embankments - Part 2](#)

[Lecture 38 - Remedial Measures for Slope Failures in Embankments / Dykes of Slurry Ponds](#)

[Lecture 39 - Environmental Control at Slurry Ponds](#)

[Lecture 40 - Geotechnical Reuse of Waste Materials - Part 1](#)

[Lecture 41 - Geotechnical Reuse of Waste Materials - Part 2](#)

[Lecture 42 - End-of-the-Course Review](#)

- Lecture 1 - Introduction to Environmental Factors - 1
- Lecture 2 - Introduction to Environmental Factors - 2
- Lecture 3 - Introduction to Environmental Factors - 3
- Lecture 4 - Introduction to Environmental Factors - 4
- Lecture 5 - Introduction to Environmental Factors - 5
- Lecture 6 - Introduction to Environmental Factors - 6
- Lecture 7 - Introduction to Environmental Factors - 7
- Lecture 8 - Comfort and Heat Transfer Concepts
- Lecture 9 - Heat Flow in Buildings - 1
- Lecture 10 - Heat Flow in buildings - 2
- Lecture 11 - Heat Flow in buildings - 3
- Lecture 12 - Admittance Method - 1
- Lecture 13 - Admittance Method - 2
- Lecture 14 - Heat Flow in buildings - 1 (Frequency Domain)
- Lecture 15 - Heat Flow in buildings - 2 (Frequency Domain)
- Lecture 16 - Heat Flow in buildings - 2 (Frequency Domain)
- Lecture 17 - Heat flow in buildings
- Lecture 18 - Admittance Method
- Lecture 19 - Comfort - 1
- Lecture 20 - Comfort - 2
- Lecture 21 - Comfort and Thermal Design of Buildings - 1
- Lecture 22 - Comfort and Thermal Design of Buildings - 2
- Lecture 23 - Comfort and Thermal Design of Buildings - 3
- Lecture 24 - Thermal Design of Unconditioned Building
- Lecture 25 - External Shading Multipliers for external suns shading
- Lecture 26 - Passive Concepts
- Lecture 27 - Design for Thermal Efficiency
- Lecture 28 - Ventilation - 1
- Lecture 29 - Ventilation - 2
- Lecture 30 - Natural ventilation design
- Lecture 31 - Noise and Acoustic Fundamentals - 1

- [Lecture 32 - Noise and Acoustic Fundamentals - 2](#)
- [Lecture 33 - Noise and Acoustic Fundamentals - 3](#)
- [Lecture 34 - Noise and Acoustic Fundamentals, Noise Outdoors](#)
- [Lecture 35 - Noise outdoors](#)
- [Lecture 36 - Sound within enclosure - 1](#)
- [Lecture 37 - Sound within enclosure - 2](#)
- [Lecture 38 - Sound within enclosure - 3](#)
- [Lecture 39 - Sound within enclosure - 4](#)
- [Lecture 40 - Sound within enclosure - 5](#)
- [Lecture 41 - Sound within enclosure - 6](#)
- [Lecture 42 - Sound within enclosure, isolation](#)
- [Lecture 43 - Isolation - 1](#)
- [Lecture 44 - Isolation - 2](#)
- [Lecture 45 - Auditorium - 1](#)
- [Lecture 46 - Auditorium - 2](#)
- [Lecture 47 - Daylighting - 1](#)
- [Lecture 48 - Daylighting - 2](#)
- [Lecture 49 - Daylighting - 3](#)
- [Lecture 50 - Daylighting - 4](#)
- [Lecture 51 - Daylighting - 5](#)
- [Lecture 52 - Daylighting - 6](#)
- [Lecture 53 - Artificial Lighting](#)
- [Lecture 54 - Design Sky models](#)
- [Lecture 55 - Live Session](#)

Lecture 1 - Basic concepts of Fire Protection - I

Lecture 2 - Basic concepts of Fire Protection - II

Lecture 3 - Fire Resistance

Lecture 4 - Introduction Process of Combustion

Lecture 5 - ventilation and fuel Process of Combustion controlled fire

Lecture 6 - Process of Combustion: Flashover condition

Lecture 7 - Effect of Fire on Construction Materials

Lecture 8 - Design for Fire Resistance: Steel

Lecture 9 - Design for Fire Resistance: Steel

Lecture 10 - Design for Fire Resistance: Concrete

Lecture 11 - Fire Safety: Urban Planning

Lecture 12 - Fire Safety: Escape and Refuge

Lecture 13 - Fire safety: Internal planning, Detection and Suppression

Lecture 14 - Fire Safety: Detection and Suppression

Lecture 15 - Introduction to Lift Design

Lecture 16 - Design of Lift systems

Lecture 17 - Design of Lift systems: expected stops and floor of reversal

Lecture 18 - Design of Lift systems: Different cases

Lecture 19 - Design of Lift systems: Simulation and arrangement and Escalators

Lecture 20 - Introduction to System and Flow Systems

Lecture 21 - Water Supply System: Constant Demand

Lecture 22 - Water Supply System: Variable Demand and Diversity Factor

Lecture 23 - Diversity factor (Continued...)

Lecture 24 - Control Systems

Lecture 25 - Introduction to HVAC

Lecture 26 - Governing Equations for HVAC Process

Lecture 27 - Numerical Problem on HVAC System

Lecture 28 - Numerical Problem on HVAC System (Continued...)

Lecture 29 - Psychrometric Chart: Equation based Approach

Lecture 30 - Flow in Pipe Networks and Fixture Units

Lecture 31 - Flow in Pipe Networks (Continued...) and Design of Water Supply Distribution System

[Lecture 32 - Design of Water Supply Distribution System \(Continued...\) and Flow in Waste Water pipes](#)

[Lecture 33 - Electrical Systems \(introduction\)](#)

[Lecture 34 - Design of Electrical Systems](#)

[Lecture 35 - Intelligent Building](#)

[Lecture 36 - Life cycle cost and basics of building maintenance](#)

[Lecture 37 - Stages of maintenance management](#)

[Lecture 38 - Planning for building maintenance](#)

[Lecture 39 - Periodicity of maintenance management](#)

[Lecture 40 - Estimation of repair cycle](#)

[Lecture 41 - Cost profile of maintenance](#)

[Lecture 42 - Lamp replacement](#)

[Lecture 43 - Building inspection, Planned and Ad-hoc maintenance](#)

[Lecture 44 - Condition survey and health evaluation of buildings](#)

[Lecture 45 - Diagnosis of building by visual survey](#)

[Lecture 46 - Case studies of visual survey](#)

[Lecture 47 - Effect of corrosion and Alkali Aggregate Reaction](#)

[Lecture 48 - Sampling and choice of test location](#)

[Lecture 49 - Non Destructive Testing - 1](#)

[Lecture 50 - Non Destructive Testing - 2](#)

[Lecture 51 - Core strength test](#)

[Lecture 52 - Carbonation and Chloride measurement](#)

[Lecture 53 - Electrical methods of progress measurement](#)

[Lecture 54 - Repair, Rehabilitation and Retrofit](#)

[Lecture 55 - Periodicity and economics of condition survey](#)

[Lecture 56 - Interpretation of test results](#)

Lecture 1 - Introduction and Planet Equivalent

Lecture 2 - Basics of Carbon Cycle

Lecture 3 - Factors Affecting carbon Cycle

Lecture 4 - Fundamentals of Sustainability

Lecture 5 - Role of Materials and Embodied Energy

Lecture 6 - Case Study for Energy in Building

Lecture 7 - Calculation of Ecological Footprint

Lecture 8 - Role of Cement in Sustainability and Calculation of Chemical Exergy

Lecture 9 - Fuel for Cement

Lecture 10 - Cementitious/Supplementary Cementitious Materials and Their Characterization

Lecture 11 - Strength of Concrete With Supplementary Cementitious Materials and Composite Cements

Lecture 12 - Types of Composite Cements

Lecture 13 - Alternative Fuel for cement and Embodied Energy

Lecture 14 - Life Cycle Embodied Energy and Concrete Sustainability

Lecture 15 - Strength of Concrete and Use of Admixtures

Lecture 16 - Curing Methods and Use of Waste Water for Mixing and Curing

Lecture 17 - Modern Composite Concrete

Lecture 18 - Recycled Aggregate-ITZ and Processing

Lecture 19 - Classification of Recycled Aggregate: Crushing and Grinding of Aggregates

Lecture 20 - Crushing and Grinding: Bond's Law+Operational Energy: U-Value

Lecture 21 - Operational Energy: Thermal Conductivity Models

Lecture 22 - Operational Energy: Thermal Conductivity Models (Continued...)

Lecture 23 - Operational Energy: Estimation of Thermal Conductivity

Lecture 24 - Thermal Diffusivity and Clay Bricks

Lecture 25 - Types of Bricks Kilns and Carbon Balance

Lecture 26 - Carbon Balance, Comparison of Various Types of Brick Kilns and Sealants, Paints, Adhesive

Lecture 27 - Sealants, Health Hazards of Building Materials and Emission Models

Lecture 28 - Emission Models and Testing

Lecture 29 - Energy Efficient Design of Buildings

Lecture 30 - Design Optimization of Buildings

Lecture 31 - Building Design Optimization Using Genetic Algorithm

[Lecture 32 - Urban Heat Island: Radiation Concepts](#)

[Lecture 33 - Urban Heat Island: Urban Canopy Layer](#)

[Lecture 34 - Evapotranspiration: Theory and Models](#)

[Lecture 35 - Evapotranspiration: Case Study and Surface Water Balance](#)

[Lecture 36 - Energy Conservation Building Code \(ECBC2007\)](#)

[Lecture 37 - Energy Conservation Building Code \(ECBC2007\) \(Continued...\)](#)

[Lecture 38 - ECBC Compliant Methodology](#)

[Lecture 39 - OTTV Methodology](#)

[Lecture 40 - Solar Energy and Solar Cells](#)

[Lecture 41 - Solar Photo Volatic Cells](#)

[Lecture 42 - Solar Water Heating](#)

[Lecture 43 - Design Strategies and the Green Design Process](#)

[Lecture 44 - Green Building Rating Systems](#)

[Lecture 45 - Autoclaved Aerated Concrete, Insulated Precast System and Insulated Precast Forms](#)

[Lecture 46 - Insulated Concrete Form and Tunnel Form](#)

[Lecture 47 - Modular Construction](#)

Lecture 1 - Introduction to Projects

Lecture 2 - Inputs to Scheduling

Lecture 3 - Critical Path Method

Lecture 4 - Precedence Diagramming Method

Lecture 5 - Line of Balance Method

Lecture 6 - Resource-driven Scheduling

Lecture 7 - Information-driven Scheduling

Lecture 8 - Dependency Structure Matrix - I

Lecture 9 - Dependency Structure Matrix - II

Lecture 10 - Dependency Structure Matrix - III

Lecture 11 - Beeline Diagramming Method

Lecture 12 - Other Scheduling Techniques

Lecture 1 - Introduction to Safety in Construction

Lecture 2 - Introduction to Safety Standards; Signs, Signals in Construction

Lecture 3 - Role of Stakeholders in Construction safety

Lecture 4 - Cost of Injury Vs Investment in Safety

Lecture 5 - Safety Program Accident/Incident Investigation

Lecture 6 - PPE in Construction

Lecture 7 - A Case Study on Construction Safety

Lecture 8 - Introduction to Fatal Falls

Lecture 9 - Fall hazard in Concerting

Lecture 10 - Fall hazard in Demolition Works

Lecture 11 - Safety in Demolition Work Practical Examples

Lecture 12 - Trench Cav-ins

Lecture 13 - Tunneling Safety

Lecture 14 - Struck by and Caught-inbetween

Lecture 15 - Crane Safety

Lecture 16 - A case Study on Construction Safety - Jigar-Crane

Lecture 17 - A case Study on Construction Safety - Safety Talk

Lecture 18 - Fire Safety and Steel Construction

Lecture 19 - Electrical Safety

Lecture 20 - A case Study on Construction Safety - Contractual Provision on Construction Zone Safety

Lecture 21 - Health Issues in Construction

Lecture 22 - Ergonomics and Health Issues with Concerting

Lecture 23 - General Safety Precautions

Lecture 24 - Safety in MEP Services

Lecture 25 - Managing Hazards in Construction

Lecture 26 - BIM for Construction

Lecture 27 - BIM for Safety

- Lecture 1 - Introduction - advanced hydraulics & course structure
- Lecture 2 - Various classifications of open channel flows
- Lecture 3 - Flow classifications & velocity distribution
- Lecture 4 - Pressure distribution
- Lecture 5 - Equation of continuity & energy
- Lecture 6 - Specific energy & critical flow
- Lecture 7 - Energy, momentum & specific force
- Lecture 8 - Computation of critical flow - Part 1
- Lecture 9 - Critical flow computations
- Lecture 10 - Introduction to uniform flow
- Lecture 11 - Manning's equation and normal depth
- Lecture 12 - Uniform Flow Computations - Part 1
- Lecture 13 - Uniform flow in compound sections, concept of normal slope
- Lecture 14 - Uniform flow approximation for flood discharge
- Lecture 15 - Design of channels for uniform flow
- Lecture 16 - Design of channels using uniform flow
- Lecture 17 - Design of erodible channels
- Lecture 18 - Introduction to gradually varied flows
- Lecture 19 - Gradually varied flow equations
- Lecture 20 - Classification of gradually varied flow - Part 1
- Lecture 21 - Classification of gradually varied flow - Part 2
- Lecture 22 - Gradually varied flow profiles with change in bed slopes
- Lecture 23 - GVF profile properties and transitional depths
- Lecture 24 - Gradually varied flow computations - Part 1
- Lecture 25 - Gradually varied flow computations RK method - Part 2
- Lecture 26 - Standard step method for gradually varied flow computations
- Lecture 27 - Spatially varied flow
- Lecture 28 - Features on spatially varied flow
- Lecture 29 - Rapidly varied flow - introduction
- Lecture 30 - Theoretical aspects of hydraulic jump
- Lecture 31 - Characteristics of jumps in rectangular channel

[Lecture 32 - Features of hydraulic jumps](#)

[Lecture 33 - Jumps as energy dissipators](#)

[Lecture 34 - Jump controls](#)

[Lecture 35 - Surges - Part 1](#)

[Lecture 36 - Surges - Part 2](#)

[Lecture 37 - Channel transitions - Part 1](#)

[Lecture 38 - Channel transitions - Part 2](#)

[Lecture 39 - Channel transitions - Part 3](#)

[Lecture 40 - Application of momentum principles](#)

[Lecture 41 - Pumps - 1](#)

[Lecture 42 - Turbines - Part 3 \(pumps, turbines\)](#)

[Lecture 43 - Turbines, cavitation](#)

NPTEL : Design of Steel Structures (Civil Engineering)

Co-ordinators : Prof. Damodar Maity

- Lecture 1 - Introduction to Design of Steel Structures
- Lecture 2 - Connections
- Lecture 3 - Riveted Connections
- Lecture 4 - Design of Rivet Joint
- Lecture 5 - Welding
- Lecture 6 - Design of Fillet and Butt Welds
- Lecture 7 - Bolted Connection
- Lecture 8 - Eccentric Connections: Rivet Joints
- Lecture 9 - Design of Eccentric Connection With Load Lying in Plane of Joint Rivet Bolt
- Lecture 10 - Eccentric Connection With Load Perpendicular to Plane of Riveted Joint
- Lecture 11 - Analysis and Design of Join with Seat Connection
- Lecture 12 - Eccentric Connection
- Lecture 13 - Load Lying Perpendicular to the Plane of Weld Joint
- Lecture 14 - Tension Member
- Lecture 15 - Design of Tension Member
- Lecture 16 - Design of Tension Member: Gusset Plates. Lug Angles and Tension Splices
- Lecture 17 - Design of Tension Member: Subjected to Axial and Bending
- Lecture 18 - Compression Member
- Lecture 19 - Design of Compression Member
- Lecture 20 - Design of Eccentrically Loaded tension Member
- Lecture 21 - Built up Compression Member
- Lecture 22 - Design of Built up Compression Member
- Lecture 23 - Lacing for Built Up Compression Member
- Lecture 24 - Design of Lacing System
- Lecture 25 - Design of Batten Plates
- Lecture 26 - Introduction to Flexural Members: Beams
- Lecture 27 - Design Procedure of Beam Members
- Lecture 28 - Design of Laterally Supported Beams
- Lecture 29 - Design of Laterally Unsupported Beams
- Lecture 30 - Built-Up Beams
- Lecture 31 - Built-Up Beams: Curtailment of the Flange Plates and Shear Connections

[Lecture 32 - Design of a Built-Up Beams](#)

[Lecture 33 - Design of Shear Connections and Purlins](#)

[Lecture 34 - Gantry Girders](#)

[Lecture 35 - Design of Gantry Girders](#)

[Lecture 36 - Introduction to Plate Girders - Part 1](#)

[Lecture 37 - Introduction to Plate Girders - Part 2](#)

[Lecture 38 - Design of a Plate Girder](#)

[Lecture 39 - Column Base - Part 1](#)

[Lecture 40 - Column Base - Part 2](#)

- Lecture 1 - Introduction to Hydraulics
- Lecture 2 - Open Channel Hydraulics - Part 1
- Lecture 3 - Open Channel Hydraulics - Part 2
- Lecture 4 - Velocity and Pressure Distribution
- Lecture 5 - Practical use of velocity co-efficient in channel flow
- Lecture 6 - Conservation Principles & Governing Equations
- Lecture 7 - Uniform Flow
- Lecture 8 - Uniform Flow Formula
- Lecture 9 - Computation of Uniform Flow - Part 1
- Lecture 10 - Computation of Uniform Flow - Part 2
- Lecture 11 - Uniform Flow in Mobile Boundary Channel
- Lecture 12 - Incipient Motion Condition and Regime of Flow
- Lecture 13 - Concept of Specific Energy
- Lecture 14 - Computation of Critical Depth
- Lecture 15 - Specific Force, Critical Depth & Sequent Depth
- Lecture 16 - Non-uniform Flow: Gradually Varied Flow
- Lecture 17 - Classification of Gradually Varied Flow
- Lecture 18 - Characteristic of Gradually Varied Flow
- Lecture 19 - Characteristic of Gradually Varied Flow & its Computation
- Lecture 20 - Gradually Varied Flow & its Computation
- Lecture 21 - Computation of Gradually Varied Flow
- Lecture 22 - Gradually Varied Flow: Numerical Methods and Problem Solving
- Lecture 23 - Rapidly Varied Flow: Hydraulic Jump
- Lecture 24 - Hydraulic Jump
- Lecture 25 - Flow Over Hump and Channel Contraction
- Lecture 26 - Canal Design - 1
- Lecture 27 - Canal Design - 2
- Lecture 28 - Design of Alluvial Channel - 1
- Lecture 29 - Design of Alluvial Channel - 2
- Lecture 30 - Design of Alluvial Channel - 3
- Lecture 31 - Unsteady Flow: Waves and its Classification

[Lecture 32 - Unsteady Flow Part - 2](#)

[Lecture 33 - Unsteady Flow Part - 3](#)

[Lecture 34 - Pipe Flow: Friction Loss](#)

[Lecture 35 - Pipe Flow: Losses in Pipes](#)

[Lecture 36 - Pipe in Series & Parallel](#)

[Lecture 37 - Pipe Network Analysis](#)

[Lecture 38 - Water Hammer & Surge Tank](#)

[Lecture 39 - Pipe Flow Friction Loss](#)

[Lecture 40 - Pipe Flow: Losses in Pipe](#)

Lecture 1 - Introduction to Higher Surveying

Lecture 2 - Understanding reference system, reference frame, and coordinate system for Earth

Lecture 3 - Coordinate and datum transformations

Lecture 4 - Projected coordinate system

Lecture 5 - Fundamentals of astronomy

Lecture 6 - Applications of concepts of astronomy

Lecture 7 - Time

Lecture 8 - Application of concepts of astronomy and time

Lecture 9 - Fundamental concepts of error, accuracy, and error propagation

Lecture 10 - Applications of error propagation

Lecture 11 - Observation Equation Method of adjustments

Lecture 12 - Condition Equation Method and Combined Method of adjustments

Lecture 13 - Analysis of adjustments and reporting of errors

Lecture 14 - Global Positioning System (GPS)

Lecture 15 - Introduction to Photogrammetry

Lecture 16 - Vertical photogrammetry

Lecture 17 - Stereo photogrammetry

Lecture 18 - Analytical photogrammetry - I

Lecture 19 - Analytical photogrammetry - II

Lecture 20 - Photogrammetric products

Lecture 21 - Image matching

Lecture 22 - Close range photogrammetry

Lecture 23 - Fundamentals of LiDAR

Lecture 24 - LiDAR data acquisition

Lecture 25 - Geolocation and errors of LiDAR data

Lecture 26 - Information extraction from LiDAR data

Lecture 27 - RADAR fundamentals - I

Lecture 28 - RADAR fundamentals - II

Lecture 29 - RADAR fundamentals - III

Lecture 30 - Radargrammetry

Lecture 31 - Geoscience perspective for RADAR applications

[Lecture 32 - Fundamental concepts of hydrographic survey](#)

[Lecture 33 - Field procedures for hydrographic Surveying](#)

[Lecture 34 - Modern techniques for hydrographic Survey](#)

[Lecture 35 - Navigation](#)

[Lecture 36 - Conclusive lecture](#)

Lecture 1 - Fundamental Aspects of Unsaturated Soil Mechanics and its Basic Principles

Lecture 2 - Phases of Unsaturated Soils-I

Lecture 3 - Phases of Unsaturated Soils-II

Lecture 4 - Equilibrium between Air and Water Phases

Lecture 5 - Capillary Phenomenon in Unsaturated Soils - I

Lecture 6 - Capillary Phenomenon in Unsaturated Soils - II

Lecture 7 - Summary: Fundamental Principles and Constitutive Relationships

Lecture 8 - Concept of Water Retention and Soil Water Characteristics - I

Lecture 9 - Concept of Water Retention and Soil Water Characteristics - II

Lecture 10 - Hydraulic conductivity functions and determination of state variables

Lecture 11 - Suction Measurement/Control Techniques - I

Lecture 12 - Suction Measurement/Control Techniques - II

Lecture 13 - Summary: Suction Measurement and Control Techniques

Lecture 14 - HCF Determination

Lecture 15 - SWCC and HCF Models

Lecture 16 - HCF Modelling

Lecture 17 - Fitting of SWCC and HCF modelling

Lecture 18 - Pedo-transfer Functions (PTF)

Lecture 19 - Steady-State Flow Through Soils

Lecture 20 - Steady-State and Transient Flow

Lecture 21 - Analytical Methods for Transient Flow - I

Lecture 22 - Analytical Methods for Transient Flow - II

Lecture 23 - Shear Strength of Unsaturated Soils

Lecture 24 - Suction-Controlled Direct Shear Test

Lecture 25 - Suction-Controlled Triaxial Test

Lecture 26 - Extended M-C Criterion - I

Lecture 27 - Extended M-C Criterion - II

Lecture 28 - Extended M-C Criterion - III

Lecture 29 - Concept of Suction Stress - I

Lecture 30 - Concept of Suction Stress - II

Lecture 31 - Concept of Suction Stress - III

[Lecture 32 - Summary: Shear Strength of Unsaturated Soils and Introduction to Volume Change](#)

[Lecture 33 - Swelling Behaviour of Soils](#)

[Lecture 34 - Estimation of Swelling Pressure in the Laboratory and Behaviour of Collapsible soil](#)

[Lecture 35 - Volume Change Behaviour of Bentonite and Kaolin Clay](#)

[Lecture 36 - Demonstration of Various Experiments Related to Unsaturated Soil Mechanics](#)

Lecture 1 - Introduction

Lecture 2 - Phases and classification of subsurface Investigation

Lecture 3 - Test Pits+ Borings

Lecture 4 - Ground water table and rock drilling

Lecture 5 - Standard Penetration Test

Lecture 6 - Cone Penetration Test

Lecture 7 - Dilatometer Test

Lecture 8 - Pressuremeter Test

Lecture 9 - Seismic reflection method

Lecture 10 - Seismic refraction method

Lecture 11 - Electrical Resistivity Survey

Lecture 12 - Magnetic Survey

Lecture 13 - Surface wave method

Lecture 14 - Gravity Survey

Lecture 15 - Offshore Investigation

Lecture 16 - Geophysical Investigation in Offshore Environment

Lecture 17 - Sampling and Geotechnical Investigations in Offshore Environment

Lecture 18 - Important Terminologies in Offshore Environment

Lecture 19 - Dynamic Testing in Pile Driving

Lecture 20 - Dynamic Testing in Pile (Low Strain)

Lecture 21 - Conclusion

Lecture 1 - Basic Concepts of Fluid

Lecture 2 - Properties of Fluid

Lecture 3 - Properties of Fluid

Lecture 4 - Concepts of Hydrostatic

Lecture 5 - Measurement of Pressure and Hydrostatic forces

Lecture 6 - Buoyancy, Metacentre, Stability and Rigid body motion

Lecture 7 - Reynolds Transport Theorem

Lecture 8 - Conservation of Mass

Lecture 9 - Conservation of Momentum

Lecture 10 - Conservation of Momentum Applications

Lecture 11 - Bernoulli's Equation

Lecture 12 - Applications of Bernoulli's Equation

Lecture 13 - Fluid Statics Applications: Example Problems

Lecture 14 - Conservation of Momentum: Example problems

Lecture 15 - Bernoulli's Equation: Problems Solving on Black Board

Lecture 16 - Lagrangian and Eulerian Descriptions

Lecture 17 - Motion and deformation of fluid elements

Lecture 18 - Problems Solving on Black Board

Lecture 19 - Dimensional Homogeneity

Lecture 20 - Dimensional Analysis and Similarity

Lecture 21 - Laminar and Turbulent Flows

Lecture 22 - Losses in Pipe Fittings

Lecture 23 - Flow in Noncircular Conduits and Multiple Path Pipeflow

Lecture 24 - Mass Conservation Equation - I

Lecture 25 - Mass Conservation Equation - II

Lecture 26 - Stream Function

Lecture 27 - Cauchy's Equation

Lecture 28 - The Navier-Stokes Equation - Part I

Lecture 29 - The Navier-Stokes Equation - Part II

Lecture 30 - The Navier-Stokes Equation - Part III

Lecture 31 - Approximate solutions of Navier Stokes Equation: Boundary Layer Approximation

[Lecture 32 - Boundary Layer Approximation - II](#)

[Lecture 33 - Boundary Layer Approximation - III](#)

[Lecture 34 - Open Channel Flow - I](#)

[Lecture 35 - Open Channel Flow - II](#)

[Lecture 36 - Open Channel Flow - III](#)

[Lecture 37 - Drag and Lift](#)

Lecture 1 - Overview and Introduction

Lecture 2 - Basics of Remote Sensing

Lecture 3 - Error corrections in satellite image

Lecture 4 - Error Identification and Correction - I

Lecture 5 - Error Identification and Correction - II

Lecture 6 - Error Identification and Correction - III

Lecture 7 - DIP - I

Lecture 8 - DIP - II

Lecture 9 - DIP - III

Lecture 10 - DIP - IV

Lecture 11 - Image Classification - I

Lecture 12 - Image Classification - II

Lecture 13 - Photogrammetry

Lecture 14 - Thermal Remote Sensing

Lecture 15 - Microwave Remote Sensing

Lecture 16 - HRS - I

Lecture 17 - HRS - II

Lecture 18 - HRS - III

Lecture 19 - HRS - IV

Lecture 20 - HRS - V

Lecture 21 - GIS - I

Lecture 22 - GIS - II

Lecture 23 - Applications of Remote Sensing and GIS - I

Lecture 24 - Applications of Remote Sensing and GIS - II

- Lecture 1 - Introduction to River Engineering
- Lecture 2 - Basic properties of sediment - I
- Lecture 3 - Basic properties of sediment - II
- Lecture 4 - Mass Conservation
- Lecture 5 - Linear Momentum Equation
- Lecture 6 - Navier-Stokes Equations
- Lecture 7 - St. Venant Equation and Solver
- Lecture 8 - Specific Energy and Critical Flow
- Lecture 9 - Hydraulic Jump and Celerity
- Lecture 10 - Floodwave Celerity and Loop Rating Curve
- Lecture 11 - Sediment Transport in River - I
- Lecture 12 - Sediment Transport in River - II
- Lecture 13 - Sediment Transport in River - III
- Lecture 14 - Physical River Models
- Lecture 15 - Bridge Scour: processes and estimation
- Lecture 16 - Bridge Scour-II
- Lecture 17 - Jet Scour and River Navigation
- Lecture 18 - River Training Work
- Lecture 19 - Riverbank Stabilization - I
- Lecture 20 - Riverbank Stabilization - II
- Lecture 21 - Riverbank Protection and Control Structures
- Lecture 22 - River Equilibrium - I
- Lecture 23 - River Equilibrium - II
- Lecture 24 - River Equilibrium - III

Lecture 1 - Introduction to solid waste

Lecture 2 - Functional elements

Lecture 3 - Types and sources of solid waste

Lecture 4 - Sampling and characteristics

Lecture 5 - Estimation of solid waste quantity

Lecture 6 - Factors affecting solid waste generation rate

Lecture 7 - Handling, separation and storage at source

Lecture 8 - Processing at source

Lecture 9 - Primary collection

Lecture 10 - Types of collection system

Lecture 11 - Analysis of collection system - Part I

Lecture 12 - Analysis of collection system - Part II

Lecture 13 - Analysis of collection system - Part III

Lecture 14 - Need and types of transfer station

Lecture 15 - Transport means and methods

Lecture 16 - Unit operation for component separation

Lecture 17 - Material recovery facilities (MRF)

Lecture 18 - Recycling of dry waste components

Lecture 19 - Waste as a fuel

Lecture 20 - Incineration/Combustion

Lecture 21 - Flue gas characteristics and treatment

Lecture 22 - Solid residue generation, characterization and treatment

Lecture 23 - Waste-to-energy (WtE) plants (case studies) pyrolysis and gasification

Lecture 24 - Definition and phases of composting

Lecture 25 - Factors affecting composting process

Lecture 26 - Types of composting - I

Lecture 27 - Types of composting - II

Lecture 28 - Compost quality

Lecture 29 - Vermicomposting

Lecture 30 - Definition, stages and factors affecting anaerobic digestion

Lecture 31 - Pretreatment and co-digestion for enhancement of biogas production

[Lecture 32 - Types of biogas digesters](#)

[Lecture 33 - Site selection and types of landfill](#)

[Lecture 34 - Leachate collection and treatment](#)

[Lecture 35 - Landfill gas collection and treatment](#)

[Lecture 36 - Design of landfill and Bio-minning of old dumpsite](#)

[Lecture 37 - Construction and demolition waste](#)

[Lecture 38 - Management of bio-medical, e-waste and inert waste](#)

[Lecture 39 - Integrated solid waste management \(ISWM\)](#)

[Lecture 40 - Municipal solid waste management rules](#)

[Lecture 41 - Financing in MSWM projects](#)

[Lecture 42 - Public-Private-Partnership \(PPP\)](#)

[Lecture 43 - Public-Private-Partnership \(PPP\) in MSWM projects](#)

Lecture 1 - Planning process of equipment

Lecture 2 - Estimation of Ownership cost (Average Annual Investment method)

Lecture 3 - Estimation of Ownership cost (Time value method)

Lecture 4 - Operating cost of Equipment

Lecture 5 - Equipment cost estimation

Lecture 6 - Equipment life and replacement analysis - Part 1

Lecture 7 - Equipment life and replacement analysis - Part 2

Lecture 8 - Equipment life and replacement analysis - Part 3

Lecture 9 - Engineering Fundamentals of Moving Earth

Lecture 10 - Bull Dozers

Lecture 11 - Scrapers - Part 1

Lecture 12 - Scrapers - Part 2

Lecture 13 - Front End loaders

Lecture 14 - Excavators

Lecture 15 - Trucks

Lecture 16 - Piles and Pile driving equipment - Part 1

Lecture 17 - Piles and Pile driving equipment - Part 2

Lecture 18 - Cranes - Part 1

Lecture 19 - Cranes - Part 2

Lecture 20 - Concreting Equipment - Part 1

Lecture 21 - Concreting Equipment - Part 2

Lecture 22 - Summary

- Lecture 1 - Introduction to course content
- Lecture 2 - Stress acting at a point - Cauchy stress
- Lecture 3 - Stress acting at a point - Stress tensor
- Lecture 4 - Stress acting on a plane
- Lecture 5 - Stress acting on a plane example
- Lecture 6 - Transformation of stress tensor
- Lecture 7 - Stress invariants
- Lecture 8 - Relationship between stress invariants
- Lecture 9 - Principle stresses and Eigen vectors
- Lecture 10 - Strain in soils
- Lecture 11 - Cause effect relationship
- Lecture 12 - Important constitutive relationship
- Lecture 13 - 3D to 2D idealization
- Lecture 14 - Mathematical formulation plane stress plane strain
- Lecture 15 - Mathematical formulation axisymmetric
- Lecture 16 - Summary of Module 1
- Lecture 17 - Basics of shear strength
- Lecture 18 - Stress representation
- Lecture 19 - Shear strength granular soil - I
- Lecture 20 - Shear strength granular soil - II
- Lecture 21 - Shear strength cohesive soil
- Lecture 22 - Shear strength cohesive soil - Stress strain
- Lecture 23 - Pore water pressure and Skemptions equation
- Lecture 24 - Overall pore water pressure parameter
- Lecture 25 - Pore water pressure - plane strain-effect of sampling
- Lecture 26 - Pore water pressure estimation
- Lecture 27 - Triaxial test
- Lecture 28 - Interpretation triaxial test - UU UCS
- Lecture 29 - Interpretation triaxial test - CU
- Lecture 30 - Interpretation triaxial test - CD
- Lecture 31 - Some additional aspects of shear strength

- Lecture 32 - Summary of Module 2
- Lecture 33 - Stress path and representation
- Lecture 34 - Failure line in stress path
- Lecture 35 - Stress path-some common cases - I
- Lecture 36 - Stress path-some common cases - II
- Lecture 37 - Stress path-triaxial test-drained
- Lecture 38 - Stress path-triaxial test-undrained
- Lecture 39 - Stress path-additional undrained case
- Lecture 40 - Stress path-field cases - I
- Lecture 41 - Stress path-field cases - II
- Lecture 42 - Stress path problems
- Lecture 43 - Summary of Module 3
- Lecture 44 - Introduction-critical state soil mechanics
- Lecture 45 - Introduction-critical state soil mechanics
- Lecture 46 - CSSM-2 D representation
- Lecture 47 - Peak state
- Lecture 48 - Soil yielding
- Lecture 49 - Cam clay
- Lecture 50 - Modified Cam clay
- Lecture 51 - Prediction of soil behavior from MCCM
- Lecture 52 - Prediction of soil behavior from MCCM
- Lecture 53 - Strain from MCCM
- Lecture 54 - State boundary surface
- Lecture 55 - CSSM problems
- Lecture 56 - Summary of Module 4
- Lecture 57 - Closure of Advanced Soil Mechanics Course

NPTEL : NOC:Plates and Shells (Civil Engineering)

Co-ordinators : Prof. Sudip Talukdar

- Lecture 1 - Introduction, classification of plates and some useful relations
- Lecture 2 - Theory of thin plate bending
- Lecture 3 - Plate equations and boundary conditions with examples
- Lecture 4 - Exercises on the plate bending theory
- Lecture 5 - Simply supported plate subjected to distributed loading
- Lecture 6 - Simply supported plate subjected to concentrated load and couple
- Lecture 7 - Simply supported plate resting on elastic foundation and other examples
- Lecture 8 - General formulation for rectangular plate with two opposite edges simply supported
- Lecture 9 - Levy's solution for different loading and boundary conditions
- Lecture 10 - Rectangular plate with Levy's boundary condition subjected to edge moment
- Lecture 11 - Transformation of plate equation from rectangular co-ordinates to polar co-ordinates
- Lecture 12 - Axi-symmetrical bending of circular plate under pure moment and uniformly distributed load
- Lecture 13 - Examples in axisymmetrical bending of solid and annular plate
- Lecture 14 - Variational principle in plate problem
- Lecture 15 - Applications of Rayleigh-Ritz and Gallerkin's method
- Lecture 16 - Finite difference method in plate bending
- Lecture 17 - Plate subjected to inplane forces and transverse load
- Lecture 18 - Buckling load of rectangular plate with Navier's boundary condition
- Lecture 19 - Buckling load of rectangular with Levy's boundary condition
- Lecture 20 - Rayleigh-Ritz and Gallerkin method in buckling of plate
- Lecture 21 - Finite difference method in buckling of plate
- Lecture 22 - Introduction to shell structure and behavior of stretched membrane
- Lecture 23 - Classification of shell structure
- Lecture 24 - Stress resultants and couples in shells
- Lecture 25 - Membrane analysis of shells of surface of revolution
- Lecture 26 - Analysis of Spherical dome
- Lecture 27 - Some examples of axi-symmetrical cases in surface of revolution
- Lecture 28 - Membrane theory in pressure vessels
- Lecture 29 - Membrane theory in pressure vessel in the form a Torus and in a tank of arbitrary meridian
- Lecture 30 - Membrane theory of hyperboloid of revolution: Application to cooling tower
- Lecture 31 - Differential Equations of Equilibrium in Cylindrical shell using membrane hypothesis

[Lecture 32 - Membrane Analysis of Cylindrical Shell roof subjected to self weight and snow load](#)

[Lecture 33 - Circular Cylindrical Shell for Fourier Loading in a membrane state of stress](#)

[Lecture 34 - Simplified Bending Theory of Cylindrical Shell-Beam and Arch theories](#)

[Lecture 35 - General bending theory of cylindrical shell](#)

[Lecture 36 - Some applications of symmetrical bending of circular cylindrical shell](#)

Lecture 1 - Introduction to Optimization

Lecture 2 - Classical Optimization

Lecture 3 - Introduction to Linear Problem

Lecture 4 - General system of equations

Lecture 5 - Simplex Method

Lecture 6 - Solution of Linear Problem using Excel Solver

Lecture 7 - Bracketing Method

Lecture 8 - Region Elimination Methods

Lecture 9 - Gradient Based Method and Examples

Lecture 10 - Convex Function

Lecture 11 - Line Search Methods for Multi-Variable Problems

Lecture 12 - Quadratic Approximation Method

Lecture 13 - Constrained Optimization I: Equality constraints

Lecture 14 - Constrained Optimization II: Inequality constraints

Lecture 15 - Constrained Optimization III: Penalty function methods

Lecture 16 - Introduction to Metaheuristic Optimization

Lecture 17 - Genetic Algorithms - Part I

Lecture 18 - Genetic Algorithms - Part II

Lecture 19 - Genetic Algorithms - Part III

Lecture 20 - Real Coded Genetic Algorithms

Lecture 21 - Multi-modal optimization

Lecture 22 - Introduction to R

Lecture 23 - GA using R (Unconstrained problem)

Lecture 24 - GA using R (Constrained problem)

Lecture 25 - Constraint Handling in GAs

Lecture 26 - Evolution Strategies (ESs)

Lecture 27 - Particle swarm optimization

Lecture 28 - Introduction to R - Part II

Lecture 29 - Multi-objective Genetic Algorithms

Lecture 30 - Introduction to Differential Evolution

Lecture 31 - Introduction to Matlab

[Lecture 32 - Optimization using Matlab \(Classical methods\)](#)

[Lecture 33 - A tutorial on Differential Evolution](#)

[Lecture 34 - NSGA II Using R](#)

[Lecture 35 - Optimization using MATLAB](#)

[Lecture 36 - Optimization using Excel Solver](#)

[Lecture 37 - Multi-objective Genetic Algorithms using MATLAB](#)

[Lecture 38 - Solution of a Design Problem Using MATLAB](#)

Lecture 1 - Course Contents

Lecture 2 - Preliminary Concepts

Lecture 3 - Introduction to Reynolds Transport Theorem

Lecture 4 - Derivation of Reynolds Transport Theorem - Part I

Lecture 5 - Derivation of Reynolds Transport Theorem - Part II

Lecture 6 - Conservations Laws

Lecture 7 - Numerical Examples

Lecture 8 - Summary of Module - I

Lecture 9 - Atmospheric Water

Lecture 10 - Water Vapor Dynamics

Lecture 11 - Precipitable Water in the Static Atmospheric Column

Lecture 12 - Numerical Examples on Basic Atmospheric Parameters

Lecture 13 - Precipitation-Types and Formation

Lecture 14 - Terminal Velocity

Lecture 15 - Thunderstorm Cell Model

Lecture 16 - Numerical Examples on Terminal Velocity and Thunderstorm Cell

Lecture 17 - Forms of Precipitation

Lecture 18 - Measurement of rainfall

Lecture 19 - Raingauge Network

Lecture 20 - Presentation of Rainfall Data

Lecture 21 - Analysis of Rainfall Data

Lecture 22 - Average Areal Rainfall

Lecture 23 - Evaporation

Lecture 24 - Evaporation-Energy Balance Method

Lecture 25 - Evaporation-Aerodynamic Method

Lecture 26 - Evaporation-Combined Method

Lecture 27 - Numerical Examples on Evaporation

Lecture 28 - Evaporation-Empirical method

Lecture 29 - Evapotranspiration

Lecture 30 - Evapotranspiration-Numerical Example

Lecture 31 - Summary of Module - II

Lecture 32 - Subsurface Water

Lecture 33 - 1-D Unsteady Unsaturated Flow Equation

Lecture 34 - Infiltration

Lecture 35 - Measurement of Infiltration

Lecture 36 - Estimation of Infiltration-Empirical Equations

Lecture 37 - Numerical examples - Infiltration estimation using empirical equations

Lecture 38 - Estimation of Infiltration-Theoretical Equation

Lecture 39 - Infiltration-Green Ampt Equation

Lecture 40 - Ponding time

Lecture 41 - Numerical Examples on Green Ampt Infiltration Equation

Lecture 42 - Summary of Module - III

Lecture 43 - Surface Water

Lecture 44 - Excess Rainfall and Direct Runoff

Lecture 45 - Numerical Examples on Direct Runoff

Lecture 46 - Overland flow

Lecture 47 - Streamflow Measurement - I

Lecture 48 - Streamflow Measurement - II

Lecture 49 - Representation of Streamflow

Lecture 50 - Numerical Examples on Streamflow Measurement

Lecture 51 - Summary of Module - IV

Lecture 52 - Hydrologic Analysis - Introduction

Lecture 53 - Linear System Theory

Lecture 54 - Hydrograph Analysis-UH

Lecture 55 - Hydrograph Analysis-DRH

Lecture 56 - Numerical examples on UH and DRH

Lecture 57 - S-Hydrograph

Lecture 58 - Unit Hydrograph of Different Duration

Lecture 59 - Numerical examples UH of Different Duration

Lecture 60 - Instantaneous Unit Hydrograph

Lecture 61 - Instantaneous Unit Hydrograph-Nash's Model

Lecture 62 - Numerical Examples on IUH

Lecture 63 - Synthetic Unit Hydrograph

Lecture 64 - SCS-Synthetic Unit Hydrograph

[Lecture 65 - Numerical Examples on SUH](#)

[Lecture 66 - Hydrograph Routing](#)

[Lecture 67 - Reservoir Routing](#)

[Lecture 68 - Numerical Example on Reservoir Routing](#)

[Lecture 69 - Hydrologic Channel Routing](#)

[Lecture 70 - Numerical Examples on Channel Routing](#)

[Lecture 71 - Summary of Module - V](#)

[Lecture 72 - Hydrologic Statistics-Preliminary Concepts](#)

[Lecture 73 - Probability Distribution and Basic Descriptive Statistics](#)

[Lecture 74 - Probability Distributions](#)

[Lecture 75 - Frequency Analysis](#)

[Lecture 76 - Extreme Value Analysis](#)

[Lecture 77 - Summary of Module - VI](#)

[Lecture 78 - Hydrologic Design](#)

[Lecture 79 - Numerical examples on probability and risk](#)

[Lecture 80 - Design Storm](#)

[Lecture 81 - Design Flood](#)

[Lecture 82 - Summary of Module - VII](#)

[Lecture 83 - Closure of Engineering Hydrology](#)

NPTEL : NOC:Expansive Soil (Civil Engineering)

Co-ordinators : Prof. Anil Kumar Mishra

Lecture 1 - Formation of soil

Lecture 2 - Index properties and classification of soil

Lecture 3 - Engineering properties of soil - I

Lecture 4 - Engineering properties of soil - II

Lecture 5 - Clay mineralogy

Lecture 6 - Properties of clay particles

Lecture 7 - Definition, type and behaviour

Lecture 8 - Mechanism of soil-water interaction

Lecture 9 - Swelling of expansive soil

Lecture 10 - Factors controlling DDL thickness

Lecture 11 - Determination of swelling properties

Lecture 12 - Classification and prediction

Lecture 13 - Factors controlling swelling of soil

Lecture 14 - Shrinkage behaviour of soil

Lecture 15 - Factors controlling shrinkage behavior of soils

Lecture 16 - Measurement of various shrinkage characteristics of soil

Lecture 17 - Cyclic Swelling-Shrinkage Behaviour of Soil

Lecture 18 - Thermo-Mechanical-Hydraulic-Chemical Behaviour - I

Lecture 19 - Thermo-Mechanical-Hydraulic-Chemical Behaviour - II

Lecture 20 - Thermo-Mechanical-Hydraulic-Chemical Behaviour - III

Lecture 21 - Mechanical Methods

Lecture 22 - Hydraulic methods

Lecture 23 - Chemical methods - 1

Lecture 24 - Chemical methods - 2

Lecture 25 - By inclusion or confinement

Lecture 26 - Foundation on expansive soil

Lecture 27 - Use of expansive soil for various geotechnical engineering applications

Lecture 28 - Closure lecture

- Lecture 1 - General Introduction and Modelling of Dynamic Systems
- Lecture 2 - Time Domain Analysis of Linear System - Harmonic input
- Lecture 3 - Time Domain Analysis of Linear System - Arbitrary Input
- Lecture 4 - Transformed technique in vibration of linear system
- Lecture 5 - Formulation of problem: Equilibrium Approach
- Lecture 6 - Formulation of problem by Energy Principle
- Lecture 7 - Hamilton's principles for formulating vibration problems
- Lecture 8 - Lagrange's equation for formulating vibration problems
- Lecture 9 - One Dimensional Wave Equation
- Lecture 10 - D'Alembert's Solution of the Wave Equation
- Lecture 11 - Transverse Vibration of String
- Lecture 12 - Forced Transverse Vibration of String
- Lecture 13 - Axial Vibration of Bar
- Lecture 14 - Torsional Vibration of Bar
- Lecture 15 - Some typical problems in axial and torsional vibrations
- Lecture 16 - Transverse vibration of beams
- Lecture 17 - Natural frequencies and mode shapes of beams with various end conditions
- Lecture 18 - Free damped transverse vibration analysis of beam
- Lecture 19 - Forced damped vibration analysis of Euler Bernoulli beam
- Lecture 20 - Vibration of beams subjected to moving load
- Lecture 21 - Some special topics on the transverse vibration of beam
- Lecture 22 - Combination of continuous and lumped parameter system
- Lecture 23 - State space solutions in vibration problems
- Lecture 24 - Beam with moving oscillator, pulsating force and rolling mass
- Lecture 25 - Vibration of membrane
- Lecture 26 - Vibration of Circular membrane
- Lecture 27 - Vibration of Rectangular plate
- Lecture 28 - Free vibration of rectangular plates
- Lecture 29 - Forced vibration of rectangular plates
- Lecture 30 - Approximate method for vibration analysis
- Lecture 31 - Rayleigh-Ritz method for vibration analysis

[Lecture 32 - Gallerkin's method and Finite difference method](#)

[Lecture 33 - System subjected to support excitation](#)

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NPTEL : Advanced Hydrology (Civil Engineering)

Co-ordinators : Dr. Ashu Jain

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NPTEL : Concrete Engineering and Technology (Civil Engineering)

Co-ordinators : Dr. Sudhir Misra

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NPTEL : Environmental Air Pollution (Civil Engineering)

Co-ordinators : Prof. Mukesh Sharma

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NPTEL : Water Resources Engineering (Civil Engineering)

Co-ordinators : Dr. Pranab K Mohapatra, Prof. Rajesh Srivastava

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NPTEL : Application of Soil Mechanics (Civil Engineering)

Co-ordinators : Dr. Nihar Ranjan Patra

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Lecture 2 - Generation Introduction to the Remote Sensing - Part 1

Lecture 3 - Generation Introduction to the Remote Sensing - Part 2

Lecture 4 - Aerial Photogrammetry - Part 1

Lecture 5 - Aerial Photogrammetry - Part 2

Lecture 6 - Stereoscapy

Lecture 7 - Relief Displacement

Lecture 8 - Exploring the Remote Sensing Data and GIS Software - Part 1

Lecture 9 - Exploring the Remote Sensing Data and GIS Software - Part 2

Lecture 10 - Exploring the Remote Sensing Data and GIS Software - Part 3

Lecture 11 - Georeferencing of Toposheets on QGIS

Lecture 12 - Georeferencing of Remote Sensing Data on QGIS

Lecture 13 - Mosaicking, Merging and Generation of Shape Files on QGIS

Lecture 14 - Fluvial Systems and Associated Landforms - Part 1

Lecture 15 - Fluvial Systems and Associated Landforms - Part 2

Lecture 16 - Fluvial Systems and Associated Landforms - Part 3

Lecture 17 - Fluvial Systems and Associated Landforms - Part 4

Lecture 18 - Fluvial Systems and Associated Landforms - Part 5

Lecture 19 - Fluvial Systems and Associated Landforms - Part 6

Lecture 20 - Tectonic Geomorphology - Part 1

Lecture 21 - Tectonic Geomorphology - Part 2

Lecture 22 - Tectonic Geomorphology - Part 3

Lecture 23 - Tectonic Geomorphology - Part 4

Lecture 24 - Anaglyph and DEM Generation of Cartosat-1 data on ENVI

Lecture 25 - Tectono-Geomorphic Mapping on QGIS - Part 1

Lecture 26 - Tectono-Geomorphic Mapping on QGIS - Part 2

Lecture 27 - Tectono-Geomorphic Mapping on QGIS - Part 3

Lecture 28 - Tectono-Geomorphic Mapping on QGIS - Part 4

Lecture 29 - Total Station (TS) and Real Time Kinematics (RTK) and its Applications

Lecture 30 - Field Demonstration of Real Time Kinematics (RTK) - Part 1

Lecture 31 - Field Demonstration of Real Time Kinematics (RTK) - Part 2

[Lecture 32 - Field Demonstration of Total Station \(TS\) - Part 1](#)

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Lecture 1 - Introduction

Lecture 2 - Soil Exploration

Lecture 3 - Soil Exploration - Penetration Tests

Lecture 4 - Soil Exploration - Geophysical Exploration

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Lecture 6 - Shallow Foundation : Bearing Capacity - I

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Lecture 8 - Shallow Foundation : Bearing Capacity - III

Lecture 9 - Shallow Foundation : Bearing Capacity - IV

Lecture 10 - Shallow Foundation : Bearing Capacity - V

Lecture 11 - Shallow Foundation - Settlement Calculation - I

Lecture 12 - Shallow Foundation - Settlement Calculation - II

Lecture 13 - Shallow Foundation - Settlement Calculation - III

Lecture 14 - Design of Shallow Foundation

Lecture 15 - Design of Raft Foundation

Lecture 16 - Deep Foundation - Introduction

Lecture 17 - Pile Foundation - Load Carrying Capacity - I

Lecture 18 - Pile Foundation - Load Carrying Capacity - II

Lecture 19 - Pile Foundation - Load Carrying Capacity - III and Settlement Calculation

Lecture 20 - Tension and Lateral Loaded Piles

Lecture 21 - Well Foundation

Lecture 22 - Well Foundation (Continued...)

Lecture 23 - Design of Retaining Wall

Lecture 24 - Design of Retaining Wall (Continued...)

Lecture 25 - Design of Sheet Piles

Lecture 26 - Design of Sheet Piles (Continued...)

Lecture 27 - Design of Sheet Piles (Continued...)

Lecture 28 - Design of Sheet Piles (Continued...)

Lecture 29 - Reinforced Earth

Lecture 30 - Reinforced Retaining Wall

Lecture 31 - Seismic Design of Retaining Wall

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[Lecture 33 - Soil - Foundation Interaction](#)

[Lecture 34 - Soil - Foundation Interaction \(Continued...\)](#)

[Lecture 35 - Soil - Foundation Interaction \(Continued...\)](#)

[Lecture 36 - Soil - Foundation Interaction \(Continued...\)](#)

[Lecture 37 - Soil - Foundation Interaction \(Continued...\)](#)

[Lecture 38 - Soil - Foundation Interaction \(Continued...\)](#)

[Lecture 39 - Soil - Foundation Interaction \(Continued...\)](#)

[Lecture 40 - Soil - Foundation Interaction \(Continued...\)](#)

NPTEL : Ground Water Hydrology (Civil Engineering)

Co-ordinators : Dr. Anirban Dhar, Dr. V.R. Desai

Lecture 1 - Introduction : Ground Water (GW) Utilization and Historical Background, GW in hydrologic Cycle

Lecture 2 - Ground Water in & % Hydrologic Cycle (Continued...), Ground Water Budget, Ground Water Level Fluctuations and Environmental Influence

Lecture 3 - Ground water Level Fluctuations and Environmental Influence (Continued...) Literature/Data/Internet Resources

Lecture 4 - Ground water Level Fluctuations and Environmental Influence (Continued...) Literature/Data/Internet Resources

Lecture 5 - Occurrence and Movement of Ground Water : Origin and Age of Ground Water, Rock Properties Affecting Ground Water, Ground Water Column

Lecture 6 - Zones of Aeration and Saturation; Aquifers and their characteristics/classification

Lecture 7 - Aquifer Classification (Continued...), Ground water Basins and Springs; Darcy's Law; Permeability

Lecture 8 - Determination of Permeability : Heterogeneity and Anisotropy

Lecture 9 - Ground Water (GW) flowrates and flow directions; general flow equations through porous media

Lecture 10 - General Flow Equations Through Porous Media (Continued...), Dupuit's Assumptions

Lecture 11 - 1-D Unconfined Ground water Flows; Steady Flow into Wells

Lecture 12 - Steady Flow into Wells (Continued...); Unsteady Flow into Wells

Lecture 13 - Unsteady Flow into Wells (Continued...)

Lecture 14 - Unsteady Radial Flow in Confined and Unconfined Aquifers

Lecture 15 - Unsteady Radial Flow in Leaky Aquifers (Continued...); Well Flow Near Aquifer Boundaries

Lecture 16 - Well Flow for Special Conditions; Partially Penetrating Wells; Horizontal Wells and Collector Wells; Multiple Well Systems

Lecture 17 - Well Completion; Well Development; Well Protection; Well Rehabilitation; Well testing for Yields

Lecture 18 - Well Protection/Rehabilitation/Testing for yield (Continued...); Artificial Ground Water Recharge : Concept and Methods

Lecture 19 - Concept and methods of Artificial Ground Water Recharge (Continued...); Recharge Mounds and Induced Recharge

Lecture 20 - Induced Recharge (Continued...); Wastewater recharge for reuse; Water spreading

Lecture 21 - Pollution and Quality Analysis of Ground Water : Sources of Pollution of GW-Municipal, Industrial, Agricultural and Miscellaneous

Lecture 22 - Ground Water Pollution from Industrial, Agricultural and Miscellaneous Sources (Continued...)

Lecture 23 - Ground Water Pollution from Miscellaneous Sources (Continued...), Attenuation and Underground Distribution of Pollutants

Lecture 24 - Potential Evaluation of Ground water Pollution; Physical/Chemical/Biological analysis of Ground Water quality; Criteria and measures of Ground water quality

Lecture 25 - Ground water salinity and samples ; Graphical representations of ground water quality

Lecture 26 - Graphical representations of ground water quality (Continued...), Surface/Sub-Surface Investigation Of Ground Water: Geological/geophysical exploration; Remote sensing/electrical resistivity methods

Lecture 27 - Surface Investigation of ground water (Continued...): Electrical resistivity seismic refraction/gravity/magnetic methods

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Lecture 28 - Seismic refraction/gravity/magnetic methods (Continued...);Sub-surface investigation of ground water: Geographical/resistivity methods

Lecture 29 - Sub-surface investigation of ground water (Continued...): Geographical/resistivity/spontaneous potential/radiation of methods of logging

Lecture 30 - Radiation method of logging (Continued...); Temperature/caliper/fluid conductivity/fluid velocity/miscellaneous logging methods

Lecture 31 - Saline Water Intrusion in Aquifers:Occurence, Features affecting aquifers,Bodon - Ghyben - Hergberg Principle

Lecture 32 - Saline Water Intrusion in Aquifers : Bodon - Ghyben - Hergberg principle (Continued...), Analytical Solution of Saline Water Intrusion in Coastal Aquifer

Lecture 33 - Saline Water Intrusion in Aquifers : Analytical Solution of Saline Water Intrusion in Coastal Aquifer (Continued...), Density dependent salt water intrusion model

Lecture 34 - Saline Water Intrusion in Aquifers : Geochemical Investigations, Control of salt water intrusion, Practical Modeling of salt water intrusion

Lecture 35 - Modeling and Management of Ground Water : Ground Water Simulation Models, Ground Water Management Model : Confined Aquifer

Lecture 36 - Modeling and Management of Ground Water : Ground Water Management Model : Confined and Unconfined Aquifer, Linked Simulation - Optimization, Meta Model Based Approach

Lecture 37 - Modeling and Management of Ground Water : Contaminant Source Identification , Monitoring Network Design

Lecture 38 - Modeling and Management of Ground Water : Aquifer Yield and Ground Water Availability, Effects of Ground Water Development, Regional Scale Development of Ground Water

Lecture 39 - Modeling and Management of Ground Water : Conjunctive Surface - Subsurface Modeling of Overland Flow including flow through Vadose zone

Lecture 40 - Modeling and Management of Ground Water : Ground Water - Surface Water Interaction

Lecture 1 - Introduction to Numerical Methods

Lecture 2 - Error Analysis

Lecture 3 - Introduction to Linear Systems - I

Lecture 4 - Linear Systems - II

Lecture 5 - Linear Systems - III

Lecture 6 - Linear Systems - Error Bounds

Lecture 7 - Error Bounds and Iterative Methods for Solving Linear Systems

Lecture 8 - Iterative Methods for Solving Linear Systems - I

Lecture 9 - Iterative Methods - II

Lecture 10 - Iterative Methods - III

Lecture 11 - Iterative Methods for Eigen Value Extraction

Lecture 12 - Solving Nonlinear Equations - I

Lecture 13 - Solving Nonlinear Equations - II

Lecture 14 - Solving Multi Dimensional Nonlinear Equations - I

Lecture 15 - Solving Multi Dimensional Nonlinear Equations - II

Lecture 16 - ARC Length and Gradient Based Methods

Lecture 17 - Gradient Based Methods

Lecture 18 - Conjugate Gradient Method - I

Lecture 19 - Conjugate Gradient Method - II

Lecture 20 - Nonlinear Conjugate Gradient and Introduction to PDEs

Lecture 21 - Eigenfunction Solutions for the Wave Equation

Lecture 22 - Analytical Methods for Solving the Wave Equation

Lecture 23 - Analytical Methods for Hyperbolic and Parabolic PDEs

Lecture 24 - Analytical Methods for Parabolic and Elliptic PDEs

Lecture 25 - Analytical Methods for Elliptic PDE's

Lecture 26 - Series Solutions for Elliptic PDE's and Introduction to Differential Operators

Lecture 27 - Differential Operators - I

Lecture 28 - Differential Operators - II

Lecture 29 - Differential Operators - III

Lecture 30 - Interpolation

Lecture 31 - Polynomial Fitting

[Lecture 32 - Orthogonal Polynomials - I](#)

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[Lecture 34 - Orthogonal Polynomials - III](#)

[Lecture 35 - Spline Functions](#)

[Lecture 36 - Orthogonal Basis Functions for Solving PDE's - I](#)

[Lecture 37 - Orthogonal Basis Functions for Solving PDE's - II](#)

[Lecture 38 - Integral Equations - I](#)

[Lecture 39 - Integral Equations - II](#)

[Lecture 40 - Integral Equations - III](#)

NPTEL : Probability Methods in Civil Engineering (Civil Engineering)

Co-ordinators : Dr. Rajib Maity

Lecture 1 - Introduction - Role of Probability in Civil Engineering

Lecture 2 - Random Events and Probability Concept

Lecture 3 - Set Theory and Set Operations

Lecture 4 - Axioms of Probability

Lecture 5 - Probability of Events

Lecture 6 - Concept and Definition of Random Variables

Lecture 7 - Probability Distribution of Random Variables

Lecture 8 - CDF and Descriptors of Random Variables

Lecture 9 - Further Descriptors of Random Variables

Lecture 10 - Discrete Probability Distribution

Lecture 11 - Probability Distribution of Continuous RVs

Lecture 12 - Probability Distribution of Continuous RVs (Continued...1)

Lecture 13 - Probability Distribution of Continuous RVs (Continued...2)

Lecture 14 - Functions of Single Random Variables

Lecture 15 - Functions of Random Variables - Different Methods

Lecture 16 - Functions of Random Variables - Different Methods (Continued...)

Lecture 17 - Expectation and Moments of Functions of RV

Lecture 18 - Expectation and Moments of Functions of RV (Continued...)

Lecture 19 - Joint Probability Distribution

Lecture 20 - Marginal Probability Distribution

Lecture 21 - Conditional Probability Distribution

Lecture 22 - Conditional Probability Distribution (Continued...)

Lecture 23 - Properties of Multiple Random Variables

Lecture 24 - Properties of Multiple Random Variables (Continued...)

Lecture 25 - MGF of Multivariate RVs and Multivariate Probability Distributions

Lecture 26 - Multivariate Distribution and Functions of Multiple Random Variables

Lecture 27 - Functions of Multiple Random Variables (Continued...1)

Lecture 28 - Functions of Multiple Random Variables (Continued...2)

Lecture 29 - Introduction to Copulas

Lecture 30 - Introduction to Copulas (Continued...)

Lecture 31 - Probability Models using Normal Distribution

[Lecture 32 - Probability Models using Log Normal and Exponential Distribution](#)

[Lecture 33 - Probability Models using Gamma and Extreme Value Distribution](#)

[Lecture 34 - Probability Models using Discrete Probability Distributions](#)

[Lecture 35 - Sampling Distribution and Parameter Estimation](#)

[Lecture 36 - Sampling Distribution and Parameter Estimation \(Continued...\)](#)

[Lecture 37 - Hypothesis Testing](#)

[Lecture 38 - Goodness - of - fit tests](#)

[Lecture 39 - Regression Analyses and Correlation](#)

[Lecture 40 - Regression Analyses and Correlation \(Continued...\)](#)

Lecture 1 - Introduction - I

Lecture 2 - Materials

Lecture 3 - Different Methods of Design of Reinforced Concrete Structures

Lecture 4 - Working Stress Method

Lecture 5 - Working Stress Method (Continued...)

Lecture 6 - Limit State of Collapse Flexure - I

Lecture 7 - Limit State of Collapse Flexure - II

Lecture 8 - Design of Doubly Reinforced Beam Flexure - I

Lecture 9 - Design of Doubly Reinforced Beam Flexure - II

Lecture 10 - Design of Doubly Reinforced Beam Flexure

Lecture 11 - Limit State of Collapse Shear

Lecture 12 - Design for Shear

Lecture 13 - Design for Shear (Continued...)

Lecture 14 - Design of Slabs - Part I

Lecture 15 - Design of Slabs - Part II

Lecture 16 - Design of Slabs - Part III

Lecture 17 - Design of Slabs - Part IV

Lecture 18 - Design of Slabs - Part V

Lecture 19 - Design of Columns - Part I

Lecture 20 - Design of Columns - Part II

Lecture 21 - Design of Columns - Part III

Lecture 22 - Design of Columns - Part IV

Lecture 23 - Design of Columns - Part V

Lecture 24 - Design of Footings - Part I

Lecture 25 - Design of Footings - Part II

Lecture 26 - Design of Staircases

Lecture 27 - Design for Torsion - Part I

Lecture 28 - Design for Torsion - Part II

Lecture 29 - Design of RC Slender Columns

Lecture 30 - Deflection of RC Beams

NPTEL : Engineering Geology (Civil Engineering)

Co-ordinators : Dr. Debasis Roy

- Lecture 1 - Introduction to Engineering Geology
- Lecture 2 - Geologic Structures
- Lecture 3 - Geologic Maps and Stratigraphic Sections
- Lecture 4 - Remote Sensing in Engineering Geology
- Lecture 5 - Physical Properties of Minerals
- Lecture 6 - Crystallography and Optical Properties
- Lecture 7 - Chemical Characteristics of Minerals
- Lecture 8 - Origin And Types of Rocks
- Lecture 9 - Origin And Types of Soils
- Lecture 10 - Igneous Rocks
- Lecture 11 - Sedimentary Rocks
- Lecture 12 - Metamorphic Rocks
- Lecture 13 - Weathering
- Lecture 14 - Sediment Transport and Deposition
- Lecture 15 - Introduction to Subsurface Exploration
- Lecture 16 - Introduction to Subsurface Exploration
- Lecture 17 - Sampling and Non - Intrusive Methods
- Lecture 18 - Index Properties and Classification of Soils
- Lecture 19 - Index Properties of Rock and Rock Mass
- Lecture 20 - Stress-Strain Behavior of Soil and Rock - I
- Lecture 21 - Stress-Strain Behavior of Soil and Rock - II
- Lecture 22 - In-situ State of Stress
- Lecture 23 - Geologic Considerations in Tunneling
- Lecture 24 - Geologic Considerations in Dam Construction
- Lecture 25 - Groundwater - Preliminaries
- Lecture 26 - Groundwater Flow - I
- Lecture 27 - Groundwater Flow - II
- Lecture 28 - Groundwater Related Engineering Issues
- Lecture 29 - Groundwater Over Utilization
- Lecture 30 - Plate Tectonics
- Lecture 31 - Plate Tectonics - 2 and Earthquake

[Lecture 32 - Earthquake Hazard Assessment](#)

[Lecture 33 - Geologic Hazards - Seismicity and Volcanism](#)

[Lecture 34 - Geologic Hazards - Shoreline Processes](#)

[Lecture 35 - Geologic Hazards - Shoreline Processes](#)

[Lecture 36 - Geologic Hazards - Landslide Hazards - Zoning](#)

[Lecture 37 - Geologic Hazards Subsidence , Collapsible Soils](#)

[Lecture 38 - Preparation of Geologic Sections](#)

[Lecture 39 - Index testing of soil & rocks](#)

[Lecture 40 - Identification of minerals and rock samples](#)

NPTEL : Introduction to Transportation Engineering (Civil Engineering)

Co-ordinators : Dr. K.S. Reddy, Dr. Bhargab Maitra

- Lecture 1 - Transportation Engineering
- Lecture 2 - Elements of Concern and Components
- Lecture 3 - Traffic Stream Characteristics
- Lecture 4 - Traffic Studies : Part - I
- Lecture 5 - Traffic Studies : Part - II
- Lecture 6 - Highway Capacity and Level of Service
- Lecture 7 - Intersection Control and Signalization
- Lecture 8 - Functional Classification, Design Elements
- Lecture 9 - Cross Section Elements
- Lecture 10 - Stopping Sight Distance And Decision Sight
- Lecture 11 - Overtaking, Intermediate and Headlight Sight
- Lecture 12 - Intersection Sight Distance - I
- Lecture 13 - Intersection Sight Distance - II
- Lecture 14 - Horizontal Alignment - I
- Lecture 15 - Horizontal Alignment - II
- Lecture 16 - Horizontal Alignment - III
- Lecture 17 - Horizontal Alignment - IV
- Lecture 18 - Horizontal Alignment - V
- Lecture 19 - Horizontal Alignment - VI
- Lecture 20 - Vertical Alignment - I
- Lecture 21 - Vertical Alignment - II
- Lecture 22 - Vertical Alignment - III
- Lecture 23 - Highway Alignment
- Lecture 24 - Principles of Pavement Design
- Lecture 25 - Traffic Loading - I
- Lecture 26 - Traffic Loading - II
- Lecture 27 - Pavement Materials - I
- Lecture 28 - Pavement Materials - II
- Lecture 29 - Pavement Materials - III
- Lecture 30 - Pavement Materials - IV
- Lecture 31 - Pavement Materials - V

[Lecture 32 - Design of Bituminous Mixes - I](#)

[Lecture 33 - Design of Bituminous Mixes - II](#)

[Lecture 34 - Analysis of Flexible Pavements](#)

[Lecture 35 - Analysis of Concrete Pavements](#)

[Lecture 36 - Flexible Pavement Design Indian Roads Congress](#)

[Lecture 37 - Flexible Pavement Design AASHTO Method - 1993](#)

[Lecture 38 - Concrete Pavement Design Indian Congress Method](#)

[Lecture 39 - Concrete Pavement Design PCA and AASHTO Methods](#)

[Lecture 40 - Pavement Evaluation and Rehabilitation](#)

[Lecture 41 - Overlay Design - IRC Method](#)

NPTEL : Strength of Materials (Civil Engineering)

Co-ordinators : Prof. S.K. Bhattacharyya

Lecture 1 - Introduction - Strength of Materials

Lecture 2 - Analysis of Stress - I

Lecture 3 - Analysis of Stress - II

Lecture 4 - Analysis of Stress - III

Lecture 5 - Analysis of Stress - IV

Lecture 6 - Analysis of Stress - V

Lecture 7 - Analysis of Strain - I

Lecture 8 - Analysis of Strain - II

Lecture 9 - Analysis of Strain - III

Lecture 10 - Analysis of Strain - IV

Lecture 11 - Analysis of Strain - V

Lecture 12 - Analysis of Strain - VI

Lecture 13 - Analysis of Strain - VII

Lecture 14 - Analysis of Strain - VIII

Lecture 15 - Application of Stress/Strain

Lecture 16 - Application of Stress / Strain

Lecture 17 - Application of Stress / Strain

Lecture 18 - Torsion - I

Lecture 19 - Torsion - II

Lecture 20 - Torsion - III

Lecture 21 - Torsion - IV

Lecture 22 - Bending of Beams - I

Lecture 23 - Bending of Beams - II

Lecture 24 - Bending of Beams - III

Lecture 25 - Bending of Beams - IV

Lecture 26 - Stresses in Beams - I

Lecture 27 - Stresses in Beams - II

Lecture 28 - Stresses in Beams - III

Lecture 29 - Stresses in Beams - IV

Lecture 30 - Deflection of Beams - I

Lecture 31 - Deflection of Beams - II

[Lecture 32 - Deflection of Beams - III](#)

[Lecture 33 - Deflection of Beams - IV](#)

[Lecture 34 - Combined Stresses - I](#)

[Lecture 35 - Combined Stresses - II](#)

[Lecture 36 - Combined Stresses - III](#)

[Lecture 37 - Stability of Columns - I](#)

[Lecture 38 - Stability of Columns - II](#)

[Lecture 39 - Springs - I](#)

[Lecture 40 - Springs - II](#)

- Lecture 1 - Random Events and Probability Concept
- Lecture 2 - Set Theory and Set Operations
- Lecture 3 - Axioms of Probability
- Lecture 4 - Probability of Events
- Lecture 5 - Concept and definition of Random variables
- Lecture 6 - Probability distribution of random variables
- Lecture 7 - CDF and Descriptors of Random Variables
- Lecture 8 - Further Descriptors of Random Variables
- Lecture 9 - Discrete Probability Distribution
- Lecture 10 - Probability Distribution of Continuous RVs
- Lecture 11 - Probability Distribution of Continuous RVs (Continued.....1)
- Lecture 12 - Probability Distribution of Continuous RVs (Continued.....2)
- Lecture 13 - Functions of Single Random Variables
- Lecture 14 - Functions of Different Variables - Different Methods
- Lecture 15 - Functions of Random Variables : Different Methods (Continued...)
- Lecture 16 - Probability Models using Normal Distribution
- Lecture 17 - Probability Models using Log Normal and Exponential Distribution
- Lecture 18 - Probability Models using Gamma and Extreme Value Distribution
- Lecture 19 - Probability Models using Discrete Probability Distributions
- Lecture 20 - Sampling Distribution and Parameter Estimation
- Lecture 21 - Sampling Distribution and Parameter Estimation (Continued...)
- Lecture 22 - Hypothesis Testing
- Lecture 23 - Goodness of Fit-Tests
- Lecture 24 - Regression Analyses and Correlation
- Lecture 25 - Regression Analyses and Correlation (Continued...)

- Lecture 1 - Visual Semantics for Visual Communication
- Lecture 2 - Visual Semantics for Visual Communication (Continued...)
- Lecture 3 - Visual Semantics for Visual Communication (Continued...)
- Lecture 4 - Visual Semantics for Visual Communication (Continued...)
- Lecture 5 - Introduction to Millimeter-Wave Technology (Continued...)
- Lecture 6 - Visual Semantics for Visual Communication (Continued...)
- Lecture 7 - Visual Semantics for Visual Communication (Continued...)
- Lecture 8 - Visual Semantics for Visual Communication (Continued...)
- Lecture 9 - Introduction to Millimeter-Wave Technology
- Lecture 10 - Visual Semantics for Visual Communication (Continued...)
- Lecture 11 - Visual Semantics for Visual Communication (Continued...)
- Lecture 12 - Visual Semantics for Visual Communication (Continued...)
- Lecture 13 - Conceptual Model and Affordances
- Lecture 14 - Visual Semantics for Visual Communication (Continued...)
- Lecture 15 - Visual Semantics for Visual Communication (Continued...)
- Lecture 16 - Visual Semantics for Visual Communication (Continued...)
- Lecture 17 - Visual Semantics for Visual Communication (Continued...)
- Lecture 18 - Visual Semantics for Visual Communication (Continued...)
- Lecture 19 - Visual Semantics for Visual Communication (Continued...)
- Lecture 20 - Visual Semantics for Visual Communication (Continued...)

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[Lecture 4 - LCA and Environmental Systems](#)

[Lecture 5 - LCA and Water, Food and Energy](#)

[Lecture 6 - RISK Assessment and LCA Frameworks](#)

[Lecture 7 - RISK Assessment - Toxicology](#)

[Lecture 8 - RISK Assessment Methods](#)

[Lecture 9 - RISK Assessment Methods \(Continued...\)](#)

[Lecture 10 - Environmental Risk Assessment](#)

[Lecture 11 - Environmental Data Collection and LCA Methodology](#)

[Lecture 12 - Environmental Data Collection and LCA Methodology \(Continued...\)](#)

[Lecture 13 - Environmental Data Collection and LCA Methodology \(Continued...\)](#)

[Lecture 14 - Environmental Data Collection and LCA Methodology \(Continued...\)](#)

[Lecture 15 - LCA Methodology](#)

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[Lecture 17 - LCA - A Detailed Methodology \(Continued...\)](#)

[Lecture 18 - LCA Benefits and Drawbacks](#)

[Lecture 19 - History of LCA](#)

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[Lecture 21 - Unit Process, Data and LCI Databases](#)

[Lecture 22 - Unit Process and System Boundary \(Continued...\)](#)

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[Lecture 28 - Chemical Release in Environment](#)

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[Lecture 31 - Design for Sustainability](#)

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[Lecture 33 - Design for Sustainability \(Continued...\)](#)

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[Lecture 38 - Summary and Case Studies \(Continued...\)](#)

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[Lecture 40 - Tutorial II](#)

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[Lecture 2 - Introduction \(Continued...\)](#)

[Lecture 3 - Introduction \(Continued...\)](#)

[Lecture 4 - Introduction \(Continued...\)](#)

[Lecture 5 - Introduction \(Continued...\)](#)

[Lecture 6 - Introduction \(Continued...\)](#)

[Lecture 7 - Municipal Solid Waste Characteristics and Quantities](#)

[Lecture 8 - Municipal Solid Waste Characteristics and Quantities \(Continued...\)](#)

[Lecture 9 - Municipal Solid Waste Characteristics and Quantities \(Continued...\)](#)

[Lecture 10 - Municipal Solid Waste Characteristics and Quantities \(Continued...\)](#)

[Lecture 11 - MSW Characteristics - Thermal Properties and Chemical Composition](#)

[Lecture 12 - Chemical Analysis Procedure](#)

[Lecture 13 - Chemical Analysis Procedure \(Continued...\)](#)

[Lecture 14 - Working with Data and Statistical Methods](#)

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[Lecture 17 - Swachh Bharat Mission and Smart Cities Program Overview](#)

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[Lecture 19 - MSW Collection System](#)

[Lecture 20 - MSW Collection System \(Continued...\)](#)

[Lecture 21 - Waste Collection and Transport](#)

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[Lecture 25 - Waste Collection and Transport \(Continued...\)](#)

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[Lecture 28 - Review of MSW Management in Proposed Smart Cities](#)

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- [Lecture 32 - Biological Treatment of Waste \(Continued...\)](#)
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NPTEL : Finite Element Analysis (Civil Engineering)

Co-ordinators : Dr. B.N. Rao

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NPTEL : Urban transportation planning (Civil Engineering)

Co-ordinators : Dr. V. Thamizh Arasan

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Co-ordinators : Prof. M.S. Sivakumar

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DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Mechanical Characterization of Bituminous Materials (Civil Engineering)

Co-ordinators : Dr. J. Murali Krishnan, Prof. M. R. Nivitha, Prof. Neethu Roy, Prof. A. Padmarekha

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Lecture 8 - Small Amplitude Oscillatory Shear - Part 1

Lecture 9 - Small Amplitude Oscillatory Shear - Part 2

Lecture 10 - Small Amplitude Oscillatory Shear - Part 3

Lecture 11 - Small Amplitude Oscillatory Shear - Part 4

Lecture 12 - Time temperature superposition principle - Part 1

Lecture 13 - Time temperature superposition principle - Part 2

Lecture 14 - Master curve models

Lecture 15 - Asphalt Usage and Processing - Part 1

Lecture 16 - Asphalt Usage and Processing - Part 2

Lecture 17 - Chemical composition of bitumen - Part 1

Lecture 18 - Chemical composition of bitumen - Part 2

Lecture 19 - Chemical composition of bitumen - Part 3

Lecture 20 - Chemical composition of bitumen - Part 4

Lecture 21 - Chemical composition of bitumen - Part 5

Lecture 22 - Aging of Bituminous Binders and Mixtures - Part I

Lecture 23 - Aging of Bituminous Binders and Mixtures - Part II

Lecture 24 - Aging of Bituminous Binders and Mixtures - Part III

Lecture 25 - Dynamic Shear Rheometer - Part I

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Lecture 31 - PG-Theoretical Basis

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- [Lecture 33 - Modifiers for Bitumen - Part 1](#)
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- [Lecture 40 - Dynamic Modulus of Bituminous Mixtures - Part 1](#)
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- [Lecture 44 - Rutting Characterisation - Different approaches](#)
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- [Lecture 49 - Fatigue of Bituminous mixtures - Part 2](#)
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- [Lecture 56 - Summary](#)

Lecture 1 - Introduction and motivation

Lecture 2 - Colloidal dispersions, terminology and classification

Lecture 3 - Stability in colloids

Lecture 4 - Source, synthesis and characterisation of colloids

Lecture 5 - Characterisation of colloidal particles - I

Lecture 6 - Characterisation of colloidal particles - II

Lecture 7 - Introduction to forces acting on an individual colloidal particle

Lecture 8 - Introduction to interaction between colloidal particles

Lecture 9 - Application of Brownian force: Measurement of diffusivity and size

Lecture 10 - Radiation used to study colloidal systems

Lecture 11 - Radiation used to study colloidal systems

Lecture 12 - Molecular origin of Van der waals forces

Lecture 13 - Vanderwaal interactions between particles

Lecture 14 - Problem on scaling of Vanderwaal interactions

Lecture 15 - Calculation of Vanderwaal's forces between semi-infinite blocks and Hamaker constant - I

Lecture 16 - Calculation of Vanderwaal's forces between semi-infinite blocks and Hamaker constant - II

Lecture 17 - Theories of Vanderwaal forces based on bulk properties and calculation of Hamaker constant using bulk properties

Lecture 18 - Effect of medium on Vanderwaal's interactions - I

Lecture 19 - Effect of medium on Vanderwaal's interactions - II

Lecture 20 - Colloid Polymer mixtures

Lecture 21 - Colloid polymer mixtures: colloid-solvent interactions and colloid-polymer interactions

Lecture 22 - Colloid polymer mixtures: Depletion flocculation

Lecture 23 - Colloid polymer mixtures: Depletion stabilisation

Lecture 24 - Depletion interactions

Lecture 25 - Steric interactions/osmotic repulsion

Lecture 26 - Tutorial problem on depletion interactions

Lecture 27 - Colloidal Interactions: Introduction to electrostatic interactions/electrical double layer interactions

Lecture 28 - Introduction to models of electrical double layer: Helmholtz model/capacitor model

Lecture 29 - Review and summary of Helmholtz model (or capacitor model) of electrical double layer

Lecture 30 - Models of electrical double layer: Diffuse double layer model/Gouy-Chapman model

Lecture 31 - Potential distribution near planar surfaces: Derivation of the Poisson-Boltzmann equation

Lecture 32 - Potential distribution near planar surfaces: Solution to the linearised Poisson-Boltzmann equation

Lecture 33 - Potential distribution near spherical surfaces: Solution to linearised Poisson-Boltzmann equation

Lecture 34 - Comparison of Capacitor model and Diffuse double layer model

Lecture 35 - Models of electrical double layer: Gouy Chapman Theory - I

Lecture 36 - Models of electrical double layer: Gouy Chapman Theory - II

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Lecture 38 - Force of Repulsion between interacting surfaces

Lecture 39 - Potential Energy of repulsion between Planar double layers and DLVO Theory

Lecture 40 - Zeta Potential and Electrophoretic mobility of an ion

Lecture 41 - Electrokinetic Phenomena

Lecture 42 - Relation between Electrophoretic mobility and Zeta potential - I

Lecture 43 - Relation between Electrophoretic mobility and Zeta potential - II

Lecture 44 - Colloidal particles at interfaces:Introduction

Lecture 45 - Characterization of Particles at interface

Lecture 46 - Experimental Observations -Concept of Electrostatic interactions and Stability at interfaces

Lecture 47 - Implications from Surface energy balances and Estimation of energy required for detachment

Lecture 48 - Colloidal interactions at interface

Lecture 1 - Why are polymers so common?

Lecture 2 - Polymers: Molecular structure

Lecture 3 - Process, structure, property

Lecture 4 - Biopolymers

Lecture 5 - Molecular weight and distribution

Lecture 6 - Polymerization

Lecture 7 - Macromolecular nature

Lecture 8 - Renewable sources for polymers

Lecture 9 - Polymerization/depolymerization

Lecture 10 - States of interest

Lecture 11 - Application based terms

Lecture 12 - Reuse and repurpose

Lecture 13 - Molecular conformations

Lecture 14 - Size, mobility and flexibility

Lecture 15 - Polyelectrolytes

Lecture 16 - Structures in biopolymers

Lecture 17 - Amorphous/crystalline states - 1

Lecture 18 - Amorphous/crystalline states - 2

Lecture 19 - Orientation

Lecture 20 - Interactions

Lecture 21 - Kinetics of crystallization

Lecture 22 - Glass transition - 1

Lecture 23 - Glass transition - 2

Lecture 24 - States in environment

Lecture 25 - Liquid crystalline polymers

Lecture 26 - Copolymers - 1

Lecture 27 - Copolymers - 2

Lecture 28 - Blends - 1

Lecture 29 - Blends - 2

Lecture 30 - Microstructure in polymers

Lecture 31 - Composites

- Lecture 32 - Stress strain response
- Lecture 33 - Additives for polymeric systems
- Lecture 34 - Blends/composites in recycling
- Lecture 35 - Physical/chemical crosslinking
- Lecture 36 - Mechanical properties - I
- Lecture 37 - Mechanical properties - II
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- Lecture 39 - Solutions: properties
- Lecture 40 - Conducting polymers
- Lecture 41 - Dielectric response - I
- Lecture 42 - Dielectric response - II
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- Lecture 48 - Viscoelasticity: simple models
- Lecture 49 - Dynamic Mechanical analysis
- Lecture 50 - Damping Applications
- Lecture 51 - Time Temperature superposition
- Lecture 52 - Impact and energy absorption
- Lecture 53 - Testing for applications
- Lecture 54 - Properties of blends
- Lecture 55 - Biomimetic polymers
- Lecture 56 - Advanced mechanics
- Lecture 57 - Viscoelastic response: examples
- Lecture 58 - Polymer packaging
- Lecture 59 - Porous polymers/membranes
- Lecture 60 - Polymer at interfaces
- Lecture 61 - Diffusion in polymers
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[Lecture 86 - Biodegradable polymers - 1](#)

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[Lecture 1 - Introduction to Construction Materials - Part 1](#)

[Lecture 2 - Introduction to Construction Materials - Part 2](#)

[Lecture 3 - Introduction to Construction Materials - Part 3](#)

[Lecture 4 - Materials Engineering Concepts - Part 1](#)

[Lecture 5 - Materials Engineering Concepts - Part 2](#)

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[Lecture 11 - Nature of Materials - Part 1](#)

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[Lecture 16 - Nature of Materials - Part 6](#)

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[Lecture 18 - Stone, Brick and Mortar 1 - Part 1](#)

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[Lecture 22 - Stone, Brick and Mortar 2 - Part 1](#)

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[Lecture 24 - Cement and Concrete 1 - Part 1](#)

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[Lecture 26 - Cement and Concrete 1 - Part 3](#)

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[Lecture 31 - Cement and Concrete 4 - Part 1](#)

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[Lecture 33 - Metals - 1 - Part 1](#)

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[Lecture 40 - Metals - 5 - Part 1](#)

[Lecture 41 - Metals - 5 - Part 2](#)

[Lecture 42 - Polymers and Composites - Part 1](#)

[Lecture 43 - Polymers and Composites - Part 2](#)

[Lecture 44 - Polymers and Composites - Part 3](#)

[Lecture 45 - Pavement Materials 1 - Part 1](#)

[Lecture 46 - Pavement Materials 1 - Part 2](#)

[Lecture 47 - Pavement Materials 2 - Part 1](#)

[Lecture 48 - Pavement Materials 2 - Part 2](#)

[Lecture 49 - Wood and wood products - Part 1](#)

[Lecture 50 - Wood and wood products - Part 2](#)

[Lecture 51 - Glass](#)

NPTEL : NOC:Introduction to Lean Construction (Civil Engineering)

Co-ordinators : Prof. Koshy Varghese, Prof. N Raghavan

- Lecture 1 - Course Contents, Long-term Goals, Structure and Module 1 Topics
- Lecture 2 - Pedagogy, Approach, Institutions, Instructors, Audience and Pre-requisites
- Lecture 3 - ILCE, Conferences, Resources, Further Work Possible
- Lecture 4 - Lean Implementation in India from ILCE Directors and other Talks/Testimonials
- Lecture 5 - Status of Lean Implementation in India through Industry Panel Discussion with ILCE Directors
- Lecture 6 - History of Lean and other Management Philosophies; Toyota Production System (TPS); What is Lean?
- Lecture 7 - Lean Construction Timeline; Lean Project Delivery vs LC; Project Management vs LC
- Lecture 8 - Key Lean Concepts#1 (Wastes)
- Lecture 9 - Key Lean Concepts#1 (Value, Value Stream, Flow, Pull, Perfection)
- Lecture 10 - Key Lean Concepts#2 (Continuous Improvement, Collaborative working, Production System, Lean Culture)
- Lecture 11 - Key Lean Tools#1 (Productivity Measurement System, Work Sampling, Value Stream Mapping)
- Lecture 12 - Lean Overview - Key Lean Tools#2 (5S, CPS/ LPS, Big Room Approach)
- Lecture 13 - Lean Overview - Future module
- Lecture 14 - Productivity Measurement and Improvement, Construction Productivity, Productivity levels
- Lecture 15 - What is Productivity, Production?; Illustration
- Lecture 16 - Productivity and Production Impact; Visualizing Activity Productivity and Production Performance
- Lecture 17 - Profit, ROCE, Influences on Operational Productivity; Operational view vs. System view, Summary
- Lecture 18 - Outline, Planning and monitoring levels; Productivity Measurement System
- Lecture 19 - Measuring Output - Level of Effort (LOE)
- Lecture 20 - Productivity and Production Calculations: daily, weekly, cumulative
- Lecture 21 - Productivity and Production Calculations: Performance Evaluation
- Lecture 22 - Productivity and Production Calculations: Workhour Forecast and Analysis of Trends
- Lecture 23 - Factors Influencing Productivity, Productivity Improvement Approach, Summary
- Lecture 24 - Sampling/ Surveying Techniques - Data Sources in Construction
- Lecture 25 - Construction Activity with Workers doing VA/ NVAN/ NVA; WS vs PMS; Work Sampling
- Lecture 26 - Sampling basics, Sampling in construction
- Lecture 27 - Steps to Conduct a Work Sampling Study; WS Outcomes
- Lecture 28 - Illustration of Tour-based Work Sampling Approach
- Lecture 29 - Illustration of Crew-based Work Sampling Approach
- Lecture 30 - Explore relationship between WS Categories and Productivity; Summary
- Lecture 31 - Sampling/ Surveying Techniques - Foreman delay survey

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- Lecture 32 - Sampling/ Surveying Techniques - Foreman delay survey - Implementation
- Lecture 33 - Foreman delay survey - Illustrations; Comparison - PMS vs WS vs FDS - discussion
- Lecture 34 - Value Stream, Value Stream Mapping (VSM), System vs Process, References
- Lecture 35 - Illustration: Value and Value Stream in Food Delivery
- Lecture 36 - Value, Value Stream, VSM/PM, Language, Basic VSM - current state and future state
- Lecture 37 - Key steps for VSM, Work: Degrees of Granularity, Measurement Metrics
- Lecture 38 - VSM - Example 1 (Reinforcement)
- Lecture 39 - VSM - Example 2 (Blockwork); Summary
- Lecture 40 - Flow Process Chart, Symbols, Process mapping - steps and timing, Measurement metrics
- Lecture 41 - Process mapping - Illustration: Reinforcement shifting
- Lecture 42 - VSM vs PM; Process Flow chart - variations; Swim-lane diagrams; Summary
- Lecture 43 - Understand the Basics of 5S, Explanations and 5S Steps
- Lecture 44 - Understand Each -S- in Detail - Sort, Set in Order, Shine
- Lecture 45 - Understand Each -S- in Detail - Standardize, Sustain
- Lecture 46 - 5S: Key Points, Benefits, Signs of a 5S Site
- Lecture 47 - Experiment 5S with Yourself First, Project Implementation, Facilitations, Why 5S May Fail?, Recap
- Lecture 48 - Understand the Applications of 5S through Case Studies_2 cases
- Lecture 49 - Understand the Applications of 5S through Case Studies_3 cases
- Lecture 50 - Understand the Applications of 5S through Case Study - Ms Diamond Barretto (Godrej Construction)
- Lecture 51 - Current Project Performance, Workflow Variation, Traditional PM vs Lean Production Management
- Lecture 52 - Some Key Lean Concepts, Focusing on frontline Execution, CPS - Collaborative Planning System
- Lecture 53 - CPS Process, Overall Schedules (Master Schedule,Phase Schedule,LAP, Weekly Plan),Constraint Analysis
- Lecture 54 - Collaborative -Pull- Planning, Percentage Plan Completed (PPC), Daily Huddle, Variance Analysis, RCA
- Lecture 55 - Lean Work Structuring
- Lecture 56 - Impact of PPC on Productivity, Key aspects,Advantages,The Necessary Conditions,Blocks - CPS,Summary
- Lecture 57 - COLPLASSE: Look-Ahead Plan, Constraint Analysis, Weekly Plan, Summary
- Lecture 58 - Lean Project Delivery System, Conclusion
- Lecture 59 - Understand the Applications of CPS/LPS through Case Studies
- Lecture 60 - CPS/LPS implementation in Construction Projects through a Panel of Experts - Part 1
- Lecture 61 - CPS/LPS implementation in Construction Projects through a Panel of Experts - Part 2
- Lecture 62 - CPS/LPS implementation in Construction Projects through a Panel of Experts - Part 3
- Lecture 63 - Introduction of Big Room Approach, Some Requirements for Efficient Working, Virtual BR Meetings
- Lecture 64 - Big Room Approach through Case Studies

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[Lecture 65 - Big Room Approach - Implementation case from URC Construction](#)

[Lecture 66 - Future Construction Site, Lean Tools and Processes, Automation strategies and impact, Programming](#)

[Lecture 67 - Document Management, Workflow Process, Communication/Collab./Authen., Sensing](#)

[Lecture 68 - Mechanisation/ Robots, Visualization, AI/ Analytics, BIM, CPS/ IOT/ Industry 4.0, Digital Twin](#)

[Lecture 69 - Challenges and Causes, Problem?, Lean, BIM?, Traditional vs BIM, Tools/Technology providers](#)

[Lecture 70 - BIM uses; Metrics](#)

[Lecture 71 - BIM and Lean, Implementation Framework, BIM Execution Plan, Evidence Cases, Key takeaway](#)

[Lecture 72 - How to Start Practicing Lean Tools in Project Sites-1: Work Sampling](#)

[Lecture 73 - How to Start Practicing Lean Tools in Project Sites-1: VSM](#)

[Lecture 74 - How to Start Practicing Lean Tools in Project Sites-1: 5S](#)

[Lecture 75 - How to Start Practicing Lean Tools in Project Sites-1: CPS/ LPS](#)

[Lecture 76 - How to Start Practicing Lean Tools in Project Sites-1: Big Room Approach](#)

[Lecture 77 - Acknowledgement](#)

Lecture 1 - Bolts: dimensions and material

Lecture 2 - Bolts: installation techniques and clearances

Lecture 3 - Design of Bearing type bolts in shear: Basic design principle

Lecture 4 - Correction factors for bolts for long joints, long grip lengths, and thick packing plate

Lecture 5 - Design of friction grip bolts in shear and design of bolts in tension

Lecture 6 - Structural Welding Process

Lecture 7 - Groove/Butt Welds

Lecture 8 - Fillet Welds - 1

Lecture 9 - Fillet Welds - 2

Lecture 10 - Weld symbols, defects, and filler material

Lecture 11 - Design of groove welds

Lecture 12 - Design of fillet welds - 1

Lecture 13 - Design of fillet welds - 2

Lecture 14 - Design example of a bolt group

Lecture 15 - Design example of a weld group

Lecture 16 - Simple and rigid frame connections

Lecture 17 - Design of double angle connections

Lecture 18 - Design of seated angle connections

Lecture 19 - End-plate rigid connection: Introduction

Lecture 20 - End-plate connection: Design example

Lecture 21 - Welded-flange rigid connection

Lecture 22 - Ductile detailed beam-column connections - 1

Lecture 23 - Ductile detailed beam-column connections - 2

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NPTEL : NOC:Analysis and Design of Bituminous Pavements (Civil Engineering)

Co-ordinators : A. Padmarekha, J. Murali Krishnan, M. R. Nivitha, Neethu Roy

Lecture 1 - Pavement Cross-sections and Pavement Design Process

Lecture 2 - Pavement Design Factors - I

Lecture 3 - Pavement Design Factors - II

Lecture 4 - Stresses and Strains in Bituminous Pavements - I

Lecture 5 - Stresses and Strains in Bituminous Pavements - II

Lecture 6 - Numerical Problems in One-layer Theory

Lecture 7 - Numerical Problems in Two-layer Theory

Lecture 8 - Introduction to KENLAYER

Lecture 9 - KENLAYER - 1

Lecture 10 - KENLAYER - 2

Lecture 11 - KENLAYER - 3

Lecture 12 - KENLAYER - 4

Lecture 13 - Traffic Analysis - ESWL - Part 1

Lecture 14 - Traffic Analysis - ESWL - Part 2

Lecture 15 - Traffic Analysis - EALF

Lecture 16 - Traffic Analysis - ESAL using VDF

Lecture 17 - Traffic Analysis - ESAL using TF

Lecture 18 - Traffic Analysis - Examples

Lecture 19 - Traffic Analysis - Load Spectra Factor

Lecture 20 - Modulus for Design - CBR

Lecture 21 - Modulus for Design - Resilient modulus (Granular material)

Lecture 22 - Modulus for Design - Resilient modulus (Bituminous material)

Lecture 23 - Modulus for Design - Dynamic Modulus

Lecture 24 - Environmental Effect - Part 1

Lecture 25 - Environmental Effect - Part 2

Lecture 26 - Environmental Effect - Part 3

Lecture 27 - Environmental Effect - Part 4

Lecture 28 - Enhanced Integrated Climatic Model - Part 1

Lecture 29 - Enhanced Integrated Climatic Model - Part 2

Lecture 30 - Climate Consideration in Design Procedures

Lecture 31 - Reliability in Pavement Design - Part 1

- [Lecture 32 - Reliability in Pavement Design - Part 2](#)
- [Lecture 33 - Reliability in Pavement Design - Part 3](#)
- [Lecture 34 - Reliability in Pavement Design - Part 4](#)
- [Lecture 35 - Reliability in Pavement Design - Part 5](#)
- [Lecture 36 - Reliability in Pavement Design - Part 6](#)
- [Lecture 37 - Distress Transfer Function - Fatigue Cracking](#)
- [Lecture 38 - Rutting and Low-Temperature Cracking](#)
- [Lecture 39 - KENLAYER - Nonlinear Analysis](#)
- [Lecture 40 - KENLAYER - Damage Analysis](#)
- [Lecture 41 - IRC design steps](#)
- [Lecture 42 - Design Input and IITPAVE software](#)
- [Lecture 43 - Pavement design with granular base](#)
- [Lecture 44 - Pavement design with CTB](#)
- [Lecture 45 - Pavement design with RAP Base](#)
- [Lecture 46 - Overview of Mechanistic-Empirical Pavement Design Methods - IRC](#)
- [Lecture 47 - Overview of Mechanistic-Empirical Pavement Design Methods - South Africa - Part I](#)
- [Lecture 48 - Overview of Mechanistic-Empirical Pavement Design Methods - South Africa - Part II](#)
- [Lecture 49 - Overview of Mechanistic-Empirical Pavement Design Methods - South Africa - Part III](#)
- [Lecture 50 - Overview of Mechanistic-Empirical Pavement Design Methods - Australia - Part I](#)
- [Lecture 51 - Overview of Mechanistic-Empirical Pavement Design Methods - Australia - Part II](#)
- [Lecture 52 - Overview of Mechanistic-Empirical Pavement Design Methods - AASHTO - Part I](#)
- [Lecture 53 - Overview of Mechanistic-Empirical Pavement Design Methods - AASHTO - Part II](#)
- [Lecture 54 - Summary of the course and design projects](#)

Lecture 1 - Introductory lecture and course outline

Lecture 2 - Matrix algebra and Gauss elimination method

Lecture 3 - Development of equilibrium equations for 1-d systems

Lecture 4 - Development of equilibrium equations for 2-d bar elements and truss structures

Lecture 5 - Development of equilibrium equations for beam elements

Lecture 6 - Virtual work and principle of stationary potential energy

Lecture 7 - Introduction to Rayleigh-Ritz Method

Lecture 8 - Use of GEOFEM finite element program - Part I

Lecture 9 - Use of GEOFEM finite element program - Part II

Lecture 10 - Stresses and strains in continuum

Lecture 11 - 2-dimensional approximations of continuum

Lecture 12 - Analysis of continuum systems

Lecture 13 - 3-node Constant Strain Triangle

Lecture 14 - Classical methods for developing shape functions

Lecture 15 - Numerical integration techniques

Lecture 16 - Isoparametric Elements - Part I

Lecture 17 - Isoparametric Elements - Part II

Lecture 18 - Isoparametric calculations for stiffness and load vectors

Lecture 19 - Force vector due to surface traction

Lecture 20 - Patch test and Finite Element Modelling

Lecture 21 - GEOFEM - Part III

Lecture 22 - In situ earth pressures, construction and excavation sequences

Lecture 23 - Joint and interface element modelling

Lecture 24 - Modelling of interfaces - Joint Elements

Lecture 25 - Mapped infinite elements for semi-infinite soil medium

Lecture 26 - Some observations of soil behaviour and stress invariants

Lecture 27 - Nonlinear analysis technique - 1

Lecture 28 - Nonlinear analysis technique - 2

Lecture 29 - Nonlinear analysis technique - 3

Lecture 30 - Bilinear elastic models

Lecture 31 - Nonlinear elastic and hyperbolic models

[Lecture 32 - Modified hyperbolic model and determination of material parameters](#)

[Lecture 33 - Stress correction procedures in finite element analysis](#)

[Lecture 34 - Numerical examples on working with modified hyperbolic models](#)

[Lecture 35 - Some Limit solutions in geotechnical engineering](#)

[Lecture 36 - Elastic - Plastic Constitutive Matrix](#)

[Lecture 37 - Nonassociated Elastic - Plastic Joint Element](#)

[Lecture 38 - Introduction to consolidation and dynamic analysis](#)

[Lecture 39 - Cam Clay models](#)

[Lecture 40 - Modified cam clay models](#)

[Lecture 41 - FEM in Geotechnical applications](#)

[Lecture 42 - Soil behaviour and An Introduction to the Existing Soil Models](#)

[Lecture 43 - Simulation of soil liquefaction using FLAC](#)

[Lecture 44 - Mitigation of soil liquefaction using granular columns](#)

Lecture 1 - Course Structure

Lecture 2 - Introduction to Google Earth

Lecture 3 - How Does Earth Science Work ?

Lecture 4 - What is a Mineral

Lecture 5 - Minerals and Rock Cycle

Lecture 6 - Continental Drift

Lecture 7 - Plate Tectonics

Lecture 8 - What are Igneous Rocks ?

Lecture 9 - Compositional Variation of Igneous Rocks

Lecture 10 - Why Does the Rock Melt ?

Lecture 11 - Igneous Activity and Plate Tectonics

Lecture 12 - Igneous Structures

Lecture 13 - Volcanoes

Lecture 14 - Discussion on Posted Questions

Lecture 15 - What are Metamorphic Rocks

Lecture 16 - Types of Metamorphism

Lecture 17 - Metamorphism and Plate Tectonics

Lecture 18 - Weathering and Erosion

Lecture 19 - Detrital Sedimentary Rocks

Lecture 20 - Chemical and Organic Sedimentary Rocks

Lecture 21 - Sedimentary Environment and Plate Tectonics

Lecture 22 - Discussion on Conceptual Questions

Lecture 23 - Discussion on Posted Questions

Lecture 24 - Diversity of Life

Lecture 25 - Why Do Groups Change ?

Lecture 26 - Nature of Paleontological Data

Lecture 27 - Introduction to PaleoDB

Lecture 28 - Relative Age

Lecture 29 - Correlation

Lecture 30 - Attempts to Estimate Absolute Age

Lecture 31 - Radiometric Dating

[Lecture 32 - Rocks Full of Life](#)

[Lecture 33 - Discussion on Posted Questions_3](#)

[Lecture 34 - The Beginning](#)

[Lecture 35 - The Formation of the Planets and Moon](#)

[Lecture 36 - The Formation of the Continents](#)

[Lecture 37 - The Formation of the Atmosphere and Ocean](#)

[Lecture 38 - Origin of Life: Initial Ideas](#)

[Lecture 39 - Origin of Life: Which Biomolecules Came First ?](#)

[Lecture 40 - Origin of Life: Where did it all Start ?](#)

[Lecture 41 - Evidence of Early Life](#)

[Lecture 42 - Proterozoic Events and Life](#)

[Lecture 43 - Discussion on Posted Questions_4](#)

[Lecture 44 - Cambrian Earth and Life](#)

[Lecture 45 - Cambrian Explosion](#)

[Lecture 46 - Journey to Land: Fishes and Tetrapods](#)

[Lecture 47 - Journey to Land: Transitional Forms](#)

[Lecture 48 - Appearance of Amniotes](#)

[Lecture 49 - Dinosaurs](#)

[Lecture 50 - Dinosaurs Footprints](#)

[Lecture 51 - Appearance of Feathers](#)

[Lecture 52 - Mass Extinctions and Their Impact](#)

[Lecture 53 - K-Pg Extinction: Patterns](#)

[Lecture 54 - K-Pg Extinction: Mechanisms](#)

[Lecture 55 - Paleoclimatic Reconstruction](#)

[Lecture 56 - Cenozoic Climate](#)

[Lecture 57 - Recovery from K-Pg: Paleogene Event](#)

[Lecture 58 - Who are Whales ?](#)

[Lecture 59 - Discussion on Posted Questions_5](#)

[Lecture 60 - Development of Bipedality](#)

[Lecture 61 - Early Hominids](#)

[Lecture 62 - Megafaunal Extinction](#)

[Lecture 63 - Recent Extinctions](#)

[Lecture 64 - Anthropocene and Future](#)

Lecture 1 - Introduction-Overview of RCC - Part 1

Lecture 2 - Introduction-Overview of RCC - Part 2

Lecture 3 - Introduction to Design Concepts and Philosophies - Part 1

Lecture 4 - Introduction to Design Concepts and Philosophies - Part 2

Lecture 5 - Materials Short Term Properties - Part 1

Lecture 6 - Materials Short Term Properties - Part 2

Lecture 7 - Materials Short Term Properties - Part 3

Lecture 8 - Materials Short Term Properties - Part 4

Lecture 9 - Materials Long Term Properties - Part 1

Lecture 10 - Materials Long Term Properties - Part 2

Lecture 11 - Materials Rebar Properties

Lecture 12 - Durability - Overview

Lecture 13 - Durability - Effect of Chemical actions

Lecture 14 - Durability - Effect of Physical,mechanical and corrosion

Lecture 15 - Durability - Design approaches and code provisions

Lecture 16 - Axial Behaviour - Introduction

Lecture 17 - Axial Behaviour of Reinforced Concrete

Lecture 18 - Axial Behaviour - Effect of Compressive Strength

Lecture 19 - Flexure Behaviour - Background to flexural theory

Lecture 20 - Flexure Behaviour - Moment curvature analysis-procedure

Lecture 21 - Flexure Behaviour - Example-Moment curvature of singly reinforced section

Lecture 22 - Flexure Behaviour - Effect of increasing reinforcement on Moment curvature behaviour

Lecture 23 - Flexure Behaviour - Effect of compressive strength on Moment curvature, behaviour

Lecture 24 - Flexure Behaviour - Effect of axial Compression on Moment curvature behaviour - Part 1

Lecture 25 - Flexure Behaviour - Effect of axial Compression on Moment curvature behaviour - Part 2

Lecture 26 - Flexure Behaviour - Effect of Compression steel on Moment curvature behaviour - Part 1

Lecture 27 - Flexure Behaviour - Effect of Compression steel on Moment curvature behaviour - Part 2

Lecture 28 - Flexure Behaviour - Analysis and Design of Singly Reinforced Sections using IS Code - Part 1

Lecture 29 - Flexure Behaviour - Analysis and Design of Singly Reinforced Sections using IS Code - Part 2

Lecture 30 - Flexure Behaviour - Examples in Flexure using IS Code Provisions

Lecture 31 - Flexure Behaviour - Analysis and Design of Doubly Reinforced Sections using IS Code

- Lecture 32 - Flexure Behaviour - Analysis and Design of Flanged Sections using IS \ddot{A} , Code \ddot{A} , Provisions
- Lecture 33 - Shear Behaviour of RC elements - Part 1
- Lecture 34 - Shear Behaviour of RC elements - Part 2
- Lecture 35 - Shear Behaviour of RC elements - Part 3
- Lecture 36 - Shear Behaviour - Shear Design using IS 456 Provisions
- Lecture 37 - Shear Behaviour - Examples for Shear Design using IS 456 Provisions
- Lecture 38 - Shear Behaviour - Torsional Behaviour of RC elements - Part 1
- Lecture 39 - Shear Behaviour - Torsional Behaviour of RC elements - Part 2
- Lecture 40 - Shear Behaviour - Torsional Behaviour of RC elements - Part 3
- Lecture 41 - Shear Behaviour - Torsion Design of RC Beams using IS 456 Provisions
- Lecture 42 - Compression behaviour of RC Columns - Intro and Types - Part 1
- Lecture 43 - Compression behaviour of RC Columns - Short vs Slender and Effective length - Part 2
- Lecture 44 - Compression behaviour of RC Columns - Lateral Flexibility and Example - Part 3
- Lecture 45 - Compression behaviour of RC Columns IS Code Provisions - Part 1
- Lecture 46 - Compression behaviour of RC Columns Confinement and Tied Vs Spiral Confined Columns - Part 2
- Lecture 47 - Compression behaviour of RC Columns - P-M Interaction : Theory
- Lecture 48 - Compression behaviour of RC Columns - P-M Interaction : Example as per IS 456
- Lecture 49 - Compression behaviour of Design of RC Columns for Biaxial Bending - Part 1
- Lecture 50 - Compression behaviour of Design of RC Columns for Biaxial Bending - Part 2
- Lecture 51 - Compression behaviour of Slender Column Design: Theory - Part 1
- Lecture 52 - Compression behaviour of Slender Column Design: Example as per IS 456 - Part 2
- Lecture 53 - Serviceability - Introduction to Deflection of RC Beam Part - 1
- Lecture 54 - Serviceability - Introduction to Deflection of RC Beam Part - 2
- Lecture 55 - Serviceability - Long term deflection and IS code Provisions
- Lecture 56 - Serviceability - Numerical Example for the calculation of Deflection of RC beam
- Lecture 57 - Crack width calculation - Theory - Part 1
- Lecture 58 - Crack width Calculation - Example - Part 2
- Lecture 59 - Serviceability - Design for Bond - Theory - Part 1
- Lecture 60 - Serviceability - Design for Bond - Theory - Part 2
- Lecture 61 - Serviceability - Design example for Bond and Splicing - Part 3
- Lecture 62 - Two way slabs - Background
- Lecture 63 - Two way slabs - Design Methods
- Lecture 64 - Two way slabs - Direct Design Method - Part 1

[Lecture 65 - Two way slabs - Direct Design Method - Part 2](#)

[Lecture 66 - Two way slabs - Equivalent Frame Method - Part 1](#)

[Lecture 67 - Two way slabs - Equivalent Frame Method \(Example\) - Part 2](#)

NPTEL : NOC:Admixtures and Special Concretes (Civil Engineering)

Co-ordinators : Prof. Manu Santhanam

Lecture 1 - Overview of Cement Chemistry and concrete performance: Cement history and production

Lecture 2 - Overview of Cement Chemistry and concrete performance: Quality control and composition

Lecture 3 - Overview of Cement Chemistry: Composition of Cement and Classification of Cement

Lecture 4 - Overview of Cement Chemistry: Hydration of Cement

Lecture 5 - Overview of Concrete Performance: Curing and Hardened Concrete

Lecture 6 - Overview of Concrete Performance: Basics of Hardened Concrete

Lecture 7 - Chemical Admixtures: Introduction

Lecture 8 - Chemical Admixtures: Water reducers - Part 1

Lecture 9 - Chemical Admixtures: Water reducers - Part 2

Lecture 10 - Chemical Admixtures: Water reducers - Part 3

Lecture 11 - Chemical Admixtures: Water reducers - Part 4

Lecture 12 - Chemical Admixtures: Water reducers - Part 5

Lecture 13 - Chemical Admixtures: Water reducers - Part 6

Lecture 14 - Chemical Admixtures: Set controllers

Lecture 15 - Chemical Admixtures: Set controllers - Accelerators

Lecture 16 - Chemical Admixtures: Set controllers - Retarders

Lecture 17 - Chemical Admixtures: Standards

Lecture 18 - Chemical Admixtures: Air entrainers - Part 1

Lecture 19 - Chemical Admixtures: Air entrainers - Part 2

Lecture 20 - Chemical Admixtures: Understanding Concrete Rheology - Part 1

Lecture 21 - Chemical Admixtures: Understanding Concrete Rheology - Part 2

Lecture 22 - Chemical Admixtures: Viscosity Modifying Agents (VMA)

Lecture 23 - Chemical Admixtures: Mechanism of corrosion

Lecture 24 - Chemical Admixtures: Corrosion inhibitors, Shrinkage reducing admixtures

Lecture 25 - Chemical Admixtures: Other specialty admixtures

Lecture 26 - Chemical Admixtures: Curing compounds

Lecture 27 - Mineral Admixtures: Introduction

Lecture 28 - Mineral Admixtures: Types, Composition and Particle size distribution

Lecture 29 - Mineral Admixtures: Microstructure of SCMs and Pozzolonic reactions

Lecture 30 - Mineral Admixtures: Pozzolonic activity

Lecture 31 - Mineral Admixtures: Electrical Conductivity method, Frattini test and Lime saturation method

Lecture 32 - Mineral Admixtures: Strength Activity test, Lime reactivity test, Mixture Proportioning and R3 test

Lecture 33 - Mineral Admixtures: Flyash - Part 1: Introduction

Lecture 34 - Mineral Admixtures: Flyash - Part 2: Classification and structure

Lecture 35 - Mineral Admixtures: Flyash - Part 3: Effects on fresh concrete

Lecture 36 - Mineral Admixtures: Flyash - Part 4: Effects on hardened concrete

Lecture 37 - Mineral Admixtures: Silica fume - Part 1: Introduction

Lecture 38 - Mineral Admixtures: Silica fume - Part 2: Effects on fresh and hardened concrete

Lecture 39 - Mineral Admixtures: Silica fume - Part 3: Effects on Microstructure + GGBS - Part 1 : Introduction

Lecture 40 - Mineral Admixtures: GGBS - Part 2 : Properties

Lecture 41 - Mineral Admixtures: GGBS - Part 3 : Hydration of slag and Durability of slag cements

Lecture 42 - Mineral Admixtures: Metakaolin

Lecture 43 - Mineral Admixtures: LC3 - Part 1 : Introduction

Lecture 44 - Mineral Admixtures: LC3 - Part 2 : Comparison with other SCMs

Lecture 45 - Mineral Admixtures: LC3 - Part 3 : Durability Performance

Lecture 46 - Mineral Admixtures: Agricultural ashes - Part 1 : Sugarcane bagasse ash

Lecture 47 - Mineral Admixtures: Agricultural ashes - Part 2 : Rice husk ash

Lecture 48 - Mineral Admixtures: Calorimeter

Lecture 49 - Mineral Admixtures: Pore solution analysis

Lecture 50 - Mineral Admixtures: CASH analysis in blended system and Life cycle assessment of concrete - Part 1

Lecture 51 - Life cycle assessment of concrete - Part 2

Lecture 52 - Life cycle assessment of concrete - Part 3

Lecture 53 - Special concretes - High strength concrete - Definition, design and concept of particle packing

Lecture 54 - Special concretes - High strength concrete - Particle packing models

Lecture 55 - Special concretes - High strength concrete - Mix designs, strength and durability

Lecture 56 - Special concretes - High strength concrete - Design attributes, fresh and hardened properties

Lecture 57 - Special concretes - High strength concrete - Stress:strain relationships, applications

Lecture 58 - Special concretes - Ultra high performance concrete - Design principles, strength, durability

Lecture 59 - Special concretes: Self compacting concrete -Introduction, design requirements and plastic shrinkage

Lecture 60 - Special concretes: Self compacting concrete - Segregation and laboratory tests

Lecture 61 - Special concretes - Self Compacting Concrete - Workability test methods, classifications and issues

Lecture 62 - Special concretes - Self Compacting Concrete - Design principles, mix designs, concrete properties

Lecture 63 - Special concretes - Mass concrete - Introduction, materials, thermal cracking

Lecture 64 - Special concretes - Mass concrete - Design guidelines, temperature differential measurement

- [Lecture 65 - Special concretes - Mass concrete - Temperature differential measurement, Design](#)
- [Lecture 66 - Special concretes - Mass concrete - Temperature monitoring, nomogram, minimizing restraints](#)
- [Lecture 67 - Special concretes - Mass concrete - Heat modelling](#)
- [Lecture 68 - Special concretes - Lightweight concrete - Introduction, classifications](#)
- [Lecture 69 - Special concretes - Lightweight concrete - Foamed concrete, lightweight aggregates](#)
- [Lecture 70 - Special concretes - Lightweight concrete - Light weigh aggregates, aerated concrete](#)
- [Lecture 71 - Special concretes - High density concrete - Heavy weight aggregates, design, case stud](#)
- [Lecture 72 - Special concretes - Concrete for 3D printing - Introduction, classification, printing process](#)
- [Lecture 73 - Special concretes - Concrete for 3D printing - Developments, advantages, case study](#)
- [Lecture 74 - Special concretes - Concrete for 3D printing - Critical parameters, yield stress](#)
- [Lecture 75 - Special concretes - Concrete for 3D printing - Mix design approach, admixtures](#)
- [Lecture 76 - Special concretes - Concrete for 3D printing - Failure modes, buildability, early-age behaviour](#)

- Lecture 1 - Aggregates and their effects on concrete properties - Part 1
- Lecture 2 - Aggregates and their effects on concrete properties - Part 2
- Lecture 3 - An overview of recycled concrete aggregates (RCA): sources and types - Part 1
- Lecture 4 - An overview of recycled concrete aggregates (RCA): sources and types - Part 2
- Lecture 5 - Recycled Concrete Aggregate (RCA): Availability, Collection, and Processing Methods - Part 1
- Lecture 6 - Recycled Concrete Aggregate (RCA): Availability, Collection, and Processing Methods - Part 2
- Lecture 7 - Recycled Concrete Aggregates: Properties and Performance - Part 1
- Lecture 8 - Recycled Concrete Aggregates: Properties and Performance - Part 2
- Lecture 9 - Recycled Concrete Aggregates: Properties and Performance - Part 3
- Lecture 10 - Recycled Concrete Aggregates: Properties and Performance - Part 4
- Lecture 11 - Recycled Concrete Aggregates: Properties and Performance - Part 5
- Lecture 12 - Effect of moisture condition on the microstructure and design of RCA concrete - Part 1
- Lecture 13 - Effect of moisture condition on the microstructure and design of RCA concrete - Part 2
- Lecture 14 - Overview and generation of recycled concrete fines
- Lecture 15 - Utilisation of recycled concrete fines
- Lecture 16 - Recycled Concrete Aggregates: Properties, Design, and Standards
- Lecture 17 - Environmental impact and life cycle assessment (LCA) - Part 1
- Lecture 18 - Environmental impact and life cycle assessment (LCA) - Part 2
- Lecture 19 - Construction supply chains - Part 1
- Lecture 20 - Construction supply chains - Part 2
- Lecture 21 - Recycled concrete aggregates market: problems and prospects - Part 1
- Lecture 22 - Recycled concrete aggregates market: problems and prospects - Part 2

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:An Introduction to Climate Dynamics, Variability and Monitoring (Civil Engineering)

Co-ordinators : Prof. Sayak Banerjee

Lecture 1 - Introduction to Climate Dynamics, Variability and Monitoring - Part 1

Lecture 2 - Introduction to Climate Dynamics, Variability and Monitoring - Part 2

Lecture 3 - Climatic Variables of the Atmosphere

Lecture 4 - Atmospheric Layers; Troposphere; Temperature Lapse Rate

Lecture 5 - Atmospheric Structure and Composition

Lecture 6 - Atmospheric Gas Concentration and introduction to Atmospheric Pressure

Lecture 7 - Atmospheric Pressure and Mass

Lecture 8 - How to Measure Vertical Variation of Pressure

Lecture 9 - Fundamentals of Atmospheric Humidity and Weather Variables

Lecture 10 - Advanced Atmospheric Humidity Concepts Contours and Key Relationships

Lecture 11 - Virtual Temperature and Atmospheric Stability Concepts

Lecture 12 - Understanding Atmospheric Stability Adiabatic Relations and Lapse Rate

Lecture 13 - Potential Temperature, Adiabatic Lapse Rate of Moist Air, Three Possible Stability Relationships

Lecture 14 - Derivation of Potential Temperature, Deriving the Expression for Saturated Adiabatic Lapse Rate

Lecture 15 - Temperature Variation With Changes in Vertical Pressure

Lecture 16 - Temperature Gradient of Dry and Saturated Air Parcel, Earth Sun Relationship

Lecture 17 - Fundamentals of Earth'S Climate System Latitude, Longitude, and Temperature Dynamics

Lecture 18 - Understanding Earth'S Seasons Axial Tilt, Solstice, and Equinox Dynamics

Lecture 19 - Mean Emission Temperature of Earth and the Greenhouse Effect - Part 1

Lecture 20 - Mean Emission Temperature of Earth and the Greenhouse Effect - Part 2

Lecture 21 - Mean Emission Temperature of Earth and the Greenhouse Effect - Part 3

Lecture 22 - Net Radiative Flux Imbalance Annual Averaged and Seasonal

Lecture 23 - Derivation of Beam Spreading Effect, Derivation of the Greenhouse Effect

Lecture 24 - Derivation of Analysing the Atmosphere of Venus, Radiation Fluxes

Lecture 25 - Principles of Electromagnetic Radiation Spectral Intensity, Irradiance, and Material Interactions

Lecture 26 - Blackbody Radiation Relations

Lecture 27 - Atmospheric Absorption and Radiative Transfer

Lecture 28 - Radiative Transfer in the Atmosphere Key Concepts

Lecture 29 - Infrared Radiative Transfer in the Earth'S Atmosphere

Lecture 30 - Radiative Flux and Optical Depth

Lecture 31 - Introduction to Atmospheric Heating and Heat Balance

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[Lecture 32 - Advanced Atmospheric Heating and Heat Balance](#)

[Lecture 33 - Temperature Distribution for a Continuously Stratified Atmosphere in Radiative Equilibrium - Part 1](#)

[Lecture 34 - Temperature Distribution for a Continuously Stratified Atmosphere in Radiative Equilibrium - Part 2](#)

[Lecture 35 - Temperature Distribution and Greenhouse Effect in a Continuously Stratified Atmosphere](#)

[Lecture 36 - Atmospheric Circulation Systems - Basic Concepts](#)

[Lecture 37 - Atmospheric Circulation Systems - Coriolis Forces](#)

[Lecture 38 - Atmospheric Circulation Systems - Pressure Forces](#)

[Lecture 39 - Atmospheric Circulation Systems - Frictional Forces and Surface Level Winds](#)

[Lecture 40 - Atmospheric Circulation Systems - High Level Winds](#)

[Lecture 41 - Seasonal Shifts - Advanced Concepts](#)

[Lecture 42 - The Ocean and the Climate](#)

[Lecture 43 - Ocean Salinity and Mixing Layer](#)

[Lecture 44 - Importance of Mixing Layer and Wind Driven Surface Current](#)

[Lecture 45 - Ocean Circulation and Deep Oceanic thermohaline Circulation](#)

[Lecture 46 - Coupled Ocean Atmosphere Variability](#)

[Lecture 47 - Global Temperature Model, Radiative Forcing and Zero Dimensional Energy Balance Model](#)

[Lecture 48 - Zero Dimensional Energy Balance Model \(Continued...\)](#)

[Lecture 49 - Energy Balance Model and Temperature Response to Radiative Forcing](#)

[Lecture 50 - Temperature Response to Radiative Forcing \(Continued...\)](#)

[Lecture 51 - Planck Feedback or Blackbody Radiative Feedback, Simple Radiative Balance Model](#)

[Lecture 52 - Indirect Feedback: Water Vapour Feedback and Spectral Outgoing Longwave Radiation](#)

[Lecture 53 - Absorption of Outgoing Longwave Radiation By Atmospheric CO₂](#)

[Lecture 54 - Introduction to Principles of Measurement and Instrumentation - Part 1](#)

[Lecture 55 - Introduction to Principles of Measurement and Instrumentation - Part 2](#)

[Lecture 56 - Introduction to Principles of Measurement and Instrumentation - Part 3](#)

[Lecture 57 - Automatic Weather Stations, Temperature Measurements and Humidity Measurements](#)

[Lecture 58 - Humidity Measurements and Pressure Measurements](#)

[Lecture 59 - Wind Measurements Techniques](#)

[Lecture 60 - Radiation and Temperature Measurements - Part 1](#)

[Lecture 61 - Radiation and Temperature Measurements - Part 2](#)

[Lecture 62 - Radiation and Precipitation Measurements](#)

[Lecture 63 - Upper Air Measurements](#)

[Lecture 64 - Remote Sensing: Climatological Applications](#)

[Lecture 65 - Types of Satellite Orbit and its Remote Sensing Applications, VNIR Imaging through Electro Optic](#)

[Lecture 66 - Spatial and Spectral Resolution of Satellite Imagery and Application of VNIR Imaging in Climatology](#)

[Lecture 67 - Application of VNIR Imaging in Climatology and Thermal Infrared Imaging Systems](#)

[Lecture 68 - Cloud Detection, Nadir Viewing, Limb Sounding, Solar Occultation](#)

[Lecture 69 - Ground Based Atmospheric Remote Sounding](#)

- Lecture 1 - Introduction and Common Air Pollutants
- Lecture 2 - Sources of indoor air pollutants - 1
- Lecture 3 - Sources of indoor air pollutants - 2
- Lecture 4 - Sources of indoor air pollutants - 3
- Lecture 5 - Methods to estimate emissions
- Lecture 6 - Mass balance
- Lecture 7 - Mass balance Simple Examples
- Lecture 8 - Residence times and Fractional losses
- Lecture 9 - Multi-room (multi-box) models
- Lecture 10 - Examples
- Lecture 11 - Outdoor air as source to indoor air. Introduction
- Lecture 12 - Outdoor air as source to indoor air. Infiltration, health
- Lecture 13 - Indoor-Outdoor relationship
- Lecture 14 - Air exchange and ventilation rates
- Lecture 15 - Health-based ventilation framework
- Lecture 16 - Aerosol Basics
- Lecture 17 - Aerosol Deposition
- Lecture 18 - Coagulation, condensation and evaporation processes
- Lecture 19 - Aerosol sources and aerosol properties
- Lecture 20 - Indoor air chemistry: basics of chemical kinetics
- Lecture 21 - Indoor air chemistry: some key reactions
- Lecture 22 - Surface reactions
- Lecture 23 - Examples
- Lecture 24 - Bioaerosols in the Indoor Atmosphere: Introduction
- Lecture 25 - Bioaerosols in the Indoor Atmosphere: Sources
- Lecture 26 - Indoor bioaerosols and health impacts
- Lecture 27 - Environmental factors and bioaerosols
- Lecture 28 - Indoor air exposure risk assessment - principles
- Lecture 29 - Calculation of daily dose
- Lecture 30 - Time-activity and inhalation risk assessment
- Lecture 31 - Examples

[Lecture 32 - Indoor air pollution monitoring of physico-chemical pollutants: Introduction and sampling methods](#)

[Lecture 33 - Indoor air pollution sampling and instruments](#)

[Lecture 34 - Indoor air pollutants analysis - 1](#)

[Lecture 35 - Indoor air pollutants analysis - 2](#)

[Lecture 36 - Indoor bioaerosol sampling methods - 1](#)

[Lecture 37 - Indoor bioaerosol sampling methods - 2](#)

[Lecture 38 - Methods for bioaerosol analysis - 1](#)

[Lecture 39 - Methods for bioaerosol analysis - 2](#)

[Lecture 40 - Guest lecture: Case study on comparison of two methods for indoor bioaerosol sampling and analysis](#)

[Lecture 41 - Indoor Air Pollution/Quality in the Indian Context](#)

[Lecture 42 - Indoor Air Quality in India - Case studies 1](#)

[Lecture 43 - Indoor Air Quality in India - Case studies 2](#)

[Lecture 44 - Guest lecture: Case study on bioaerosols in Indian indoor environment](#)

[Lecture 45 - Indoor Air Quality in India - Overview and Gaps](#)

[Lecture 46 - Indoor air quality guidelines and control: Introduction](#)

[Lecture 47 - IAQ guidelines and control: Ventilation](#)

[Lecture 48 - IAQ control methods](#)

[Lecture 49 - Introduction to Contam](#)

[Lecture 50 - Indoor air pollution effects: sick building syndrome](#)

[Lecture 51 - Managing indoor air quality](#)

[Lecture 52 - Air pollution control methods](#)

[Lecture 53 - Modeling Example](#)

[Lecture 1 - Shallow Foundation - 1](#)

[Lecture 2 - Shallow Foundation - 2](#)

[Lecture 3 - Shallow Foundation - 3](#)

[Lecture 4 - Shallow Foundation - 4](#)

[Lecture 5 - Shallow Foundation - 5](#)

[Lecture 6 - Shallow Foundation - 6](#)

[Lecture 7 - Shallow Foundation - 7](#)

[Lecture 8 - Lateral Earth pressure Theories Retaining Walls - 1](#)

[Lecture 9 - Lateral Earth pressure Theories Retaining Walls - 2](#)

[Lecture 10 - Lateral Earth pressure Theories Retaining Walls - 3](#)

[Lecture 11 - Lateral Earth Pressure Theories Retaining Walls - 4](#)

[Lecture 12 - Lateral Earth Pressure Theories Retaining Walls - 5](#)

[Lecture 13 - Pile Foundations - 1](#)

[Lecture 14 - Pile Foundations - 2](#)

[Lecture 15 - Pile Foundations - 3](#)

[Lecture 16 - Pile Foundations - 4](#)

[Lecture 17 - Pile Foundations - 5](#)

[Lecture 18 - Pile Foundations - 6](#)

[Lecture 19 - Pile Foundations - 7](#)

[Lecture 20 - Machine Foundations - 1](#)

[Lecture 21 - Machine Foundations - 2](#)

[Lecture 22 - Machine Foundations - 3](#)

[Lecture 23 - Machine Foundations - 4](#)

[Lecture 24 - Well Foundations - 1](#)

[Lecture 25 - Well Foundations - 2](#)

[Lecture 26 - Well Foundations - 3](#)

[Lecture 27 - Foundation Engineering - 1](#)

[Lecture 28 - Foundation Engineering - 2](#)

[Lecture 29 - Foundation Engineering - 3](#)

[Lecture 30 - Foundation Engineering - 4](#)

[Lecture 31 - Foundation Engineering - 5](#)

[Lecture 32 - Foundation Engineering - 6](#)

[Lecture 33 - Foundation Engineering - 7](#)

[Lecture 34 - Foundation Engineering - 8](#)

[Lecture 35 - Foundation Engineering - 9](#)

[Lecture 36 - Foundation Engineering - 10](#)

[Lecture 37 - Foundation Engineering - 11](#)

[Lecture 38 - Foundation Engineering - 12](#)

[Lecture 39 - Foundation Engineering - 13](#)

[Lecture 40 - Foundation Engineering - 14](#)

Lecture 1 - Geographic Information System An Introduction

Lecture 2 - Introduction to Global Positioning System

Lecture 3 - GPS Positioning Methods

Lecture 4 - GPS Solutions and Errors

Lecture 5 - GPS Application

Lecture 6 - Remote Sensing Introduction

Lecture 7 - Electromagnetic Spectrum

Lecture 8 - Sensors and Platform

Lecture 9 - Sensors and Platform

Lecture 10 - Image Interpretation

Lecture 11 - Statistical Evaluation of RS Data

Lecture 12 - Rectification and Restoration

Lecture 13 - Image Enhancement

Lecture 14 - Image Transformation

Lecture 15 - Orthogonal Transformation

Lecture 16 - Image Classification (Supervised Classification)

Lecture 17 - Image Classification (Unsupervised Classification)

Lecture 18 - Spatial Filtering-Noise Removal

Lecture 19 - Spatial Filtering-Edge Removal

Lecture 20 - Photogramatic-Basic concepts of a single photography

Lecture 21 - Stereoscopy-Basic concepts

Lecture 22 - Stereoscopy-Geometry of overlaping photograph

Lecture 23 - Terrestrial Photogrammetry

Lecture 24 - Digital Elevation Model-Basic Concepts

Lecture 25 - Digital Elevation Model-Data Input and Stamping

Lecture 26 - Digital Elevation Model-Surface representation and analysis

Lecture 27 - GIS-Introductory Concepts

Lecture 28 - GIS-Data Input

Lecture 29 - Data Verification and Editing

Lecture 30 - GIS Data Model

Lecture 31 - GIS Data Base

[Lecture 32 - Spatial Analysis](#)

[Lecture 33 - Map Overlay and Spatial Correlation](#)

[Lecture 34 - Application to Drought Management](#)

[Lecture 35 - GIS base planning model for educational facilities in rural areas](#)

[Lecture 36 - Application extraction of building attributes](#)

[Lecture 37 - Zonal based tourism planning](#)

[Lecture 38 - Zonal Planning using remote sensing](#)

[Lecture 39 - Municipal GIS for assessment of property tax](#)

[Lecture 40 - Application of remote sensing](#)

Lecture 1 - Introduction to Railway Engineering

Lecture 2 - Gauges and Permanent Way

Lecture 3 - Wheel and Axles, Coning of Wheels

Lecture 4 - Track Resistances, Hauling Capacity

Lecture 5 - Track Modulus, Stresses in Track

Lecture 6 - Stresses in Components of Track

Lecture 7 - Rails

Lecture 8 - Creep in Rails

Lecture 9 - Wears & Failures in Rails

Lecture 10 - Jointed or Welded rails

Lecture 11 - Sleepers

Lecture 12 - Ballast

Lecture 13 - Fastenings

Lecture 14 - Geometric Design - Alignment of Track

Lecture 15 - Horizontal Curve and Super elevation

Lecture 16 - Speeds on Track

Lecture 17 - Transition Curve & Widening of Track

Lecture 18 - Vertical Curve & Gradients

Lecture 19 - Turnouts - Components

Lecture 20 - Crossing and Design of Turnout

Lecture 21 - Track Junctions and Designs

Lecture 22 - Signals - Part 1

Lecture 23 - Signals - Part 2

Lecture 24 - Train Control Systems

Lecture 25 - Interlocking of Track

Lecture 26 - High Speed Tracks

Lecture 27 - Introduction of Air Transport

Lecture 28 - Aircraft Characteristics

Lecture 29 - Aircraft Controls, Airport Site&Size Selection

Lecture 30 - Airport Obstructions

Lecture 31 - Runway Orientation

[Lecture 32 - Runway Length](#)

[Lecture 33 - Runway Geometric](#)

[Lecture 34 - Taxiway](#)

[Lecture 35 - Exit Taxiway](#)

[Lecture 36 - Aprons and Aircraft Parking](#)

[Lecture 37 - Terminal Area and Building](#)

[Lecture 38 - Terminal Planning and Hangers](#)

[Lecture 39 - Visual Aids-Markings](#)

[Lecture 40 - Visual Aids-Lighting and Signage](#)

- Lecture 1 - What is Geographic Information Systems ?
- Lecture 2 - Different components of GIS
- Lecture 3 - Different types of vector data and concept of topology
- Lecture 4 - Raster data models and comparisons with vector
- Lecture 5 - TIN data model and comparisons with raster
- Lecture 6 - Non-spatial data (attributes) and their type
- Lecture 7 - Raster data compression techniques
- Lecture 8 - Spatial database systems and their types
- Lecture 9 - Pre-processing of spatial datasets
- Lecture 10 - Geo-referencing
- Lecture 11 - Different map projections
- Lecture 12 - Spatial interpolation techniques
- Lecture 13 - Digital Elevation Models and different types of resolutions
- Lecture 14 - Quality assessment of freely available DEMS
- Lecture 15 - GIS analysis - Part 1
- Lecture 16 - GIS analysis - Part 2 (Overlaying Operations)
- Lecture 17 - GIS analysis - Part 3 (Buffer Analysis)
- Lecture 18 - Classification Methods
- Lecture 19 - Errors in GIS and Key elements of maps
- Lecture 20 - Limitations of GIS

Lecture 1 - Solar Geometry

Lecture 2 - Climate Classification

Lecture 3 - Thermal Comfort in Built Environment - 1

Lecture 4 - Thermal Comfort in Built Environment - 2

Lecture 5 - Thermal Adaptation

Lecture 6 - Bioclimatic Assessment

Lecture 7 - Thermal Performance of Building Envelop

Lecture 8 - Thermal Performance of Building Envelop - Indices and Measures (1/2)

Lecture 9 - Thermal Performance of Building Envelop - Indices and Measures (2/2)

Lecture 10 - Glazing and Shading Systems

Lecture 11 - Shading Analysis

Lecture 12 - Energy Efficiency and Simulation

Lecture 13 - Building Acoustics - Basics

Lecture 14 - Sound Propagation

Lecture 15 - Acoustic Quality Indicators (1/2)

Lecture 16 - Acoustic Quality Indicators (2/2)

Lecture 17 - Acoustic Design Considerations

Lecture 18 - Acoustic Materials

Lecture 19 - Lighting - Basics

Lecture 20 - Lighting – Design Concepts

Lecture 1 - Introduction (GPS Surveying and Applications)

Lecture 2 - GPS System

Lecture 3 - GPS Signal (Civilian Perspective)

Lecture 4 - GPS Receiver

Lecture 5 - GPS Software

Lecture 6 - GPS Position

Lecture 7 - GPS Positioning (Principle and Methods)

Lecture 8 - Field demonstration of GPS Positioning Method

Lecture 9 - GPS Observables (Types, Errors and Quality)

Lecture 10 - Errors in GPS Observables (Systematics Errors)

Lecture 11 - GPS Data Pre-Processing - I

Lecture 12 - GPS Data Pre-Processing - II

Lecture 13 - GPS Data Processing - I

Lecture 14 - GPS Data Processing - II

Lecture 15 - Quality Assessment of GPS Surveying

Lecture 16 - Procedure of GPS Surveying - I

Lecture 17 - Procedure of GPS Surveying - II

Lecture 18 - Procedure of GPS Surveying - III

Lecture 19 - GPS Field Surveying

Lecture 20 - GPS Data Processing

Lecture 1 - Introduction and Applications

Lecture 2 - Fundamentals and Operations

Lecture 3 - Overview of Digital Land Surveying

Lecture 4 - Introduction of GPS

Lecture 5 - GPS Signal (Civilian Perspective)

Lecture 6 - GPS User Segment

Lecture 7 - GPS Positioning of Control Point

Lecture 8 - Demonstration of GPS Receivers, Software and Positioning of Control Point

Lecture 9 - GPS Position

Lecture 10 - Principle of GPS Positioning and GPS Observables

Lecture 11 - Errors in GPS Observables

Lecture 12 - GPS Data Pre-processing: Differencing

Lecture 13 - GPS Data Pre-processing: Point Positioning

Lecture 14 - GPS Data Processing: Baseline Processing

Lecture 15 - GPS Data Processing: Network Adjustment

Lecture 16 - Quality Assessment of GPS Surveying

Lecture 17 - Introduction to Total Station

Lecture 18 - Parts of Total Station

Lecture 19 - Accessories of Total Station

Lecture 20 - Handling and Setting of Total Station

Lecture 21 - Measurement of Distance

Lecture 22 - Measurement of Distance Using TS

Lecture 23 - Measurement of Horizontal Angle Using TS

Lecture 24 - Measurement of Vertical Angle and Height Using TS

Lecture 25 - Errors in Total Station

Lecture 26 - Other Errors in Total Station

Lecture 27 - Errors and Quality of Surveying Measurements

Lecture 28 - Error Propagation and Survey Specifications

Lecture 29 - Basics of Vertical Representation

Lecture 30 - Contouring

Lecture 31 - Mapping Fundamentals

[Lecture 32 - Mapping Basics](#)

[Lecture 33 - Mapping Software](#)

[Lecture 34 - Automated Mapping](#)

[Lecture 35 - Working Steps](#)

[Lecture 36 - Establishment of Control Point](#)

[Lecture 37 - Detailing of Digital Land Surveying](#)

[Lecture 38 - Demonstration of Digital Land Survey Detailing](#)

[Lecture 39 - Data Preparation and Map Making](#)

[Lecture 40 - Overview of the Course](#)

Lecture 1 - Remote-sensing Image and How it is represented

Lecture 2 - Different Techniques of Image Acquisition

Lecture 3 - Why is Digital Image processing Important ?

Lecture 4 - Image characteristics and Different Resolutions in Remote Sensing

Lecture 5 - Electromagnetic spectrum, solar reflection, and thermal emission

Lecture 6 - Color Representation and Transformations

Lecture 7 - Image histograms and statistics

Lecture 8 - Geo-referencing Techniques

Lecture 9 - Image Enhancement Techniques part 1

Lecture 10 - Image Enhancement Techniques part 2

Lecture 11 - Multispectral Transform, Scatter Plot, Principal Component Analysis and Decorrelation Stretch

Lecture 12 - Spatial Filtering Techniques

Lecture 13 - Frequency Domain Fourier Transformation

Lecture 14 - Basic Image Compression Techniques and Different Image File Formats

Lecture 15 - Image Classification Techniques

Lecture 16 - Principles of Image Interpretation

Lecture 17 - SAR Interferometry (InSAR) Techniques

Lecture 18 - Image Merging and Image Mosaicing Techniques

Lecture 19 - Application of Image Analysis

Lecture 20 - Limitations and Future of Digital Image Processing

Lecture 1 - Introduction - I

Lecture 2 - Introduction - II

Lecture 3 - Cell Structure - I

Lecture 4 - Cell Structure - II

Lecture 5 - Central Dogma - I

Lecture 6 - Central Dogma - II

Lecture 7 - Microbial Energetics - I

Lecture 8 - Microbial Energetics - II

Lecture 9 - Microbial Energetics - III

Lecture 10 - Microbial Energetics - IV

Lecture 11 - Microbial Metabolism - I

Lecture 12 - Microbial Metabolism - II

Lecture 13 - Functional Diversity of Bacteria - I

Lecture 14 - Functional Diversity of Bacteria - II

Lecture 15 - Functional Diversity of Bacteria - III

Lecture 16 - Microbial Ecosystem - I

Lecture 17 - Microbial Ecosystem - II

Lecture 18 - Microbial Ecosystem - III

Lecture 19 - Microbial Ecosystem - IV

Lecture 20 - Microbial Ecosystem - V

Lecture 21 - Environmental Genomics - I

Lecture 22 - Environmental Genomics - II

Lecture 23 - Environmental Genomics - III

Lecture 24 - Environmental Genomics - IV

Lecture 25 - Environmental Genomics - V

Lecture 26 - Microbial Symbiosis - I

Lecture 27 - Microbial Symbiosis - II

Lecture 28 - Virus - I

Lecture 29 - Virus - II

Lecture 30 - Applied Environmental Microbiology

Lecture 31 - Techniques in Environmental Microbiology - I

[Lecture 32 - Techniques in Environmental Microbiology - II](#)

[Lecture 33 - Bioremediation - I](#)

[Lecture 34 - Bioremediation - II](#)

[Lecture 35 - Bioremediation - III](#)

[Lecture 36 - Wastewater Microbiology - I](#)

[Lecture 37 - Wastewater Microbiology - II](#)

[Lecture 38 - Built Microbiology](#)

[Lecture 39 - Exposomes - I](#)

[Lecture 40 - Exposomes - II](#)

[Lecture 41 - Drinking Water Microbiology - I](#)

[Lecture 42 - Drinking Water Microbiology - II](#)

[Lecture 43 - Drinking Water Microbiology - III](#)

[Lecture 44 - Drinking Water Microbiology - IV](#)

[Lecture 45 - Drinking Water Microbiology - V](#)

[Lecture 46 - Solid Waste Microbiology - I](#)

[Lecture 47 - Solid Waste Microbiology - II](#)

[Lecture 48 - Solid Waste Microbiology - III](#)

[Lecture 49 - Antimicrobial Resistance - I](#)

[Lecture 50 - Antimicrobial Resistance - II](#)

[Lecture 51 - Epidemiology - I](#)

[Lecture 52 - Epidemiology - II](#)

[Lecture 53 - Biosensors - I](#)

[Lecture 54 - Biosensors - II](#)

[Lecture 55 - Biosensors - III](#)

[Lecture 56 - Bioinformatics - I](#)

[Lecture 57 - Bioinformatics - II](#)

[Lecture 58 - Bioinformatics - III](#)

[Lecture 59 - Bioinformatics - IV](#)

[Lecture 60 - Bioinformatics - V](#)

- Lecture 1 - Concept of Digital Elevation Model and How It Is Represented
- Lecture 2 - Various Techniques to Generate Digital Elevation Model - 1
- Lecture 3 - Various Techniques to Generate Digital Elevation Model - 2
- Lecture 4 - Various Techniques to Generate Digital Elevation Model - 3
- Lecture 5 - Importance of Spatial Resolution With DEMs
- Lecture 6 - How To Assess Quality of DEM?
- Lecture 7 - Integration of DEMs With Satellite Data
- Lecture 8 - Common Derivatives of DEMs- Slope and Aspect
- Lecture 9 - Triangulated Irregular Network (TIN) and Its Derivatives
- Lecture 10 - Shaded Relief Models and Their Applications
- Lecture 11 - DEMs Derivatives - 1
- Lecture 12 - DEMs Derivatives - 2
- Lecture 13 - DEMs Derivatives - 3
- Lecture 14 - DEMs Derivatives - 4
- Lecture 15 - DEM Based Surface Hydrologic Modelling - 1
- Lecture 16 - DEM Based Surface Hydrologic Modelling - 2
- Lecture 17 - DEM and DAM Simulation and Its Application In Ground Water Hydrology
- Lecture 18 - Applications of DEMs In Solar and Wind Energy Potential Estimations
- Lecture 19 - Applications of DEMs in Viewshed and Flood Hazard Mapping
- Lecture 20 - DEMs Sources, Limitations and Future of Digital Elevation Models

- Lecture 1 - Introduction, Fundamentals of Equilibrium and Kinetics
- Lecture 2 - Equilibrium-Process Feasibility, Gibbs Energy-Standard Condition
- Lecture 3 - Gibbs Free Energy-Non Standard Conditions - I
- Lecture 4 - Gibbs Free Energy-Non Standard Conditions - II
- Lecture 5 - Phase Equilibrium
- Lecture 6 - Component Balance
- Lecture 7 - Reaction Kinetics
- Lecture 8 - Rate of Reaction - I
- Lecture 9 - Rate of Reaction - II, Types of Reactors
- Lecture 10 - Mass Balance on different types of Reactors
- Lecture 11 - Material Balance for Complex Reactions
- Lecture 12 - Material Balance for Reversible Reactions
- Lecture 13 - Determination of Kinetic Equations
- Lecture 14 - Acid-Base Reactions
- Lecture 15 - Acid Dissociation Constant, Strength of Acid
- Lecture 16 - Ionization Fractions
- Lecture 17 - Introduction to VMINTEQ
- Lecture 18 - Estimation of pH using VMINTEQ
- Lecture 19 - Mixing Problems
- Lecture 20 - Inverse Dose Problems
- Lecture 21 - logC-pH Diagram
- Lecture 22 - Carbonate System: Closed System
- Lecture 23 - Carbonate System: Open System
- Lecture 24 - VMINTEQ: Application of Gases, Acid-Base Titration
- Lecture 25 - VMINTEQ: Titration and Multisweep, Buffer: Introduction
- Lecture 26 - VMINTEQ: Buffer System, Buffer Intensity: Introduction
- Lecture 27 - Buffer Intensity: Monoprotic and Diprotic Acids
- Lecture 28 - Alkalinity: Introduction
- Lecture 29 - Alkalinity: Theoretical and Practical Definition
- Lecture 30 - Acidity and its Applications
- Lecture 31 - Alkalinity and Acidity: Applications

- Lecture 32 - Mixing of Two Solutions and Conservative Quantities - I
- Lecture 33 - Mixing of Two Solutions and Conservative Quantities - II
- Lecture 34 - Carbonate and Non-Carbonate Alkalinity
- Lecture 35 - Anaerobic Digester: Acid Formation and Neutralization
- Lecture 36 - Aqueous Complexes: Applications in Toxicity Reduction
- Lecture 37 - Aqueous Complexes: Solubility, Rate Constants and Strength of Ligands
- Lecture 38 - Aqueous Complexes of Aluminium (Al)
- Lecture 39 - Aqueous Complexes of Mercury (Hg)
- Lecture 40 - Precipitation and Dissolution: Introduction and Applications
- Lecture 41 - Applications of Precipitation and Dissolution
- Lecture 42 - Different Stages in Precipitation, Equilibrium of Precipitation - I
- Lecture 43 - Equilibrium of Precipitation - II
- Lecture 44 - Examples Related to Equilibrium of Precipitation
- Lecture 45 - Other Examples of Equilibrium of Precipitation
- Lecture 46 - Solubility and Competitive Precipitation
- Lecture 47 - Predominance Area Diagram and Introduction to Redox Processes
- Lecture 48 - Redox Reactions and its Applications
- Lecture 49 - Balancing of Redox and Development of Half Reaction
- Lecture 50 - Kinetics of Redox Processes
- Lecture 51 - Equilibrium of Redox - I
- Lecture 52 - Equilibrium of Redox - II and Reaction Feasibility
- Lecture 53 - Reaction Feasibility Based on P_e - I
- Lecture 54 - Reaction Feasibility Based on P_e - II
- Lecture 55 - Effect of Complexation on Redox
- Lecture 56 - Effect of Complexation and Solid Phase on Redox
- Lecture 57 - Reaction Feasibility based on E_h
- Lecture 58 - Introduction to Electrochemical cell (Ecell)
- Lecture 59 - Applications of Ecell
- Lecture 60 - $\log C$ - P_e and pH - P_e Diagram

Lecture 1 - Introduction - I

Lecture 2 - Introduction - II

Lecture 3 - Course Outline

Lecture 4 - Introduction to hazardous waste laws and risk assessment

Lecture 5 - The major aspects of Risk Assessment

Lecture 6 - Risk Characterization

Lecture 7 - Risk Assessment - Deterministic approach

Lecture 8 - Risk Assessment - Stochastic Approach

Lecture 9 - Hazardous Waste laws - The TCLP Test

Lecture 10 - Hazardous rules and regulations

Lecture 11 - Remediation of contaminated GW-Plume Containment

Lecture 12 - Remediation of contaminated GW-Javandel et al's approach

Lecture 13 - Remediation of contaminated GW by Pump and Treat - I

Lecture 14 - Remediation of contaminated GW by Pump and Treat - II

Lecture 15 - Remediation of contaminated GW- Calculation of remediation time and introduction to source control

Lecture 16 - Permeable Reactive Barriers - I

Lecture 17 - Permeable Reactive Barriers - II

Lecture 18 - Permeable Reactive Barriers - III

Lecture 19 - Design of Permeable Reactive Barriers

Lecture 20 - Case Study on Permeable Reactive Barriers - I

Lecture 21 - Case Study on Permeable Reactive Barriers - II

Lecture 22 - Case Study- PRB (Utah)

Lecture 23 - Case Study (Utah) (Continued...)

Lecture 24 - Mechanism of natural attenuation and the affecting factors

Lecture 25 - Introduction to natural attenuation and its types

Lecture 26 - Pathways of Contaminant Transport and Rate of Degradation of Contaminant

Lecture 27 - Rate of Degradation of Contaminant when advection is considered

Lecture 28 - Rate of Degradation of Contaminant when both diffusion and advection are considered

Lecture 29 - Example of Rate of Degradation in natural attenuation

Lecture 30 - Case study: Natural Attenuation

Lecture 31 - Results of Case Study: Natural Attenuation

- Lecture 32 - Introduction of Soil/Sediments contamination with some examples
- Lecture 33 - Case Study: Soil/Sediments Contamination and remediation by Excavation and Disposal
- Lecture 34 - Hazardous waste disposal site/TSDF
- Lecture 35 - Different type of fluxes through containment barrier
- Lecture 36 - Introduction to Solidification and Stabilisation and Case Study
- Lecture 37 - Different contaminant reactions during solidification and stabilisation
- Lecture 38 - Diffusion of contaminant through solidified form
- Lecture 39 - Calculations for fractions of binders, admixtures, waste and water used in solidification
- Lecture 40 - Discussion of TCLP approach in solidification and its examples
- Lecture 41 - Discussion of TCLP approach (contd.) and Cost estimation of Solidification
- Lecture 42 - Case Study: Solidification and Stabilization
- Lecture 43 - Chemical Treatment
- Lecture 44 - Case Study: In-Situ Chemical Oxidation - Part I
- Lecture 45 - Case Study: In-Situ Chemical Oxidation - Part II
- Lecture 46 - Case Study: In-Situ Chemical Oxidation - Part III
- Lecture 47 - Surfactant Extraction - Part I
- Lecture 48 - Surfactant Extraction - Part II
- Lecture 49 - Case Study: Surfactant Extraction - Part I
- Lecture 50 - Case Study: Surfactant Extraction - Part II
- Lecture 51 - Soil Vapor Extraction - Part I
- Lecture 52 - Soil Vapor Extraction - Part II
- Lecture 53 - Bioremediation - Part I
- Lecture 54 - Bioremediation - Part II
- Lecture 55 - Case Study: Bioremediation
- Lecture 56 - Case Study: Soil Vapor Extraction - Part I
- Lecture 57 - Case Study: Soil Vapor Extraction - Part II
- Lecture 58 - Phyto-remediation
- Lecture 59 - Conceptual Site Model
- Lecture 60 - Adaptive Design in Remediation Engineering
- Lecture 61 - Solubilization Theory - Part I
- Lecture 62 - Solubilization Theory - Part II
- Lecture 63 - Enhanced Aquifer Flushing Technologies

Lecture 1 - Introduction to Global Navigation Satellite System (GNSS)

Lecture 2 - How position is determined by the GNSS? - Part I

Lecture 3 - How position is determined by the GNSS? - Part II

Lecture 4 - How position is determined by the GNSS? - Part III

Lecture 5 - NAVSTAR - Global Positioning System

Lecture 6 - Global Navigation Satellite System (GLONASS)

Lecture 7 - BeiDou Navigation Satellite System (BDS)

Lecture 8 - Indian Regional Navigation Satellite System (IRNSS)

Lecture 9 - GALILEO

Lecture 10 - Quasi-Zenith Satellite System (QZSS)

Lecture 11 - Differential Global Navigation Satellite System (DGNSS)

Lecture 12 - Real-Time Kinematic (RTK)

Lecture 13 - Satellite Based Augmentation System (SBAS)

Lecture 14 - GNSS Errors

Lecture 15 - GNSS Correction Methods

Lecture 16 - Why altitude estimated by GNSS receivers is not very accurate

Lecture 17 - Global Navigation Satellite Systems (GNSS) Applications - I

Lecture 18 - Global Navigation Satellite Systems (GNSS) Applications - II

Lecture 19 - GNSS: Current Trends and Future

Lecture 20 - GNSS: Opportunities in India

Lecture 1 - Introduction to Geomorphology and Concept of Time Scale in a Geomorphic System

Lecture 2 - Process of Landform Development

Lecture 3 - Energy Flow in Geomorphic System and Role of Uniformitarianism Vs Catastrophism

Lecture 4 - Landform Development - Equilibrium and Evolution

Lecture 5 - Process Geomorphology - I

Lecture 6 - Process Geomorphology - II

Lecture 7 - Weathering and soil Formation Introduction - I

Lecture 8 - Weathering and soil Formation Introduction - II

Lecture 9 - Weathering and Soil Formation (Types of Weathering)

Lecture 10 - Weathering and Soil Formation (Mechanical Weathering)

Lecture 11 - Weathering and Soil Formation (Mechanical and Chemical Weathering)

Lecture 12 - Weathering and Soil Formation (Chemical and Biological Weathering)

Lecture 13 - Weathering of Silicate rocks and Weathering Products

Lecture 14 - Factors of Weathering

Lecture 15 - Soil Formation

Lecture 16 - Soil Formation Processes

Lecture 17 - Soil Classification

Lecture 18 - Mass Wasting

Lecture 19 - Classification of Mass Wasting - I

Lecture 20 - Classification of Mass Wasting - II

Lecture 21 - Hill Slope Evolution - I

Lecture 22 - Hill Slope Evolution - II

Lecture 23 - Arid Zone Geomorphology

Lecture 24 - Landforms in Dry Region

Lecture 25 - Pediment Evolution

Lecture 26 - Aeolian Processes and Landforms - I

Lecture 27 - Aeolian Processes and Landforms - II

Lecture 28 - Wind Erosional Landforms - I

Lecture 29 - Wind Erosional Landforms - II

Lecture 30 - Dune Classification - I

Lecture 31 - Dune Classification - II

- Lecture 32 - Coastal Geomorphology - I
- Lecture 33 - Coastal Geomorphology and Landforms
- Lecture 34 - Coastal Geomorphology - II
- Lecture 35 - Coastal Geomorphology - III
- Lecture 36 - Shoreline Platform
- Lecture 37 - Coastal Geomorphology - IV
- Lecture 38 - Coastal Geomorphology - V
- Lecture 39 - Coastal Geomorphology - VI
- Lecture 40 - Coastal Geomorphology - VII
- Lecture 41 - Coastal Geomorphology - VIII
- Lecture 42 - Coastal Geomorphology - IX
- Lecture 43 - Tectonic Geomorphology
- Lecture 44 - Fluvial Process
- Lecture 45 - Fluvial Process - I
- Lecture 46 - Fluvial Process - II
- Lecture 47 - Fluvial Process - III
- Lecture 48 - Fluvial Process - IV
- Lecture 49 - Fluvial Process - V and Drainage Analysis
- Lecture 50 - Fluvial Process - VI and Drainage Analysis
- Lecture 51 - Fluvial Geomorphology River System - I
- Lecture 52 - Fluvial Geomorphology River System - II
- Lecture 53 - Glacial Geomorphology - I
- Lecture 54 - Glacial Geomorphology - II (Valley Glacier)
- Lecture 55 - Glacial Geomorphology - III
- Lecture 56 - Glacial Geomorphology - IV (Geomorphologic Changes by Glacier)
- Lecture 57 - Exploration Geomorphology in Oil field Sandbody Geometry - I
- Lecture 58 - Exploration Geomorphology in Oil Field Sandbody Geometry - II
- Lecture 59 - Seismic Geomorphology - I
- Lecture 60 - Seismic Geomorphology - II

Lecture 1 - Rudiments of Remote Sensing and Advantages

Lecture 2 - Historical Perspective of development of remote sensing technology

Lecture 3 - EM spectrum, solar reflection and thermal emission

Lecture 4 - Interaction of EM radiation with atmosphere including atmospheric scattering, absorption and emission

Lecture 5 - Interaction mechanisms of EM radiation with ground, spectral response curves

Lecture 6 - Laws of Radiation and their relevance in Remote Sensing

Lecture 7 - Basis of remote sensing image representation

Lecture 8 - Various Remote Sensing Platforms

Lecture 9 - Multi-spectral scanners and imaging devices

Lecture 10 - Significant characteristics of LANDSAT, SPOT, Sentinel sensors

Lecture 11 - Prominent characteristics of IRS, Cartosat, ResourceSat sensors

Lecture 12 - Unmanned Aerial Vehicle/Drone

Lecture 13 - Passive Microwave Remote Sensing

Lecture 14 - Image characteristics and different resolutions in Remote Sensing

Lecture 15 - Different techniques of Image acquisition

Lecture 16 - Importance of digital image processing

Lecture 17 - Digital Image Processing Software

Lecture 18 - Basic image enhancement techniques

Lecture 19 - Colour representations and transformtions

Lecture 20 - Image Histograms and statistics

Lecture 21 - Atmospheric errors and corrections

Lecture 22 - Geometric transformations/Geo-referencing Technique

Lecture 23 - Digital Image Processing Software Demonstration - 1

Lecture 24 - Image enhancement techniques - 1

Lecture 25 - Image enhancement techniques - 2

Lecture 26 - Digital Image Processing Software Demonstration - 2

Lecture 27 - Spatial Filtering Techniques, Band rationing and PCA

Lecture 28 - Frequency Doman Fourier Transformation

Lecture 29 - Digital Image Processing Software Demonstration - 3

Lecture 30 - Unsupervised image classification and density slicing techniques

Lecture 31 - Supervised image classification techniques and limitations

- Lecture 32 - Digital Image Processing Software Demonstration - 4
- Lecture 33 - LiDAR Technique and applications
- Lecture 34 - Mosaicking, subsets, sub-sampling techniques and applications
- Lecture 35 - False Topographic Phenomena and correction techniques - 1
- Lecture 36 - False Topographic Phenomena and correction techniques - 2
- Lecture 37 - High Spatial Resolution Satellite Images and limitations
- Lecture 38 - Basic Image Compression techniques and different image file formats
- Lecture 39 - Hyperspectral Remote Sensing
- Lecture 40 - Digital Image vs Digital Photograph
- Lecture 41 - NDVI and other indices
- Lecture 42 - Active Microwave Remote Sensing - 1
- Lecture 43 - Active Microwave Remote Sensing - 2
- Lecture 44 - Radar Images interpretation and applications
- Lecture 45 - SAR Interferometry (InSAR) Technique - 1
- Lecture 46 - SAR Interferometry (InSAR) Technique - 2
- Lecture 47 - Principles of image interpretation
- Lecture 48 - Image interpretation of different geological landforms, rock types and structures
- Lecture 49 - Remote Sensing of Moon and Mars
- Lecture 50 - Google Earth and its Applications
- Lecture 51 - Integrated applications of RS and GIS in groundwater studies - 1
- Lecture 52 - Integrated applications of RS and GIS in groundwater studies - 2
- Lecture 53 - Applications of Remote Sensing in Earthquake Studies - 1
- Lecture 54 - Applications of Remote Sensing in Earthquake Studies - 2
- Lecture 55 - Different sources of free satellite images
- Lecture 56 - Limitations of Remote Sensing Techniques

Lecture 1 - Introduction

Lecture 2 - Shallow Foundations: General Requirements

Lecture 3 - Shallow Foundations: Bearing Capacity

Lecture 4 - Shallow Foundations: Settlement

Lecture 5 - Shallow Foundations: Numerical Examples

Lecture 6 - Combined Footings

Lecture 7 - Raft Foundations: General Requirements

Lecture 8 - Raft Foundations: Methods of Analysis

Lecture 9 - Footings under Dynamic Loads: Eccentric and Inclined Loads, A New Method

Lecture 10 - Footings under Dynamic Loads: Design Procedure and Example on a New Method

Lecture 11 - Footings under Dynamic Loads: Analytical Approaches

Lecture 12 - Footings under Dynamic Loads: Numerical on Analytical Approaches

Lecture 13 - Pile Foundations subjected to Static Vertical Load

Lecture 14 - Pile Foundations: Group Action of Piles and Numerical

Lecture 15 - Pile Foundations under Lateral Loads: Conventional and Elastic Methods

Lecture 16 - Pile Foundations under Lateral Loads: Elastic Method for Cohesionless Soils

Lecture 17 - Pile Foundations under Lateral Loads: Elastic Method for Cohesive Soils including degradation of modulus of subgrade reaction (k)

Lecture 18 - Pile Foundations under Lateral Loads: Numerical Examples

Lecture 19 - Dynamic Analysis of Piles under Vertical and Horizontal Vibrations

Lecture 20 - Dynamic Analysis of Piles under Horizontal Vibration: Continue with Numerical Example

Lecture 21 - Seismic Response of Pile Foundations - 1

Lecture 22 - Seismic Response of Pile Foundations - 2

Lecture 23 - Combined Pile-Raft Foundations (CPRF) - General

Lecture 24 - Geotechnical and Seismic Analyses of CPRF

Lecture 25 - Design of Piles in Liquefiable Soils - 1

Lecture 26 - Design of Piles in Liquefiable Soils - 2

Lecture 27 - Introduction to Well Foundations

Lecture 28 - Lateral Stability of Well Foundations

Lecture 29 - Lateral Stability, Construction and Sinking of Well Foundation

Lecture 30 - Tiltling and Shifting of Wells, Numerical Problems

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[Lecture 31 - Introduction to Soil-Structure Interaction](#)

[Lecture 32 - Effects of Soil-Structure Interaction](#)

[Lecture 33 - SGM and Wave Propagation](#)

[Lecture 34 - Dispersion, Attenuation of Waves and Damping](#)

[Lecture 35 - Ground Response Analysis \(GRA\)](#)

[Lecture 36 - Soil-Pile Interaction \(SPI\)](#)

[Lecture 37 - Raft Foundations – Numerical Examples](#)

[Lecture 38 - Foundations on Slopes - 1](#)

[Lecture 39 - Foundations on Slopes - 2](#)

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Lecture 1 - What is Geographic Information Systems ?

Lecture 2 - Essential Components of GIS

Lecture 3 - Different types of vector data

Lecture 4 - Concept of topology

Lecture 5 - Demonstration through GIS software

Lecture 6 - Raster data model and comparisons with vector

Lecture 7 - TIN data model and comparisons with raster

Lecture 8 - Non-spatial data (attributes) and their types

Lecture 9 - Vector data compression techniques

Lecture 10 - Demonstration through GIS software

Lecture 11 - Raster data compression techniques - 1

Lecture 12 - Raster data compression techniques - 2

Lecture 13 - Georeferencing

Lecture 14 - Pre-processing of spatial datasets - 1

Lecture 15 - Demonstration through GIS software

Lecture 16 - Pre-processing of spatial datasets - 2

Lecture 17 - Pre-processing of spatial datasets - 3

Lecture 18 - Spatial Interpolation Techniques - 1

Lecture 19 - Spatial Interpolation Techniques - 2

Lecture 20 - GIS ANALYSIS - 1

Lecture 21 - GIS Analysis - 2

Lecture 22 - GIS Analysis - 3

Lecture 23 - GIS Analysis - 4

Lecture 24 - GIS Analysis - 5

Lecture 25 - Demonstration through GIS software

Lecture 26 - GIS Analysis - 6

Lecture 27 - GIS Analysis - 7

Lecture 28 - Attributes Classification Methods

Lecture 29 - Special database systems and their types - 1

Lecture 30 - Demonstration through GIS software

Lecture 31 - Spatial database systems and their types - 2

[Lecture 32 - Concept of NoData in Raster](#)

[Lecture 33 - Different map projections](#)

[Lecture 34 - Concept of digital elevation model \(DEM\) and how it is represented](#)

[Lecture 35 - Demonstration through GIS software](#)

[Lecture 36 - Various techniques to generate digital elevation model - 1](#)

[Lecture 37 - Various techniques to generate digital elevation model - 2](#)

[Lecture 38 - Various techniques to generate digital elevation model - 3](#)

[Lecture 39 - Digital Elevation Models and different types of resolutions](#)

[Lecture 40 - Demonstration through GIS software](#)

[Lecture 41 - How to assess quality of a DEM?](#)

[Lecture 42 - Integration of DEMs with satellite data](#)

[Lecture 43 - Demonstration through GIS software...](#)

[Lecture 44 - Common derivatives of DEMs - Slope and aspect - 1](#)

[Lecture 45 - Common derivatives of DEMs - Slope and aspect - 2](#)

[Lecture 46 - Common derivatives of DEMs - Slope and aspect - 3](#)

[Lecture 47 - Demonstration through GIS software](#)

[Lecture 48 - DEMs derivatives - 1](#)

[Lecture 49 - DEMs derivatives - 2](#)

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[Lecture 51 - DEMs derivatives - 4](#)

[Lecture 52 - Shaded relief models and their applications](#)

[Lecture 53 - DEM based Surface Hydrologic Modelling - 1](#)

[Lecture 54 - DEM based Surface Hydrologic Modelling - 2](#)

[Lecture 55 - DEMs and Dam Simulation and its application in groundwater hydrology](#)

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[Lecture 57 - Applications of DEMs in solar and wind energy potential estimations](#)

[Lecture 58 - DEMs Sources, limitations and future of Digital Elevation Models](#)

[Lecture 59 - Errors in GIS and key elements of maps](#)

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- Lecture 1 - Importance of water and wastewater treatment
- Lecture 2 - Life expectancy and real-world scenario
- Lecture 3 - Course outline
- Lecture 4 - Review of fundamentals
- Lecture 5 - Mass balance
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- Lecture 49 - Cementitious Materials - Part 1
- Lecture 50 - Cementitious Materials - Part 2
- Lecture 51 - Types of Cement, Admixtures, Geopolymers - Part 1
- Lecture 52 - Types of Cement, Admixtures, Geopolymers - Part 2
- Lecture 53 - Mix Design of PQC - IRC 44
- Lecture 54 - Mix Design of PQC - Examples - Part 1
- Lecture 55 - Mix Design of PQC - Examples - Part 2
- Lecture 56 - Mix Design of DLC - IRC SP 49
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- Lecture 58 - Mix Design of Pervious Concrete - Part 2
- Lecture 59 - Overview of Alternate Pavement Materials - Part 1
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- Lecture 5 - Design Controls and Space Requirements
- Lecture 6 - Space and Sight Distance Requirements - 1
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- Lecture 9 - Sight Distance Requirements - 4
- Lecture 10 - Sight Distance Requirements - 5
- Lecture 11 - Cross-Section Elements - 1
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- Lecture 20 - Crossing Facility and Road Furniture - 1
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- Lecture 25 - Road Furniture - 6
- Lecture 26 - Road Furniture - 7
- Lecture 27 - Alignment Design - 1
- Lecture 28 - Alignment Design - 2
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- Lecture 31 - Alignment Design - 5

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Lecture 2 - Interior of Earth - II

Lecture 3 - Interior of Earth - III

Lecture 4 - Interior of Earth - IV

Lecture 5 - Interior of Earth - V

Lecture 6 - Interior of Earth - VI

Lecture 7 - Oceanic Crust - I

Lecture 8 - Oceanic Crust - II

Lecture 9 - Continental Crust - I

Lecture 10 - Continental Crust - II

Lecture 11 - Types of Plates and Plate Margins

Lecture 12 - Basic Assumption of Plate Tectonics

Lecture 13 - Relative Motion of Lithospheric Plates

Lecture 14 - Euler's Theory on Lithospheric Plate Motion

Lecture 15 - Constructive/Creative Plate Margin

Lecture 16 - Slow and Fast Spreading Ridges

Lecture 17 - Magma Chamber Properties at Mid-Oceanic Ridge

Lecture 18 - Age-Depth Relationship Around the Mid-Oceanic Ridge

Lecture 19 - Along Axis Segmentation of the Mid Oceanic Ridge

Lecture 20 - Propagating Rifts and Microplate Development

Lecture 21 - Conservative Plate Margin - I

Lecture 22 - Conservative Plate Margin - II, Continental Transform Faults

Lecture 23 - Conservative Plate Margin - III, Transform Continental Margins

Lecture 24 - Conservative Plate Margin - IV, Continental Transform Faults

Lecture 25 - Destructive Plate Margins - I

Lecture 26 - Destructive Plate Margins - II, The Oceanic Trench

Lecture 27 - Destructive Plate Margins - III, The Island Arc System

Lecture 28 - Destructive Plate Margins - IV, The Back Arc Basin and Accretionary Prism

Lecture 29 - Destructive Plate Margins - V, Seismicity in the Subduction Zone

Lecture 30 - Destructive Plate Margins - VI, Gravity Anomaly and Thermal Structure at Subduction Zone

Lecture 31 - Magmatism and Metamorphism at Different Plate Settings - I, Magmatism at Subduction Zone

- Lecture 32 - Magmatism and Metamorphism at Different Plate Settings - II, Metamorphic at Subduction Zone
- Lecture 33 - Orogeny and Epiorogeny - I, Ocean-Continent Collision
- Lecture 34 - Orogeny and Epiorogeny - II, Continent-Continent Collision
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- Lecture 36 - Fault Plane Solution
- Lecture 37 - Plate Tectonics and Mineralisation - I
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- Lecture 39 - Plate Tectonics and Mineralisation at Divergent Margins - III
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- Lecture 41 - Plate Tectonics and Mineralisation at Convergent Margins - V
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- Lecture 43 - Plate Tectonics and Mineralisation at Convergent Margins - VII
- Lecture 44 - Plate Tectonics and Mineralisation at Intraplate Tectono-Metallogenic System - VIII
- Lecture 45 - Plate Tectonics and Hydrocarbon Exploration - I
- Lecture 46 - Plate Tectonics and Hydrocarbon Exploration - II
- Lecture 47 - Plate Tectonics and Climate Change
- Lecture 48 - Stability of Triple Junction
- Lecture 49 - Volcano
- Lecture 50 - Volcano and its Products - I
- Lecture 51 - Volcano and its Products - II
- Lecture 52 - Himalayan Tectonics - I
- Lecture 53 - Himalayan Tectonics - II
- Lecture 54 - Indian Seismicity
- Lecture 55 - Neotectonics - I
- Lecture 56 - Neotectonics - II
- Lecture 57 - Continental Drift - I
- Lecture 58 - Continental Drift - II
- Lecture 59 - Seafloor Spreading
- Lecture 60 - Global Positioning System (GPS) and Plate

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Lecture 2 - Introduction (Continued...)

Lecture 3 - Engineering Seismology

Lecture 4 - Engineering Seismology (Continued...)

Lecture 5 - Strong Ground Motion

Lecture 6 - Strong Ground Motion (Continued...)

Lecture 7 - Seismic Hazard Analysis

Lecture 8 - Seismic Hazard Analysis (Continued...)

Lecture 9 - Wave Propagation

Lecture 10 - Wave Propagation (Continued...)

Lecture 11 - Stress Conditions

Lecture 12 - Field Tests

Lecture 13 - Field Tests (Continued...)

Lecture 14 - Field Tests (Continued...)

Lecture 15 - Laboratory Tests

Lecture 16 - Laboratory Tests (Continued...)

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Lecture 18 - Constitutive Relationships of Soils

Lecture 19 - Constitutive Relationships of Soils (Continued...)

Lecture 20 - Constitutive Relationships of Soils (Continued...)

Lecture 21 - One-Dimensional

Lecture 22 - One-Dimensional (Continued...)

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Lecture 25 - Soil-Structure Interaction

Lecture 26 - Soil-Structure Interaction (Continued...)

Lecture 27 - Local Site Effects

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Lecture 30 - Local Site Effects (Continued...)

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- [Lecture 32 - Liquefaction Susceptibility](#)
- [Lecture 33 - Liquefaction Susceptibility \(Continued...\)](#)
- [Lecture 34 - Initiation of Liquefaction](#)
- [Lecture 35 - Initiation of Liquefaction \(Continued...\)](#)
- [Lecture 36 - Initiation of Liquefaction \(Continued...\)](#)
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- [Lecture 39 - Initiation of Liquefaction \(Continued...\)](#)
- [Lecture 40 - Effects of Liquefaction](#)
- [Lecture 41 - Slope Stability Analysis](#)
- [Lecture 42 - Slope Stability Analysis \(Continued...\)](#)
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- [Lecture 44 - Slope Stability Analysis \(Continued...\)](#)
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- [Lecture 46 - Introduction to Retaining Walls](#)
- [Lecture 47 - Static Pressure on Retaining Walls](#)
- [Lecture 48 - Static Pressure on Retaining Walls \(Continued...\)](#)
- [Lecture 49 - Design of Retaining Walls](#)
- [Lecture 50 - Design of Retaining Walls \(Continued...\)](#)
- [Lecture 51 - Slope Stability and Retaining Walls: Design of Retaining Walls](#)
- [Lecture 52 - Ground Improvement Techniques: Types of GIT](#)
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- [Lecture 54 - Ground Improvement Techniques: Types of GIT](#)
- [Lecture 55 - Ground Improvement Techniques: Geosynthetics](#)
- [Lecture 56 - Ground Improvement Techniques: Geosynthetics](#)
- [Lecture 57 - Ground Improvement Techniques: Vertical Drains](#)
- [Lecture 58 - Ground Improvement Techniques: Vertical Drains](#)
- [Lecture 59 - Ground Improvement Techniques: Reinforced Fibers](#)
- [Lecture 60 - Ground Improvement Techniques: Verification and IS Code](#)

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Lecture 2 - Permanent Way

Lecture 3 - Gauges

Lecture 4 - Wheels and Axles, Locomotives, Wagons

Lecture 5 - Wagons, Coning of Wheels

Lecture 6 - Rail Sections

Lecture 7 - Rail Length, Tests and Failures

Lecture 8 - Sleepers - Density and Spacing

Lecture 9 - Sleepers - Types and Uses

Lecture 10 - Ballast Cushion

Lecture 11 - Traction and Resistances

Lecture 12 - Resistances

Lecture 13 - Hauling Capacity and Tractive Effort

Lecture 14 - Hauling Capacity Numerical

Lecture 15 - Track Modulus and Relief of Stresses

Lecture 16 - Track Stresses - Vertical Lateral Longitudinal

Lecture 17 - Track Stresses - Rails

Lecture 18 - Track Stresses - Rails and Sleepers

Lecture 19 - Track Stresses - Ballast Formation

Lecture 20 - Joints in Rails - Types and Requirements

Lecture 21 - Joints in Rails - Insulated and Welded

Lecture 22 - Joints in Rails - Flash Butt Weld

Lecture 23 - SWR Rails

Lecture 24 - Creep in Rails

Lecture 25 - Buckling, Hogging, Battering, Corrosion and Corrugation

Lecture 26 - Corrosion, Corrugation and Rail Failures - I

Lecture 27 - Rail Failures - II

Lecture 28 - Rail Failures and Wears

Lecture 29 - Rail Wears

Lecture 30 - Permissible Wear, LWR and CWR

Lecture 31 - LWR and CWR

- Lecture 32 - Fastenings - Rail to Rail
- Lecture 33 - Fastenings - Rail to Sleeper (Elastic)
- Lecture 34 - Fastenings - Rail to Sleeper (Others)
- Lecture 35 - Track Alignment
- Lecture 36 - Speed on Track
- Lecture 37 - Circular Curve on Track
- Lecture 38 - Superelevation on Track - I
- Lecture 39 - Superelevation on Track - II and Transition Curves - I
- Lecture 40 - Transition Curves - II, Extra Clearances
- Lecture 41 - Widening of Gauge and Vertical Curves
- Lecture 42 - Realignment of Curves
- Lecture 43 - Turnouts, Points and Crossings - I
- Lecture 44 - Turnouts, Points and Crossings - II
- Lecture 45 - Crossings and Turnout Design
- Lecture 46 - Turnout Design and Maintenance
- Lecture 47 - Track Junctions and Design - I
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- Lecture 49 - Signaling - I
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- Lecture 51 - Signaling - III
- Lecture 52 - Interlocking Systems - I
- Lecture 53 - Interlocking Systems - II
- Lecture 54 - Interlocking Systems - III
- Lecture 55 - Interlocking Systems - IV
- Lecture 56 - Train Control Systems - I
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- Lecture 58 - Stations, Yards, Level Crossings
- Lecture 59 - Track Maintenance - I
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- Lecture 61 - Track Maintenance - III
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- Lecture 2 - Introduction to Groundwater Hydrology - 2
- Lecture 3 - Why to study groundwater
- Lecture 4 - Hydrological Cycle - 1
- Lecture 5 - Hydrological Cycle - 2
- Lecture 6 - Surface water vs groundwater
- Lecture 7 - Water Balance and its Components
- Lecture 8 - Types of aquifers - 1
- Lecture 9 - Types of aquifers - 2
- Lecture 10 - Infiltration and Percolation
- Lecture 11 - Porosity
- Lecture 12 - Permeability
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- Lecture 14 - Darcy's Law - 1
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- Lecture 17 - Reynolds Number
- Lecture 18 - Groundwater Flow and Flow Nets
- Lecture 19 - Darcy's law applied to aquifers
- Lecture 20 - Flow to a well
- Lecture 21 - Transmissibility
- Lecture 22 - Speed of Groundwater Movement
- Lecture 23 - Drawdowns in the vicinity of discharging wells
- Lecture 24 - Aquifer Boundaries
- Lecture 25 - Flow nets near aquifer boundaries
- Lecture 26 - Nonsteady state steady shape and steady shape conditions
- Lecture 27 - Jacob Method
- Lecture 28 - Field determination of transmissibility and storage coefficient - 1
- Lecture 29 - Field determination of transmissibility and storage coefficient - 2
- Lecture 30 - Theis Equation and example of superposition for solution
- Lecture 31 - Theis Equation Theis Equation Assumptions and Applications - 1

- Lecture 32 - Theis Equation Theis Equation Assumptions and Applications - 2
- Lecture 33 - Geologic Formations as Aquifers - 1
- Lecture 34 - Geologic Formations as Aquifers - 2
- Lecture 35 - Geologic Formations as Aquifers - 3
- Lecture 36 - Springs
- Lecture 37 - Springs in India - 1
- Lecture 38 - Springs in India - 2
- Lecture 39 - Groundwater Exploration - 1
- Lecture 40 - Groundwater Exploration - 2
- Lecture 41 - Groundwater Exploration - 3
- Lecture 42 - Groundwater Exploration - 4
- Lecture 43 - Groundwater Exploration - 5
- Lecture 44 - Groundwater Exploration - 6
- Lecture 45 - Groundwater Exploration - 7
- Lecture 46 - Groundwater Exploration - 8
- Lecture 47 - Groundwater Exploration - 9
- Lecture 48 - Groundwater Exploration - 10
- Lecture 49 - Groundwater Exploration - 11
- Lecture 50 - Groundwater Exploration - 12
- Lecture 51 - Groundwater Exploration - 13 : Sampling
- Lecture 52 - Groundwater Exploration - 14 : Hydrogeological Well Logging
- Lecture 53 - Groundwater Exploration - 15 : Spontaneous potential logging
- Lecture 54 - Groundwater Exploration - 16 : Selection of types of wells and Exploration for Art-Rec sites
- Lecture 55 - Groundwater Exploration - 17 : Exploration for hot springs
- Lecture 56 - Groundwater Exploration - 18 : Pollution related exploration
- Lecture 57 - Groundwater Quality
- Lecture 58 - Conjunctive use of ground and surface water
- Lecture 59 - Groundwater Modelling - 1
- Lecture 60 - Groundwater Modelling - 2
- Lecture 61 - Groundwater Recharge Methods in India
- Lecture 62 - Artificial Recharge Techniques and Designs

- Lecture 1 - Need for Ground Improvement
- Lecture 2 - Classification of ground modification techniques
- Lecture 3 - Emerging trends in ground improvement
- Lecture 4 - Mechanical modification
- Lecture 5 - Compaction Control
- Lecture 6 - Deep compaction
- Lecture 7 - Dynamic compaction
- Lecture 8 - Vibro-compaction methods
- Lecture 9 - Case studies in stone columns
- Lecture 10 - Prefabricated Vertical Drains (PVDS) - I
- Lecture 11 - Prefabricated drains (PVDS) - II
- Lecture 12 - Dewatering - I
- Lecture 13 - Dewatering - II
- Lecture 14 - Electro-kinetic stabilization
- Lecture 15 - Heating and freezing methods, Blasting methods - I
- Lecture 16 - Heating and freezing methods, Blasting methods - II
- Lecture 17 - Ground Treatment with lime - I
- Lecture 18 - Ground Treatment with lime - II
- Lecture 19 - Ground treatment with cement
- Lecture 20 - Grouting procedures
- Lecture 21 - Grouting
- Lecture 22 - Micropiles
- Lecture 23 - Introduction to Geosynthetics - I
- Lecture 24 - Introduction to Geosynthetics - II
- Lecture 25 - Reinforced soil principles and mechanisms
- Lecture 26 - Material properties
- Lecture 27 - Factors affecting reinforced soil
- Lecture 28 - Bearing capacity improvement - I
- Lecture 29 - Bearing capacity improvement - II
- Lecture 30 - Reinforced soil slopes
- Lecture 31 - Reinforced Soil Walls

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[Lecture 34 - Design of embankments on soft soil using geosynthetics](#)

[Lecture 35 - Design of embankments on soft soil using geocells, Use of geosynthetics for filtration and drainage](#)

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[Lecture 38 - Sustainable development and energy geotechnology](#)

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Lecture 2 - Bivariate Distributions

Lecture 3 - Independence ; Functions of Random Variables

Lecture 4 - Moments of a Distribution

Lecture 5 - Normal Distribution

Lecture 6 - Other Continuous Distributions

Lecture 7 - Parameter Estimation

Lecture 8 - Covariance and Correlation

Lecture 9 - Data Generation

Lecture 10 - Time Series Analysis (1)

Lecture 11 - Time Series Analysis (2)

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Lecture 13 - Frequency Domain Analysis (1)

Lecture 14 - Frequency Domain Analysis (2) and ARIMA Models (1)

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Lecture 16 - ARIMA Models (3)

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Lecture 18 - Case Studies (1)

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Lecture 20 - Case Studies (3)

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Lecture 22 - Markov Chains (1)

Lecture 23 - Markov Chains (2)

Lecture 24 - Frequency Analysis (1)

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Lecture 26 - Frequency Analysis (3) and Probability Plotting (1)

Lecture 27 - Probability Plotting (2)

Lecture 28 - Goodness of Fit

Lecture 29 - IDF Relationships

Lecture 30 - Multiple Linear Regression

Lecture 31 - Principal Component Analysis

[Lecture 32 - Regression on Principal Components](#)

[Lecture 33 - Multivariate Stochastic Models \(1\)](#)

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[Lecture 35 - Multivariate Stochastic Models \(3\)](#)

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[Lecture 38 - Data Consistency Checks \(3\)](#)

[Lecture 39 - Recent Applications: Climate Change Impact Assessment](#)

[Lecture 40 - Summary of the Course](#)

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Lecture 2 - Scalar random variables - 1

Lecture 3 - Scalar random variables - 2

Lecture 4 - Multi-dimensional random variables - 1

Lecture 5 - Multi-dimensional random variables - 2

Lecture 6 - Random processes - 1

Lecture 7 - Random processes - 2

Lecture 8 - Random processes - 3

Lecture 9 - Random processes - 4, Random vibrations of sdof systems - 1

Lecture 10 - Random processes - 4, Random vibrations of sdof systems - 1

Lecture 11 - Random vibrations of sdof systems - 2

Lecture 12 - Random vibrations of sdof systems - 3

Lecture 13 - Random vibrations of sdof systems - 4

Lecture 14 - Random vibrations of mdof systems - 1

Lecture 15 - Random vibrations of mdof systems - 2

Lecture 16 - Random vibrations of mdof systems - 3

Lecture 17 - Random vibrations of mdof systems - 4

Lecture 18 - Failure of randomly vibrating systems - 1

Lecture 19 - Failure of randomly vibrating systems - 2

Lecture 20 - Failure of randomly vibrating systems - 3

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Lecture 22 - Markov vector approach - 1

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Lecture 24 - Markov vector approach - 3

Lecture 25 - Markov vector approach - 4

Lecture 26 - Markov vector approach - 5, Monte Carlo simulation approach - 1

Lecture 27 - Markov vector approach - 5 & Monte Carlo simulation approach - 1

Lecture 28 - Monte Carlo simulation approach - 2

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[Lecture 34 - Probabilistic methods in earthquake engineering - 1](#)

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[Lecture 38 - Fatigue failure & Vibration energy flow models](#)

[Lecture 39 - Problem solving session - 1](#)

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Lecture 2 - Definitions and types of systems

Lecture 3 - Optimization: Functions of a single variable

Lecture 4 - Optimization: Functions of multiple variables

Lecture 5 - Constrained optimization (1)

Lecture 6 - Constrained optimization (2)

Lecture 7 - Kuhn-Tucker conditions and Introduction to Linear Programming

Lecture 8 - Linear Programming: Graphical method

Lecture 9 - Linear Programming: Simplex method (1)

Lecture 10 - Linear Programming: Simplex method (2)

Lecture 11 - Linear Programming: Multiple solutions

Lecture 12 - Linear Programming: Unbounded and infeasible problems

Lecture 13 - Linear Programming: Dual problem

Lecture 14 - Introduction to Dynamic Programming

Lecture 15 - Dynamic Programming: Water allocation problem

Lecture 16 - Dynamic Programming: Reservoir operation problem

Lecture 17 - Dynamic Programming: Capacity expansion and shortest route problems

Lecture 18 - Simulation: Introduction to Multi-objective planning

Lecture 19 - Multi-objective planning

Lecture 20 - Reservoir sizing

Lecture 21 - Reservoir capacity using Linear Programming (1)

Lecture 22 - Reservoir capacity using Linear Programming (2)

Lecture 23 - Reservoir operation

Lecture 24 - Multi-reservoir systems

Lecture 25 - Stationary policy using Dynamic Programming

Lecture 26 - Hydropower generation

Lecture 27 - Basic probability theory (1)

Lecture 28 - Basic probability theory (2)

Lecture 29 - Chance constrained Linear Programming for reservoir operation and design (1)

Lecture 30 - Chance constrained Linear Programming for reservoir operation and design (2)

Lecture 31 - Stochastic Dynamic Programming for reservoir operation (1)

[Lecture 32 - Stochastic Dynamic Programming for reservoir operation \(2\)](#)

[Lecture 33 - Stochastic Dynamic Programming for reservoir operation \(3\)](#)

[Lecture 34 - Fuzzy optimization \(1\)](#)

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[Lecture 36 - Fuzzy optimization for water quality control and reservoir operation](#)

[Lecture 37 - Conjunctive use of ground and surface water](#)

[Lecture 38 - Hydropower optimization](#)

[Lecture 39 - Crop yield optimization](#)

[Lecture 40 - Multi-basin and multi-reservoir systems](#)

Lecture 1 - Equations of motion using Hamilton's principle

Lecture 2 - Equations of motion for continuous systems and Rayleigh's quotient

Lecture 3 - Rayleigh Ritz method and method of weighted residuals

Lecture 4 - FEM: motivations. Analysis of axially vibrating rods and Euler-Bernoulli beams

Lecture 5 - Beam elements. Reference system. Assembly of matrices. Imposition of BCS. Final equation of motion

Lecture 6 - FE modelling of planar structures

Lecture 7 - FE modelling of planar structures (Continued...)

Lecture 8 - FRF-s and damping models-1

Lecture 9 - FRF-s and damping models-2

Lecture 10 - Material damping models. Dynamic stiffness and transfer matrices

Lecture 11 - Twisting of circular bars and rectangular bars. Analysis of grids

Lecture 12 - 3D frames

Lecture 13 - Mathematical preliminaries and terminologies; Euler's forward and backward difference methods

Lecture 14 - Forward and backward Euler method. Central difference method

Lecture 15 - Second order implicit methods

Lecture 16 - Energy conservation. Nonlinear systems

Lecture 17 - Model reduction schemes

Lecture 18 - Substructuring schemes

Lecture 19 - Plane stress models

Lecture 20 - Plane stress models (Continued...)

Lecture 21 - 3d Solid element

Lecture 22 - Axisymmetric models. Plate bending elements.

Lecture 23 - Plate bending elements (Continued...)

Lecture 24 - Plate bending elements (Continued...)

Lecture 25 - Plate bending elements (Continued...)

Lecture 26 - Introduction

Lecture 27 - Introduction (Continued...)

Lecture 28 - Nonlinear dynamical systems, fixed points and bifurcations

Lecture 29 - Energy methods in stability analysis

Lecture 30 - FEM for stability analysis. Euler-Bernoulli beam and general formulations

Lecture 31 - 3D beam element; plate element; imperfection sensitive structures; beams on elastic foundations; rings and arches

[Lecture 32 - Dynamic analysis of stability and analysis of time varying systems](#)

[Lecture 33 - Dynamic analysis of stability and analysis of time varying systems](#)

[Lecture 34 - FE modelling of vehicle structure interactions](#)

[Lecture 35 - Inverse response sensitivity analysis](#)

[Lecture 36 - Inverse response sensitivity analysis \(Continued...\)](#)

[Lecture 37 - Introduction and review of continuum mechanics](#)

[Lecture 38 - Review of measures of strain and stress; balance laws](#)

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[Lecture 40 - Closure](#)

Lecture 1 - Introduction

Lecture 2 - Earthquake hazard: Mitigation and preparedness

Lecture 3 - Different Earthquake Hazards

Lecture 4 - Different Earthquake Hazards (Continued...)

Lecture 5 - Earthquake Terminologies

Lecture 6 - Plate Tectonics

Lecture 7 - Faults; Seismic Sources

Lecture 8 - Types of Earthquakes; Causes of Earthquakes

Lecture 9 - Introduction to Wave Propagation

Lecture 10 - Seismic Wave propagation;

Lecture 11 - Instrumentation to record Earthquake

Lecture 12 - Seismic Sensors

Lecture 13 - Seismic Instrumentation in India

Lecture 14 - Seismic Instrumentation in India (Continued...)

Lecture 15 - Intensity scales of Earthquake

Lecture 16 - Road Damage Intensity Scale; and Seismic Vulnerability assessment

Lecture 17 - Quantification of Earthquake (magnitude)

Lecture 18 - Energy released due to earthquakes

Lecture 19 - Interpretation of Earthquake records; Baseline correction

Lecture 20 - Interpretation of Earthquake records (Continued...); Time Domain Parameters

Lecture 21 - Time Domain Parameters (Continued...)

Lecture 22 - Duration parameters; Duration Prediction Equations

Lecture 23 - Frequency Domain Characteristics; Response Spectrum

Lecture 24 - Fourier Spectrum

Lecture 25 - Seismic Source Parameters;

Lecture 26 - Time history; response Spectra (design); Stochastic models

Lecture 27 - Ground Motion Simulation models

Lecture 28 - Prediction Relationships

Lecture 29 - Recapitulation - 1

Lecture 30 - Recapitulation - 2

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DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : Design and Analysis of Algorithms (Computer Science and Engineering)

Co-ordinators : Prof. Sundar Viswanathan, Prof. Ajit A Diwan, Prof. Abhiram G Ranade

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Lecture 7 - Divide And Conquer - II Median Finding

Lecture 8 - Divide And Conquer - III Surfing Lower Bounds

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Lecture 11 - Greedy Algorithms - II

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Lecture 27 - NP-Completeness - II

Lecture 28 - NP-Completeness - III

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DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : Software Engineering (Computer Science and Engineering)

Co-ordinators : Prof. N.L. Sarda, Prof. Umesh Bellur, Prof. Rushikesh K Joshi

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Lecture 2 - Introduction to Software Engineering

Lecture 3 - Overview of Phases

Lecture 4 - Overview of Phases

Lecture 5 - Requirements Engineering / Specification

Lecture 6 - Formal Specification

Lecture 7 - Algebraic Specification Methods

Lecture 8 - Systems Modeling Overview

Lecture 9 - Process Modeling - DFD , Function Decomp

Lecture 10 - Process Modeling - DFD, Function Decomp

Lecture 11 - Data Modeling - ER Diagrams, Mapping

Lecture 12 - Data Modeling - ER Diagrams, Mapping

Lecture 13 - Production Quality Software - Introduction

Lecture 14 - Software Design - Primary Consideration

Lecture 15 - Design Patterns

Lecture 16 - Class and Component Level Design

Lecture 17 - Architectural Design

Lecture 18 - Software Testing - I

Lecture 19 - Software Testing - II

Lecture 20 - Structural Programming and Some implementation

Lecture 21 - Software Metrics and Quality

Lecture 22 - Verification and Validation

Lecture 23 - Case Study

Lecture 24 - Case Study

Lecture 25 - Software Evolution

Lecture 26 - Agile Development

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Lecture 29 - Introduction to Project Management

Lecture 30 - Project Scope Management

Lecture 31 - Project Time Management

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Lecture 3 - Testing based on Models and Criteria

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Lecture 5 - Basics of Graphs: As used in testing

Lecture 6 - Structural Graph Coverage Criteria

Lecture 7 - Elementary Graph Algorithms - Part 1

Lecture 8 - Elementary Graph Algorithms - Part 2

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Lecture 14 - Testing Source Code: Classical Coverage Criteria

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Lecture 17 - Design Integration Testing and Graph Coverage

Lecture 18 - Specification Testing and Graph Coverage

Lecture 19 - Graph Coverage and Finite state Machines

Lecture 20 - Assignment 4: Graph Coverage Criteria

Lecture 21 - Logic: Basics Needed for Software Testing

Lecture 22 - Logic: Coverage Criteria

Lecture 23 - Coverage Criteria, (Continued...)

Lecture 24 - Logic Coverage Criteria

Lecture 25 - Logic Coverage Criteria: Applied to Test Code_1

Lecture 26 - Logic Coverage Criteria: Applied to Test Code_2

Lecture 27 - Logic Coverage Criteria: Issues in Applying to Test Code

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DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Design and Pedagogy of the Introductory Programming Course (Computer Science and Engineering)

Co-ordinators : Prof. Abhiram G Ranade

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Lecture 3 - Introduction and Survey.1: Experience with the standard approach

Lecture 4 - Introduction and Survey.2: Alternative approaches, Summary, and Conclusion

Lecture 5 - Basic Ideas in Our Approach.0: Introduction

Lecture 6 - Basic Ideas in Our Approach.1: Examples of translating manual algorithms to computer programs

Lecture 7 - Basic Ideas in Our Approach.2: More examples

Lecture 8 - Basic Ideas in Our Approach.3: Should we teach students (manual) problem solving strategies?

Lecture 9 - Basic Ideas in Our Approach.4: The design of the course

Lecture 10 - Basic Ideas in Our Approach.5: Remarks on individual topics - 1

Lecture 11 - Basic Ideas in Our Approach.6: Remarks on individual topics - 2, Conclusion

Lecture 12 - Pedagogy.0: Introduction and basic principles

Lecture 13 - Pedagogy.1: Scaffolding, Lesson Plan

Lecture 14 - Pedagogy.2: A quick tour of the course - 1

Lecture 15 - Pedagogy.3: Tour-2

Lecture 16 - Pedagogy.4: Tour-3, Conclusion

Lecture 17 - Advanced Programming Topics.0: Introduction, Organization of medium sized programs

Lecture 18 - Advanced Programming Topics.1: Advanced memory management, Standard Library

Lecture 19 - Advanced Programming topics.2: Object Oriented Programming, Concluding remarks

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Lecture 21 - In class questions, Assignments, Examinations.1: Examinations

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DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:An Introduction to Programming through C++ (Computer Science and Engineering)

Co-ordinators : Prof. Abhiram G Ranade

Lecture 1 - Introduction - Part 1

Lecture 2 - Introduction - Part 2

Lecture 3 - Introduction - Part 3

Lecture 4 - Introduction - Part 4

Lecture 5 - Problem Solving using Computer - Part 1

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Lecture 9 - Problem Solving using Computer - Part 5

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Lecture 12 - Basic Elements of Program - Part 3

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Lecture 16 - Program Design - Part 3

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Lecture 18 - Conditional Execution - Part 1

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Lecture 20 - More general form of conditions - Part 3

Lecture 21 - A somewhat large program example - Part 4

Lecture 22 - Switch statement and logical data - Part 5

Lecture 23 - Loops - Part 1

Lecture 24 - Mark averaging - Part 2

Lecture 25 - The break and continue statements - Part 3

Lecture 26 - The for statement - Part 4

Lecture 27 - Euclid's algorithm for GCD - Part 5

Lecture 28 - Correctness proof for GCD - Part 6

Lecture 29 - Computing Mathematical Functions - Part 1 : Taylor series

Lecture 30 - Computing Mathematical Functions - Part 2 : Numerical integration

Lecture 31 - Computing Mathematical Functions - Part 3 : Bisection Method

- Lecture 32 - Computing Mathematical Functions - Part 4 : Newton Raphson Method
- Lecture 33 - Loops in various applications - Part 1 : Loops in various applications brute force algorithms
- Lecture 34 - Loops in various applications - Part 2 : Finding Pythagorean Triples
- Lecture 35 - Loops in various applications - Part 3 : Modelling a system: bargaining
- Lecture 36 - Loops in various applications - Part 4 : Simulating a water tank
- Lecture 37 - Loops in various applications - Part 5 : Arithmetic on very large numbers
- Lecture 38 - Functions - Part 1 : Basics
- Lecture 39 - Functions - Part 2 : Examples
- Lecture 40 - Functions - Part 3 : Reference parameters
- Lecture 41 - Functions - Part 4 : Pointers
- Lecture 43 - Recursion - Part 1 : Introduction
- Lecture 44 - Recursion - Part 2 : Recursive objects, Tree drawing
- Lecture 45 - Recursion - Part 3 : How to think about recursion
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- Lecture 47 - Virahanka Numbers - Part 2 : Recursive Program
- Lecture 48 - Virahanka Numbers - Part 3 : Iterative Program and Conclusion
- Lecture 49 - Program Organization and Functions - Part 1 : Introduction
- Lecture 50 - Program Organization and Functions - Part 2 : Splitting into files
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- Lecture 53 - Advanced Features of Functions - Part 1 : Introduction and passing one function to another
- Lecture 54 - Advanced Features of Functions - Part 2 : Lambda expressions
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- Lecture 58 - Array Part-1 - Part 2 : Marks averaging problem
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- Lecture 60 - Array Part-1 - Part 4 : Marks display variation
- Lecture 61 - Array Part-1 - Part 5 : Polynomial multiplication
- Lecture 62 - Array Part-1 - Part 6 : Queues in dispatching taxis
- Lecture 63 - Array Part-1 - Part 7 : More efficient Queues in dispatching taxis
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Lecture 24 - Address Translation

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Lecture 42 - How does a switch forwards packets CPT

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Lecture 9 - Elimination of dominated strategies

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Lecture 12 - Relation between Maxmin and PSNE in matrix

Lecture 13 - Mixed strategies

Lecture 14 - Mixed strategy Nash equilibrium (MSNE)

Lecture 15 - Find MSNE

Lecture 16 - MSNE characterization theorem proof

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Lecture 19 - Computing correlated equilibrium

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Lecture 23 - Imperfect Information Extensive Form Games (IIEFG)

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- Lecture 56 - Myerson's Lemma
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DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Introduction to Computer and Network Performance Analysis using Queuing Systems (Computer Science and Engineering)

Co-ordinators : Prof. Varsha Apte

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- Lecture 2 - Performance metrics and parameters
- Lecture 3 - Introducing Queuing Systems
- Lecture 4 - Memoryless Distributions
- Lecture 5 - Operational Laws
- Lecture 6 - Asymptotic Analysis of G/G/1, G/G/1/K queues
- Lecture 7 - Asymptotic Analysis of G/G/c/K queues
- Lecture 8 - Little's Law
- Lecture 9 - Little's Law examples and A Case Study of Open Load test on a Web server
- Lecture 10 - Some results for M/G/1 queue and Memoryless Arrivals
- Lecture 11 - Continuing the Case Study of Open Load test on a web server (Response Time)
- Lecture 12 - Open queuing networks - tandem queuing network
- Lecture 13 - Open queuing networks - general (Jackson) queuing networks
- Lecture 14 - Open queuing networks - examples
- Lecture 15 - Closed Queuing Systems
- Lecture 16 - Closed Queuing System (Continued...)
- Lecture 17 - Case study of Closed Load Test on a Web Server
- Lecture 18 - General formulation of Jacksonian Closed Queuing Networks
- Lecture 19 - Mean Value Analysis for Closed Queuing Networks
- Lecture 20 - Mean Value Analysis examples, Case Study of a Load test on a web server, Closing Remarks

- Lecture 1 - Introduction, why do delays happen, contention for resources
- Lecture 2 - Performance metrics and parameters
- Lecture 3 - Introducing Queuing Systems
- Lecture 4 - Memoryless Distributions
- Lecture 5 - Operational Laws
- Lecture 6 - Aumann model of incomplete information: Definition and Examples
- Lecture 7 - Knowledge operator: Definition and Examples
- Lecture 8 - Common knowledge: Definition and Examples
- Lecture 9 - The structural theorem of common knowledge
- Lecture 10 - Proof of the structural theorem (forward direction)
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- Lecture 13 - Aumann's agreement theorem
- Lecture 14 - Zero-sum game definition and Security strategies
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- Lecture 16 - Further properties of saddle point strategies
- Lecture 17 - Mixed strategies
- Lecture 18 - Weirstrass lemma and existence of a mixed saddle point strategy
- Lecture 19 - Von Nuenmann minmax theorem
- Lecture 20 - Computing mixed saddle point startegy: Holmes and Moriarty
- Lecture 21 - Computing mixed strategy saddle point: 2X2 matrix game
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- Lecture 24 - Proof: Existence of Nash equilibrium (Condition 1 of Kakutani fixed point)
- Lecture 25 - Proof: Existence of Nash equilibrium (Condition 2 of Kakutani fixed point)
- Lecture 26 - Existence of Nash equilibrium for infinite strategy space (Using Brower's)
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- Lecture 30 - Solution concept in dynamic games
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- Lecture 5 - Convex sets and Convex functions
- Lecture 6 - Strictly and strongly convex functions
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- Lecture 8 - Primal and dual optimization problems
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DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : Design Verification and Test of Digital VLSI Circuits (Computer Science and Engineering)

Co-ordinators : Dr. Santosh Biswas, Prof. Jatindra Kumar Deka

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- Lecture 2 - High Level Design Representation
- Lecture 3 - Transformations for High Level Synthesis
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- Lecture 11 - Heuristic Minimization of Two-Level Circuits
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- Lecture 6 - Execution of Program and Programming Languages
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- Lecture 10 - Instruction Format
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DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Embedded Systems-Design Verification and Test (Computer Science and Engineering)

Co-ordinators : Prof.Jatindra Kumar Deka, Dr. Santosh Biswas, Prof.Arnab Sarkar

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Lecture 5 - DFAs solve set membership problems in linear time, pumping lemma

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Lecture 7 - A generalization of pumping lemma, nondeterministic finite automata (NFAs), computation trees for NFAs

Lecture 8 - Formal description of NFA, language accepted by NFA, such languages are also regular

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Lecture 22 - Parse trees, inductive proof that L is $L(G)$. All regular languages are context free

Lecture 23 - Towards Chomsky normal forms: elimination of useless symbols, analysis of reachable symbols, generating nonterminals, order of substeps matter

Lecture 24 - Simplification of cfgs continued, Removal of epsilon productions: algorithm and its correctness

Lecture 25 - Elimination of unit productions. Converting a cfg into Chomsky normal form. Towards pumping lemma for cfls

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Co-ordinators : Prof. Phalguni Gupta

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Lecture 6 - Docker Containers

Lecture 7 - Kubernetes

Lecture 8 - NoSQL Databases and Key Value Stores

Lecture 9 - Edge AI Intelligence at the Edge

Lecture 10 - Edge AI Intelligence at the Edge

Lecture 11 - Mobile Edge Computing

Lecture 12 - Geo-distributed Data Centers

Lecture 13 - Time and Clock Synchronization

Lecture 14 - Edge Computing Security and Privacy

Lecture 15 - Network Virtualization

Lecture 16 - Resource Allocation in Private and Public Edge-Cloud Systems

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Practical Cyber Security for Cyber Security Practitioners (Computer Science and Engineering)

Co-ordinators : Prof. Sandeep K. Shukla

Lecture 1 - Introduction to the Course - Practical Cyber Security for Cyber Practitioners

Lecture 2 - Introduction to Cyber Kill Chains - Lockheed Martin Kill Chain

Lecture 3 - Understanding Cyber Kill Chain - Delivery, Exploitation, and Installation

Lecture 4 - Mastering the Cyber Kill Chain: Command and Control and Actions on Objectives

Lecture 5 - Introduction to MITRE ATT&CK framework

Lecture 6 - Understanding MITRE ATT&CK: A Guide to Cyber Threat Intelligence

Lecture 7 - Mapping to ATT&CK from Finished Cyber Incident

Lecture 8 - Introduction to Mapping to ATT&CK from Raw Data

Lecture 9 - Mapping to ATT&CK from RAW Data

Lecture 10 - Storing and Analyzing ATT&CK-Mapped Data

Lecture 11 - Making Defensive Recommendations from ATT&CK-Mapped Data

Lecture 12 - TTP Mapping and Introduction to Unified Kill Chain

Lecture 13 - Deep Dive into Unified Kill Chain - Part 1

Lecture 14 - Deep Dive into Unified Kill Chain - Part 2

Lecture 15 - Introduction to MITRE DEF3ND Framework

Lecture 16 - Deep dive into MITRE DEF3ND framework - I

Lecture 17 - Deep dive into MITRE DEF3ND framework - II

Lecture 18 - MITRE DEF3ND Framework Conclusion and Introduction to Risk Identification and Assessment

Lecture 19 - Deep dive into Risk Assessment - I

Lecture 20 - Deep dive into Risk Assessment - II

Lecture 21 - Introduction to Cyber Crisis Management

Lecture 22 - Cyber Crisis Conclusion and Introduction to Cyber Resilience

Lecture 23 - Deep dive into Cyber Resilience - I

Lecture 24 - Deep dive into Cyber Resilience - II

Lecture 25 - Cyber Resilience Review (Self-Assessment)

Lecture 26 - Cyber Threat Intelligence Sharing - STIX Tutorial - Part 1

Lecture 27 - Cyber Threat Intelligence Sharing - STIX Tutorial - Part 2

Lecture 28 - Introduction to SCAP, CVE and CCE

Lecture 29 - Deep Dive into CVE, CCE, CPE, CVSS Scoring, XCCDF, OVAL Languages - Part 1

Lecture 30

Lecture 31

Lecture 1 - Course outline and Fundamentals

Lecture 2 - Ideals and Varieties

Lecture 3 - Dimension of Varieties

Lecture 4 - Projective varieties

Lecture 5 - Morphisms and rational functions

Lecture 6 - Local rings

Lecture 7 - Rational maps and Birationality

Lecture 8 - Tangent space and Singularities

Lecture 9 - Resolution of singularities

Lecture 10 - Discrete valuation rings

Lecture 11 - Existence of nonsingular model

Lecture 12 - Nonsingular curves

Lecture 13 - Divisor on Curves

Lecture 14 - Riemann-Roch Spaces - I

Lecture 15 - Riemann-Roch Spaces - II

Lecture 16 - Divisor Class Group

Lecture 17 - Genus of a curve

Lecture 18 - Riemann-Roch and Adeles

Lecture 19 - Differentials and Riemann-Roch

Lecture 20 - Canonical divisor and proof of Riemann-Roch

Lecture 21 - Jacobian of a curve

Lecture 22 - Zeta function of curves

Lecture 23 - Functional equation and point counting

Lecture 24 - Riemann hypothesis for curves

Lecture 25 - Proof of RH for curves: Galois covers

Lecture 26 - Proof of RH for curves II: Multilinear algebra

Lecture 27 - Cohomological interpretation of zeta function

Lecture 1 - Introduction

Lecture 2 - Overview on Modern Cryptography

Lecture 3 - Introduction to Number Theory

Lecture 4 - Probability and Information Theory

Lecture 5 - Classical Cryptosystems

Lecture 6 - Cryptanalysis of Classical Ciphers

Lecture 7 - Shannons Theory

Lecture 8 - Shannons Theory (Continued...1)

Lecture 9 - Shannons Theory (Continued...2)

Lecture 10 - Symmetric Key Ciphers

Lecture 11 - Block Cipher Standards (DES)

Lecture 12 - Block Cipher Standards (AES)

Lecture 13 - Block Cipher Standards (AES) (Continued...)

Lecture 14 - Linear Cryptanalysis

Lecture 15 - Differential Cryptanalysis

Lecture 16 - Few other Cryptanalytic Techniques

Lecture 17 - Overview on S-Box Design Principles

Lecture 18 - Modes of Operation of Block Ciphers

Lecture 19 - Stream Ciphers

Lecture 20 - Stream Ciphers (Continued...1)

Lecture 21 - Stream Ciphers (Continued...2)

Lecture 22 - Pseudorandomness

Lecture 23 - Cryptographic Hash Functions

Lecture 24 - Cryptographic Hash Functions (Continued...1)

Lecture 25 - Cryptographic Hash Functions (Continued...2)

Lecture 26 - Message Authentication Codes

Lecture 27 - More Number Theoretic Results

Lecture 28 - The RSA Cryptosystem

Lecture 29 - Primality Testing

Lecture 30 - Factoring Algorithms

Lecture 31 - Some Comments on the Security of RSA

[Lecture 32 - Discrete Logarithm Problem \(DLP\)](#)

[Lecture 33 - The Diffie-Hellman Problem and Security of ElGamal Systems](#)

[Lecture 34 - An Introduction to Elliptic Curve Cryptography](#)

[Lecture 35 - Application of Elliptic Curves to Cryptography](#)

[Lecture 36 - Implementation of Elliptic Curve Cryptography](#)

[Lecture 37 - Secret Sharing Schemes](#)

[Lecture 38 - A Tutorial on Network Protocols](#)

[Lecture 39 - System Security](#)

[Lecture 40 - Firewalls and Intrusion Detection Systems](#)

[Lecture 41 - Side Channel Analysis of Cryptographic Implementations](#)

[Lecture 1 - Introduction & Course Outline](#)

[Lecture 2 - Performance](#)

[Lecture 3 - Instruction Set Architecture](#)

[Lecture 4 - MIPS ISA and Processor](#)

[Lecture 5 - MIPS ISA and Processor \(Continued...\)](#)

[Lecture 6 - Pipelining - Introduction](#)

[Lecture 7 - Instruction Pipelining](#)

[Lecture 8 - Pipeline Hazards](#)

[Lecture 9 - Data Hazards](#)

[Lecture 10 - Software Pipelining](#)

[Lecture 11 - In Quest of Higher ILP](#)

[Lecture 12 - In Quest of Higher ILP \(Continued...\)](#)

[Lecture 13 - Dynamic Instruction Scheduling](#)

[Lecture 14 - Dynamic Instruction Scheduling \(Continued...\)](#)

[Lecture 15 - Control Hazards](#)

[Lecture 16 - Branch Prediction](#)

[Lecture 17 - Branch Prediction \(Continued...\)](#)

[Lecture 18 - Dynamic Instruction Scheduling with Branch Prediction](#)

[Lecture 19 - Hardware-based Speculation](#)

[Lecture 20 - Tutorial - I](#)

[Lecture 21 - Hierarchical Memory Organization](#)

[Lecture 22 - Hierarchical Memory Organization \(Continued...1\)](#)

[Lecture 23 - Hierarchical Memory Organization \(Continued...2\)](#)

[Lecture 24 - Hierarchical Memory Organization \(Continued...3\)](#)

[Lecture 25 - Cache Optimization Techniques \(Continued...1\)](#)

[Lecture 26 - Cache Optimization Techniques \(Continued...2\)](#)

[Lecture 27 - Main Memory Organization](#)

[Lecture 28 - Main Memory Optimizations](#)

[Lecture 29 - Virtual Memory](#)

[Lecture 30 - Virtual Memory \(Continued...\)](#)

[Lecture 31 - Virtual Machines](#)

[Lecture 32 - Storage Technology](#)

[Lecture 33 - Storage Technology \(Continued...\)](#)

[Lecture 34 - Case Studies](#)

[Lecture 35 - Case Studies \(Continued...1\)](#)

[Lecture 36 - Case Studies \(Continued...2\)](#)

[Lecture 37 - Multithreading & Multiprocessing](#)

[Lecture 38 - Simultaneous Multithreading](#)

[Lecture 39 - Symmetric Multiprocessors](#)

[Lecture 40 - Distributed Memory Multiprocessors](#)

[Lecture 41 - Cluster, Grid and Cloud Computing](#)

Lecture 1 - Introduction & Course Outline

Lecture 2 - MOS Transistors - I

Lecture 3 - MOS Transistors - II

Lecture 4 - MOS Transistors - III

Lecture 5 - MOS Transistors - IV

Lecture 6 - MOS Inverters - I

Lecture 7 - MOS Inverters - II

Lecture 8 - MOS Inverters - III

Lecture 9 - MOS Inverters - IV

Lecture 10 - Static CMOS Circuits - I

Lecture 11 - Static CMOS Circuits - II

Lecture 12 - MOS Dynamic Circuits - I

Lecture 13 - MOS Dynamic Circuits - II

Lecture 14 - Pass Transistor Logic Circuits - I

Lecture 15 - Pass Transistor Logic Circuits - II

Lecture 16 - MOS Memories

Lecture 17 - Finite State Machines

Lecture 18 - Switching Power Dissipation

Lecture 19 - Tutorial - I

Lecture 20 - Dynamic Power Dissipation

Lecture 21 - Leakage Power Dissipation

Lecture 22 - Supply Voltage Scaling - I

Lecture 23 - Supply Voltage Scaling - II

Lecture 24 - Supply Voltage Scaling - III

Lecture 25 - Supply Voltage Scaling - IV

Lecture 26 - Tutorial - II

Lecture 27 - Minimizing Switched Capacitance - I

Lecture 28 - Minimizing Switched Capacitance - II

Lecture 29 - Minimizing Switched Capacitance - III

Lecture 30 - Minimizing Switched Capacitance - IV

Lecture 31 - Minimizing Switched Capacitance - V

[Lecture 32 - Minimizing Leakage Power - I](#)

[Lecture 33 - Minimizing Leakage Power - II](#)

[Lecture 34 - Minimizing Leakage Power - III](#)

[Lecture 35 - Variation Tolerant Design](#)

[Lecture 36 - Adiabatic Logic Circuits](#)

[Lecture 37 - Battery-Driven System Design](#)

[Lecture 38 - CAD Tools for Low Power](#)

[Lecture 39 - Tutorial - III](#)

[Lecture 40 - Course Summary](#)

Lecture 1 - Introduction

Lecture 2 - Real - Time System Characteristics

Lecture 3 - Few Basic Issues

Lecture 4 - Modelling Timing Constraints

Lecture 5 - Modelling Timing Constraints (Continued.)

Lecture 6 - Basics of Real - Time Task Scheduling

Lecture 7 - Cyclic Scheduler

Lecture 8 - Event - Driven Scheduling

Lecture 9 - Rate Monotonic Scheduler

Lecture 10 - RMA Scheduling : Further Issues

Lecture 11 - Deadline Monotonic Scheduling and Other Issues

Lecture 12 - Few Issues in Use of RMA

Lecture 13 - Resource Sharing Among Real-Time Tasks

Lecture 14 - Highest Locker and Priority Ceiling Protocols

Lecture 15 - An Analysis of Priority Ceiling Protocol

Lecture 16 - Handling Task Dependencies

Lecture 17 - Real-Time Task Scheduling on Multiprocessors and Distributed Systems

Lecture 18 - Real-Time Task Scheduling on Multiprocessors and Distributed Systems (Continued.)

Lecture 19 - Clock Synchronization in Distributed Real-Time Systems

Lecture 20 - Internal Clock Synchronization in Presence of Byzantine Clocks

Lecture 21 - A Few Basic Issues in Real-Time Operating Systems

Lecture 22 - Tutorial - I

Lecture 23 - A Few Basic Issues in Real-Time Operating Systems (Continued.)

Lecture 24 - Unix and Windows as RTOS

Lecture 25 - Real - Time POSIX

Lecture 26 - Real - Time POSIX (Continued.)

Lecture 27 - Open Source and Commercial RTOS

Lecture 28 - Open Source and Commercial RTOS (Continued.)

Lecture 29 - Benchmarking Real - Time Computer & Operating Systems

Lecture 30 - Benchmarking Real - Time Computer & Operating Systems (Continued.)

Lecture 31 - Real - Time Communications

[Lecture 32 - Few Basic Issues in Real - Time Communications](#)

[Lecture 33 - Review of Computer Networking](#)

[Lecture 34 - Real - Time Communication in a LAN](#)

[Lecture 35 - Real - Time Communication in a LAN \(Continued.\)](#)

[Lecture 36 - Performance of Two Real -Time Communication Protocols](#)

[Lecture 37 - Real - Time Communication over Packet Switched Networks](#)

[Lecture 38 - Real - Time Communication over Packet Switched Networks \(Continued.\)](#)

[Lecture 39 - Real - Time Communication over Packet Switched Networks \(Continued.\)](#)

[Lecture 40 - Real - Time Databases](#)

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : Artificial Intelligence (Prof. Anupam Basu) (Computer Science and Engineering)

Co-ordinators : Prof. Sudeshna Sarkar, Prof. Anupam Basu

Lecture 1 - Introduction to Artificial Intelligence

Lecture 2 - Intelligent Agents

Lecture 3 - State Space Search

Lecture 4 - Uninformed Search

Lecture 5 - Informed Search

Lecture 6 - Informed Search - 2

Lecture 7 - Two Players Games - I

Lecture 8 - Two Players Games - II

Lecture 9 - Constraint Satisfaction Problems - 1

Lecture 10 - Constraint Satisfaction Problems - 2

Lecture 11 - Knowledge Representation and Logic

Lecture 12 - Interface in Propositional Logic

Lecture 13 - First Order Logic

Lecture 14 - Reasoning Using First Order Logic

Lecture 15 - Resolution in FOPL

Lecture 16 - Rule Based System

Lecture 17 - Rule Based Systems II

Lecture 18 - Semantic Net

Lecture 19 - Reasoning in Semantic Net

Lecture 20 - Frames

Lecture 21 - Planning - 1

Lecture 22 - Planning - 2

Lecture 23 - Planning - 3

Lecture 24 - Planning - 4

Lecture 25 - Rule Based Expert System

Lecture 26 - Reasoning with Uncertainty - I

Lecture 27 - Reasoning with Uncertainty - II

Lecture 28 - Reasoning with Uncertainty - III

Lecture 29 - Reasoning with Uncertainty - IV

Lecture 30 - Fuzzy Reasoning - I

Lecture 31 - Fuzzy Reasoning - II

[Lecture 32 - Introduction to Learning - I](#)

[Lecture 33 - Introduction to Learning - II](#)

[Lecture 34 - Rule Induction and Decision Trees - I](#)

[Lecture 35 - Rule Induction and Decision Trees - II](#)

[Lecture 36 - Learning Using neural Networks - I](#)

[Lecture 37 - Learning Using Neural Networks - II](#)

[Lecture 38 - Probabilistic Learning](#)

[Lecture 39 - Natural Language Processing - I](#)

[Lecture 40 - Natural Language Processing - II](#)

Lecture 1 - Introduction to Artificial Intelligence

Lecture 2 - Problem Solving by Search

Lecture 3 - Searching with Costs

Lecture 4 - Informed State Space Search

Lecture 5 - Heuristic Search: A* and Beyond

Lecture 6 - Problem Reduction Search: AND/OR Graphs

Lecture 7 - Searching Game Trees

Lecture 8 - Knowledge Based Systems: Logic and Deduction

Lecture 9 - First Order Logic

Lecture 10 - Inference in First Order Logic

Lecture 11 - Resolution - Refutation Proofs

Lecture 12 - Resolution Refutation Proofs

Lecture 13 - Logic Programming : Prolog

Lecture 14 - Prolog Programming

Lecture 15 - Prolog: Exercising Control

Lecture 16 - Additional Topics

Lecture 17 - Introduction to Planning

Lecture 18 - Partial Order Planning

Lecture 19 - GraphPLAN and SATPlan

Lecture 20 - SATPlan

Lecture 21 - Reasoning under uncertainty

Lecture 22 - Bayesian Networks

Lecture 23 - Reasoning with Bayes Networks

Lecture 24 - Reasoning with Bayes networks (Contd.)

Lecture 25 - Reasoning under uncertainty: Issues

Lecture 26 - Learning : Decision Trees

Lecture 27 - Learning : Neural Networks

Lecture 28 - Back Propagation Learning

Lecture 1 - Emergence of Networks & Reference Models

Lecture 2 - Network Topology

Lecture 3 - Physical Medium - I

Lecture 4 - Physical Medium - II

Lecture 5 - Multiplexing (Sharing a Medium)

Lecture 6 - Telecom Networks

Lecture 7 - Switches - I

Lecture 8 - Pocket Switches

Lecture 9 - SONET/SDH

Lecture 10 - Fiber Optic Components

Lecture 11 - Routing and Wavelength Assignment

Lecture 12 - Protection and Restoration

Lecture 13 - Multiple Access

Lecture 14 - Token Based Mac

Lecture 15 - Data Link Protocols

Lecture 16 - Error Control

Lecture 17 - Stop & Wait Protocol

Lecture 18 - Satellite Communication

Lecture 19 - Ethernet - CSMA/CD

Lecture 20 - Modern Ethernet

Lecture 21 - Local Internetworking

Lecture 22 - Cellular Networks

Lecture 23 - Wireless Network

Lecture 24 - ATM : Asynchronous Transfer Mode

Lecture 25 - ATM Signaling, Routing and LAN Emulation

Lecture 26 - Introduction to Routing

Lecture 27 - RIP - Distance Vector Routing

Lecture 28 - IP version 4

Lecture 29 - IP Version 6 & Mobile IP

Lecture 30 - UDP & Client Server

Lecture 31 - TCP

[Lecture 32 - IP Multicasting](#)

[Lecture 33 - DHCP and ICMP](#)

[Lecture 34 - DNS & Directory](#)

[Lecture 35 - Congestion Control](#)

[Lecture 36 - QOS & Multimedia](#)

[Lecture 37 - Network Management](#)

[Lecture 38 - Security](#)

[Lecture 39 - FTP - SMTP](#)

[Lecture 40 - HTTP](#)

Lecture 1 - Introduction and Course Outline - Data Communication

Lecture 2 - Layered Architecture

Lecture 3 - Data and Signal

Lecture 4 - Transmission Impairments and Channel Capacity

Lecture 5 - Guided Transmission Media

Lecture 6 - Unguided Media

Lecture 7 - Transmission of Digital Signal - I

Lecture 8 - Transmission of Digital Signal - II

Lecture 9 - Transmission of Analog Signal - I

Lecture 10 - Transmission of Analog Signal - II

Lecture 11 - Multiplexing

Lecture 12 - Multiplexing

Lecture 13 - Multiplexing Applications - I

Lecture 14 - Multiplexing Applications - II

Lecture 15 - Interfacing to the Media

Lecture 16 - Error Detection and Correction

Lecture 17 - Flow and Error Control

Lecture 18 - Data Link Control

Lecture 19 - Switching Techniques Circuit Switching

Lecture 20 - Switching Techniques Packet Switching

Lecture 21 - Routing - I

Lecture 22 - Routing - II

Lecture 23 - Congestion Control

Lecture 24 - X.25 and Frame Relay

Lecture 25 - ATM

Lecture 26 - Medium Access Control - I

Lecture 27 - Medium Access Control - II

Lecture 28 - Medium Access Control - III

Lecture 29 - IEEE 802 LANs

Lecture 30 - High Speed LANs

Lecture 31 - Wireless LANs

[Lecture 32 - Cellular Telephone Systems](#)

[Lecture 33 - Satellite Communications](#)

[Lecture 34 - Internet and Internetworking](#)

[Lecture 35 - TCP/IP - I](#)

[Lecture 36 - TCP/IP - II](#)

[Lecture 37 - Multimedia Networks](#)

[Lecture 38 - Audio and Video Compression](#)

[Lecture 39 - Multimedia Services](#)

[Lecture 40 - Secured Communication - I](#)

[Lecture 41 - Secured Communication - II](#)

Lecture 1 - Introduction

Lecture 2 - Verilog : Part - I

Lecture 3 - Verilog : Part - II

Lecture 4 - Verilog : Part - III

Lecture 5 - Verilog : Part - IV

Lecture 6 - Verilog : Part - V

Lecture 7 - Verilog : Part - VI

Lecture 8 - Synthesis : Part - I

Lecture 9 - Synthesis : Part - II

Lecture 10 - Synthesis : Part - III

Lecture 11 - Synthesis : Part - IV

Lecture 12 - Synthesis : Part - V

Lecture 13 - Synthesis : Part - VI

Lecture 14 - Synthesis : Part - VII

Lecture 15 - Backend Design : Part - I

Lecture 16 - Backend Design : Part - II

Lecture 17 - Backend Design : Part - III

Lecture 18 - Backend Design : Part - IV

Lecture 19 - Backend Design : Part - V

Lecture 20 - Backend Design : Part - VI

Lecture 21 - Backend Design : Part - VII

Lecture 22 - Backend Design : Part - VIII

Lecture 23 - Backend Design : Part - IX

Lecture 24 - Backend Design : Part - X

Lecture 25 - Backend Design : Part - XI

Lecture 26 - Backend Design : Part - XII

Lecture 27 - Backend Design : Part - XIII

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Lecture 30 - Testing Part - I

Lecture 31 - Testing Part - II

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DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : Internet Technology (Computer Science and Engineering)

Co-ordinators : Prof. Indranil Sengupta

Lecture 1 - Introduction To Internet

Lecture 2 - Review Of Network Technologies

Lecture 3 - TCP/IP - Part-I

Lecture 4 - TCP/IP - Part-II

Lecture 5 - TCP/IP - Part-III

Lecture 6 - IP Subnetting and Addressing

Lecture 7 - Internet Routing Protocol - Part-I

Lecture 8 - Internet Routing Protocol - Part-II

Lecture 9 - Client Server Concepts DNS, Telnet, FTP

Lecture 10 - Electronic Mail

Lecture 11 - World Wide Web - Part-I

Lecture 12 - World Wide Web - Part-II

Lecture 13 - HTML : Part-I

Lecture 14 - HTML : Part-II

Lecture 15 - HTML : Part-III

Lecture 16 - Extensible Markup Language (XML)

Lecture 17 - HTML Forms

Lecture 18 - Image Maps

Lecture 19 - CGI Scripts

Lecture 20 - Other Technologies

Lecture 21 - PERL - Part-I

Lecture 22 - PERL - Part II

Lecture 23 - PERL - Part III

Lecture 24 - PERL - Part IV

Lecture 25 - Javascript : Part-I

Lecture 26 - Javascript Examples (Continued)

Lecture 27 - Using Cookies

Lecture 28 - Java Applets : Part-I

Lecture 29 - Java Applets : Part-II

Lecture 30 - Client-Server Programming In Java

Lecture 31 - Intranet, Extranet, Firewall

[Lecture 32 - Basic Cryptographic Concepts Part - I](#)

[Lecture 33 - Basic Cryptographic Concepts Part - II](#)

[Lecture 34 - Basic Cryptographic Concepts Part - III](#)

[Lecture 35 - Electronic Commerce](#)

[Lecture 36 - Streaming Multimedia Applications](#)

[Lecture 37 - Internet Telephony](#)

[Lecture 38 - Search Engine And Web Crawlers : Part-I](#)

[Lecture 39 - Search Engine And Web Crawlers : Part-II](#)

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Lecture 2 - C Programming - I

Lecture 3 - C Programming - II

Lecture 4 - C Programming - III

Lecture 5 - Data Structuring : Case Study - I

Lecture 6 - Data Structuring : Case Study - II

Lecture 7 - Data Structuring : Case Study - III

Lecture 8 - Problem Decomposition By Recursion - I

Lecture 9 - Problem Decomposition By Recursion - II

Lecture 10 - Problem Decomposition By Recursion - III

Lecture 11 - Merge sort And Quick sort

Lecture 12 - Characters And Strings

Lecture 13 - Arrays: Addresses And Contents

Lecture 14 - Structures - I

Lecture 15 - Structures - II

Lecture 16 - Dynamic Allocation Part - I

Lecture 17 - Linked Lists - I

Lecture 18 - Complexity (Efficiency) of Algorithms

Lecture 19 - Asymptotic Growth Functions

Lecture 20 - Asymptotic Analysis of Algorithms

Lecture 21 - Data Structuring

Lecture 22 - Search Trees

Lecture 23 - Search Trees - II

Lecture 24 - Search Trees - III

Lecture 25 - 2-3 Trees

Lecture 26 - Algorithm Design - I

Lecture 27 - Algorithm Design - II

Lecture 28 - Algorithm Design - III

Lecture 29 - Graphs - I

Lecture 30 - Graphs - II

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[Lecture 2 - Levels of Testing](#)

[Lecture 3 - Basic Concepts in Testing](#)

[Lecture 4 - Basic Concepts in Testing \(Continued...\)](#)

[Lecture 5 - Unit Testing](#)

[Lecture 6 - Equivalence and BV Testing](#)

[Lecture 7 - Special Value Testing](#)

[Lecture 8 - Combinatorial Testing](#)

[Lecture 9 - Pairwise Testing](#)

[Lecture 10 - White Box Testing](#)

[Lecture 11 - MC/DC Testing](#)

[Lecture 12 - MC/DC Testing \(Continued...\)](#)

[Lecture 13 - Path Testing](#)

[Lecture 14 - Dataflow and Mutation Testing](#)

[Lecture 15 - Mutation Testing](#)

[Lecture 16 - Integration Testing](#)

[Lecture 17 - System Testing](#)

[Lecture 18 - Regression Testing](#)

[Lecture 19 - Testing Object-Oriented Program - Part 1](#)

[Lecture 20 - Testing Object-Oriented Program - Part 2](#)

Lecture 1 - Module 1 : Recap of C

Lecture 2 - Module 1 : Recap of C

Lecture 3 - Module 1 : Recap of C

Lecture 4 - Module 2 : Programs with IO and Loop

Lecture 5 - Module 3 : Arrays and Strings

Lecture 6 - Module 4 : Sorting and Searching

Lecture 7 - Module 5 : Stack and its Applications

Lecture 8 - Module 6 : Constants and Inline Functions

Lecture 9 - Module 6 : Constants and Inline Functions (Continued...)

Lecture 10 - Module 7 : Reference and Pointer

Lecture 11 - Module 7 : Reference and Pointer (Continued...)

Lecture 12 - Module 8 : Default Parameters and Function Overloading

Lecture 13 - Module 8 : Default Parameters and Function Overloading (Continued...)

Lecture 14 - Module 8 : Default Parameters and Function Overloading (Continued...)

Lecture 15 - Module 9 : Operator Overloading

Lecture 16 - Module 9 : Operator Overloading (Continued...)

Lecture 17 - Module 10 : Dynamic Memory Management

Lecture 18 - Module 10 : Dynamic Memory Management (Continued...)

Lecture 19 - Module 11 : Classes and Objects

Lecture 20 - Module 11 : Classes and Objects (Continued...)

Lecture 21 - Module 12 : Access Specifiers

Lecture 22 - Module 12 : Access Specifiers (Continued...)

Lecture 23 - Module 13 : Constructors, Destructors and Object Lifetime

Lecture 24 - Module 13 : Constructors, Destructors and Object Lifetime (Continued...)

Lecture 25 - Module 13 : Constructors, Destructors and Object Lifetime (Continued...)

Lecture 26 - Module 14 : Copy Constructor and Copy Assignment Operator

Lecture 27 - Module 14 : Copy Constructor and Copy Assignment Operator (Continued...)

Lecture 28 - Module 14 : Copy Constructor and Copy Assignment Operator (Continued...)

Lecture 29 - Module 15 : Const-ness

Lecture 30 - Module 15 : Const-ness (Continued...)

Lecture 31 - Module 16 : Static Members

- Lecture 32 - Module 17 : friend Function and friend Class
- Lecture 33 - Module 18 : Overloading Operator for User Defined Types - Part I
- Lecture 34 - Module 19 : Overloading Operator for User Defined Types - Part II
- Lecture 35 - Module 20 : Namespace
- Lecture 36 - Module 21 : Inheritance - Part I
- Lecture 37 - Module 22 : Inheritance - Part II
- Lecture 38 - Module 23 : Inheritance - Part III
- Lecture 39 - Module 24 : Inheritance - Part IV
- Lecture 40 - Module 25 : Inheritance - Part V
- Lecture 41 - Module 26 : Dynamic Binding - Part I
- Lecture 42 - Module 27 : Dynamic Binding (Polymorphism) - Part II
- Lecture 43 - Module 28 : Dynamic Binding (Polymorphism) - Part III
- Lecture 44 - Module 29 : Dynamic Binding (Polymorphism) - Part IV
- Lecture 45 - Module 30 : Dynamic Binding (Polymorphism) - Part V
- Lecture 46 - Module 31 : Virtual Function Table
- Lecture 47 - Module 32 : Type casting and cast operators - Part I
- Lecture 48 - Module 33 : Type casting and cast operators - Part II
- Lecture 49 - Module 34 : Type casting and cast operators - Part III
- Lecture 50 - Module 35 : Multiple Inheritance
- Lecture 51 - Module 35 : Multiple Inheritance (Continued...)
- Lecture 52 - Module 36 : Exceptions (Error Handling in C) - Part I
- Lecture 53 - Module 37 : Exceptions (Error Handling in C) - Part II
- Lecture 54 - Module 38 : Template (Function Template) - Part I
- Lecture 55 - Module 39 : Template (Function Template) - Part II
- Lecture 56 - Module 40 : Closing Comments

Lecture 1 - Introduction

Lecture 2 - Different Types of Learning

Lecture 3 - Hypothesis Space and Inductive Bias

Lecture 4 - Evaluation and Cross-Validation

Lecture 5 - Tutorial - I

Lecture 6 - Linear Regression

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Lecture 27 - Introduction to Python Programming - II

Lecture 28 - Introduction to Raspberry Pi - I

Lecture 29 - Introduction to Raspberry Pi - II

Lecture 30 - Implementation of IoT with Raspberry Pi - I

Lecture 31 - Implementation of IoT with Raspberry Pi - II

- Lecture 32 - Implementation of IoT with Raspberry Pi - III
- Lecture 33 - Software Defined Networking - Part I
- Lecture 34 - Software Defined Networking - Part II
- Lecture 35 - Software Defined IoT Networking - I
- Lecture 36 - Software Defined IoT Networking - II
- Lecture 37 - Cloud Computing-Fundamental
- Lecture 38 - Cloud Computing-Service Model
- Lecture 39 - Cloud Computing-Service Management and Security
- Lecture 40 - Cloud Computing - Case Studies
- Lecture 41 - Cloud Computing - Practical
- Lecture 42 - Sensor-Cloud - I
- Lecture 43 - Sensor-Cloud - II
- Lecture 44 - Fog Computing - I
- Lecture 45 - Fog Computing - II
- Lecture 46 - Smart Cities and Smart Homes - I
- Lecture 47 - Smart Cities and Smart Homes - II
- Lecture 48 - Smart Cities and Smart Homes - III
- Lecture 49 - Connected Vehicles - I
- Lecture 50 - Connected Vehicles - II
- Lecture 51 - Smart Grid - I
- Lecture 52 - Smart Grid - II
- Lecture 53 - Industrial Internet of Things - I
- Lecture 54 - Industrial Internet of Things - II
- Lecture 55 - Data Handling and Analytics - I
- Lecture 56 - Data Handling and Analytics - II
- Lecture 57 - Case Study: Agriculture
- Lecture 58 - Case Study: Healthcare
- Lecture 59 - Case Study: Activity Monitoring - I
- Lecture 60 - Case Study: Activity Monitoring - II

- Lecture 1 - Cloud Computing Overview
- Lecture 2 - Cloud Computing Overview (Continued...)
- Lecture 3 - Cloud Computing - Introduction
- Lecture 4 - Cloud Computing Architecture
- Lecture 5 - Cloud Computing Architecture (Continued...)
- Lecture 6 - Cloud Computing Architecture - Deployment Models
- Lecture 7 - Cloud Computing Virtualization
- Lecture 8 - Cloud Computing XML Basics
- Lecture 9 - Cloud Computing XML Basics - II
- Lecture 10 - Cloud Computing Web Services, Service Oriented Architecture
- Lecture 11 - Service Level Agreement
- Lecture 12 - Cloud Economics
- Lecture 13 - Managing Data
- Lecture 14 - Introduction to MapReduce
- Lecture 15 - Open Stack
- Lecture 16 - Cloud Computing - Opensource Cloud - Openstack Demo
- Lecture 17 - Cloud Computing Case Study with a commercial Cloud - Microsoft Azure
- Lecture 18 - Cloud Computing Demo - Microsoft Azure
- Lecture 19 - Cloud Computing Case Study - Google Cloud Platform (GCP)
- Lecture 20 - Cloud Computing Demo - Google Cloud Platform (GCP)
- Lecture 21 - SLA-Tutorial
- Lecture 22 - Cloudeconomics-Tutorial
- Lecture 23 - MapReduce-Tutorial
- Lecture 24 - Resource Management - I
- Lecture 25 - Resource Management - II
- Lecture 26 - Cloud Computing: Security - I
- Lecture 27 - Cloud Computing: Security - II
- Lecture 28 - Cloud Computing: Security - III
- Lecture 29 - Cloud Computing: Security Issues in Collaborative SaaS Cloud
- Lecture 30 - Cloud Computing: Broker for Cloud Marketplace
- Lecture 31 - Mobile Cloud Computing - I

- Lecture 32 - Mobile Cloud Computing - II
- Lecture 33 - Fog Computing - I
- Lecture 34 - Fog Computing - II
- Lecture 35 - Use Case-Geo-spatial Cloud
- Lecture 36 - Introduction to DOCKER Container
- Lecture 37 - Green Cloud
- Lecture 38 - Sensor Cloud Computing
- Lecture 39 - IoT Cloud
- Lecture 40 - Course Summary and Research Areas
- Lecture 41 - Cloud-Fog Computing - Overview
- Lecture 42 - Resource Management - I
- Lecture 43 - Resource Management - II
- Lecture 44 - Cloud Federation
- Lecture 45 - VM Migration - Basics Migration strategies
- Lecture 46 - VM Migration - Basics Migration strategies
- Lecture 47 - Containers Container based Virtualization Kubernetes Docker Container
- Lecture 48 - Docker Container - Overview Docker - Components Docker - Architecture
- Lecture 49 - Docker Container - Demo
- Lecture 50 - Docker Container - Demo
- Lecture 51 - Dew Computing
- Lecture 52 - Serverless Computing - I
- Lecture 53 - Serverless Computing - II
- Lecture 54 - Sustainable Cloud Computing - I
- Lecture 55 - Sustainable Cloud Computing - II
- Lecture 56 - Cloud Computing in 5G Era
- Lecture 57 - CPS and Cloud Computing
- Lecture 58 - Case Study I (Spatial Cloud Computing)
- Lecture 59 - Case Study II (Internet of Health Things) - Part A
- Lecture 60 - Case Study II (Internet of Health Things) - Part B

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Problem Solving through Programming in C (Computer Science and Engineering)

Co-ordinators : Prof.Arnab sarkar, Prof.Jatindra Kumar Deka, Dr. Santosh Biswas

Lecture 1 - Introduction

Lecture 2 - Idea of Algorithms

Lecture 3 - Flow Chart and Pseudocode

Lecture 4 - Introduction to Programming Language Concepts

Lecture 5 - Variables and Memory

Lecture 6 - Types of Software and Compilers

Lecture 7 - Introduction to C Programming Language

Lecture 8 - Variables and Variable Types in C

Lecture 9 - Introducing Functions

Lecture 10 - Address and Content of Variables and Types

Lecture 11 - Assignment Statement and Operators in C

Lecture 12 - Arithmetic Expressions and Relational Expressions

Lecture 13 - Logical Operators and Change in Control Flow

Lecture 14 - Use of Logical Operatoers in Branching

Lecture 15 - Branching : IF-ELSE Statement

Lecture 16 - IF-ELSE Statement (Continued...)

Lecture 17 - Switch statement

Lecture 18 - Switch Statement (Continued...) and Introduction to Loops

Lecture 19 - Implementing Repetitions (Loops)

Lecture 20 - Implementation of Loops with for Statement (Continued...)

Lecture 21 - For Statement (Continued...)

Lecture 22 - Example of If-Else

Lecture 23 - Example of Loops

Lecture 24 - Example of Loops (Continued...)

Lecture 25 - Example of Loops (Continued...), Use of FOR Loops

Lecture 26 - Introduction to Arrays

Lecture 27 - Arrays (Continued...)

Lecture 28 - Arrays (Continued...)

Lecture 29 - Program using Arrays

Lecture 30 - Array Problem

Lecture 31 - Linear Search

[Lecture 32 - Character Array and Strings](#)

[Lecture 33 - String Operations](#)

[Lecture 34 - 2-D Array Operation](#)

[Lecture 35 - Introducing Functions](#)

[Lecture 36 - More on Functions](#)

[Lecture 37 - Function \(Continued...\)](#)

[Lecture 38 - Scanf and Printf Functions; Function Prototype](#)

[Lecture 39 - Parameter Passing in Function Revision](#)

[Lecture 40 - Parameter Passing in Function Revision \(Continued...\)](#)

[Lecture 41 - Substitution of # include and Macro](#)

[Lecture 42 - search as a function](#)

[Lecture 43 - Binary Search](#)

[Lecture 44 - Binary Search \(Continued...\)](#)

[Lecture 45 - Sorting Methods](#)

[Lecture 46 - Bubble Sort \(Continued...\)](#)

[Lecture 47 - Use of Pointer in Function : Context Bubble Sort](#)

[Lecture 48 - Arrays at Strings](#)

[Lecture 49 - Data Representation](#)

[Lecture 50 - Bisection Method](#)

[Lecture 51 - Interpolation](#)

[Lecture 52 - Trapezoidal Rule and Runge-Kutta Method](#)

[Lecture 53 - Recursion](#)

[Lecture 54 - Recursion \(Continued...\)](#)

[Lecture 55 - Structure](#)

[Lecture 56 - Structure \(Continued...\)](#)

[Lecture 57 - Structure with typedef](#)

[Lecture 58 - Pointer](#)

[Lecture 59 - Pointer \(Continued...\)](#)

[Lecture 60 - Pointer in Structures](#)

[Lecture 61 - Dynamic Allocation and File](#)

Lecture 1 - Introduction

Lecture 2 - Basics of Task scheduling

Lecture 3 - Cyclic executives

Lecture 4 - Cyclic Scheduler

Lecture 5 - Cyclic Scheduler

Lecture 6 - Exercises on Frame size Selection

Lecture 7 - Event-driven schedulers

Lecture 8 - Rate Monotonic Algorithm

Lecture 9 - RMA Task Schedulability

Lecture 10 - Rate Monotonic Analysis

Lecture 11 - RMA Generalizations

Lecture 12 - Further RMA Generalizations

Lecture 13 - Resource Sharing among Real-Time Tasks

Lecture 14 - Solution to Priority Inversion Problem

Lecture 15 - Highest Locker Protocol

Lecture 16 - Priority Ceiling Protocol

Lecture 17 - PCP Priority Inversions

Lecture 18 - Analysis of PCP priority inversions

Lecture 19 - Some basic issues in Real-Time Operating Systems

Lecture 20 - Unix as a Real-Time operating System

Lecture 1 - Introduction to soft computing

Lecture 2 - Introduction to Fuzzy Logic

Lecture 3 - Fuzzy membership functions (Continued...) and Defining Membership functions

Lecture 4 - Fuzzy operations

Lecture 5 - Fuzzy relations

Lecture 6 - Fuzzy Relations (Continued...) and Fuzzy propositions

Lecture 7 - Fuzzy implications

Lecture 8 - Fuzzy Inferences

Lecture 9 - Defuzzification techniques (Part-I)

Lecture 10 - Defuzzification Techniques (Part-I) (Continued...)

Lecture 11 - Fuzzy logic controller

Lecture 12 - Fuzzy Logic Controller (Continued...)

Lecture 13 - Fuzzy logic controller (Continued...)

Lecture 14 - Concept of Genetic Algorithm

Lecture 15 - Concept of Genetic Algorithm (Continued...) and GA Strategies

Lecture 16 - GA Operator : Encoding schemes

Lecture 17 - GA operator : encoding scheme (Continued...)

Lecture 18 - GA Operator : Selection

Lecture 19 - GA Operator : Selection (Continued...)

Lecture 20 - GA Operator : Crossover techniques

Lecture 21 - GA Operator : Crossover (Continued...)

Lecture 22 - GA Operator : Crossover (Continued...)

Lecture 23 - GA Operator : Mutation and others

Lecture 24 - Multi-objective optimization problem solving

Lecture 25 - Multi-objective optimization problem solving (Continued...)

Lecture 26 - Concept of domination

Lecture 27 - Non-Pareto based approaches to solve MOOPs

Lecture 28 - Non-Pareto based approaches to solve MOOPs (Continued...)

Lecture 29 - Pareto-Based approaches to solve MOOPs

Lecture 30 - Pareto-based approaches to solve MOOPs (Continued...)

Lecture 31 - Pareto-based approach to solve MOOPs

[Lecture 32 - Pareto-based approach to solve MOOPs \(Continued...\)](#)

[Lecture 33 - Pareto-based approach to solve MOOPs \(Continued...\)](#)

[Lecture 34 - Introduction to Artificial Neural Network](#)

[Lecture 35 - ANN Architectures](#)

[Lecture 36 - Training ANNs](#)

[Lecture 37 - Training ANNs \(Continued....\)](#)

[Lecture 38 - Training ANNs \(Continued....\)](#)

[Lecture 39 - Training ANNs \(Continued....\)](#)

[Lecture 40 - Soft computing tools](#)

Lecture 1 - Introduction, Knowledge Discovery Process

Lecture 2 - Data Preprocessing - I

Lecture 3 - Data Preprocessing - II

Lecture 4 - Association Rules

Lecture 5 - Apriori algorithm

Lecture 6 - Rule generation

Lecture 7 - Classification

Lecture 8 - Decision Tree - I

Lecture 9 - Decision Tree - II

Lecture 10 - Decision Tree - III

Lecture 11 - Decision Tree - IV

Lecture 12 - Bayes Classifier - I

Lecture 13 - Bayes Classifier - II

Lecture 14 - Bayes Classifier - III

Lecture 15 - Bayes Classifier - IV

Lecture 16 - Bayes Classifier - V

Lecture 17 - K Nearest Neighbor - I

Lecture 18 - K Nearest Neighbor - II

Lecture 19

Lecture 20

Lecture 21

Lecture 22 - Support Vector Machine - I

Lecture 23 - Support Vector Machine - II

Lecture 24 - Support Vector Machine - III

Lecture 25 - Support Vector Machine - IV

Lecture 26 - Support Vector Machine - V

Lecture 27 - Kernel Machines

Lecture 28 - Artificial Neural Networks - I

Lecture 29 - Artificial Neural Networks - II

Lecture 30 - Artificial Neural Networks - III

Lecture 31 - Artificial Neural Networks - IV

[Lecture 32 - Clustering - I](#)

[Lecture 33 - Clustering - II](#)

[Lecture 34 - Clustering - III](#)

[Lecture 35 - Clustering - IV](#)

[Lecture 36 - Clustering - V](#)

[Lecture 37 - Regression - I](#)

[Lecture 38 - Regression - II](#)

[Lecture 39 - Regression - III](#)

[Lecture 40 - Regression - IV](#)

[Lecture 41 - Dimensionality Reduction - I](#)

[Lecture 42 - Dimensionality Reduction - II](#)

[Lecture 43 - Tutorial](#)

[Lecture 44 - Live Session](#)

Lecture 1 - Course Overview

Lecture 2 - Introduction to DBMS/1

Lecture 3 - Introduction to DBMS/2

Lecture 4 - Introduction to Relational Model/1

Lecture 5 - Introduction to Relational Model/2

Lecture 6 - Introduction to SQL/1

Lecture 7 - Introduction to SQL/2

Lecture 8 - Introduction to SQL/3

Lecture 9 - Intermediate SQL/1

Lecture 10 - Intermediate SQL/2

Lecture 11 - Advanced SQL

Lecture 12 - Formal Relational Query Languages

Lecture 13 - Entity-Relationship Model/1

Lecture 14 - Entity-Relationship Model/2

Lecture 15 - Entity-Relationship Model/3

Lecture 16 - Relational Database Design

Lecture 17 - Relational Database Design (Continued...)

Lecture 18 - Relational Database Design/3

Lecture 19 - Relational Database Design (Continued...)

Lecture 20 - Relational Database Design/5

Lecture 21 - Application Design and Development/1

Lecture 22 - Application Design and Development/2

Lecture 23 - Application Design and Development/3

Lecture 24 - Storage and File Structure/1: Storage

Lecture 25 - Storage and File Structure/2: File Structure

Lecture 26 - Indexing and Hashing/1 : Indexing/1

Lecture 27 - Indexing and Hashing/2 : Indexing/2

Lecture 28 - Indexing and Hashing/3 : Indexing/3

Lecture 29 - Indexing and Hashing/4 : Hashing

Lecture 30 - Indexing and Hashing/5 : Index Design

Lecture 31 - Transactions/1

[Lecture 32 - Transactions/2 : Serializability](#)

[Lecture 33 - Transactions/3 : Recoverability](#)

[Lecture 34 - Concurrency Control/1](#)

[Lecture 35 - Concurrency Control/2](#)

[Lecture 36 - Recovery/1](#)

[Lecture 37 - Recovery/2](#)

[Lecture 38 - Query Processing and Optimization/1 : Processing](#)

[Lecture 39 - Query Processing and Optimization/2 : Optimization](#)

[Lecture 40 - Course Summarization](#)

[Lecture 41 - Live Session](#)

[Lecture 42 - Live Session - 2](#)

Lecture 1 - Introduction - I

Lecture 2 - Introduction - II

Lecture 3 - Introduction - III

Lecture 4 - Introduction - IV

Lecture 5 - Introduction - V

Lecture 6 - Life Cycle Model

Lecture 7 - Life Cycle Model

Lecture 8 - Waterfall Model

Lecture 9 - Waterfall Derivatives

Lecture 10 - Incremental Model

Lecture 11 - Evolutionary Model

Lecture 12 - Agile Model

Lecture 13 - Extreme Programming and Scrum

Lecture 14 - Scrum

Lecture 15 - Introduction to requirement specification

Lecture 16 - Requirement gathering and analysis

Lecture 17 - Functional requirements

Lecture 18 - Representation of complex programming logic

Lecture 19 - Design Fundamentals

Lecture 20 - Modular Design

Lecture 21 - Classification of Cohesion

Lecture 22 - Classification of Coupling

Lecture 23 - Introduction to structured analysis and structured design

Lecture 24 - Basics of Data Flow Diagrams (DFD)

Lecture 25 - Developing DFD Model

Lecture 26 - Examples of DFD Model development

Lecture 27 - DFD Model - More Examples

Lecture 28 - Essentials of Structure Chart

Lecture 29 - Transform Analysis, Transaction Analysis

Lecture 30 - Structured Design Examples

Lecture 31 - Use Case Modelling

- Lecture 32 - Factoring Use Cases
- Lecture 33 - Overview of Class diagram
- Lecture 34 - Inheritance relationship
- Lecture 35 - Association relationship
- Lecture 36 - Aggregation/ Composition and dependency relations
- Lecture 37 - Interaction Modelling
- Lecture 38 - Development of Sequence diagrams
- Lecture 39 - State-Machine diagram
- Lecture 40 - An Object-Oriented design process
- Lecture 41 - Domain Analysis
- Lecture 42 - Examples of object-oriented design
- Lecture 43 - Basic concepts in Testing - I
- Lecture 44 - Basic concepts in Testing - II
- Lecture 45 - Basic concepts in Testing - III
- Lecture 46 - Unit testing strategies - I
- Lecture 47 - Unit testing strategies - II
- Lecture 48 - Equivalence Class Testing - I
- Lecture 49 - Equivalence Class Testing - II
- Lecture 50 - Special Value Testing
- Lecture 51 - Combinatorial Testing
- Lecture 52 - Decision Table Testing
- Lecture 53 - Cause effect graphing
- Lecture 54 - Pairwise Testing
- Lecture 55 - White box Testing
- Lecture 56 - Condition Testing
- Lecture 57 - MC/DC Coverage
- Lecture 58 - MC/DC Testing
- Lecture 59 - Path Testing
- Lecture 60 - Dataflow and Mutation Testing

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Computer Networks and Internet Protocol (Computer Science and Engineering)

Co-ordinators : Prof. Sandip Chakraborty, Prof. Soumya Kanti Ghosh

- Lecture 1 - Introduction to Computer Networks - A brief history
- Lecture 2 - Data Networks - from Circuit Switching Network to Packet Switching Network
- Lecture 3 - Network Protocol Stack
- Lecture 4 - Services at the Different Layers of the Protocol Stack
- Lecture 5 - Application Layer I - Different Protocols at the Application Layer
- Lecture 6 - Application Layer II - Domain Name Systems
- Lecture 7 - Application Layer III - The Web
- Lecture 8 - Application Layer III - Hypertext Transfer Protocol
- Lecture 9 - Application Layer III - Internet Mail Transfer
- Lecture 10 - Application Layer IV - File Transfer (FTP)
- Lecture 11 - Transport Layer I - Services
- Lecture 12 - Transport Layer II - Connection
- Lecture 13 - Transport Layer II - Connection (Continued...)
- Lecture 14 - Transport Layer IV - Reliability
- Lecture 15 - Transport Layer V - Sliding Window Protocols
- Lecture 16 - Transport Layer Performance
- Lecture 17 - Buffer Management and Congestion Control
- Lecture 18 - Transport Layer Primitives
- Lecture 19 - Transmission Control Protocol I - Basics
- Lecture 20 - Transmission Control Protocol II - Connections
- Lecture 21 - Transmission Control Protocol III - Flow Control
- Lecture 22 - Transmission Control Protocol IV - Congestion Control
- Lecture 23 - User Datagram Protocol
- Lecture 24 - Socket Programming - I
- Lecture 25 - Socket Programming - II
- Lecture 26 - Network Layer I - Introduction
- Lecture 27 - IP Addressing (IPv4) I - Classful addressing
- Lecture 28 - IP Addressing (IPv4) II - CIDR
- Lecture 29 - IP Addressing (IPv4) III - Network Address Translation (NAT)
- Lecture 30 - IPv6 Addressing
- Lecture 31 - Internet QoS - I (What is QoS)

- [Lecture 32 - Internet QoS - II \(Basic QoS Architecture\)](#)
- [Lecture 33 - Internet QoS - III \(Traffic Policing and Traffic Shaping\)](#)
- [Lecture 34 - Internet QoS - IV \(Traffic Scheduling\)](#)
- [Lecture 35 - Internet QoS - V \(Integrated and Differentiated Service Architecture\)](#)
- [Lecture 36 - IP Routing Table](#)
- [Lecture 37 - Routing in the Internet I - Intra-domain routing](#)
- [Lecture 38 - Routing in the Internet II - Routing protocols](#)
- [Lecture 39 - Routing in the Internet III - Inter-domain Routing](#)
- [Lecture 40 - Routing in the Internet IV - Border Gateway Protocol](#)
- [Lecture 41 - IP Routers](#)
- [Lecture 42 - IP Routers Demo](#)
- [Lecture 43 - Software Defined Networking - I \(Basics\)](#)
- [Lecture 44 - Software Defined Networking - II \(Open Flow\)](#)
- [Lecture 45 - Software Defined Networking - III \(Demo\)](#)
- [Lecture 46 - Data Link Layer - Overview](#)
- [Lecture 47 - Data Link Layer - Basic Concepts](#)
- [Lecture 48 - Data Link Layer - Ethernet](#)
- [Lecture 49 - Data Link Layer - Ethernet \(Continued...\)](#)
- [Lecture 50 - Data Link Layer - Flow and Error Control](#)
- [Lecture 51 - ARP-RAPP-BOOTP-DHCP](#)
- [Lecture 52 - ARP-RAPP-BOOTP-DHCP \(Continued...\)](#)
- [Lecture 53](#)
- [Lecture 54 - Wireless LANs](#)
- [Lecture 55 - Layer 1: Physical Layer](#)
- [Lecture 56 - Layer 1: Physical Layer - II](#)
- [Lecture 57 - Layer 1: Physical Layer - III](#)
- [Lecture 58 - Network Security - Overview](#)
- [Lecture 59 - Network Security - II](#)
- [Lecture 60 - Network Security - III \[TCP/IP Security\]](#)

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NPTEL : NOC:Blockchain Architecture Design and Use Cases (Computer Science and Engineering)

Co-ordinators : Praveen Jayachandran, Prof. Sandip Chakraborty

- Lecture 1 - Introduction to Blockchain - I (Basics)
- Lecture 2 - Introduction to Blockchain - II (History)
- Lecture 3 - Introduction to Blockchain - III (Architecture)
- Lecture 4 - Introduction to Blockchain - IV (Conceptualization)
- Lecture 5 - Basic Crypto Primitives - I
- Lecture 6 - Basic Crypto Primitives - II
- Lecture 7 - Bitcoin Basics - I
- Lecture 8 - Bitcoin Basics - II
- Lecture 9 - Bitcoin Basics - III
- Lecture 10 - Distributed Consensus
- Lecture 11 - Consensus in Bitcoin - I (The Basics)
- Lecture 12 - Consensus in Bitcoin - II (PoW and Beyond)
- Lecture 13 - Consensus in Bitcoin - III (The Miners)
- Lecture 14 - Permissioned Blockchain - I (Basics)
- Lecture 15 - Permissioned Blockchain - II (Consensus)
- Lecture 16 - Permissioned Blockchain - III (RAFT Consensus)
- Lecture 17 - Permissioned Blockchain - IV (Byzantine General Problem)
- Lecture 18 - Permissioned Blockchain - V (Practical Byzantine Fault Tolerance)
- Lecture 19 - Blockchain for Enterprise - Overview
- Lecture 20 - Blockchain Components and Concepts
- Lecture 21 - Hyperledger Fabric - Transaction Flow
- Lecture 22 - Hyperledger Fabric Details
- Lecture 23 - Fabric - Membership and Identity Management
- Lecture 24 - Hyperledger Fabric Network Setup
- Lecture 25 - Fabric Demo on IBM Blockchain Cloud - I
- Lecture 26 - Fabric Demo on IBM Blockchain Cloud - II
- Lecture 27 - Fabric Demo, deploy from scratch - III
- Lecture 28 - Hyperledger Composer - Application Development
- Lecture 29 - Hyperledger Composer - Network Administration
- Lecture 30 - Blockchain Use Cases
- Lecture 31 - Blockchain in Financial Service - I (Payments and Secure Trading)

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- Lecture 32 - Blockchain in Financial Service - II (Compliance and Mortgage)
- Lecture 33 - Blockchain in Financial Service - III (Financial Trade)
- Lecture 34 - Revolutionizing Global Trade
- Lecture 35 - Blockchain in Supply Chain - I
- Lecture 36 - Blockchain in Supply Chain - II
- Lecture 37 - Blockchain in Other Industries
- Lecture 38 - Blockchain in Government - I (Advantages)
- Lecture 39 - Blockchain in Government - II (Use Cases)
- Lecture 40 - Blockchain in Government - III (Digital Identity)
- Lecture 41 - Blockchain in Government - IV (Hyperledger Indy)
- Lecture 42 - Blockchain in Government - V (Tax Payments and Land Registry Records)
- Lecture 43 - Blockchain Security - I (Overview)
- Lecture 44 - Blockchain Security - II (Membership and Access control in Fabric)
- Lecture 45 - Blockchain Security - III (Privacy in Fabric)
- Lecture 46 - Blockchain Security - III (Fabric SideDB)
- Lecture 47 - Research Aspects - I (Consensus Scalability)
- Lecture 48 - Research Aspects - II (Bitcoin-NG)
- Lecture 49 - Research Aspects - III (Collective Signing)
- Lecture 50 - Research Aspects - IV (Byzcoin)
- Lecture 51 - Research Aspects - V (Algorand)
- Lecture 52 - Research Aspects - VI (Cross Fault Tolerance)
- Lecture 53 - Research Aspects - VII (Secured Multi-Party Computation)
- Lecture 54 - Blockchain for Science - I (Blockchain for Big Data)
- Lecture 55 - Blockchain for Science - II (Blockchain and AI)
- Lecture 56 - Comparing Ecosystems - Ethereum
- Lecture 57 - Comparing Ecosystems - Ethereum development tools and Quorum
- Lecture 58 - Comparing Ecosystems - Corda Part 1
- Lecture 59 - Comparing Ecosystems - Corda Part 2
- Lecture 60 - Concluding the course

Lecture 1 - Introduction

Lecture 2 - Octal and Hexadecimal Number Systems

Lecture 3 - Signed and Unsigned Binary Number Representation

Lecture 4 - Binary Addition and Subtraction

Lecture 5 - BCD and Gray Code Representations

Lecture 6 - Error Detection and Correction

Lecture 7 - Logic Gates

Lecture 8 - Logic Families to Implement Gates

Lecture 9 - Emerging Technologies - Part I

Lecture 10 - Emerging Technologies - Part II

Lecture 11 - Switching Algebra

Lecture 12 - Algebraic Manipulation

Lecture 13 - Properties of Switching Functions

Lecture 14 - Obtaining Canonical Representations of Functions

Lecture 15 - Functional Completeness

Lecture 16 - Minimization Using Karnaugh Maps - Part I

Lecture 17 - Minimization Using Karnaugh Maps - Part II

Lecture 18 - Minimization Using Karnaugh Maps - Part III

Lecture 19 - Minimization using Tabular Method - Part I

Lecture 20 - Minimization using Tabular Method - Part II

Lecture 21 - Design of Adders - Part I

Lecture 22 - Design of Adders - Part II

Lecture 23 - Design of Adders - Part III

Lecture 24 - Logic Design - Part I

Lecture 25 - Logic Design - Part II

Lecture 26 - Logic Design - Part III

Lecture 27 - Binary Decision Diagrams - Part I

Lecture 28 - Binary Decision Diagrams - Part II

Lecture 29 - Logic Design using AND-EXOR Network

Lecture 30 - Threshold Logic and Threshold Gates

Lecture 31 - Latches and Flip-Flops - Part I

- Lecture 32 - Latches and Flip-Flops - Part II
- Lecture 33 - Latches and Flip-Flops - Part III
- Lecture 34 - Clocking and Timing - Part I
- Lecture 35 - Clocking and Timing - Part II
- Lecture 36 - Synthesis of Synchronous Sequential Circuits - Part I
- Lecture 37 - Synthesis of Synchronous Sequential Circuits - Part II
- Lecture 38 - Synthesis of Synchronous Sequential Circuits - Part III
- Lecture 39 - Synthesis of Synchronous Sequential Circuits - Part IV
- Lecture 40 - Minimization of Finite State Machines - Part I
- Lecture 41 - Minimization of Finite State Machines - Part II
- Lecture 42 - Design of Registers - Part I
- Lecture 43 - Design of Registers - Part II
- Lecture 44 - Design of Registers - Part III
- Lecture 45 - Design of Counters - Part I
- Lecture 46 - Design of Counters - Part II
- Lecture 47 - Digital-to-Analog Converter - Part I
- Lecture 48 - Digital-to-Analog Converter - Part II
- Lecture 49 - Analog-to-Digital Converter - Part I
- Lecture 50 - Analog-to-Digital Converter - Part II
- Lecture 51 - Analog-to-Digital Converter - Part III
- Lecture 52 - Asynchronous Sequential Circuits - Part I
- Lecture 53 - Asynchronous Sequential Circuits - Part II
- Lecture 54 - Algorithmic State Machine (ASM Chart
- Lecture 55 - Testing of Digital Circuits
- Lecture 56 - Fault Modeling
- Lecture 57 - Test Pattern Generation
- Lecture 58 - Design for Testability
- Lecture 59 - Built-in Self-Test - Part I
- Lecture 60 - Built-in Self-Test - Part II

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NPTEL : NOC:Scalable Data Science (Computer Science and Engineering)

Co-ordinators : Prof. Sourangshu Bhattacharya, Prof. Anirban Dasgupta

Lecture 1 - Background: Introduction

Lecture 2 - Probability: Concentration inequalities

Lecture 3 - Linear algebra: PCA, SVD

Lecture 4 - Optimization: Basics, Convex, GD

Lecture 5 - Machine Learning: Supervised, generalization, feature learning, clustering.

Lecture 6 - Memory-efficient data structures: Hash functions, universal / perfect hash families

Lecture 7 - Bloom filters

Lecture 8 - Sketches for distinct count

Lecture 9 - Sketches for distinct count (Continued...)

Lecture 10 - Misra-Gries sketch

Lecture 11 - Frequent Element: Space Saving and Count Min

Lecture 12 - Frequent Element: Count Sketch

Lecture 13 - Near Neighbors

Lecture 14 - Locality Sensitive Hashing

Lecture 15 - Building LSH Tables

Lecture 16 - Approximate near neighbors search: Extensions e.g. multi-probe, b-bit hashing, Data dependent variants

Lecture 17 - Approximate near neighbors search: Extensions e.g. multi-probe, b-bit hashing, Data dependent variants (Continued...)

Lecture 18 - Approximate near neighbors search: Extensions e.g. multi-probe, b-bit hashing, Data dependent variants (Continued...)

Lecture 19 - Randomized Numerical Linear Algebra: Random projection

Lecture 20 - Randomized Numerical Linear Algebra: Random projection (Continued...)

Lecture 21 - Randomized Numerical Linear Algebra: a) Matrix multiplication + QB decomposition

Lecture 22 - Randomized Numerical Linear Algebra: b) CUR+CX

Lecture 23 - Randomized Numerical Linear Algebra: a) L2 regression using RP

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Co-ordinators : Prof. Soumya Kanti Ghosh

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NPTEL : NOC:Machine Learning for Earth System Sciences (Computer Science and Engineering)

Co-ordinators : Prof. Adway Mitra

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Co-ordinators : Prof. Kamala Krithivasan

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Co-ordinators : Prof. Hema A Murthy, Prof. Shankar Balachandran, Dr. N.S. Narayanaswamy

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NPTEL : NOC:Programming, Data Structures and Algorithms (Aricent) (Computer Science and Engineering)

Co-ordinators : Dr. N S. Narayanaswamy, Prof. Shankar Balachandran, Prof. Hema A Murthy

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NPTEL : Virtual Reality ()

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DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Introduction to Machine Learning (Sponsored by Arihant) (Computer Science and Engineering)

Co-ordinators : Dr. Balaraman Ravindran

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Lecture 2 - Tutorial 1 - Probability Basics 2

Lecture 3 - Tutorial 2 - Linear algebra - 1

Lecture 4 - Tutorial 2 - Linear algebra - 2

Lecture 5 - Introduction to RL

Lecture 6 - RL Framework and applications

Lecture 7 - Introduction to Immediate RL

Lecture 8 - Bandit Optimalities

Lecture 9 - Value function based methods

Lecture 10 - UCB 1

Lecture 11 - Concentration Bounds

Lecture 12 - UCB 1 Theorem

Lecture 13 - PAC Bounds

Lecture 14 - Median Elimination

Lecture 15 - Thompson Sampling

Lecture 16 - Policy Search

Lecture 17 - REINFORCE

Lecture 18 - Contextual Bandits

Lecture 19 - Full RL Introduction

Lecture 20 - Returns, Value Functions and MDPs

Lecture 21 - MDP Modelling

Lecture 22 - Bellman Equation

Lecture 23 - Bellman Optimality Equation

Lecture 24 - Cauchy Sequence and Green's Equation

Lecture 25 - Banach Fixed Point Theorem

Lecture 26 - Convergence Proof

Lecture 27 - L_p Convergence

Lecture 28 - Value Iteration

Lecture 29 - Policy Iteration

Lecture 30 - Dynamic Programming

Lecture 31 - Monte Carlo

Lecture 32 - Control in Monte Carlo

Lecture 33 - Off Policy MC

Lecture 34 - UCT

Lecture 35 - TD(0)

Lecture 36 - TD(0) Control

Lecture 37 - Q-Learning

Lecture 38 - Afterstate

Lecture 39 - Eligibility Traces

Lecture 40 - Backward View of Eligibility Traces

Lecture 41 - Eligibility Trace Control

Lecture 42 - Thompson Sampling Recap

Lecture 43 - Function Approximation

Lecture 44 - Linear Parameterization

Lecture 45 - State Aggregation Methods

Lecture 46 - Function Approximation and Eligibility Traces

Lecture 47 - LSTD and LSTDQ

Lecture 48 - LSPI and Fitted Q

Lecture 49 - DQN and Fitted Q-Iteration

Lecture 50 - Policy Gradient Approach

Lecture 51 - Actor Critic and REINFORCE

Lecture 52 - REINFORCE (cont'd)

Lecture 53 - Policy Gradient with Function Approximation

Lecture 54 - Hierarchical Reinforcement Learning

Lecture 55 - Types of Optimality

Lecture 56 - Semi Markov Decision Processes

Lecture 57 - Options

Lecture 58 - Learning with Options

Lecture 59 - Hierarchical Abstract Machines

Lecture 60 - MAXQ

Lecture 61 - MAXQ Value Function Decomposition

Lecture 62 - Option Discovery

Lecture 63 - POMDP Introduction

Lecture 64 - Solving POMDP

Lecture 1 - Intro to the Course

Lecture 2 - Introduction to OS

Lecture 3 - PC Hardware

Lecture 4 - From Programs to Processes

Lecture 5 - Sharing the CPU

Lecture 6 - Introduction

Lecture 7 - Virtual Memory

Lecture 8 - MMU Mapping

Lecture 9 - Segmentation

Lecture 10 - Memory Management in xv6

Lecture 11 - PC Booting

Lecture 12 - Week 3 Introduction

Lecture 13 - Create Execute and Exit from Processes

Lecture 14 - System Calls for Process Management

Lecture 15 - Interrupts

Lecture 16 - Interrupt Handling

Lecture 17 - Software Interrupts and System calls

Lecture 18 - CPU Context switching

Lecture 19 - CPU Scheduling

Lecture 20 - Priority Based Scheduling Algorithms

Lecture 21 - Multi-Processor Scheduling

Lecture 22 - Scheduling in Linux

Lecture 23 - Completely Fair Scheduling

Lecture 24 - Inter Process Communication

Lecture 25 - Synchronization

Lecture 26 - Software solutions for critical sections

Lecture 27 - Bakery Algorithm

Lecture 28 - Hardware Locks

Lecture 29 - Mutexes

Lecture 30 - Semaphores

Lecture 31 - Dining Philosophers Problem

[Lecture 32 - Deadlocks](#)

[Lecture 33 - Dealing with Deadlocks](#)

[Lecture 34 - Threads - Part 1](#)

[Lecture 35 - Threads - Part 2](#)

[Lecture 36 - Operating system security](#)

[Lecture 37 - Information Flow policies](#)

[Lecture 38 - Buffer Overflows](#)

[Lecture 39 - Preventing Buffer Overflow Attacks](#)

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Programming, Data Structures and Algorithms in Python (Computer Science and Engineering)

Co-ordinators : Prof. Madhavan Mukund

Lecture 1 - Lecture 1 - Algorithms and programming: simple gcd

Lecture 2 - Lecture 2 - Improving naive gcd

Lecture 3 - Lecture 3 - Euclid's algorithm for gcd

Lecture 4 - Lecture 4 - Downloading and installing Python

Lecture 5 - Lecture 1 - Assignment statement, basic types - int, float, bool

Lecture 6 - Lecture 2 - Strings

Lecture 7 - Lecture 3 - Lists

Lecture 8 - Lecture 4 - Control Flow

Lecture 9 - Lecture 5 - Functions

Lecture 10 - Lecture 6 - Examples

Lecture 11 - Lecture 1 - More about range()

Lecture 12 - Lecture 2 - Manipulating lists

Lecture 13 - Lecture 3 - Breaking out of a loop

Lecture 14 - Lecture 4 - Arrays vs lists, binary search

Lecture 15 - Lecture 5 - Efficiency

Lecture 16 - Lecture 6 - Selection Sort

Lecture 17 - Lecture 7 - Insertion Sort

Lecture 18 - Lecture 8 - Recursion

Lecture 19 - Lecture 1 - Mergesort

Lecture 20 - Lecture 2 - Mergesort, analysis

Lecture 21 - Lecture 3 - Quicksort

Lecture 22 - Lecture 4 - Quicksort analysis

Lecture 23 - Lecture 5 - Tuples and dictionaries

Lecture 24 - Lecture 6 - Function definitions

Lecture 25 - Lecture 7 - List Comprehension

Lecture 26 - Lecture 1 - Exception Handling

Lecture 27 - Lecture 2 - Standard input and output

Lecture 28 - Lecture 3 - Handling files

Lecture 29 - Lecture 4 - String functions

Lecture 30 - Lecture 5 - Formatting printed output

Lecture 31 - Lecture 6 - pass, del() and None

[Lecture 32 - Lecture 1 - Backtracking, N queens](#)

[Lecture 33 - Lecture 2 - Global scope, nested functions](#)

[Lecture 34 - Lecture 3 - Generating permutations](#)

[Lecture 35 - Lecture 4 - Sets, stacks, queues](#)

[Lecture 36 - Lecture 5 - Priority queues and heaps](#)

[Lecture 37 - Lecture 1 - Abstract datatypes, classes and objects](#)

[Lecture 38 - Lecture 2 - Classes and objects in Python](#)

[Lecture 39 - Lecture 3 - User defined lists](#)

[Lecture 40 - Lecture 4 - Search trees](#)

[Lecture 41 - Lecture 1 - Memoization and dynamic programming](#)

[Lecture 42 - Lecture 2 - Grid paths](#)

[Lecture 43 - Lecture 3 - Longest common subsequence](#)

[Lecture 44 - Lecture 4 - Matrix multiplication](#)

[Lecture 45 - Lecture 5 - Wrap-up, Python vs other languages](#)

Lecture 1 - Intro to Course

Lecture 2 - Intro to Course

Lecture 3 - Incidents

Lecture 4 - Tutorial 1 - Part 1 Ubuntu

Lecture 5 - Tutorial 1 - Part 2 Python

Lecture 6 - OSM APIs and tools for data collection

Lecture 7 - Tutorial 2 - Part 1 Facebook API

Lecture 8 - Tutorial 2 - Part 2 Facebook API

Lecture 9 - Trust and Credibility on OSM

Lecture 10 - Misinformation on Social Media

Lecture 11 - Privacy and Social Media

Lecture 12 - Tutorial 3 - Part 1 Twitter API

Lecture 13 - Tutorial 3 - Part 2 MySQL

Lecture 14 - Tutorial 3 - Part 3 MongoDB

Lecture 15 - Privacy and Pictures on Online Social Media

Lecture 16 - Policing and Online Social Media

Lecture 17 - Policing and Online Social Media

Lecture 18 - Policing and Online Social Media

Lecture 19 - eCrime on Online Social Media

Lecture 20 - eCrime on Online Social Media

Lecture 21 - Tutorial 4 - Social Network Analysis

Lecture 22 - Link Farming in Online Social Media

Lecture 23 - Nudges

Lecture 24 - Semantic attacks: Spear phishing

Lecture 25 - Tutorial 5 - Analyzing text using Python NLTK

Lecture 26 - Profile Linking on Online Social Media

Lecture 27 - Anonymous Networks

Lecture 28 - Tutorial 6 - Gephi Network Visualization

Lecture 29 - Privacy in Location Based Social Networks - Part 1

Lecture 30 - Privacy in Location Based Social Networks - Part 2

Lecture 31 - Tutorial 7 - Visualization - Highcharts

[Lecture 32 - Beware of What You Share Inferring Home Location in Social Networks](#)

[Lecture 33 - On the dynamics of username change behavior on Twitter](#)

[Lecture 34 - Boston Marathon Analyzing Fake Content on Twitter](#)

Lecture 1 - Java Basics

Lecture 2 - Java : Primitive Data Types, Strings, Loops, Conditional Statements

Lecture 3 - Java : Strings, OOP principles

Lecture 4 - Java : Interfaces

Lecture 5 - Java : Classes, Exceptions, Threads

Lecture 6 - Introduction to Android Studio

Lecture 7 - Your First App

Lecture 8 - Deploying your App to a Phone

Lecture 9 - Extending app - Buttons, Toast

Lecture 10 - Android Development Environment

Lecture 11 - User Interface

Lecture 12 - Application Fundamentals

Lecture 13 - Extending the application

Lecture 14 - Activity Lifecycle - I

Lecture 15 - Activity Lifecycle - II

Lecture 16 - Activity LifeCycle - III

Lecture 17 - Adding Icon, Layouts, Handling Rotation - I

Lecture 18 - Adding Icon, Layouts, Handling Rotation - II

Lecture 19 - Debugging

Lecture 20 - Intents - I

Lecture 21 - Intents - II

Lecture 22 - Observer Pattern

Lecture 23 - Fragments - I

Lecture 24 - Fragments - II

Lecture 25 - Fragment Basic Programming Example

Lecture 26 - Fragments - Advanced Example

Lecture 27 - Implicit Intents

Lecture 28 - Saving Data - I

Lecture 29 - Saving Data - II

Lecture 30 - Security and System Permissions

Lecture 31 - Services

[Lecture 32 - Processes and threads](#)

[Lecture 33 - Working with Fragments - I](#)

[Lecture 34 - Working with Fragments - II](#)

[Lecture 35 - Working with Fragments - III](#)

[Lecture 36 - RecyclerView, Adapter](#)

[Lecture 37 - RecyclerView, Adapter, ViewHolder](#)

[Lecture 38 - ViewPager](#)

[Lecture 39 - Dialogues](#)

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Introduction to Modern Application Development (Computer Science and Engineering)

Co-ordinators : Tanmai Gopal, Prof. Gaurav Raina

Lecture 1 - Introduction to the course

Lecture 2 - Introduction to a web-app

Lecture 3 - Building a web-app

Lecture 4 - Networks

Lecture 5 - Practical - Running your own web-server

Lecture 6 - Protocols

Lecture 7 - Practical - SSH + Network experiments

Lecture 8 - Practical - Building a webapp with nodejs and using git. Introduction to reverse proxies.

Lecture 9 - Practical - Introduction to server-side javascript and HTML/CSS

Lecture 10 - Introduction to client-side Javascript

Lecture 11 - Practical - APIs and mobile apps use web-servers

Lecture 12 - Introduction to databases

Lecture 13 - Data modelling and constraints

Lecture 14 - Interacting with a DBMS

Lecture 15 - Practical - Deeper exploration of a DBMS (column types and more)

Lecture 16 - Introduction to SQL

Lecture 17 - Understanding database performance

Lecture 18 - Transactions and ACID properties

Lecture 19 - Database security, backup and recovery

Lecture 20 - Analytics and Views

Lecture 21 - Scaling a database

Lecture 22 - Connecting your webapp to your database and SQL Injection

Lecture 23 - SQL and NoSQL systems

Lecture 24 - Authentication with HTTP

Lecture 25 - Understanding security, and some best practices for webapps

Lecture 26 - Introduction to authentication, hashing, curl and sessions

Lecture 27 - Introduction to mobile apps

Lecture 28 - Introduction to Mobile Application Development Part 2

Lecture 29 - Introduction to Android

Lecture 30 - Getting started with Android Application Development

Lecture 31 - Building Custom UI using XML and Logs

[Lecture 32 - Building a Blog App](#)

[Lecture 33 - Deploying an app to the Google Play Store](#)

[Lecture 34 - Introduction to iOS](#)

[Lecture 35 - The API Economy](#)

[Lecture 36 - Version Control using Git](#)

[Lecture 37 - Backend Architectures](#)

Lecture 1 - Operating System Introduction

Lecture 2 - Storage Hierarchy, Exceptions, Interrupts and traps

Lecture 3 - OS Management Services

Lecture 4 - OS Security Issues

Lecture 5 - Process and Threads

Lecture 6 - Process Scheduling

Lecture 7 - Scheduling Algorithm

Lecture 8 - Process Synchronization

Lecture 9 - Memory Management - 1

Lecture 10 - Memory Management - 2

Lecture 11 - File Systems - 1

Lecture 12 - File Systems - 2

Lecture 13 - Unix Filesystem

Lecture 14 - Unix Filesystem (Continued...)

Lecture 15 - Linux: Basic Commands

Lecture 16 - Linux: Basic Commands (Continued...)

Lecture 17 - Linux: Users and Permissions

Lecture 18 - Linux: I/O Redirection and Pipes

Lecture 19 - Linux: Task Control

Lecture 20 - Linux: Shell Environment

Lecture 21 - Linux: Text Editors

Lecture 22 - Linux: Compression / Archiving

Lecture 23 - Linux: Print and Sync Commands

Lecture 24 - Linux: File Comparison

Lecture 25 - Basic Networking Administration

Lecture 26 - Filesystems and Devices

Lecture 27 - Shell Introduction

Lecture 28 - Shell Comments and Variables

Lecture 29 - Shell Variables

Lecture 30 - Shell Arrays and Arithmetic

Lecture 31 - Shell Condition and Relation

[Lecture 32 - Shell Examples](#)

[Lecture 33 - Shell Functions](#)

[Lecture 34 - Shell File Test](#)

[Lecture 35 - Shell Loop Control](#)

[Lecture 36 - Shell Script Variations](#)

[Lecture 37 - Shell Pattern Matching](#)

[Lecture 38 - Shell Case Statements](#)

[Lecture 39 - Shell Co-routines](#)

[Lecture 40 - Shell Signals and Traps](#)

[Lecture 41 - Shell Subshell](#)

[Lecture 42 - Shell Declarations](#)

[Lecture 43 - Shell Examples 2](#)

[Lecture 44 - Shell Review](#)

[Lecture 45 - An Introduction](#)

[Lecture 46 - Structure of a Network](#)

[Lecture 47 - Network Core - Definition](#)

[Lecture 48 - Network Access and Physical Media](#)

[Lecture 49 - Structure of ISP and Packet Delays](#)

[Lecture 50 - Network Protocol Layers](#)

[Lecture 51 - Network Devices](#)

[Lecture 52 - Network Security - An Introduction](#)

[Lecture 53 - Public Key Cryptography](#)

[Lecture 54 - Digital Signatures](#)

[Lecture 55 - Security in Practise](#)

[Lecture 56 - Security in Practise \(Continued...\)](#)

[Lecture 57 - Wireshark](#)

[Lecture 58 - Snort](#)

[Lecture 59 - Review I](#)

[Lecture 60 - Review II](#)

Lecture 1 - Constraint Satisfaction Problems

Lecture 2 - CSP Examples: Map colouring, N-Queens, Classroom scheduling

Lecture 3 - CSP Examples: Huffman-Clowes Labelling, Waltz Algorithm, Crosswords

Lecture 4 - Model Based Diagnosis - An application of CSP

Lecture 5 - Constraint Networks - An Introduction

Lecture 6 - Binary Constraint Networks (BCN), Equivalent Networks

Lecture 7 - Projection Networks

Lecture 8 - Constraint Propagation

Lecture 9 - Algorithms AC1 and AC3

Lecture 10 - Can we do better than AC3?

Lecture 11 - Algorithm AC4

Lecture 12 - Generalized AC, Path-Consistency

Lecture 13 - i-Consistency, Algorithm PC1

Lecture 14 - Algorithm PC2, Strong i-Consistency

Lecture 15 - Directional Consistency and Graph Ordering

Lecture 16 - Min-Width and Min-Induced-Width Ordering

Lecture 17 - Directional Arc-Consistency and Tree CSPs

Lecture 18 - Directional Path-Consistency and Directional i-Consistency

Lecture 19 - Backtrack-Free search and Adaptive Consistency

Lecture 20 - Adaptive Consistency: Bucket Elimination

Lecture 21 - Search Methods for Solving CSPs

Lecture 22 - Algorithm Backtracking

Lecture 23 - Look-Ahead Methods in Search

Lecture 24 - Look-Ahead Search: Examples

Lecture 25 - Combining Search with Reasoning: Algorithm DPLL

Lecture 26 - Algorithm Backmarking

Lecture 27 - Dynamic Value Ordering, Dynamic Variable Ordering

Lecture 28 - Look-Back Methods - Definitions

Lecture 29 - Gaschnig's Backjumping: The Culprit Variable

Lecture 30 - Gaschnig's Backjumping, Graph-Based Backjumping

Lecture 31 - Graph-Based Backjumping: Internal and Relevant Dead-Ends

[Lecture 32 - Conflict-Directed Backjumping: Definitions](#)

[Lecture 33 - Algorithm Conflict-Directed Backjumping](#)

[Lecture 34 - Combining Look-Ahead and Look-Back: FC-CBJ](#)

[Lecture 35 - Learning During Search](#)

[Lecture 36 - Model Based Systems](#)

[Lecture 37 - Model Based Diagnosis](#)

[Lecture 38 - Truth Maintenance Systems](#)

[Lecture 39 - Planning as Constraint Satisfaction](#)

[Lecture 40 - Planning as Constraint Satisfaction \(Continued...\)](#)

[Lecture 41 - Planning as Satisfiability](#)

[Lecture 42 - Wrapping Up and Further Study](#)

Lecture 1 - Introduction High Speed Circuit - Design Recursive Doubling

Lecture 2 - High Speed Circuit Design - Fast Adder Circuits

Lecture 3 - Lab 1 : Introduction

Lecture 4 - Fast Adder Circuits (Continued...)

Lecture 5 - Fast Multiplier Circuit

Lecture 6 - Fast Multiplier Circuit (Continued...)

Lecture 7 - Programming using X86 ISA - Addressing Modes

Lecture 8 - Programming using X86 ISA - Addressing Modes

Lecture 9 - Floating point - Precision and Accuracy

Lecture 10 - Floating Point - Addition, Subtraction and Multiplication

Lecture 11 - Instruction Set Architecture

Lecture 12 - Instruction Set Architecture (Continued...)

Lecture 13 - Lab 2 : Segmentation - Part I

Lecture 14 - Lab 2 : Segmentation - Part II

Lecture 15 - Lab 2 : Segmentation - Part III

Lecture 16 - Orthogonal ISA, C Constructs Mapping, Addressing Modes

Lecture 17 - Atomic and Predicated Instructions

Lecture 18 - Atomic and Predicated Instructions (Continued...)

Lecture 19 - General Purpose Registers

Lecture 20 - Expanding opcodes

Lecture 21 - Introduction to Pipelining

Lecture 22 - Pipelining

Lecture 23 - Data Hazards

Lecture 24 - Lab 2 : Instruction Scheduling - Static and Dynamic

Lecture 25 - Dynamic Instruction Scheduling

Lecture 26 - Dynamic Instruction Scheduling (Continued...)

Lecture 27 - Control Hazard, Branch Prediction

Lecture 28 - Process Management

Lecture 29 - Branch prediction

Lecture 30 - Global Branch Prediction

Lecture 31 - Structural Hazard, Architectural Enhancements

[Lecture 32 - Lab 3 : Virtual Memory](#)

[Lecture 33 - Locality of Reference, Demand paging](#)

[Lecture 34 - Page Replacement Algorithm](#)

[Lecture 35 - Multilevel Paging, Translational Lookaside Buffer](#)

[Lecture 36 - Multilevel Paging](#)

[Lecture 37 - Multilevel Paging - Part 1](#)

[Lecture 38 - Page Frame Allocation, Beledy's Anomaly](#)

[Lecture 39 - Paging, Cache](#)

[Lecture 40 - Cache](#)

[Lecture 41 - Cache Organisation](#)

[Lecture 42 - Cache - Cache Coherency, Dual Ported Cache](#)

[Lecture 43 - Multilevel Caching, Multitasking](#)

[Lecture 44 - Cache, Degree of Multiprogramming](#)

[Lecture 45 - Shared Memory Architecture](#)

[Lecture 46 - Shared Memory Architecture - Part I](#)

[Lecture 47 - Virtually Indexed - Virtually Tagged and Physically Tagged Caches](#)

[Lecture 48 - Lab 4 : Task Switching \(Continued...\)](#)

[Lecture 49 - Shared Memory Architecture, Cache Coherence](#)

[Lecture 50 - Concurrent Programming in Hardware - Part I](#)

[Lecture 51 - Concurrent Programming in Hardware - Part II](#)

[Lecture 52 - Conclusion : Recent Trends in Computer Organization and Architecture](#)

Lecture 1 - Overview of Cellular Systems - Part 1

Lecture 2 - Overview of Cellular Systems - Part 2

Lecture 3 - Overview of Cellular Systems - Part 3

Lecture 4 - 5G and other Wireless Technologies

Lecture 5 - Basic Cellular Terminology

Lecture 6 - Introduction to Antennas and Propagation Models

Lecture 7 - Link budget, Fading margin, Outage

Lecture 8 - Cellular Concept

Lecture 9 - Cellular system design and analysis

Lecture 10 - Cellular Geometry and System Design

Lecture 11 - Cellular System Capacity, Trunking

Lecture 12 - Handoff and Mobility

Lecture 13 - Handoff Part 2, Classification of Signal Variation

Lecture 14 - Shadowing, Outage, Multipath

Lecture 15 - Rayleigh Fading and Statistical Characterization

Lecture 16 - Properties of Rayleigh Distribution

Lecture 17 - BER in Fading, Narrowband vs Wideband Channels

Lecture 18 - Characterization of Multipath Fading Channels

Lecture 19 - Choice of Modulation

Lecture 20 - Coherent versus Differential Detection

Lecture 21 - Review of Lecture 1-19

Lecture 22 - Coherent vs Differential Detection - Part II and BER in Fading

Lecture 23 - BER in Fading - Part II, Ricean Fading

Lecture 24 - Ricean and Nakagami Fading, Moment Generating Function (MGF)

Lecture 25 - MGF Part II, WSSUS Model

Lecture 26 - WSSUS Part II, Coherence Time, Doppler Spectrum

Lecture 27 - Doppler, Temporal Characteristics of Fading Channels

Lecture 28 - WSSUS-Characterization of Time Dispersive Fading Channels

Lecture 29 - WSSUS-Classification of Fading Channels

Lecture 30 - Practical Channel Models (ITU, COST), Computer generation of Rayleigh fading

Lecture 31 - Rayleigh Fading simulation - Clark and Gans Method, Jakes's™ Method

[Lecture 32 - Jakes's™ Method properties](#)

[Lecture 33 - Introduction to Diversity, Antenna selection diversity](#)

[Lecture 34 - Statistical Characterization of Antenna Diversity, Optimal Diversity Combining](#)

[Lecture 35 - BER in fading, Equal Gain Combining](#)

[Lecture 36 - Array Gain, Diversity Gain, Alamouti Scheme](#)

[Lecture 37 - Alamouti Scheme - Part II, Channel Capacity](#)

[Lecture 38 - Capacity of fading Channels, Capacity with Outage](#)

[Lecture 39 - Channel State Information, Optimum Power Allocation](#)

[Lecture 40](#)

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[Lecture 46](#)

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[Lecture 48 - Rake Receiver for multipath channels](#)

[Lecture 49 - Multiuser environment](#)

[Lecture 50 - CDMA system Capacity](#)

[Lecture 51 - CDMA Multiuser Detectors - Part 1](#)

[Lecture 52 - CDMA Multiuser Detectors - Part 2](#)

[Lecture 53](#)

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Lecture 1 - Introduction to Distributed Systems

Lecture 2 - Basic Algorithms in Message Passing System

Lecture 3 - Leader Election in Rings

Lecture 4 - Distributed Models of Computation, Causality and Logical Time

Lecture 5 - Size of Vector Clock, Matrix Clocks, Virtual Time and Physical Clock Synchronization

Lecture 6 - Global State and Snapshot Recording Algorithms

Lecture 7 - Distributed Mutual Exclusion and Non-Token based Approaches

Lecture 8 - Quorum Based Distributed Mutual Exclusion Approaches

Lecture 9 - Token Based Distributed Mutual Exclusion Approaches

Lecture 10 - Consensus and Agreement Algorithms

Lecture 11 - Checkpointing and Rollback Recovery

Lecture 12 - Deadlock Detection in Distributed Systems

Lecture 13 - Distributed Shared Memory

Lecture 14 - Distributed Minimum Spanning Tree

Lecture 15 - Termination Detection in Distributed System

Lecture 16 - Message Ordering and Group Communication

Lecture 17 - Self-Stabilization

Lecture 18 - Case Study 1 - Distributed Randomized Algorithms

Lecture 19 - Case Study 2 - Peer-to-Peer Computing and Structured Overlay Network

Lecture 20 - Case Study 3 - The Google File System (GFS)

Lecture 21 - Case Study 4 - MapReduce

Lecture 22 - Case Study 5 - HDFS

Lecture 23 - Case Study 6 - Spark

Lecture 24 - Case Study 7 - Distributed Algorithms for Sensor Networks

Lecture 25 - Case Study 8 - Authentication in Distributed Systems

Lecture 26 - Case Study 9 - Bitcoin: A Peer-to-Peer Electronic Cash System

Lecture 27 - Case Study 10 - BlockChain Technology

Lecture 1 - Introduction

Lecture 2 - Answer to the puzzle

Lecture 3 - Introduction to Python - 1

Lecture 4 - Introduction to Python - 2

Lecture 5 - Introduction to Networkx - 1

Lecture 6 - Introduction to Networkx - 2

Lecture 7 - Social Networks: The Challenge

Lecture 8 - Google Page Rank

Lecture 9 - Searching in a Network

Lecture 10 - Link Prediction

Lecture 11 - The Contagions

Lecture 12 - Importance of Acquaintances

Lecture 13 - Marketing on Social Networks

Lecture 14 - Introduction to Datasets

Lecture 15 - Ingredients Network

Lecture 16 - Synonymy Network

Lecture 17 - Web Graph

Lecture 18 - Social Network Datasets

Lecture 19 - Datasets : Different Formats

Lecture 20 - Datasets : How to Download?

Lecture 21 - Datasets : Analysing Using Networkx

Lecture 22 - Datasets : Analysing Using Gephi

Lecture 23 - Introduction : Emergence of Connectedness

Lecture 24 - Advanced Material : Emergence of Connectedness

Lecture 25 - Programming Illustration : Emergence of Connectedness

Lecture 26 - Summary to Datasets

Lecture 27 - Introduction

Lecture 28 - Granovetter's Strength of weak ties

Lecture 29 - Triads, clustering coefficient and neighborhood overlap

Lecture 30 - Structure of weak ties, bridges, and local bridges

Lecture 31 - Validation of Granovetter's experiment using cell phone data

[Lecture 32 - Embededness](#)

[Lecture 33 - Structural Holes](#)

[Lecture 34 - Social Capital](#)

[Lecture 35 - Finding Communities in a graph \(Brute Force Method\)](#)

[Lecture 36 - Community Detection Using Girvan Newman Algorithm](#)

[Lecture 37 - Visualising Communities using Gephi](#)

[Lecture 38 - Tie Strength, Social Media and Passive Engagement](#)

[Lecture 39 - Betweenness Measures and Graph Partitioning](#)

[Lecture 40 - Strong and Weak Relationship - Summary](#)

[Lecture 41 - Introduction to Homophily - Should you watch your company ?](#)

[Lecture 42 - Selection and Social Influence](#)

[Lecture 43 - Interplay between Selection and Social Influence](#)

[Lecture 44 - Homophily - Definition and measurement](#)

[Lecture 45 - Foci Closure and Membership Closure](#)

[Lecture 46 - Introduction to Fatman Evolutionary model](#)

[Lecture 47 - Fatman Evolutionary Model - The Base Code \(Adding people\)](#)

[Lecture 48 - Fatman Evolutionary Model - The Base Code \(Adding Social Foci\)](#)

[Lecture 49 - Fatman Evolutionary Model - Implementing Homophily](#)

[Lecture 50 - Quantifying the Effect of Triadic Closure](#)

[Lecture 51 - Fatman Evolutionary Model - Implementing Closures](#)

[Lecture 52 - Fatman Evolutionary Model - Implementing Social Influence](#)

[Lecture 53 - Fatman Evolutionary Model - Storing and analyzing longitudinal data](#)

[Lecture 54 - Spatial Segregation : An Introduction](#)

[Lecture 55 - Spatial Segregation : Simulation of the Schelling Model](#)

[Lecture 56 - Spatial Segregation : Conclusion](#)

[Lecture 57 - Schelling Model Implementation - 1 \(Introduction\)](#)

[Lecture 58 - Schelling Model Implementation - 2 \(Base Code\)](#)

[Lecture 59 - Schelling Model Implementation - 3 \(Visualization and Getting a list of boundary and internal nodes\)](#)

[Lecture 60 - Schelling Model Implementation - 4 \(Getting a list of unsatisfied nodes\)](#)

[Lecture 61 - Schelling Model Implementation - 5 \(Shifting the unsatisfied nodes and visualizing the final graph\)](#)

[Lecture 62 - Chapter - 5 Positive and Negative Relationships \(Introduction\)](#)

[Lecture 63 - Structural Balance](#)

[Lecture 64 - Enemy'S Enemy is a Friend](#)

- Lecture 65 - Characterizing the Structure of Balanced Networks
- Lecture 66 - Balance Theorem
- Lecture 67 - Proof of Balance Theorem
- Lecture 68 - Introduction to positive and negative edges
- Lecture 69 - Outline of implementation
- Lecture 70 - Creating graph, displaying it and counting unstable triangles
- Lecture 71 - Moving a network from an unstable to stable state
- Lecture 72 - Forming two coalitions
- Lecture 73 - Forming two coalitions (Continued...)
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- Lecture 84 - Implementing PageRank Using Random Walk Method - 1
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- Lecture 96 - The Base Code
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- Lecture 106 - PageRank Revisited - Convergence in the Example
- Lecture 107 - PageRank Revisited - Conservation and Convergence
- Lecture 108 - PageRank, conservation and convergence - Another example
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- Lecture 110 - Convergence in Repeated Matrix Multiplication (Pre-requisite 1)
- Lecture 111 - Addition of Two Vectors (Pre-requisite 2)
- Lecture 112 - Convergence in Repeated Matrix Multiplication- The Details
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- Lecture 114 - PageRank Explained
- Lecture 115 - Introduction to Powerlaw
- Lecture 116 - Why do Normal Distributions Appear?
- Lecture 117 - Power Law emerges in WWW graphs
- Lecture 118 - Detecting the Presence of Powerlaw
- Lecture 119 - Rich Get Richer Phenomenon
- Lecture 120 - Summary So Far
- Lecture 121 - Implementing Rich-getting-richer Phenomenon (Barabasi-Albert Model) - 1
- Lecture 122 - Implementing Rich-getting-richer Phenomenon (Barabasi-Albert Model) - 2
- Lecture 123 - Implementing a Random Graph (Erdos-Renyi Model) - 1
- Lecture 124 - Implementing a Random Graph (Erdos-Renyi Model) - 2
- Lecture 125 - Forced Versus Random Removal of Nodes (Attack Survivability)
- Lecture 126 - Rich Get Richer - A Possible Reason
- Lecture 127 - Rich Get Richer - The Long Tail
- Lecture 128 - Epidemics- An Introduction
- Lecture 129 - Introduction to epidemics (Continued...)
- Lecture 130 - Simple Branching Process for Modeling Epidemics

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- [Lecture 158 - Time Taken by Myopic Search](#)
- [Lecture 159 - PseudoCores : Introduction](#)
- [Lecture 160 - How to be Viral](#)
- [Lecture 161 - Who are the right key nodes?](#)
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- [Lecture 163 - Coding K-Shell Decomposition](#)

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[Lecture 165 - Coding the importance of core nodes in cascading](#)

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Lecture 3 - Introduction to Probability - Verifying Matrix Multiplication (Statement, Algorithm and Independence)

Lecture 4 - Introduction to Probability - Verifying Matrix Multiplication (Correctness and Law of Total Probability)

Lecture 5 - Introduction to Probability - How Strong is your Network?

Lecture 6 - Introduction to Probability - How to Understand the World? Play with it!

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Lecture 8 - Tutorial 2

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Lecture 10 - Discrete Random Variables - Linearity of Expectation and Jensen's Inequality

Lecture 11 - Discrete Random Variables - Conditional Expectation I

Lecture 12 - Discrete Random Variables - Conditional Expectation II

Lecture 13 - Discrete Random Variables - Geometric Random Variables and Collecting Coupons

Lecture 14 - Discrete Random Variables - Randomized Selection

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Lecture 16 - Tail Bounds I - The Second Moment, Variance and Chebyshev's Inequality

Lecture 17 - Tail Bounds I - Median via Sampling

Lecture 18 - Tail Bounds I - Median via Sampling - Analysis

Lecture 19 - Tail Bounds I - Moment Generating Functions and Chernoff Bounds

Lecture 20 - Tail Bounds I - Parameter Estimation

Lecture 21 - Tail Bounds I - Control Group Selection

Lecture 22 - Applications of Tail Bounds - Routing in Sparse Networks

Lecture 23 - Applications of Tail Bounds - Analysis of Valiant's Routing

Lecture 24 - Applications of Tail Bounds - Random Graphs

Lecture 25 - Live Session 2

Lecture 26 - Live Session

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Introduction to Human Computer Interaction (Computer Science and Engineering)

Co-ordinators : Prof. Ponnurangam Kumaraguru

Lecture 1 - Introduction to Human Computer Interaction

Lecture 2 - What is HCI? Commonalities and Differences in Interfaces

Lecture 3 - Door handle, Elevators, Contextual Inquiry, Affinity Diagrams

Lecture 4 - Lab Session Contextual Inquiry

Lecture 5 - Lab Session Affinity Diagram

Lecture 6 - Tutorial on Photoshop

Lecture 7 - Tutorial on UI Designing using Photoshop

Lecture 8 - Institutional Review Board, Ethics committee, IRB documents / application, consent form

Lecture 9 - Tutorial on Proto.io

Lecture 10 - Tutorial on Lookback

Lecture 11 - How to understand user needs? Surveys, Questionnaire

Lecture 12 - How to understand user needs? Surveys, Questionnaire - Continues

Lecture 13 - Prototyping: Low fidelity and High fidelity

Lecture 14 - User-Centered Design

Lecture 15 - Lab Session: Task Analysis

Lecture 16 - Design Patterns

Lecture 17 - Lab Session: Material Design

Lecture 18 - Usable security

Lecture 19 - Lab Session: Task Analysis - 2

Lecture 20 - Continuity of Usable Security

Lecture 21 - Visual Design

Lecture 22 - Visual Design - 2

Lecture 23 - Crypto price Tracker App

Lecture 24 - Interacto

Lecture 25 - Tech Hinder

Lecture 26 - busKARO

Lecture 27 - MayMayMe

Lecture 28 - noWhinge

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[Lecture 2 - WISE Gen and The IT Revolution - 1 \(Continued...\)](#)

[Lecture 3 - WISE GEN - Next Step](#)

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[Lecture 5 - Symmetric Key Cryptography and Digital Signatures](#)

[Lecture 6 - Basic Network Security Components](#)

[Lecture 7 - Internet Security Threats](#)

[Lecture 8 - History of Kali Linux](#)

[Lecture 9 - Penetration Testing with Kali Linux](#)

[Lecture 10 - Network Security and Forensics Introduction - I](#)

[Lecture 11 - Network Security and Forensics Introduction - II](#)

[Lecture 12 - Penetration Testing: An Introduction](#)

[Lecture 13 - Penetration testing steps in Kali Linux](#)

[Lecture 14 - Kali Linux Installation](#)

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[Lecture 18 - Serverside Attacks: Tools in Kali Linux \(Continued...\)](#)

[Lecture 19 - Serverside Attacks: Tools in Kali Linux \(Continued...\)](#)

[Lecture 20 - Serverside Attacks: Tools in Kali Linux \(Continued...\)](#)

[Lecture 21 - Serverside Attacks: Tools in Kali Linux \(Continued...\)](#)

[Lecture 22 - Serverside Attacks: Tools in Kali Linux \(Continued...\)](#)

[Lecture 23 - Client Side Attacks - Tools in Kali Linux - 1](#)

[Lecture 24 - Client Side Attacks - Tools in Kali Linux - 2](#)

[Lecture 25 - Client Side Attacks - Tools in Kali Linux - 3](#)

[Lecture 26 - Client Side Attacks - Tools in Kali Linux - 4](#)

[Lecture 27 - Authentication Based Attacks - Tools in Kali Linux - 1](#)

[Lecture 28 - Authentication Based Attacks - Tools in Kali Linux - 2](#)

[Lecture 29 - Authentication Based Attacks - Tools in Kali Linux - 3](#)

[Lecture 30 - Authentication Based Attacks - Tools in Kali Linux - 4](#)

[Lecture 31 - Authentication Based Attacks - Tools in Kali Linux - 5](#)

- [Lecture 32 - Web Attacks - Tools in Kali Linux - 1](#)
- [Lecture 33 - Web Attacks - Tools in Kali Linux - 2](#)
- [Lecture 34 - Penetration Testing Attacks - Defensive Countermeasures](#)
- [Lecture 35 - Technical Fundamentals for Evidence Acquisition - 1](#)
- [Lecture 36 - Technical Fundamentals for Evidence Acquisition - 2](#)
- [Lecture 37 - Packet Capture Tools and Methods](#)
- [Lecture 38 - Wireshark Introduction](#)
- [Lecture 39 - Packet Analysis](#)
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- [Lecture 41 - Case study 1](#)
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- [Lecture 43 - Wireless Forensics - Technology](#)
- [Lecture 44 - Wireless Network Security Framework](#)
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- [Lecture 48 - IDS Evidence Acquisition and SNORT](#)
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- [Lecture 56 - Re-cap of All Topics](#)
- [Lecture 57 - Introduction to Meltdown Attack](#)
- [Lecture 58 - Introduction to Meltdown - Address Space Basics](#)
- [Lecture 59 - Meltdown Attack - Out of Order Execution](#)
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Lecture 4 - Variables and datatypes in R

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Lecture 6 - Recasting and joining of dataframes

Lecture 7 - Arithmetic,Logical and Matrix operations in R

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Lecture 9 - Advanced Programming in R : Functions (Continued...)

Lecture 10 - Control structures

Lecture 11 - Data visualization in R Basic graphics

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Lecture 13 - Solving Linear Equations

Lecture 14 - Solving Linear Equations (Continued...)

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Lecture 16 - Linear Algebra - Distance,Hyperplanes and Halfspaces,Eigenvalues,Eigenvectors (Continued... 1)

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Lecture 18 - Linear Algebra - Distance,Hyperplanes and Halfspaces,Eigenvalues,Eigenvectors (Continued... 3)

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Lecture 21 - Sample Statistics

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Lecture 23 - Optimization for Data Science

Lecture 24 - Unconstrained Multivariate Optimization

Lecture 25 - Unconstrained Multivariate Optimization (Continued...)

Lecture 26 - Gradient (Steepest) Descent (OR) Learning Rule

Lecture 27 - Multivariate Optimization With Equality Constraints

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Lecture 29 - Introduction to Data Science

Lecture 30 - Solving Data Analysis Problems - A Guided Thought Process

Lecture 31 - Module : Predictive Modelling

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[Lecture 34 - Diagnostics to Improve Linear Model Fit](#)

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[Lecture 46 - K-Nearest Neighbors \(kNN\)](#)

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[Lecture 48 - K-means Clustering](#)

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Lecture 2 - Why Programming ?

Lecture 3 - Programming for Everybody

Lecture 4 - Any Prerequisites ?

Lecture 5 - Where to start?

Lecture 6 - Why do we have so many languages?

Lecture 7 - How to go about programming?

Lecture 8 - Why to learn programming?

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Lecture 10 - How to give instructions ?

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Lecture 13 - More About Loops

Lecture 14 - Solution To Looping Problem

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Lecture 18 - More On Scratch

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Lecture 20 - Installation of Anaconda

Lecture 21 - Introduction to Spyder IDE

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Lecture 23 - Understanding Variables in Python

Lecture 24 - Executing a sequence of instructions in the Console

Lecture 25 - Writing your First Program

Lecture 26 - Taking inputs from the user

Lecture 27 - Discount Calculation

Lecture 28 - Motivation to if condition

Lecture 29 - A reminder on how to deal with numbers

Lecture 30 - Understanding if condition's working

Lecture 31 - Realizing the importance of syntax and indentation

Lecture 32 - Introductions to loops

Lecture 33 - Loops: Sum of numbers

Lecture 34 - Loops: Sum of numbers (Continued...)

Lecture 35 - Loops: Multiplication Tables

Lecture 36 - Introduction to While Loop

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Lecture 38 - Lists Part 2 : Manipulation

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Lecture 40 - Lists Part 4 : Slicing

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Lecture 57 - Magic Square Hit and Trial 01

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Lecture 64 - Dobble Game - Spot the similarity 02

- Lecture 65 - Dobble Game - Spot the similarity 03
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- Lecture 67 - What is your date of birth?
- Lecture 68 - Birthday Paradox - Find your twin 01
- Lecture 69 - Birthday Paradox - Find your twin 02
- Lecture 70 - Birthday Paradox - Find your twin 03
- Lecture 71 - Birthday Paradox - Find your twin 04
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- Lecture 73 - What's your favourite movie?
- Lecture 74 - Guess the Movie Name 01
- Lecture 75 - Guess the Movie Name 02
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- Lecture 80 - Dictionaries
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- Lecture 84 - Monte Hall : 3 doors and a twist 01
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- Lecture 86 - Rock, Paper and Scissor : Cheating not allowed !! 01
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- Lecture 90 - Sorting and Searching : 20 questions game 01
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Lecture 126 - Spiral Traversing - Let's Animate - Part 04
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- Lecture 132 - GPS - Track the route - Part 02
- Lecture 133 - GPS - Track the route - Part 03
- Lecture 134 - GPS - Track the route - Part 04
- Lecture 135 - Tuples- Python Data Structure
- Lecture 136 - Lottery Simulation - Profit or Loss
- Lecture 137 - Lottery Simulation - Profit or Loss - Part 01
- Lecture 138 - Lottery Simulation - Profit or Loss - Part 02
- Lecture 139 - Lottery Simulation - Profit or Loss - Part 03
- Lecture 140 - Lottery Simulation - Profit or Loss - Part 04
- Lecture 141 - Lottery Simulation - Profit or Loss - Part 05
- Lecture 142 - Lottery Simulation - Profit or Loss - Part 06
- Lecture 143 - Image Processing - Enhance your images
- Lecture 144 - Image Processing - Enhance your images - Part 01
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- Lecture 157 - Natural Language Processing - Author Stylometry
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Lecture 3 - Rubik's Cube Example

Lecture 4 - Factorial Example

Lecture 5 - Counting in Computer Science

Lecture 6 - Motivation for Catalan numbers

Lecture 7 - Rule of Sum and Rule of Product

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Lecture 9 - Factorial Explained

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Co-ordinators : Prof. Ganapathy, Prof. Balaji Srinivasan

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NPTEL : NOC:Machine Learning (Computer Science and Engineering)

Co-ordinators : Prof. Henrik Bostrom, Prof. Fredrik Kilander, Prof. Carl Gustaf Jansson

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NPTEL : NOC:Applied Accelerated Artificial Intelligence (Computer Science and Engineering)

Co-ordinators : Prof. Satyadhyan Chickerur, Prof. Bharatkumar Sharma, Prof. Adesuyi Tosin, Prof. Satyajit Das

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NPTEL : ACM India - RBCDSAI Summer School on DS-AI-ML (Computer Science and Engineering)

Co-ordinators : Multi-Faculty

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NPTEL : NOC:Responsible and Safe AI Systems (Computer Science and Engineering)

Co-ordinators : Prof. Ponnurangam Kumaraguru, Prof. Balaraman Ravindran, Prof. Arun Rajkumar

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Lecture 2 - Understanding GNU Radio features for Digital Communication: Basic blocks, input and output

Lecture 3 - Understanding GNU Radio features for Digital Communication: Advanced blocks, hardware interfacing

Lecture 4 - Fundamentals of Digital Communication: Signal Processing methods, vectors, and relevant GNU Radio Examples - Part 1

Lecture 5 - Fundamentals of Digital Communication: Signal Processing methods, vectors, and relevant GNU Radio Examples - Part 2

Lecture 6 - Complex Baseband Signal Representation

Lecture 7 - Real Passband Signal Representation, Up and Down Conversion of Complex Baseband Signals

Lecture 8 - Random Variables and Random Processes

Lecture 9 - Fundamentals of Digital Modulation

Lecture 10 - Linear Modulation Methods: Amplitude Shift Keying (ASK)

Lecture 11 - Linear Modulation Methods: Phase Shift Keying (PSK)

Lecture 12 - Linear Modulation Methods: Quadrature Amplitude Modulation (QAM) and Frequency Shift Keying (FSK)

Lecture 13 - Pulse Shaping for ISI Free Signaling

Lecture 14 - ASK using Raised Cosine (RC) and Root-Raised Cosine (RRC) Pulse Shaping

Lecture 15 - Basics of Detection: Properties of Gaussian Random Variables

Lecture 16 - Basics of Detection: Gaussian Random Vectors and Hypothesis Testing

Lecture 17 - Optimal Receivers for M-ary Signaling

Lecture 18 - Gram-Schmidt Orthogonalisation

Lecture 19 - Optimal Reception of M-ary Signals in AWGN

Lecture 20 - Detection and Optimal Decision for On-Off Signaling in AWGN Channel

Lecture 21 - Detection and Optimal Decision for M-ary Signaling

Lecture 22 - Python for GNU Radio

Lecture 23 - Extending GNU Radio Features using Python

Lecture 24 - Constructing and Visualising Constellations using GNU Radio

Lecture 25 - Understanding matched filtering using GNU Radio

Lecture 26 - Histograms in GNU Radio

Lecture 27 - Visualising Symbol Error Rate in GNU Radio

Lecture 28 - Signal-to-Noise Ratio and Symbol Error Probability - Part 1

Lecture 29 - Signal-to-Noise Ratio and Symbol Error Probability - Part 2

Lecture 30 - Symbol error rate and Bit error rate

Lecture 31 - Computing bit error rates in GNU Radio

- Lecture 32 - End-to-end Digital Communication System Simulation in GNU Radio
- Lecture 33 - Parameter Estimation for Practical Receivers - Part 1
- Lecture 34 - Parameter Estimation for Practical Receivers - Part 2
- Lecture 35 - Phase Locked Loop and Differential Modulation
- Lecture 36 - Maximum Likelihood delay estimate for a single symbol in GNU Radio
- Lecture 37 - Maximum Likelihood delay estimate for multiple symbols in GNU Radio
- Lecture 38 - Phase offset estimation in GNU Radio
- Lecture 39 - Phase Locked Loop in GNU Radio
- Lecture 40 - Costas Loop and Differential PSK in GNU Radio
- Lecture 41 - Channel Equalisation
- Lecture 42 - Detection Strategy for Dispersive Channels
- Lecture 43 - Maximum Likelihood sequence estimation: Viterbi Algorithm
- Lecture 44 - Suboptimal Channel Equalisation: Zero-forcing Receiver
- Lecture 45 - Zero forcing Receiver in GNU Radio
- Lecture 46 - Suboptimal Channel Equalisation: Linear Minimum mean-square error receiver
- Lecture 47 - LMMSE Receiver in GNU Radio
- Lecture 48 - Parallelising Frequency Selective Channels
- Lecture 49 - Orthogonal Frequency Division Multiplexing (OFDM)
- Lecture 50 - OFDM in the presence of dispersive channels
- Lecture 51 - Equalisation using OFDM in GNU Radio
- Lecture 52 - Error Control Coding: Parity Check Codes
- Lecture 53 - Error Control Coding: Repetition Codes
- Lecture 54 - Error Control Coding: Linear Block Codes
- Lecture 55 - Repetition Codes in GNU Radio
- Lecture 56 - Error Control Coding: Perfect Codes
- Lecture 57 - Error Control Coding: Hamming Codes
- Lecture 58 - (7,4) Hamming Code in GNU Radio
- Lecture 59 - Rate and error-free Communication
- Lecture 60 - Quantisation
- Lecture 61 - Visualising Quantisation in GNU Radio
- Lecture 62 - Course Summary

NPTEL : Circuit Theory (Electrical Engineering)

Co-ordinators : Prof. S.C. Dutta Roy

Lecture 1 - Review of Signals and Systems

Lecture 2 - Review of Signals and Systems

Lecture 3 - Network Equations; Initial and Final Conditions

Lecture 4 - Problem Session 1

Lecture 5 - Step, Impulse and Complete Responses

Lecture 6 - 2nd Order Circuits:Magnetically Coupled Circuits

Lecture 7 - Transformer Transform Domain Analysis

Lecture 8 - Problem Session 2 : Step,Impulse

Lecture 9 - Network Theorems and Network Functions

Lecture 10 - Network Functions (Continued.)

Lecture 11 - Amplitude and Phase of Network Functions

Lecture 12 - Problem Session 3 : Network Theorems Transform

Lecture 13 - Poles, Zeros and Network Response

Lecture 14 - Single Tuned Circuits

Lecture 15 - Single Tuned Circuits (Continued.)

Lecture 16 - Double Tuned Circuits

Lecture 17 - Double Tuned Circuits (Continued.)

Lecture 18 - Problem Session 4 : Network Functions, Analysis

Lecture 19 - Double Tuned Circuits (Continued.)

Lecture 20 - Concept of Delay and Introduction

Lecture 21 - Two-port Networks (Continued.)

Lecture 22 - Problem Session 5

Lecture 23 - Minor - 1

Lecture 24 - The Hybrid & Transmission Parameters of 2 ports

Lecture 25 - Problem Session 6 : Two - port networks

Lecture 26 - Two - port Network parameters

Lecture 27 - Two-port Interconnections

Lecture 28 - Interconnection of Two-port Networks (Continued.)

Lecture 29 - Problem Session 7 : Two-port Networks (Continued.)

Lecture 30 - Scattering Matrix

Lecture 31 - Scattering Parameters of a Two-port

- Lecture 32 - Problem Session 8 : Two- port Parameters
- Lecture 33 - Solutions of Minor - 2 Problems
- Lecture 34 - Insertion Loss
- Lecture 35 - Example of Insertion Loss and Elements
- Lecture 36 - Elements of Realizability Theory (Continued.)
- Lecture 37 - Positive Real Functions
- Lecture 38 - Testing of Positive Real Functions
- Lecture 39 - Problem Session 9
- Lecture 40 - More on PRF's and their Synthesis
- Lecture 41 - LC Driving Point Functions
- Lecture 42 - LC Driving Point Synthesis (Continued.)
- Lecture 43 - RC and RL Driving Point Synthesis
- Lecture 44 - Problem Session 10 : LC Driving Point Synthesis
- Lecture 45 - RC & RL One-port Synthesis (Continued.)
- Lecture 46 - Elementary RLC One-port Synthesis
- Lecture 47 - Properties and Synthesis of Transfer Parameters
- Lecture 48 - Resistance Terminated LC Ladder
- Lecture 49 - Resistance Terminated LC Ladder (Continued.)
- Lecture 50 - Problem session 11: Two-port Synthesis
- Lecture 51 - Network Transmission Criteria

Lecture 1 - Introduction to control problem

Lecture 2 - Basic Feedback Structure

Lecture 3 - Introduction to Control Problem (Continued.)

Lecture 4 - Dynamic Systems and Dynamic Response

Lecture 5 - Dynamic Systems and Dynamic Response (Continued.)

Lecture 6 - Dynamic Systems and Dynamic Response (Continued.)

Lecture 7 - Dynamic Systems and Dynamic Response (Continued.)

Lecture 8 - Dynamic Systems and Dynamic Response (Continued.)

Lecture 9 - Dynamic Systems and Dynamic Response (Continued.)

Lecture 10 - Models of Industrial Control Devices and Systems

Lecture 11 - Models of Industrial Control Devices and Systems (Continued.)

Lecture 12 - Models of Industrial Control Devices and Systems(Continued.)

Lecture 13 - Models of Industrial Control Devices and Systems(Continued.)

Lecture 14 - Models of Industrial Control Devices and Systems(Continued.)

Lecture 15 - Models of Industrial Control Devices and Systems(Continued.)

Lecture 16 - Models of Industrial Control Devices and Systems (Continued.)

Lecture 17 - Models of Industrial Control Devices and Systems (Continued.)

Lecture 18 - Models of Industrial Control Devices and Systems (Continued.)

Lecture 19 - Basic Principles of Feedback Control

Lecture 20 - Basic Principles of Feedback Control (Continued.)

Lecture 21 - Basic Principles of Feedback Control (Continued.)

Lecture 22 - Basic Principles of Feedback Control (Continued.)

Lecture 23 - Concepts of stability and Routh Stability Criterion

Lecture 24 - Concepts of stability and Routh Stability Criterion (Continued.)

Lecture 25 - Concepts of stability and Routh Stability Criterion (Continued.)

Lecture 26 - The Performance of Feedback Systems

Lecture 27 - The Performance of Feedback Systems (Continued.)

Lecture 28 - The Performance of Feedback Systems (Continued.)

Lecture 29 - The Performance of Feedback Systems (Continued.)

Lecture 30 - Compensator Design Using Root Locus Plots

Lecture 31 - Compensator Design Using Root Locus Plots (Continued.)

[Lecture 32 - Compensator Design Using Root Locus Plots \(Continued.\)](#)

[Lecture 33 - Compensator Design Using Root Locus Plots \(Continued.\)](#)

[Lecture 34 - Compensator Design Using Root Locus Plots \(Continued.\)](#)

[Lecture 35 - The Nyquist Stability Criterion and Stability Margins](#)

[Lecture 36 - The Nyquist Stability Criterion and Stability Margins \(Continued.\)](#)

[Lecture 37 - The Nyquist Stability Criterion and Stability Margins \(Continued.\)](#)

[Lecture 38 - The Nyquist Stability Criterion and Stability Margins \(Continued.\)](#)

[Lecture 39 - Feedback System Performance Based on the Frequency Response](#)

[Lecture 40 - Feedback System Performance Based on the Frequency Response \(Continued.\)](#)

[Lecture 41 - Compensator Design Using Frequency Response Plots](#)

Lecture 1 - Embedded Systems: Introduction

Lecture 2 - Embedded Hardware

Lecture 3 - PIC: Instruction Set

Lecture 4 - PIC Peripherals On Chip

Lecture 5 - ARM Processor

Lecture 6 - More ARM Instructions

Lecture 7 - ARM: Interrupt Processing

Lecture 8 - Digital Signal Processors

Lecture 9 - More on DSP Processors

Lecture 10 - System On Chip (SOC)

Lecture 11 - Memory

Lecture 12 - Memory Organization

Lecture 13 - Virtual Memory and Memory Management Unit

Lecture 14 - Bus Structure

Lecture 15 - Bus Structure - 2

Lecture 16 - Bus Structure - 3 Serial Interfaces

Lecture 17 - Serial Interfaces

Lecture 18 - Power Aware Architecture

Lecture 19 - Software for Embedded Systems

Lecture 20 - Fundamentals of Embedded Operating Systems

Lecture 21 - Scheduling Policies

Lecture 22 - Resource Management

Lecture 23 - Embedded - OS

Lecture 24 - Networked Embedded Systems - I

Lecture 25 - Networked Embedded Systems - II

Lecture 26 - Networked Embedded Systems - III

Lecture 27 - Networked Embedded Systems - IV

Lecture 28 - Designing Embedded Systems - I

Lecture 29 - Designing Embedded Systems - II

Lecture 30 - Designing Embedded Systems- III

Lecture 31 - Embedded System Design - IV

[Lecture 32 - Designing Embedded Systems - V](#)

[Lecture 33 - Platform Based Design](#)

[Lecture 34 - Compilers for Embedded Systems](#)

[Lecture 35 - Developing Embedded Systems](#)

[Lecture 36 - Building Dependable Embedded Systems](#)

[Lecture 37 - Pervasive and Ubiquitous Computing](#)

Lecture 1 - Electric Energy Systems A Perspective

Lecture 2 - Structure of Power Systems

Lecture 3 - Conventional Sources of Electric Energy

Lecture 4 - Hydroelectric Power Generation

Lecture 5 - Non Conventional Energy Sources

Lecture 6 - Renewable Energy (Continued.)

Lecture 7 - Energy Storage

Lecture 8 - Deregulation

Lecture 9 - Air Pollutants

Lecture 10 - Transmission Line Parameters

Lecture 11 - Capacitance of Transmission Lines

Lecture 12 - Characteristics and Performance of Transmission Lines

Lecture 13 - Voltage Regulation (VR)

Lecture 14 - Power Flow through a Line

Lecture 15 - Methods of Voltage Control

Lecture 16 - Compensation of Transmission Lines

Lecture 17 - Compensation of Transmission Lines (Continued.)

Lecture 18 - Underground Cables

Lecture 19 - Cables (Continued.)

Lecture 20 - Insulators for Overhead Lines

Lecture 21 - HVDC

Lecture 22 - HVDC (Continued.)

Lecture 23 - Distribution Systems

Lecture 24 - Automatic Generation Control

Lecture 25 - Automatic Generation Control (Continued.)

Lecture 26 - Load Flow Studies

Lecture 27 - Load Flow Problem

Lecture 28 - Load Flow Analysis (Continued.), Gauss Siedel Method

Lecture 29 - Newton Raphson (NR), Load Flow Method

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Lecture 31 - Control of Voltage Profile

[Lecture 32 - Optimal System Operation \(Economic Operation\)](#)

[Lecture 33 - Optimal Unit Commitment](#)

[Lecture 34 - Optimal Generation Scheduling](#)

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- Lecture 1 - Introduction to Power System Stability Problem - Part-1
- Lecture 2 - Introduction to Power System Stability Problem - Part-2
- Lecture 3 - Introduction to Power System Stability Problem - Part-3
- Lecture 4 - Solution of Switching Equation
- Lecture 5 - The Equal Area Criterion for Stability - Part-1
- Lecture 6 - The Equal Area Criterion for Stability - Part-2
- Lecture 7 - Transient Stability Analysis of a Multi Machine System
- Lecture 8 - Modeling of Synchronous Machine - Part-1
- Lecture 9 - Modeling of Synchronous Machine - Part-2
- Lecture 10 - Modeling of Synchronous Machine - Part-3
- Lecture 11 - Modeling of Synchronous Machine - Part-4
- Lecture 12 - Synchronous Machine Representation for Stability Studies - Part-1
- Lecture 13 - Synchronous Machine Representation for Stability Studies - Part-2
- Lecture 14 - Excitation Systems - Part-1
- Lecture 15 - Excitation Systems - Part-2
- Lecture 16 - Modeling of Excitation Systems - Part-1
- Lecture 17 - Modeling of Excitation Systems - Part-2
- Lecture 18 - Small Signal Stability of a Single Machine Infinite Bus System - Part-1
- Lecture 19 - Small Signal Stability of a Single Machine Infinite Bus System - Part-2
- Lecture 20 - Small Signal Stability of a Single Machine Infinite Bus System - Part-3
- Lecture 21 - Small Signal Stability of a Single Machine Infinite Bus System - Part-4
- Lecture 22 - Small Signal Stability of a Single Machine Infinite Bus System - Part-5
- Lecture 23 - Dynamic Modeling of Steam turbines and Governors
- Lecture 24 - Dynamic modeling of Hydro Turbines and Governors
- Lecture 25 - Load modeling for Stability Studies
- Lecture 26 - Numerical Integration Methods for Solving a Set of Ordinary Nonlinear Differential Equation
- Lecture 27 - Simulation of Power System Dynamic Response
- Lecture 28 - Dynamic Equivalents for Large Scale Systems - Part-1
- Lecture 29 - Dynamic Equivalents for Large Scale Systems - Part-2
- Lecture 30 - Dynamic Equivalents for Large Scale Systems - Part-3
- Lecture 31 - Direct Method of Transient Stability Analysis - Part-1

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[Lecture 33 - Sub Synchronous Oscillations - Part-1](#)

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[Lecture 36 - Voltage Stability - Part-2](#)

[Lecture 37 - Voltage Stability - Part-3](#)

[Lecture 38 - Voltage Stability - Part-4](#)

[Lecture 39 - Methods of Improving Stability - Part-1](#)

[Lecture 40 - Methods of Improving Stability - Part-2](#)

Lecture 1 - Review of DC Models of Diodes & BJT's

Lecture 2 - Review of DC Models of BJT (Continued...) and FET

Lecture 3 - FET Characteristics and Models

Lecture 4 - Problem Session-1 on DC Analysis of BJT Circuits

Lecture 5 - BJT Biasing and Bias Stability

Lecture 6 - BJT Bias Stability (Continued...)

Lecture 7 - FET Biasing, Current Sources

Lecture 8 - Problem Session-2 on FET and BJT Characteristics and Biasing

Lecture 9 - Current Mirrors; BJT Small Signal Models

Lecture 10 - Small Signal Amplifiers: Mid Frequency Analysis

Lecture 11 - Mid Frequency Analysis of the CE and CB Amplifier

Lecture 12 - Problem Session-3 on Mid- Frequency Analysis of CE Amplifiers

Lecture 13 - Midband Analysis of CB and CC Amplifiers

Lecture 14 - Midband Analysis of FET Amplifiers

Lecture 15 - Problem Session-4 on Midband Analysis of Amplifiers

Lecture 16 - High Frequency Response of Small Signal Amplifiers

Lecture 17 - High Frequency Response of Small Signal Amplifiers (Continued...)

Lecture 18 - Low Frequency Response of Small Signal Amplifiers

Lecture 19 - Problem Session-5 on Frequency Response of Small Signal Amplifiers

Lecture 20 - Differential Amplifiers

Lecture 21 - Differential Amplifiers (Continued...)

Lecture 22 - Discussion on Minor-1 Problems and Differential Amplifiers (Continued...)

Lecture 23 - Problem Session-6 on Frequency Response of Small Signal Amplifiers (Continued...) and Differential Amplifiers

Lecture 24 - Use of Current Mirrors in Differential Amplifiers

Lecture 25 - FET Differential Amplifiers and Introduction to Power Amplifiers

Lecture 26 - Class B, Class AB and Class A Power Amplifiers

Lecture 27 - Class A Power Amplifiers; Efficiency Considerations

Lecture 28 - Problem Session-7 on Deferential and Power Amplifiers

Lecture 29 - Introduction to Feedback Amplifiers

Lecture 30 - Advantages of Negative Feedback Amplifiers

Lecture 31 - Analysis of Feedback Amplifiers

[Lecture 32 - Analysis of the Series - Series and Other Feedback Configurations](#)

[Lecture 33 - Problem Session-8 on Feedback Amplifiers](#)

[Lecture 34 - Sinusoidal Oscillators : An Example of Positive Feedback](#)

[Lecture 35 - More on Oscillators](#)

[Lecture 36 - Solutions to Minor-2 Exam and Concluding Discussions on Oscillators](#)

[Lecture 37 - Problem Session-9 on Oscillators](#)

[Lecture 38 - Tuned \(or Narrowband\) Amplifiers](#)

[Lecture 39 - Widebanding Techniques : Introduction & Use of Inductors](#)

[Lecture 40 - Widebanding By Using an Inductance](#)

[Lecture 41 - Problem Session-10 on Tuned Amplifiers](#)

[Lecture 42 - Widebanding by Using Compound Devices](#)

[Lecture 43 - Cascode Configuration as Wideband Amplifier](#)

[Lecture 44 - Widebanding by Local Feedback](#)

[Lecture 45 - Problem Session-11 on Minor-3 Problems & Widebanding by Compound Devices](#)

[Lecture 46 - Widebanding by Local Feedback and Feedback Cascades](#)

[Lecture 47 - Widebanding by Overall Feedback and Dual Loop Feedback](#)

[Lecture 48 - The Differential Pair and the Gilbert Cell as Wideband Amplifiers](#)

[Lecture 49 - Correction to Gilbert Cell Analysis and Operational Amplifier Imperfections](#)

[Lecture 50 - Op-Amp offsets, Compensation and Slew Rate](#)

[Lecture 51 - Op-Amp Compensation, Slew Rate and Some Problems](#)

Lecture 1 - Introduction to the Course

Lecture 2 - Digital Representation of Analog Signals, Delta Modulation

Lecture 3 - Digital Representation of Analog Signals, Pulse Code Modulation

Lecture 4 - Digital Representation of Analog Signals

Lecture 5 - Quantization Noise in Delta Modulation (Continued...) and Time Division Multiplexing

Lecture 6 - Introduction to Line Coding

Lecture 7 - Spectral Properties of Line Codes: General Relations

Lecture 8 - Spectral Properties of Line Codes: On-off / Polar / Bipolar Signalling

Lecture 9 - Spectral Properties of Line Codes: Duobinary Manchester and HDB Codes

Lecture 10 - Baseband Pulse Shaping: Nyquist's First Criterion

Lecture 11 - Baseband Pulse Shaping: Raised Cosine Family of Pulses

Lecture 12 - Partial Response Signalling: Duobinary and Modified Duobinary Pulse Shaping

Lecture 13 - Precoding for Duobinary and Modified Duobinary Systems

Lecture 14 - Precoding for Modified Duobinary Systems (Continued...) and General Partial Response Signalling

Lecture 15 - Binary Baseband Digital Modulation Techniques

Lecture 16 - M-ary Baseband Digital Modulation Techniques

Lecture 17 - Passband Digital Modulations - I : PSK and QPSK

Lecture 18 - Passband Digital Modulations - II : Offset QPSK

Lecture 19 - Passband Digital Modulations - III : Minimum Shift Keying (MSK)

Lecture 20 - Passband Digital Modulations - IV : MSK (Continued...) : Passband Waveforms for M-ary Signalling

Lecture 21 - Passband Modulations for Band Limited Channels

Lecture 22 - Baseband and Passband Digital Demodulations : General Issues and Concepts

Lecture 23 - Digital Modulation Part - II Matched Filters

Lecture 24 - Matched Filters and Coherent Demodulation-I

Lecture 25 - Coherent Demodulation for Binary Wave Form

Lecture 26 - Demodulators for Binary Waveforms (Continued...) : Coherent and Noncoherent Receivers for Orthogonal Signalling (OOK and FSK)

Lecture 27 - Performance Analysis of Binary Digital Modulations: Signal and Noise Statistics in Coherent and Noncoherent Receivers

Lecture 28 - Error Rates for Binary Signalling : Coherent Receivers

Lecture 29 - Performance of Non Coherent FSK and Differential Phase Shift Keying

Lecture 30 - Demodulation of DPSK and M-ary Signals

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[Lecture 31 - Performance of M'ary Digital Modulations](#)

[Lecture 32 - Performance of M'ary Digital Modulations \(Continued...\)](#)

[Lecture 33 - Introduction to Information Theory, Part-1](#)

[Lecture 34 - Source Coding](#)

[Lecture 35 - Error Free Communication Over a Noisy Channel](#)

[Lecture 36 - The Concept of Channel Capacity](#)

[Lecture 37 - Error Correcting Codes](#)

[Lecture 38 - Error Correcting Codes \(Continued...\)](#)

NPTEL : Introduction To Electronic Circuits (Electrical Engineering)

Co-ordinators : Prof. S.C. Dutta Roy

- Lecture 1 - Introduction to the Course and Basic Electrical Quantity
- Lecture 2 - R.L.C. Components, Energy Considerations, Sources and Circuit Laws
- Lecture 3 - KCL, KVL and Network Analysis
- Lecture 4 - Networks Theorems (Thevenin's Norton's)
- Lecture 5 - Source Transformation; Super Position Theorem and Non-Linear One-Ports
- Lecture 6 - Signal Wave Forms
- Lecture 7 - Periodic Wave Forms and Elements of Amplifiers
- Lecture 8 - Operational Amplifiers and Diodes
- Lecture 9 - Rectifiers and Power Supplies
- Lecture 10 - Wave Shaping Circuits
- Lecture 11 - More on Wave Shaping Circuits and Introduction to Natural Response of Circuits
- Lecture 12 - Natural Response (Continued...)
- Lecture 13 - Natural Response of 2nd Order Circuit
- Lecture 14 - Natural Response of 2nd Order Circuit (Continued...)
- Lecture 15 - Impedance Functions, Poles, Zeros and their Applications
- Lecture 16 - Natural Response and Poles and Zeros and Introduction to Forced Response
- Lecture 17 - Phasors and their Applications in AC Ckts, analysis
- Lecture 18 - More About Phasors and Introduction to Complete Response
- Lecture 19 - Complete Response of Electrical Circuits
- Lecture 20 - AC Circuit Analysis
- Lecture 21 - Filter Circuits and Resonance
- Lecture 22 - Resonance (Continued...)
- Lecture 23 - General Network Analysis
- Lecture 24 - Two-Port Networks
- Lecture 25 - Semiconductor Physics
- Lecture 26 - Semiconductor Physics (Continued...)
- Lecture 27 - More About Diodes Including Zener Diodes
- Lecture 28 - Bipolar Junction Transistors
- Lecture 29 - Transistors Characteristics and Biasing
- Lecture 30 - BJT Biasing and Introduction to Power Amplifiers
- Lecture 31 - BJT Power Amplifiers

[Lecture 32 - Power Amplifier](#)

[Lecture 33 - Power Amplifiers \(Continued...\) and an Introduction to Small Signal Modelling of BJT](#)

[Lecture 34 - Small Signal Model and Small Signal Amplifiers](#)

[Lecture 35 - Small Signal Amplifiers \(Continued...\)](#)

[Lecture 36 - Small Signal Amplifier \(Continued...\)](#)

[Lecture 37 - Small Signal Amplifiers \(Continued...\)](#)

[Lecture 38 - Negative Feedback](#)

[Lecture 39 - Digital Circuits](#)

[Lecture 40 - Digital Circuits \(Continued...\)](#)

Lecture 1 - Introduction to Analog Circuits Introduction to the Diode

Lecture 2 - Diodes, Introduction to The Transistor

Lecture 3 - MOS Device, Characteristics

Lecture 4 - DC operating point

Lecture 5 - DC operating point, amplifier design

Lecture 6 - Common source amplifier, small signal analysis

Lecture 7 - Common gate, common drain

Lecture 8 - Common gate circuit

Lecture 9 - Source degenerated amplifier

Lecture 10 - Swing limits

Lecture 11 - Swing limits (Continued...), multi transistor amplifiers

Lecture 12 - Multi-transistor amplifiers

Lecture 13 - Introduction to current sources

Lecture 14 - Current sources/mirrors (Continued...)

Lecture 15 - Current sources, biasing

Lecture 16 - Differential circuits

Lecture 17 - Differential amplifiers-I

Lecture 18 - Differential amplifiers-II

Lecture 19 - Differential amplifiers-III

Lecture 20 - Self biased active load diff. amp

Lecture 21 - Diff. Cascode amplifier, two stage amplifiers

Lecture 22 - Two stage diff. amps, op-amps

Lecture 23 - Op-amps, OTAs

Lecture 24 - Circuits with op-amps

Lecture 25 - Capacitance in MOS devices

Lecture 26 - Common source, drain, gate-revisited

Lecture 27 - Common gate, common drain with capacitances

Lecture 28 - Cascode, cascade-revisit with capacitance

Lecture 29 - Cascade amplifier (with capacitance)

Lecture 30 - Diversion: 2-pole systems phase margin

Lecture 31 - Diversion Continued: Two Pole Systems

[Lecture 32 - Compensation](#)

[Lecture 33 - Op-amp Design with Compensation](#)

[Lecture 34 - Unity Gain Bandwidth](#)

[Lecture 35 - Power Amplification](#)

[Lecture 36 - Power Amplifiers-2](#)

[Lecture 37 - Power Amplifiers- Class A,B,AB,C ClassD](#)

[Lecture 38 - Class D Amplifiers, Push-pull Amplifiers](#)

[Lecture 39 - Introduction to Voltage Regulators](#)

[Lecture 40 - Voltage Regulators- line, load; Conclusion Regulation](#)

[Lecture 1 - Introduction](#)

[Lecture 2 - Preliminaries](#)

[Lecture 3 - Model Reference Adaptive Control - Part 1](#)

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[Lecture 5 - Model Reference Adaptive Control - Part 3](#)

[Lecture 6 - Adaptive Command Tracking](#)

[Lecture 7 - Robust Model Reference Adaptive Control - Part 1](#)

[Lecture 8 - Robust Model Reference Adaptive Control - Part 2](#)

[Lecture 9 - Robust Model Reference Adaptive Control - Part 3](#)

[Lecture 10 - Robust Model Reference Adaptive Control - Part 4](#)

Lecture 1 - Introduction to Information Theory

Lecture 2 - Entropy, Mutual Information, Conditional and Joint Entropy

Lecture 3 - Measures for Continuous, Random Variable, Relative Entropy

Lecture 4 - Variable Length Codes, Prefix Codes

Lecture 5 - Source Coding Theorem

Lecture 6 - various source coding Techniques: Huffman, Arithmetic, Lempel Ziv, Run Length

Lecture 7 - Optimum Quantizer, Practical Application of Source Coding: JPEG Compression

Lecture 8 - Introduction to Super Information

Lecture 9 - Channel Models and Channel Capacity

Lecture 10 - Noisy Channel Coding Theorem

Lecture 11 - Gaussian Channel and Information Capacity Theorem

Lecture 12 - Capacity of MIMO Channels

Lecture 13 - Introduction to Error Control Coding

Lecture 14 - Introduction to Galois Field

Lecture 15 - Equivalent Codes, Generator Matrix and Parity Check Matrix

Lecture 16 - Systematic Codes, Error Detections and Correction

Lecture 17 - Erasure and Errors, Standard Array and Syndrome Decoding

Lecture 18 - Probability of Error, Coding Gain and Hamming Bound

Lecture 19 - Hamming Codes, LDPC Codes and MDS Codes

Lecture 20 - Introduction to Cyclic Codes

Lecture 21 - Generator Polynomial, Syndrome Polynomial and Matrix Representation

Lecture 22 - Fire Code, Golay Code, CRC Codes and Circuit Implementation of Cyclic Codes

Lecture 23 - Introduction to BCH Codes: Generator Polynomials

Lecture 24 - Multiple Error Correcting BCH Codes, Decoding of BCH Codes

Lecture 25 - Introduction to Reed Solomon (RS) Codes

Lecture 26 - Introduction to Convolutional Codes

Lecture 27 - Trellis Codes: Generator Polynomial Matrix and Encoding using Trellis

Lecture 28 - Vitrebi Decoding and Known good Convolutional Codes

Lecture 29 - Introduction to Turbo Codes

Lecture 30 - Introduction to Trellis Coded Modulation (TCM)

Lecture 31 - Ungerboeck's Design Rules and Performance Evaluation of TCM Schemes

[Lecture 32 - TCM for Fading Channel and Space Time Trellis Codes \(STTC\)](#)

[Lecture 33 - Introduction to Space Time Block Codes \(STBC\)](#)

[Lecture 34 - Space Time Codes](#)

[Lecture 35 - Space Time Codes \(Continued...\)](#)

[Lecture 36 - Introduction to Cryptography: Symmetric key and Asymmetric Key Cryptography](#)

[Lecture 37 - Some Well-Known Algorithms: DES, IDEA, PGP, DH Protocol](#)

[Lecture 38 - Introduction to Physical Layer Security: Notion of Secrecy Capacity](#)

[Lecture 39 - Secrecy Outage Capacity, Secrecy Outage Probability, Cooperative Jamming](#)

Lecture 1 - Introduction

Lecture 2 - Transmission Lines : Wave Propagation

Lecture 3 - Transmission Lines : Reflection,Transmission; Travelling Waves

Lecture 4 - Transmission Lines : Travelling Waves (Continued...); Sinusoidal Signals; Impedance Transformation

Lecture 5 - Transmission Lines : Standing Wave Ratio:Measurement of Impedance

Lecture 6 - Transmission Lines : General Transmission Lines Equations,Low loss,Transmission Lines,Transmission Lines as Circuit Elements

Lecture 7 - Transmission Lines : Section as Circuit Elements

Lecture 8 - Transmission Lines : Velocities of Propagation, Transmission Lines Charts

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NPTEL : NOC:Electronic Systems Design: Hands-on Circuits and PCB Design with CAD Software (Electrical Engineering)

Co-ordinators : Prof. Ankur Gupta

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NPTEL : Advanced Electric Drives (Electrical Engineering)

Co-ordinators : Dr. S.P. Das

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Lecture 1 - High Voltage DC Transmission

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Lecture 1 - Introduction to Intelligent Systems and Control

Lecture 2 - Linear Neural networks

Lecture 3 - Multi layered Neural Networks

Lecture 4 - Back Propagation Algorithm revisited

Lecture 5 - Non Linear System Analysis - Part I

Lecture 6 - Non Linear System Analysis - Part II

Lecture 7 - Radial Basis Function Networks

Lecture 8 - Adaptive Learning rate

Lecture 9 - Weight update rules

Lecture 10 - Recurrent networks Back propagation through time

Lecture 11 - Recurrent networks Real time recurrent learning

Lecture 12 - Self organizing Map - Multidimensional networks

Lecture 13 - Fuzzy sets - A Primer

Lecture 14 - Fuzzy Relations

Lecture 15 - Fuzzy Rule base and Approximate Reasoning

Lecture 16 - Introduction to Fuzzy Logic Control

Lecture 17 - Neural Control A review

Lecture 18 - Network inversion and Control

Lecture 19 - Neural Model of a Robot manipulator

Lecture 20 - Indirect Adaptive Control of a Robot manipulator

Lecture 21 - Adaptive neural control for Affine Systems SISO

Lecture 22 - Adaptive neural control for Affine systems MIMO

Lecture 23 - Visual Motor Coordination with KSOM

Lecture 24 - Visual Motor coordination - quantum clustering

Lecture 25 - Direct Adaptive control of Manipulators - Intro

Lecture 26 - NN based back stepping control

Lecture 27 - Fuzzy Control - a Review

Lecture 28 - Mamdani type flc and parameter optimization

Lecture 29 - Fuzzy Control of a pH reactor

Lecture 30 - Fuzzy Lyapunov controller - Computing with words

Lecture 31 - Controller Design for a T-S Fuzzy model

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Lecture 1 - Introduction to EMT

Lecture 2 - Coulombs law

Lecture 3 - Vector analysis-I and Introduction to coordinate system

Lecture 4 - Rectangular coordinate system

Lecture 5 - Vector analysis-II

Lecture 6 - Introduction to Electric field

Lecture 7 - Electric field-I

Lecture 8 - Cylindrical coordinate system

Lecture 9 - Transformation and Electric field-II

Lecture 10 - Electric Potential-I

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Lecture 13 - Gauss's law and its application-I

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Lecture 15 - Divergence and Poisson's and Laplace's equation

Lecture 16 - Gauss's law and its application -III

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Lecture 18 - Conductor and dielectric-I

Lecture 19 - Polarization - I

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Lecture 21 - Polarization - II (Continued...)

Lecture 22 - Boundary condition

Lecture 23 - Continuity equation and Conductors - III

Lecture 24 - Conductors - IV

Lecture 25 - Conductors - IV (Continued...) and Capacitor - I

Lecture 26 - Capacitor - II

Lecture 27 - Capacitor - II (Continued...) and Equipotential Surfaces

Lecture 28 - Solution of Laplace's equation-I

Lecture 29 - Solution of Laplace's equation-I I and method of images-I

Lecture 30 - Method of images-II

Lecture 31 - Solution of Laplace's equation-III

- Lecture 32 - Solution of Laplace's equation-IV
- Lecture 33 - Introduction of magnetic field
- Lecture 34 - Biot savart law and its application
- Lecture 35 - Biot savart law and its application-II
- Lecture 36 - Magnetic vector potential
- Lecture 37 - Magnetic force, torque and dipole
- Lecture 38 - Magnetic force, torque and dipole (Continued...)
- Lecture 39 - Magnetic materials-I
- Lecture 40 - Magnetic materials-I (Continued...) and Magnetic moment
- Lecture 41 - Magnetic materials-I (Continued...) and Boundary condition for Magnetic fields
- Lecture 42 - Inductor and calculation of inductance for different shapes
- Lecture 43 - Inductor and calculation of inductance for different shapes (Continued...)
- Lecture 44 - Faradays law and its application-I
- Lecture 45 - Faradays law and its application-II
- Lecture 46 - Displacement current
- Lecture 47 - Maxwell's equation
- Lecture 48 - Wave propagation
- Lecture 49 - Solution of Helmholtz equation
- Lecture 50 - Uniform plane waves
- Lecture 51 - Polarization and Poynting Vector
- Lecture 52 - Wave reflections (Normal incidence)
- Lecture 53 - Waves in imperfect dielectrics and Good conductors
- Lecture 54 - Skin depth/effect
- Lecture 55 - Oblique incidence of waves
- Lecture 56 - Oblique incidence of waves (Continued...)
- Lecture 57 - Transmission line
- Lecture 58 - Transmission line model
- Lecture 59 - Steady state sinusoidal response of T-line-I
- Lecture 60 - Steady state sinusoidal response of T-line-II
- Lecture 61 - Steady state sinusoidal response of T-line-II and Smith chart
- Lecture 62 - Application of smith chart-I
- Lecture 63 - Application of smith chart-II
- Lecture 64 - Impedance matching

- Lecture 65 - Transients on Transmission line-I
- Lecture 66 - Transients on Transmission line-II
- Lecture 67 - Pulse on Transmission line
- Lecture 68 - Capacitive termination in Transmission line
- Lecture 69 - Waveguide
- Lecture 70 - Waveguide Analysis
- Lecture 71 - TM modes in Waveguide
- Lecture 72 - Rectangular waveguide: TM modes
- Lecture 73 - Rectangular waveguide: TE modes
- Lecture 74 - Waveguide: Wavelength, Impedance and power calculation
- Lecture 75 - Waveguide losses
- Lecture 76 - Dielectric Waveguide
- Lecture 77 - Dielectric Waveguide (Continued...)
- Lecture 78 - Radiation and Antenna
- Lecture 79 - Hertzian Dipole Antenna
- Lecture 80 - Hertzian Dipole Antenna (Continued...)
- Lecture 81 - Quasi-statistics-I
- Lecture 82 - Quasi-statistics-II
- Lecture 83 - Long wire Antenna
- Lecture 84 - Group velocity and Phase velocity
- Lecture 85 - Numerical solution of Laplace's equation

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NPTEL : NOC:Principles of Communication - Part 1 (Electrical Engineering)

Co-ordinators : Prof. Aditya K. Jagannatham

Lecture 1 - Basics - Definition of Energy and Power of Signals

Lecture 2 - Frequency Domain Representation and Introduction to Discrete Fourier Series

Lecture 3 - Discrete Fourier Series Example and Parseval's Theorem for Periodic Signals

Lecture 4 - Fourier Transform (FT), Inverse Fourier Transform (IFT) of Continuous Signals, Example of FT of Pulse and Sinc Function

Lecture 5 - Modulation Property of Fourier Transform, Dirac Delta or Unit Impulse Function - Definition and Fourier Transform

Lecture 6 - Duality Property of Fourier Transform and Introduction to Linear Time Invariant (LTI) Systems

Lecture 7 - Transmission of Signal through Linear Time Invariant (LTI) Systems and Cross- Correlation of Signals

Lecture 8 - Auto-Correlation of Signal and Energy Spectral Density (ESD)

Lecture 9 - Example for Auto-Correlation of Signal and Energy Spectral Density (ESD)

Lecture 10 - Introduction to Amplitude Modulation (AM), Modulation Index, Envelope Distortion and Over Modulation

Lecture 11 - Spectrum of Amplitude Modulated(AM) Signals and Introduction to Envelope Detection

Lecture 12 - Envelope Detection for Amplitude Modulated (AM) Signals and Time Constant for Capacitor in Envelope Detector

Lecture 13 - Power of Amplitude Modulated (AM) Signals and Power Efficiency of AM Signals

Lecture 14 - Double Sideband (DSB) Suppressed Carrier (SC) Modulation, Spectrum of DSB-SC Signals and Coherent Demodulation

Lecture 15 - Double Sideband(DSB) Suppressed Carrier (SC) Demodulation, Non-coherent demodulation, Impact of Carrier Phase Offset

Lecture 16 - Carrier Phase Offset Example for Double Sideband (DSB) Suppressed Carrier (SC) Demodulation- Wireless Cellular Communication with User Mobility

Lecture 17 - Phase Synchronization using Costas Receiver for Double Sideband (DSB) Suppressed Carrier (SC) Demodulation

Lecture 18 - Introduction to Quadrature Carrier Multiplexing (QCM) and Demodulation of QCM Signals.

Lecture 19 - Introduction to Single Sideband (SSB) Modulation

Lecture 20 - Generation of Single Sideband (SSB) Modulation Signals through Frequency Discrimination

Lecture 21 - Frequency Domain Description of Hilbert Transform \hat{A} – Fourier Spectrum of the Hilbert Transformer

Lecture 22 - Time Domain Description of Hilbert Transform \hat{A} – Impulse Response of the Hilbert Transformer

Lecture 23 - Phase Shifting Method for Generation of Single Sideband (SSB) Modulated Signals based on Hilbert Transform

Lecture 24 - Complex Pre-Envelope and Complex Envelope of Passband Signals

Lecture 25 - Complex Pre- Envelope and Complex Envelope of QCM (Quadrature Carrier Modulated) Signals

Lecture 26 - Introduction to Vestigial Side Band(VSB) Modulation and Non- Ideal Filtering, Spectral Efficiency

Lecture 27 - Properties of Vestigial Side Band Filter for Reconstruction of Message Signal without Distortion

Lecture 28 - Introduction to Angle Modulation, Description of Phase Modulation (PM) and Frequency Modulation (FM)

Lecture 29 - Frequency Modulation (FM) with Sinusoidal Modulation Signal and Pictorial Examples, Insights of PM and FM signals

Lecture 30 - Indirect Method for Generation of FM Signals - Generation of Narrowband FM Signal

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- Lecture 31 - Indirect Method for Generation of FM Signals - Generation of Wideband FM Signal through Frequency Multiplication
- Lecture 32 - Spectrum of Frequency Modulated (FM) Signals
- Lecture 33 - Bandwidth of Frequency Modulated (FM) Signals - Carson's Rule
- Lecture 34 - Demodulation of Frequency Modulated (FM) Signals, Condition of Envelope Detection
- Lecture 35 - Analog to Digital Conversion of Signals and Introduction to Sampling
- Lecture 36 - Spectrum of Sampled Signal, Aliasing and Nyquist Sampling Theorem
- Lecture 37 - Ideal Impulse Train Sampling, Reconstruction of Original Signal from Samples, Sinc Interpolation
- Lecture 38 - Introduction to Pulse Amplitude Modulation (PAM), Sample and Hold, Flat Top Sampling
- Lecture 39 - Pulse Amplitude Modulation (PAM), Spectrum of PAM Signal, Reconstruction of Original Signal from PAM Signal, Equalization
- Lecture 40 - Introduction to Quantization, Uniform Quantizer, Mid-Tread Quantizer
- Lecture 41 - Quantization, Mid-Rise Quantizer, PDF and Power of Quantization Noise, Quantization Noise Power versus Quantizer Resolution
- Lecture 42 - Introduction to Lloyd-Max Quantization Algorithm, Optimal Quantizer Design
- Lecture 43 - Lloyd-Max Quantization Algorithm, Iterative Computation of Optimal Quantization Levels and Intervals
- Lecture 44 - Companding for Non-Uniform Quantization, Mu-law Compressor, A-law Compressor
- Lecture 45 - Introduction to Delta Modulation, One-bit Quantizer
- Lecture 46 - Signal Reconstruction in Delta Modulation, Schematic Diagrams, Slope Overload Distortion and Granular Noise
- Lecture 47 - Differential Pulse Coded Modulation (DPCM), DPCM Signal Reconstruction and Schematic Diagram
- Lecture 48 - Frequency Mixing and Translation in Communication Systems, Heterodyne and Super Heterodyne Receivers
- Lecture 49 - Frequency Translation and Super Heterodyne Receivers, Problem of Image Frequency
- Lecture 50 - Frequency Division Multiplexing (FDM), Carrier Spacing in FDM
- Lecture 51 - Time Division Multiplexing (TDM), Operation of TDM, Sample Spacing in TDM
- Lecture 52 - Bandwidth Requirements for Time Division Multiplexing (TDM), The T1 TDM System : A Case Study

- Lecture 1 - Introduction to Error Control Coding - I
- Lecture 2 - Introduction to Error Control Coding - II
- Lecture 3 - Introduction to Error Control Coding - III
- Lecture 4 - Introduction to Linear Block Codes, Generator Matrix and Parity Check Matrix
- Lecture 5 - Syndrome, Error Correction and Error Detection
- Lecture 6 - Problem Solving Session - I
- Lecture 7 - Decoding of Linear Block Codes
- Lecture 8 - Distance Properties of Linear Block Codes - I
- Lecture 9 - Distance Properties of Linear Block Codes - II
- Lecture 10 - Problem Solving Session - II
- Lecture 11 - Some Simple Linear Block Codes - I
- Lecture 12 - Some Simple Linear Block Codes - II: Reed Muller Codes
- Lecture 13 - Bounds on the Size of a Code
- Lecture 14 - Problem Solving Session - III
- Lecture 15 - Introduction to Convolutional Codes - I: Encoding
- Lecture 16 - Introduction to Convolutional Codes - II: State Diagram, Trellis Diagram
- Lecture 17 - Convolutional Codes: Classification, Realization
- Lecture 18 - Convolutional Codes:Distance Properties
- Lecture 19 - Decoding of Convolutional Codes - I: Viterbi Algorithm
- Lecture 20 - Decoding of Convolutional Codes - II: BCJR Algorithm
- Lecture 21 - Problem solving session - IV
- Lecture 22 - Problem solving session - V
- Lecture 23 - Performance Bounds for Convolutional Codes
- Lecture 24 - Low Density Parity Check Codes
- Lecture 25 - Decoding of Low Density Parity Check Codes - I
- Lecture 26 - Decoding of Low Density Parity Check Codes - II: Belief Propagation Algorithm
- Lecture 27 - Turbo Codes
- Lecture 28 - Turbo Decoding
- Lecture 29 - Problem Solving Sessions - VI
- Lecture 30 - Distance Properties of Turbo Codes
- Lecture 31 - Convergence of Turbo Codes

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Lecture 2 - Spectrum of Transmitted Digital Communication Signal and Wide Sense Stationarity

Lecture 3 - Spectrum of Transmitted Digital Communication Signal, Autocorrelation Function and Power Spectral Density

Lecture 4 - Spectrum of Transmitted Digital Communication Signal, Relation to Energy Spectral Density and Introduction to AWGN Channel

Lecture 5 - Additive White Gaussian Noise (AWGN) Properties, Gaussian Noise and White Noise

Lecture 6 - Structure of Digital Communication Receiver, Receiver Filter and Signal-to-Noise Power Ratio (SNR)

Lecture 7 - Digital Communication Receiver, Noise Properties and Output Noise Power

Lecture 8 - Digital Communication Receiver, Optimal SNR and Matched Filter

Lecture 9 - Probability of Error in Digital Communication and Probability Density Functions of Output

Lecture 10 - Probability of Error in Digital Communication, Optimal Decision Rule and Gaussian Q function

Lecture 11 - Introduction to Binary Phase Shift Keying (BPSK) Modulation, Optimal Decision Rule and Probability of Bit-Error or Bit-Error Rate (BER)

Lecture 12 - Introduction to Amplitude Shift Keying (ASK) Modulation

Lecture 13 - Optimal Decision Rule for Amplitude Shift Keying (ASK), Bit Error Rate (BER) and Comparison with Binary Phase Shift Keying (BPSK) Modulation

Lecture 14 - Introduction to Signal Space Concept and Orthonormal Basis Signals

Lecture 15 - Introduction to Frequency Shift Keying (FSK)

Lecture 16 - Optimal Decision Rule for FSK, Bit Error Rate (BER) and Comparison with BPSK, ASK

Lecture 17 - Introduction to Quadrature Phase Shift Keying (QPSK)

Lecture 18 - Waveforms of Quadrature Phase Shift Keying (QPSK)

Lecture 19 - Matched Filtering, Bit Error Rate and Symbol Error Rate for Quadrature Phase Shift Keying (QPSK)

Lecture 20 - Introduction to M-ary PAM (Pulse Amplitude Modulation), Average Symbol Power and Decision rules

Lecture 21 - M-ary PAM (Pulse Amplitude Modulation) -Part-II, Optimal Decision Rule and Probability of Error

Lecture 22 - M-ary QAM (Quadrature Amplitude Modulation) Part-I, Introduction, Transmitted Waveform and Average Symbol Energy

Lecture 23 - M-ary QAM (Quadrature Amplitude Modulation) - Part-II, Optimal Decision Rule, Probability of Error and Constellation Diagram

Lecture 24 - M-ary PSK (Phase Shift Keying) Part-I, Introduction , Transmitted Waveform and Constellation Diagram

Lecture 25 - M-ary PSK (Phase Shift Keying) - Part-II, Optimal Decision Rule, Nearest Neighbor Criterion and Approximate Probability of Error

Lecture 26 - Introduction to Information Theory, Relevance of Information Theory and Characterization of Information

Lecture 27 - Definition of Entropy, Average of Information / Uncertainty of source and Properties of Entropy

Lecture 28 - Entropy Example- Binary Source Maximum and Minimum Entropy of Binary Source

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- Lecture 29 - Maximum Entropy of Source with M-ary Alphabet, Concave/Convex Functions and Jensens Inequality
- Lecture 30 - Joint Entropy , Definition of Joint Entropy of Two Sources and Simple Examples for Joint Entropy Computation
- Lecture 31 - Properties of Joint Entropy and Relation between Joint Entropy and Marginal Entropies
- Lecture 32 - Conditional Entropy, Example of Conditional Entropy and Properties of Conditional Entropy
- Lecture 33 - Mutual Information, Diagrammatic Representation and Properties of Mutual Information
- Lecture 34 - Simple Example of Mutual Information and Practical Example of Mutual Information-Binary Symmetric Channel
- Lecture 35 - Channel Capacity, Implications of Channel Capacity, Claude E. Shannon- Father of Information Theory and Example of Capacity of Binary Symmetric Channel
- Lecture 36 - Differential Entropy and Example for Uniform Probability Density function
- Lecture 37 - Differential Entropy of Gaussian Source and Insights
- Lecture 38 - Joint Conditional/ Differential Entropies and Mutual Information
- Lecture 39 - Capacity of Gaussian channel - Part I
- Lecture 40 - Capacity of Gaussian Channel - Part-II, Practical Implications and Maximum rate in bits/sec
- Lecture 41 - Introduction to Source Coding and Data Compression, Variable Length codes and Unique Decodability
- Lecture 42 - Uniquely Decodable Codes, Prefix-free code, Instantaneous Code and Average Code length
- Lecture 43 - Binary Tree Representation of Code, Example and Kraft Inequality
- Lecture 44 - Lower Bound on Average Code Length and Kullback-Leibler Divergence
- Lecture 45 - Optimal Code length, Constrained Optimization and Morse Code Example
- Lecture 46 - Approaching Lower Bound on Average code length and Block Coding
- Lecture 47 - Huffman Code, Algorithm, Example and Average Code Length
- Lecture 48 - Introduction to channel coding, Rate of Code, Repetition Code and Hamming Distance
- Lecture 49 - Introduction to Convolutional Codes, Binary Field Arithmetic and Linear Codes
- Lecture 50 - Example of Convolutional Code Output and Convolution Operation for Code generation
- Lecture 51 - Matrix Representation of Convolutional Codes, Generator Matrix, Transform Domain Representation and Shift Register Architecture
- Lecture 52 - State Diagram Representation of Convolutional Code, State transitions and Example of Code Generation using State transitions
- Lecture 53 - Trellis Representation of Convolutional Code and Valid Code Words
- Lecture 54 - Decoding of the Convolutional Code, Minimum Hamming distance and Maximum Likelihood Codeword Estimate
- Lecture 55 - Principle of Decoding of Convolutional code
- Lecture 56 - Viterbi Decoder for Maximum Likelihood Decoding of Convolutional Code Using Trellis Representation, Branch Metric Calculation, State Metric Calculation and Example

- Lecture 1 - Introduction to Applied Electromagnetics
- Lecture 2 - Introduction to Transmission lines
- Lecture 3 - Sinusoidal waves on Transmission lines
- Lecture 4 - Terminating T-lines: Reflection and Transmission coefficient
- Lecture 5 - Circuit parameters of a T-line
- Lecture 6 - Lossy Transmission lines and primary constants
- Lecture 7 - When to apply T-line Theory?
- Lecture 8 - Standing Waves on T-lines
- Lecture 9 - Lumped equivalent circuits of T-lines
- Lecture 10 - Impedance transformation and power flow on T-lines
- Lecture 11 - Graphical aid: Smith Chart Derivation
- Lecture 12 - Smith chart applications
- Lecture 13 - Further applications of Smith chart - Part 1
- Lecture 14 - Further applications of Smith chart - Part 2
- Lecture 15 - Impedance matching techniques - Part 1
- Lecture 16 - Impedance matching techniques - Part 2
- Lecture 17 - Impedance matching techniques - Part 3
- Lecture 18 - T-lines in time domain: Lattice diagrams
- Lecture 19 - Further examples of use of lattice diagrams
- Lecture 20 - High-speed digital signal propagation on T-lines
- Lecture 21 - Transient analysis with reactive termination and Time-domain reflectometry
- Lecture 22 - Fault detection using TDR
- Lecture 23 - Why Electromagnetics?
- Lecture 24 - Rectangular coordinate systems
- Lecture 25 - Cylindrical coordinate systems
- Lecture 26 - Review of vector fields and Gradient
- Lecture 27 - Divergence, Curl, and Laplacian operations
- Lecture 28 - Towards Maxwells equations - Part 1
- Lecture 29 - Towards Maxwells equations - Part 2
- Lecture 30 - Faradays law
- Lecture 31 - Completing Maxwells equations and Boundary conditions

- Lecture 32 - Boundary conditions for Electromagnetic fields
- Lecture 33 - Electrostatics-I: Laplace and Poissons equations
- Lecture 34 - Electrostatics-II: Solving Laplaces equation in 1D
- Lecture 35 - Electrostatics-III: Solving Laplaces equation in 2D
- Lecture 36 - Electrostatics-IV: Finite Difference method for solving Laplaces equation
- Lecture 37 - Magnetostatic fields-I: Biot-Savart Law
- Lecture 38 - Magnetostatic fields-II: Calculation of magnetic fields
- Lecture 39 - Inductance calculations
- Lecture 40 - From Maxwells equations to uniform plane waves
- Lecture 41 - Plane wave propagation in lossless dielectric media
- Lecture 42 - Polarization of plane waves
- Lecture 43 - Can an Ideal capacitor exist?
- Lecture 44 - Skin effect in conductors
- Lecture 45 - Skin effect in round wires
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- Lecture 47 - Reflection of uniform plane waves
- Lecture 48 - Application: Reflection from multiple media and anti-reflection coating.
- Lecture 49 - Oblique incidence of plane waves
- Lecture 50 - Total internal reflection
- Lecture 51 - Application: Matrix analysis of reflection from multiple boundaries
- Lecture 52 - Application: Fabry-Perot cavity and Multi-layer films
- Lecture 53 - Introduction to waveguides
- Lecture 54 - Rectangular waveguides
- Lecture 55 - Attenuation and Dispersion in rectangular waveguides
- Lecture 56 - Planar optical waveguides
- Lecture 57 - Application: Optical Fibers
- Lecture 58 - Application: WDM Optical Components
- Lecture 59 - Mach-Zehnder Modulator
- Lecture 60 - Wave Propagation in Anisotropic Medium
- Lecture 61 - Wave Propagation in Ferrites
- Lecture 62 - Magnetic Vector Potential - Part 1
- Lecture 63 - Magnetic Vector Potential - Part 2
- Lecture 64 - Fields of a Dipole Antenna

[Lecture 65 - Antenna Parameters and Long wire Antenna](#)

[Lecture 66 - Friis Transmission Formula](#)

Lecture 1 - Principles of Signals and Systems- Introduction to Signals and Systems, Signal Classification - Continuous and Discrete Time Signals

Lecture 2 - Analog and Digital Signals

Lecture 3 - Energy and Power Signals

Lecture 4 - Real Exponential Signals

Lecture 5 - Memory/Memory-less and Causal/Non-Causal Systems

Lecture 6 - Properties of Linear Systems

Lecture 7 - Example Problems - 1

Lecture 8 - Example Problems - 2

Lecture 9 - Example Problems - 3

Lecture 10 - Properties and Analysis of LTI Systems - I

Lecture 11 - Properties and Analysis of LTI Systems - II

Lecture 12 - Properties and Analysis of LTI Systems - III

Lecture 13 - Properties of Discrete Time LTI Systems

Lecture 14 - Example Problems LTI Systems - I

Lecture 15 - Example Problems LTI Systems - II

Lecture 16 - Example Problems DT-LTI Systems

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Lecture 19 - Laplace Transform Properties - II

Lecture 20 - Laplace Transform of LTI Systems

Lecture 21 - Laplace Transform Example Problems - I

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Lecture 23 - Laplace Transform of RL, RC Circuit

Lecture 24 - Z-Transform

Lecture 25 - Z-Transform Properties - I

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Lecture 27 - Z-Transform of LTI Systems

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Lecture 31 - Z-Transform Examples - IV

Lecture 32 - Inverse Z-Transform

Lecture 33 - Fourier Analysis Introduction

Lecture 34 - Complex Exponential and Trigonometric FS

Lecture 35 - Conditions for Existence of FS

Lecture 36 - Fourier Transform (FT) Introduction

Lecture 37 - Properties of Fourier Transform - I

Lecture 38 - Properties of Fourier Transform - II

Lecture 39 - Fourier Transform - Parseval's Relation

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Lecture 41 - FT- Ideal and Non-Ideal Filters

Lecture 42 - Fourier Analysis Examples - I

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Lecture 45 - Fourier Analysis Examples - IV

Lecture 46 - Fourier Analysis Examples - V

Lecture 47 - Fourier Analysis Examples - VI

Lecture 48 - Fourier Analysis Bode Plot - I

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Lecture 50 - Fourier Transform Examples: Filtering - Ideal Low Pass Filter

Lecture 51 - Fourier Transform Problems: Unit Step Response of RC Circuit, Sampling of Continuous Signal

Lecture 52 - Sampling: Spectrum of Sampled Signal, Nyquist Criterion

Lecture 53 - Sampling: Reconstruction from Sampled Signal

Lecture 54 - Fourier Analysis of Discrete Time Signals and Systems - Introduction

Lecture 55 - Fourier Analysis of Discrete Time Signals - Duality, Parseval's Theorem

Lecture 56 - Discrete Time Fourier Transform: Definition, Inverse DTFT, Convergence, Relation between DTFT and z-Transform, DTFT of Common Signals

Lecture 57 - Discrete Time Fourier Transform: Properties of DTFT - Linearity, Time Shifting, Frequency Shifting, Conjugation, Time-Reversal, Duality

Lecture 58 - Discrete Time Fourier Transform: Properties of DTFT - Differentiation in Frequency, Difference in Time, Convolution, Multiplication, Parseval's Relation

Lecture 59 - DTFT: Discrete Time LTI Systems - LTI Systems Characterized by Difference Equations

Lecture 60 - Discrete Fourier Transform - Definition, Inverse DFT, Relation between DFT and DFS, Relation between DFT and DTFT, Properties - Linearity, Time Shifting

Lecture 61 - Discrete Fourier Transform: Properties - Conjugation, Frequency Shift, Duality, Circular Convolution, Multiplication, Parseval's Relation, Example Problems for Fourier Analysis of Discrete Time Signals

[Lecture 62 - Example Problems: DFS Analysis of Discrete Time Signals, Problems on DTFT](#)

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[Lecture 68 - Example Problems: DFT, IDFT in Matrix form](#)

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[Lecture 70 - Group/Phase Delay - Part II](#)

[Lecture 71 - IIR Filter Structures: DF-I, DF-II](#)

[Lecture 72 - IIR Filter Structures: Transpose Form](#)

[Lecture 73 - IIR Filter Structures: Example](#)

[Lecture 74 - IIR Filter Structures: Cascade Form](#)

[Lecture 75 - IIR Filter: Parallel Form-I and II](#)

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Applied Optimization for Wireless, Machine Learning, Big Data (Electrical Engineering)

Co-ordinators : Prof. Aditya K. Jagannatham

Lecture 1 - Vectors and Matrices - Linear Independence and Rank

Lecture 2 - Eigenvectors and Eigenvalues of Matrices and their Properties

Lecture 3 - Positive Semidefinite (PSD) and Positive Definite (PD) Matrices and their Properties

Lecture 4 - Inner Product Space and its Properties: Linearity, Symmetry and Positive Semi-definite

Lecture 5 - Inner Product Space and its Properties: Cauchy Schwarz Inequality

Lecture 6 - Properties of Norm, Gaussian Elimination and Echelon form of matrix

Lecture 7 - Gram Schmidt Orthogonalization Procedure

Lecture 8 - Null Space and Trace of Matrices

Lecture 9 - Eigenvalue Decomposition of Hermitian Matrices and Properties

Lecture 10 - Matrix Inversion Lemma (Woodbury identity)

Lecture 11 - Introduction to Convex Sets and Properties

Lecture 12 - Affine Set Examples and Application

Lecture 13 - Norm Ball and its Practical Applications

Lecture 14 - Ellipsoid and its Practical Applications

Lecture 15 - Norm Cone, Polyhedron and its Applications

Lecture 16 - Applications: Cooperative Cellular Transmission

Lecture 17 - Positive Semi Definite Cone And Positive Semi Definite (PSD) Matrices

Lecture 18 - Introduction to Affine functions and examples

Lecture 19 - norm balls and Matrix properties: Trace, Determinant

Lecture 20 - Inverse of a Positive Definite Matrix

Lecture 21 - Example Problems: Property of Norms, Problems on Convex Sets

Lecture 22 - Problems on Convex Sets (Continued...)

Lecture 23 - Introduction to Convex and Concave Functions

Lecture 24 - Properties of Convex Functions with examples

Lecture 25 - Test for Convexity: Positive Semidefinite Hessian Matrix

Lecture 26 - Application: MIMO Receiver Design as a Least Squares Problem

Lecture 27 - Jensen's Inequality and Practical Application

Lecture 28 - Jensen's Inequality application

Lecture 29 - Properties of Convex Functions

Lecture 30 - Conjugate Function and Examples to prove Convexity of various Functions

Lecture 31 - Examples on Operations Preserving Convexity

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Lecture 32 - Examples on Test for Convexity, Quasi-Convexity

Lecture 33 - Examples on Convex Functions

Lecture 34 - Practical Application: Beamforming in Multi-antenna Wireless Communication

Lecture 35 - Practical Application: Maximal Ratio Combiner for Wireless Systems

Lecture 36 - Practical Application: Multi-antenna Beamforming with Interfering User

Lecture 37 - Practical Application: Zero-Forcing (ZF) Beamforming with Interfering User

Lecture 38 - Practical Application: Robust Beamforming With Channel Uncertainty for Wireless Systems

Lecture 39 - Practical Application: Robust Beamformer Design for Wireless Systems

Lecture 40 - Practical Application: Detailed Solution for Robust Beamformer Computation in Wireless Systems Text

Lecture 41 - Linear modeling and Approximation Problems: Least Squares

Lecture 42 - Geometric Intuition for Least Squares

Lecture 43 - Practical Application: Multi antenna channel estimation

Lecture 44 - Practical Application: Image deblurring

Lecture 45 - Least Norm Signal Estimation

Lecture 46 - Regularization: Least Squares + Least Norm

Lecture 47 - Convex Optimization Problem representation: Canonical form, Epigraph form

Lecture 48 - Linear Program Practical Application: Base Station Co-operation

Lecture 49 - Stochastic Linear Program, Gaussian Uncertainty

Lecture 50 - Practical Application: Multiple Input Multiple Output (MIMO) Beamforming

Lecture 51 - Practical Application: Multiple Input Multiple Output (MIMO) Beamformer Design

Lecture 52 - Practical Application: Co-operative Communication, Overview and various Protocols used

Lecture 53 - Practical Application: Probability of Error Computation for Co-operative Communication

Lecture 54 - Practical Application: Optimal power allocation factor determination for Co-operative Communication

Lecture 55 - Practical Application: Compressive Sensing

Lecture 56 - Practical Application

Lecture 57 - Practical Application- Orthogonal Matching Pursuit (OMP) algorithm for Compressive Sensing

Lecture 58 - Example Problem: Orthogonal Matching Pursuit (OMP) algorithm

Lecture 59 - Practical Application : L1 norm minimization and regularization approach for Compressive Sensing Optimization problem

Lecture 60 - Practical Application of Machine Learning and Artificial Intelligence: Linear Classification, Overview and Motivation

Lecture 61 - Practical Application: Linear Classifier (Support Vector Machine) Design

Lecture 62 - Practical Application: Approximate Classifier Design

Lecture 63 - Concept of Duality

Lecture 64 - Relation between optimal value of Primal and Dual Problems, concepts of Duality gap and Strong Duality

[Lecture 65 - Example problem on Strong Duality](#)

[Lecture 66 - Karush-Kuhn-Tucker \(KKT\) conditions](#)

[Lecture 67 - Application of KKT condition:Optimal MIMO power allocation \(Waterfilling\)](#)

[Lecture 68 - Optimal MIMO Power allocation \(Waterfilling\)-II](#)

[Lecture 69 - Example problem on Optimal MIMO Power allocation \(Waterfilling\)](#)

[Lecture 70 - Linear objective with box constraints, Linear Programming](#)

[Lecture 71 - Example Problems II](#)

[Lecture 72 - Examples on Quadratic Optimization](#)

[Lecture 73 - Examples on Duality: Dual Norm, Dual of Linear Program \(LP\)](#)

[Lecture 74 - Examples on Duality: Min-Max problem, Analytic Centering](#)

[Lecture 75 - Semi Definite Program \(SDP\) and its application:MIMO symbol vector decoding](#)

[Lecture 76 - Application:SDP for MIMO Maximum Likelihood \(ML\) Detection](#)

[Lecture 77 - Introduction to big Data: Online Recommender System \(Netflix\)](#)

[Lecture 78 - Matrix Completion Problem in Big Data: Netflix-I](#)

[Lecture 79 - Matrix Completion Problem in Big Data: Netflix-II](#)

- Lecture 1 - Overview of fiber-optic communication systems
- Lecture 2 - Review of Maxwell's equations
- Lecture 3 - Uniform plane waves (UWPs) in free-space
- Lecture 4 - Properties of UWPs (propagation constant, polarization, and Poynting vector)
- Lecture 5 - Boundary conditions and reflection from a PEC
- Lecture 6 - Obliquely incident waves-I (TE and TM waves, Snell's laws)
- Lecture 7 - Obliquely incident waves-II (Reflection and transmission coefficients, Brewster angle)
- Lecture 8 - Total internal reflection
- Lecture 9 - Ray theory of dielectric slab waveguides
- Lecture 10 - Transverse resonance condition for slab waveguides
- Lecture 11 - Introduction to optical fibers
- Lecture 12 - Ray theory of light propagation in optical fibers
- Lecture 13 - Concept of waveguide modes
- Lecture 14 - Systematic procedure to obtain modes of a waveguide
- Lecture 15 - Systematic analysis of parallel plate metallic waveguide
- Lecture 16 - Systematic analysis of dielectric slab waveguides
- Lecture 17 - Further discussion on slab waveguides
- Lecture 18 - Modal analysis of step index optical fiber
- Lecture 19 - Properties of modes of step-index optical fiber - I
- Lecture 20 - Properties of modes of step-index optical fiber - II
- Lecture 21 - Linearly polarized modes
- Lecture 22 - Attenuation and power loss in fibers
- Lecture 23 - Introduction to dispersion in fibers
- Lecture 24 - Mathematical modelling of dispersion: Transfer function approach
- Lecture 25 - Pulse propagation equation and its solution
- Lecture 26 - Pre-chirped pulses and Inter and Intra-modal dispersion in optical fibers
- Lecture 27 - Beam Propagation Method
- Lecture 28 - Polarization Effects on Pulse Propagation
- Lecture 29 - Modes in Optical Fibres and Pulse Propagation in Optical Fibres
- Lecture 30 - Graded Index Fibers
- Lecture 31 - Light Sources, Detectors and Amplifiers

- Lecture 32 - Basics of Lasers-I (Structure of Lasers, Process of Photon Emission)
- Lecture 33 - Basics of Lasers-II (Einstein's Theory of Radiation)
- Lecture 34 - Basics of Lasers-III (Population Inversion and Rate Equation for Lasers)
- Lecture 35 - Basic Properties of Semiconductor Laser-I (Energy Gap, Intrinsic and Extrinsic Semiconductors)
- Lecture 36 - Basic Properties of Semiconductor Laser-II (Fermi Level)
- Lecture 37 - Optical Properties of Semiconductors-I (Direct Bandgap and Indirect Bandgap, Density of States)
- Lecture 38 - Optical Properties of Semiconductors-II (Gain, Absorption, Recombination rate) Homojunction Lasers
- Lecture 39 - Double Heterostructure Lasers, Introduction to Quantum Well Lasers
- Lecture 40 - Semiconductor Optical Amplifier
- Lecture 41 - Erbium-doped fiber amplifier
- Lecture 42 - Photodetectors
- Lecture 43 - Noise in Photodetectors
- Lecture 44 - Introduction to WDM components
- Lecture 45 - Couplers, Circulators, FRM and Filters
- Lecture 46 - Filter, MUX/DEMUX, Diffraction grating (FBG and Long period grating)
- Lecture 47 - Optical Modulators-I (Current modulation)
- Lecture 48 - Optical Modulators-II (Electro-optic modulators)
- Lecture 49 - Review of Communication Concepts-I (Deterministic and Random Signals, Baseband and Passband Signals)
- Lecture 50 - Review of Communication Concepts-II (Signal and vectors, Signal energy, Orthonormal basis functions)
- Lecture 51 - Intensity modulation/ Direct Detection
- Lecture 52 - BER discussion for OOK systems
- Lecture 53 - Higher order modulation and Coherent Receiver
- Lecture 54 - Coherent receiver for BPSK systems and BER calculation
- Lecture 55 - Recovering Polarization
- Lecture 56 - DSP algorithms for Chromatic dispersion mitigation
- Lecture 57 - DSP algorithms for Carrier phase estimation - I
- Lecture 58 - DSP algorithms for Carrier phase estimation - II
- Lecture 59 - Nonlinear effects in fiber
- Lecture 60 - Four wave mixing, Loss measurement, Dispersion measurement
- Lecture 61 - Lab Demonstration (Laser diode characteristics, Loss measurement, Optical Intensity Modulation)

Lecture 1 - Introduction and Types of Transmission Lines

Lecture 2 - Distributed Circuit Model of Uniform Transmission Line

Lecture 3 - Voltage and Current Equation of the Transmission line

Lecture 4 - Sinusoidal Excitation of Transmission Line (Propagation constant, Characteristic Impedance)

Lecture 5 - Properties of Transmission Line (Reflection Coefficient, Input Impedance, Standing Wave Ratio)

Lecture 6 - Power Calculations and Introduction to Smith Chart

Lecture 7 - Smith Chart

Lecture 8 - Additional Applications of Smith Chart

Lecture 9 - Time domain Analysis of Transmission Line - I

Lecture 10 - Time domain Analysis of Transmission Line - II

Lecture 11 - Usage of Lattice Diagrams

Lecture 12 - TDR analysis of Transmission Lines

Lecture 13 - Introduction to Propagation of Electromagnetic Waves

Lecture 14 - Uniform Plane Waves - I

Lecture 15 - Uniform Plane Waves - II

Lecture 16 - Poynting Vector, Average Power, Polarization

Lecture 17 - Uniform Plane Waves in Lossy Medium

Lecture 18 - Normal Incidence of Plane Waves

Lecture 19 - Oblique Incidence of Plane Waves - I

Lecture 20 - Oblique Incidence of Plane Waves - II

Lecture 21 - Total Internal Reflection

Lecture 22 - Slab Waveguides

Lecture 23 - Optical Fibers

Lecture 24 - Parallel Plate Waveguides

Lecture 25 - Rectangular Waveguides

Lecture 26 - Modes of Rectangular Waveguides

Lecture 27 - Waveguides summary and Introduction to Radiation

Lecture 28 - Solution to Electric Scalar Potential and Magnetic Vector Potential Equations

Lecture 29 - Further discussion on Magnetic Vector Potential and Elementary Hertzian Dipole

Lecture 30 - Near field and Far-field Antenna and Properties of Antennas

Lecture 31 - Linear antenna - I

[Lecture 32 - Linear antenna - II and Properties of Transmitting and Receiving Antenna](#)

[Lecture 33 - Friis Transmission Formula](#)

[Lecture 34 - Antenna Array](#)

[Lecture 35 - Wireless Channel](#)

[Lecture 36 - Further discussion on Wireless Channel Modelling](#)

[Lecture 37 - Diffraction - I](#)

[Lecture 38 - Diffraction - II](#)

[Lecture 39 - Distribution of Laser Beam](#)

[Lecture 40 - Interference \(Double slit experiment, Fabry Perot Interferometer\)](#)

[Lecture 41 - Summary](#)

Lecture 1 - Basic Concepts

Lecture 2 - Sinusoids and Phasors

Lecture 3 - Circuit Elements - Part 1

Lecture 4 - Circuit Elements - Part 2

Lecture 5 - AC Power Analysis

Lecture 6 - RMS Voltage and Current

Lecture 7 - Topology

Lecture 8 - Star-Delta Transformation and Mesh Analysis

Lecture 9 - Mesh Analysis.

Lecture 10 - Nodal Analysis

Lecture 11 - Linearity Property and Superposition Theorem

Lecture 12 - Source Transformation

Lecture 13 - Duality

Lecture 14 - Thevenin's Theorem - 1

Lecture 15 - Thevenin's Theorem - 2

Lecture 16 - Norton's Theorem - 1

Lecture 17 - Norton's Theorem - 2

Lecture 18 - Maximum Power Transfer Theorem - 1

Lecture 19 - Maximum Power Transfer Theorem - 2

Lecture 20 - Reciprocity and Compensation Theorem

Lecture 21 - First Order RC Circuits

Lecture 22 - First Order RL Circuits

Lecture 23 - Singularity Functions

Lecture 24 - Step Response of RC and RL Circuits

Lecture 25 - Second Order Response

Lecture 26 - Step Response of Second Order Circuits-First Order and Second Order Circuits (Continued...)

Lecture 27 - Step Response of Parallel RLC Circuit-First Order and Second Order Circuits (Continued...)

Lecture 28 - Definition of the Laplace Transform

Lecture 29 - Properties of the Laplace Transform

Lecture 30 - Inverse Laplace Transform

Lecture 31 - Laplace Transform of Circuit Elements

[Lecture 32 - Transfer Function](#)

[Lecture 33 - Convolution Integral](#)

[Lecture 34 - Graphical Approach of Convolution Integral](#)

[Lecture 35 - Network Stability and Network Synthesis](#)

[Lecture 36 - Impedance Parameters](#)

[Lecture 37 - Admittance Parameters](#)

[Lecture 38 - Hybrid Parameters](#)

[Lecture 39 - Transmission Parameters](#)

[Lecture 40 - Interconnection of Networks](#)

[Lecture 41 - Nodal and Mesh Analysis](#)

[Lecture 42 - Superposition Theorem and Source Transformation](#)

[Lecture 43 - Thevenin's, Norton's and, Maximum Power Transfer Theorem](#)

[Lecture 44 - Magnetically Coupled Circuits](#)

[Lecture 45 - Energy in Coupled Circuits and Ideal Transformer](#)

[Lecture 46 - Ideal Transformer and Introduction to Three-Phase Circuits](#)

[Lecture 47 - Balanced Three-Phase Connections](#)

[Lecture 48 - Balanced Wye-Delta and Delta-Delta Connections](#)

[Lecture 49 - Balanced Delta-Wye Connection and Power in Balanced Three-Phase System](#)

[Lecture 50 - Unbalanced Three-Phase System and Three-Phase Power Measurement](#)

[Lecture 51 - Introduction to Graphical Models](#)

[Lecture 52 - State Equations](#)

[Lecture 53 - State Diagram](#)

[Lecture 54 - State Transition Matrix](#)

[Lecture 55 - State Variable Method to Circuit Analysis](#)

[Lecture 56 - Characteristic Equation, Eigenvalues, and Eigenvectors-State Variable Analysis \(Continued...\)](#)

[Lecture 57 - Modeling of Mechanical Systems](#)

[Lecture 58 - Modeling of The Rotational Motion of Mechanical Systems](#)

[Lecture 59 - Modeling of Electrical Systems](#)

[Lecture 60 - Solving Analogous Systems](#)

Lecture 1 - Introduction to Electric Drives

Lecture 2 - Dynamics of Electric Drives, Four Quadrant Operation, Equivalent Drive Parameters

Lecture 3 - Equivalent Drive Parameters, Friction Components, Nature of Load Torque

Lecture 4 - Steady State Stability, Load Equalization

Lecture 5 - Load Equalization, Characteristics of DC Motor

Lecture 6 - Speed Torque Characteristics of Separately Excited DC Motor and Series DC Motor

Lecture 7 - Field Control of Series Motor, Motoring and Braking of Separately Excited and Series DC motors

Lecture 8 - Speed Control of Separately Excited DC Motor Using Controlled Rectifiers

Lecture 9 - Analysis of Single Phase Full Controlled Converter-fed Separately Excited DC Motor

Lecture 10 - Speed Torque Characteristics of Full Controlled Converter-fed Separately Excited DC Motor, Analysis of Single Phase Half Controlled Converter-fed Separately Excited DC Motor

Lecture 11 - Analysis of Single Phase Half Controlled Converter-fed Separately Excited DC Motor.

Lecture 12 - Three Phase Full Controlled Converter-fed Separately Excited DC Motor, Multi-quadrant Operation of DC Motor

Lecture 13 - Dual Converter-fed DC Motor, Multi-quadrant Operation Using Field Current Reversal

Lecture 14 - DC Chopper-fed Separately Excited DC Motor for Motoring and Braking

Lecture 15 - Two-quadrant DC Chopper, Four-quadrant DC Chopper

Lecture 16 - Dynamic Braking of DC Motor by Chopper Controlled Resistor, Closed-loop Operation of DC Drives, Induction Motor Drives

Lecture 17 - Speed Torque Characteristics of Induction Motor, Operation of Induction Motor from Non-sinusoidal Supply

Lecture 18 - Operation of Induction Motor from Non-sinusoidal Supply

Lecture 19 - Stator Current of Induction Motor with Non-sinusoidal Supply, Operation of Induction Motor with Unbalanced Voltage Supply

Lecture 20 - Single Phasing of Induction Motor, Braking of Induction Motor

Lecture 21 - Dynamic braking of induction motor, AC dynamic braking, DC dynamic braking

Lecture 22 - Analysis of DC dynamic braking of induction motor

Lecture 23 - Self-excited dynamic braking of induction motor, Speed control of induction motor using stator voltage regulator, Variable voltage variable frequency control

Lecture 24 - Variable voltage variable frequency control of induction motor, Open loop V/F control

Lecture 25 - Slip speed control of induction motor, Constant Volt/Hz control with slip speed regulation

Lecture 26 - Closed-loop Volt/Hz control of induction motor with slip speed regulation, Multi-quadrant operation of induction motor drive

Lecture 27 - Current Source Inverter (CSI) fed induction motor drive

Lecture 28 - Closed-loop operation of current source inverter (CSI) fed induction motor drive, Control of slip ring induction motor - Static rotor resistance control

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Lecture 29 - Closed-loop operation of slip ring induction motor with static rotor resistance control, Slip power recovery in slip ring induction motor - Static Kramer drive

Lecture 30 - Static Kramer drive and its closed-loop control, Introduction to synchronous motor

Lecture 31 - Various types of synchronous motors, Equivalent circuit and phasor diagram of cylindrical synchronous motor, Speed-torque characteristics of cylindrical synchronous motor

Lecture 32 - Phasor diagram of salient pole synchronous motor, Expression of power and torque for a salient pole synchronous motor, Synchronous reluctance motor, Open-loop V/f control of synchronous motor

Lecture 33 - Open-loop V/f control, Torque-speed characteristics, Self controlled synchronous motor drive employing load commutated thyristor inverter

Lecture 34 - Detailed analysis of commutation of load commutated thyristor inverter, Derivation of overlap angle and margin angle, Closed-loop speed control scheme for load commutated inverter-fed synchronous motor drive

Lecture 35 - Low cost brushless DC motor (BLDCM), Trapezoidal permanent magnet AC motor

Lecture 36 - Trapezoidal permanent magnet AC motor, Derivation of power and torque, Closed-loop control of trapezoidal BLDC motor, Introduction to switched reluctance motor

Lecture 37 - Construction and operating principle of switched reluctance motor

Lecture 38 - Current/ voltage control for switched reluctance motor, operating modes of switched reluctance motor, Introduction to traction drives

Lecture 39 - Current collector for mainline trains, Nature of traction load, Duty cycle of traction drives

Lecture 40 - Duty cycle of traction drives, Distance between two stops, Calculation of total tractive effort and drive rating

Lecture 1 - Introduction: Fuzzy Sets, Logic and Systems and Applications

Lecture 2 - Introduction: Real Life Applications of Fuzzy Systems

Lecture 3 - Fuzzy Sets and Fuzzy Logic Toolbox in MATLAB - I

Lecture 4 - Fuzzy Sets and Fuzzy Logic Toolbox in MATLAB - II

Lecture 5 - Membership Functions - I

Lecture 6 - Membership Functions - II

Lecture 7 - Nomenclatures used in Fuzzy Set Theory - I

Lecture 8 - Nomenclatures used in Fuzzy Set Theory - II

Lecture 9 - Nomenclatures used in Fuzzy Set Theory - III

Lecture 10 - Set Theoretic Operations on Fuzzy Sets - I

Lecture 11 - Set Theoretic Operations on Fuzzy Sets - II

Lecture 12 - Properties of Fuzzy Sets - I

Lecture 13 - Properties of Fuzzy Sets - II

Lecture 14 - Properties of Fuzzy Sets - III

Lecture 15 - Properties of Fuzzy Sets - IV

Lecture 16 - Properties of Fuzzy Sets - V

Lecture 17 - Distance between Fuzzy Sets - I

Lecture 18 - Distance between Fuzzy Sets - II

Lecture 19 - Distance between Fuzzy Sets - III

Lecture 20 - Arithmetic Operations on Fuzzy Numbers - I

Lecture 21 - Arithmetic Operations on Fuzzy Numbers - II

Lecture 22 - Arithmetic Operations on Fuzzy Numbers - III

Lecture 23 - Complement of Fuzzy Sets

Lecture 24 - T-norm Operators

Lecture 25 - S-norm Operators

Lecture 26 - Parameterized T-Norm Operators

Lecture 27 - Parameterized S-Norm Operators

Lecture 28 - Fuzzy Relation - I

Lecture 29 - Fuzzy Relation - II

Lecture 30 - Operations on Crisp and Fuzzy Relations

Lecture 31 - Projection of Fuzzy Relation Set

[Lecture 32 - Cylindrical Extension of Fuzzy Set](#)

[Lecture 33 - Properties of Fuzzy Relation - I](#)

[Lecture 34 - Properties of Fuzzy Relation - II](#)

[Lecture 35 - Extension Principle](#)

[Lecture 36 - Composition of Fuzzy Relations](#)

[Lecture 37 - Properties of Composition of Fuzzy Relations](#)

[Lecture 38 - Fuzzy Tolerance and Equivalence Relations - I](#)

[Lecture 39 - Fuzzy Tolerance and Equivalence Relations - II](#)

[Lecture 40 - Fuzzy Tolerance and Equivalence Relations - III](#)

[Lecture 41 - Linguistic Hedges](#)

[Lecture 42 - Linguistic Hedges and Negation/ Complement and Connectives](#)

[Lecture 43 - Concentration and Dilation and Composite Linguistic Term and Some Examples](#)

[Lecture 44 - Dilation and Composite Linguistic Term and Some Examples](#)

[Lecture 45 - Some Examples on Composite Linguistic Terms](#)

[Lecture 46 - Contrast Intensification of Fuzzy Sets](#)

[Lecture 47 - Orthogonality of Fuzzy Sets](#)

[Lecture 48 - Fuzzy Rules and Fuzzy Reasoning - I](#)

[Lecture 49 - Fuzzy Rules and Fuzzy Reasoning - II](#)

[Lecture 50 - Fuzzy Inference System](#)

[Lecture 51 - Mamdani Fuzzy Model - I](#)

[Lecture 52 - Mamdani Fuzzy Model - II](#)

[Lecture 53 - Mamdani Fuzzy Model - III](#)

[Lecture 54 - Example on Mamdani Fuzzy Model for Single Antecedent with Three Rules](#)

[Lecture 55 - Example on Mamdani Fuzzy Model for Two Antecedents with Four Rules](#)

[Lecture 56 - Larsen Fuzzy Model - I](#)

[Lecture 57 - Larsen Fuzzy Model - II](#)

[Lecture 58 - Larsen Fuzzy Model - III](#)

[Lecture 59 - Tsukamoto Fuzzy Model](#)

[Lecture 60 - TSK Fuzzy Model](#)

Lecture 1 - Introduction to Peer to Peer Networks

Lecture 2 - Peer to Peer Network in Telephony:Voice over Internet Telephony (VoIP) and Distributed Hash Table (DHT)

Lecture 3 - Building DHT Networks

Lecture 4 - Logarithmic Partitioning of Node ID Space and Index Entry Authenticity

Lecture 5 - Implementation of Voice over Internet Telephony in P2P Way

Lecture 6 - Leaf Nodes, Core Nodes and Type of Messages in DHT Networks

Lecture 7 - Static and Dynamic Partitioning of Node ID Space: Fixed and Floating Partitioning

Lecture 8 - PASTRY Protocol: The Efficient Use of Internet Infrastructure

Lecture 9 - Understanding the PASTRY Protocol through Example

Lecture 10 - Kademia: A DHT Routing Protocol

Lecture 11 - Tapestry: An Evolution of Kademia

Lecture 12 - Understanding the Tapestry Protocol through Example

Lecture 13 - Multi-dimensional Distributed Hash Table: Mapping of Peers into Multidimensional Space

Lecture 14 - Multi-Layer DHT: A Design for Multiple Services

Lecture 15 - Keeping Pairs at Correct Root Nodes

Lecture 16 - Abrupt and Graceful Exit of Root Node: Maintaining Pairs Alive

Lecture 17 - Resilience of Pairs

Lecture 18 - A P2P Distributed File System

Lecture 19 - Storage Space Problem and Incentives to Share Storage

Lecture 20 - P2P Nodes Communications Challenges in Heterogeneous Network Environments

Lecture 21 - P2P Overlaid Multicast: Basic Design

Lecture 22 - P2P Overlaid Multicast: Alternate Design

Lecture 23 - A Design of P2P Email System

Lecture 24 - P2P Mailing List Services: A Basic Design

Lecture 25 - P2P Mailing List Services: An Alternate Design

Lecture 26 - P2P Web: A Basic Design

Lecture 27 - P2P Web Search Engine: A Basic Design

Lecture 28 - P2P Internet: On Being Anonymous

Lecture 29 - P2P in Blockchain

Lecture 30 - P2P Anonymous Communication

Lecture 31 - The Anonymous Communication on the Internet through TOR Network

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[Lecture 32 - An Introduction To TOR Browser: The Anonymity Preserving Access of the Web Sites](#)

[Lecture 33 - Hidden Services on TOR Network](#)

[Lecture 34 - MOOC Wrap-Up : Summary of the Course](#)

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NPTEL : NOC:Applied Linear Algebra for Signal Processing, Data Analytics and Machine Learning (Electrical Engineering)

Co-ordinators : Prof. Aditya K. Jagannatham

- Lecture 1 - Vector Properties: Addition, Linear Combination, Inner Product, Orthogonality, Norm
- Lecture 2 - Vectors: Unit Norm Vector, Cauchy-Schwarz inequality, Radar Application
- Lecture 3 - Inner Product Application: Beamforming in Wireless Communication Systems
- Lecture 4 - Matrices, Definition, Addition and Multiplication of Matrices
- Lecture 5 - Matrix: Column Space, Linear Independence, Rank of Matrix, Gaussian Elimination
- Lecture 6 - Matrix: Determinant, Inverse Computation, Adjoint, Cofactor Concepts
- Lecture 7 - Applications of Matrices: Solution of System of Linear equations, MIMO Wireless Technology
- Lecture 8 - Applications of Matrices: Electric Circuits, Traffic flows
- Lecture 9 - Applications of Matrices: Graph Theory, Social Networks, Dominance Directed Graph, Influential Node
- Lecture 10 - Null Space of Matrix: Definition, Rank-Nullity Theorem, Application in Electric Circuits
- Lecture 11 - Gram-Schmidt Orthogonalization
- Lecture 12 - Gaussian Random Variable: Definition, Mean, Variance, Multivariate Gaussian, Covariance Matrix
- Lecture 13 - Linear Transformation of Gaussian Random Vectors
- Lecture 14 - Machine Learning Application: Gaussian Classification
- Lecture 15 - Eigenvalue: Definition, Characteristic Equation, Eigenvalue Decomposition
- Lecture 16 - Special Matrices: Rotation and Unitary Matrices, Application: Alamouti Code
- Lecture 17 - Positive Semi-definite (PSD) Matrices: Definition, Properties, Eigenvalue Decomposition
- Lecture 18 - Positive Semidefinite Matrix: Example and Illustration of Eigenvalue Decomposition
- Lecture 19 - Machine Learning Application: Principle Component Analysis (PCA)
- Lecture 20 - Computer Vision Application: Face Recognition, Eigenfaces
- Lecture 21 - Least Squares (LS) Solution, Pseudo-Inverse Concept
- Lecture 22 - Least Squares (LS) via Principle of Orthogonality, Projection Matrix, Properties
- Lecture 23 - Application: Pseudo-Inverse and MIMO Zero Forcing (ZF) Receiver
- Lecture 24 - Wireless Application: Multi-Antenna Channel Estimation
- Lecture 25 - Machine Learning Application: Linear Regression
- Lecture 26 - Computation Mathematics Application: Polynomial Fitting
- Lecture 27 - Least Norm Solution
- Lecture 28 - Wireless Application: Multi-user Beamforming
- Lecture 29 - Singular Value Decomposition (SVD): Definition, Properties, Example
- Lecture 30 - SVD Application in MIMO Wireless Technology: Spatial-Multiplexing and High Data Rates
- Lecture 31 - SVD for MIMO wireless optimization, water-filling algorithm, optimal power allocation

HTML Links for 1,19,200+ NPTEL PDF Lectures, Created by LinuXpert Systems, Chennai

Lecture 32 - SVD application for Machine Learning: Principal component analysis (PCA)

Lecture 33 - Multiple signal classification (MUSIC) algorithm: system model

Lecture 34 - MUSIC algorithm for Direction of Arrival (DoA) estimation

Lecture 35 - Linear minimum mean square error (LMMSE) principle

Lecture 36 - LMMSE estimate and error covariance matrix

Lecture 37 - LMMSE estimation in linear systems

Lecture 38 - LMMSE application: Wireless channel estimation and example

Lecture 39 - Time-series prediction via auto-regressive (AR) model

Lecture 40 - Recommender system: design and rating prediction

Lecture 41 - Recommender system: Illustration via movie rating prediction example

Lecture 42 - Fast Fourier transform (FFT) and Inverse fast Fourier transform (IFFT)

Lecture 43 - IFFT/ FFT application in Orthogonal Frequency Division Multiplexing (OFDM) wireless technology

Lecture 44 - OFDM system: Circulant matrices and properties

Lecture 45 - OFDM system model: Transmitter and receiver processing

Lecture 46 - Single-carrier frequency division for multiple access (SC-FDMA) technology

Lecture 47 - Linear dynamical systems: definition and solution via matrix exponential

Lecture 48 - Linear dynamical systems: matrix exponential via SVD

Lecture 49 - Machine Learning application: Support Vector Machines (SVM)

Lecture 50 - Support Vector Machines (SVM): Problem formulation via maximum hyperplane separation

Lecture 51 - Sparse regression: problem formulation and relation to Compressive Sensing (CS)

Lecture 52 - Sparse regression: solution via the Orthogonal Matching Pursuit (OMP) algorithm

Lecture 53 - OMP Example for Sparse Regression

Lecture 54 - Machine Learning Application: Clustering

Lecture 55 - K-Means Clustering algorithm

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NPTEL : NOC:Digital Switching (Electrical Engineering)

Co-ordinators : Prof. Yatindra N Singh

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NPTEL : Optimal Control (Electrical Engineering)

Co-ordinators : Prof. G.D. Ray

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- Lecture 5 - Unconstrained Optimization Problem (Numerical Techniques)
- Lecture 6 - Solution of Unconstrained Optimization Problem Using Conjugate Gradient Method and Networks Methods
- Lecture 7 - Solution of Unconstrained Optimization Problem Using Conjugate Gradient Method and Networks Methods (Continued.)
- Lecture 8 - Solution of Constraint Optimization Problem-Karush-Kuhn Tucker (KKT) Conditions
- Lecture 9 - Solution of Constraint Optimization Problem-Karush-Kuhn Tucker (KKT) Conditions (Continued.)
- Lecture 10 - Problem and Solution Session
- Lecture 11 - Post Optimality Analysis, Convex Function and its Properties
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- Lecture 13 - Quadratic Optimization Problem Using Linear Programming
- Lecture 14 - Matrix form of the Simplex Method
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- Lecture 16 - Solution of Linear Programming Using Simplex Method:- Algebraic Approach
- Lecture 17 - Solution of Linear Programming Using Simplex Method:- Algebraic Approach (Continued.)
- Lecture 18 - Solution of LP Problems with Two Phase Method
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- Lecture 20 - Standard Primal and Dual Problems
- Lecture 21 - Relationship Between Primal and Dual Variables
- Lecture 22 - Solution of Quadratic Programming Problem Using Simplex Method
- Lecture 23 - Interior Point Method for Solving Optimization Problems
- Lecture 24 - Interior Point Method for Solving Optimization Problems (Continued.)
- Lecture 25 - Solution of Nonlinear Programming Problem Using Exterior Penalty Function Method
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- Lecture 29 - Multiobjective Optimization Problem
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- Lecture 32 - Dynamic Optimization Problem: Basic Concepts and Necessary and Sufficient Condition (Continued...2)
- Lecture 33 - Numerical Example and Solution of Optimal Control Problem using Calculus of Variation principle
- Lecture 34 - Numerical Example and Solution of Optimal Control Problem using Calculus of Variation principle (Continued.)
- Lecture 35 - Hamiltonian Formulation for solution of optimal Control problem and numerical example
- Lecture 36 - Hamiltonian Formulation for solution of optimal Control problem and numerical example (Continued.)
- Lecture 37 - Performance Indices and Linear Quadratic Regulator Problem
- Lecture 38 - Performance Indices and Linear Quadratic Regulator Problem (Continued.)
- Lecture 39 - Solution and Stability Analysis of Finite - time LQR Problem: Numerical Example
- Lecture 40 - Solution and Infinite - time LQR Problem and Stability Analysis
- Lecture 41 - Numerical Example and Methods for Solution of A.R.E.
- Lecture 42 - Numerical Example and Methods for Solution of A.R.E. (Continued.)
- Lecture 43 - Frequency Domain Interpretation of LQR Controlled System
- Lecture 44 - Gain and Phase Margin of LQR Controlled System
- Lecture 45 - The Linear Quadratic Gaussian Problem
- Lecture 46 - Loop-Transfer Recovery
- Lecture 47 - Dynamic Programming for Discrete Time Systems
- Lecture 48 - Minimum ∞ Time Control of a Linear Time Invariant System
- Lecture 49 - Solution of Minimum ∞ Time Control Problem with an Example
- Lecture 50 - Constraint in Control Inputs and State Variables
- Lecture 51 - Constraint in Control Inputs and State Variables (Continued...)
- Lecture 52 - Norms for Vectors, Matrices, Signals and Linear Systems
- Lecture 53 - Signal and System Norms
- Lecture 54 - Internal Stability, Sensitivity and Complementary Sensitivity Functions
- Lecture 55 - Internal Stability, Sensitivity and Complementary Sensitivity Functions (Continued...)
- Lecture 56 - Plant Uncertainty and Standard form for Robust Stability Analysis
- Lecture 57 - Plant Uncertainty and Standard form for Robust Stability Analysis (Continued...)
- Lecture 58 - Frequency Response of Linear System and Singular Value Decomposition of System
- Lecture 59 - Control Problem Statement in H- α Framework
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- Lecture 1 - Representations of Dynamical Systems
- Lecture 2 - Vector Fields of Nonlinear Systems
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- Lecture 6 - The Rossler Equation and Forced Pendulum
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- Lecture 8 - Discrete Time Dynamical Systems
- Lecture 9 - The Logistic Map and Period doubling
- Lecture 10 - Flip and Tangent Bifurcations
- Lecture 11 - Intermittency Transcritical and pitchfork
- Lecture 12 - Two Dimensional Maps
- Lecture 13 - Bifurcations in Two Dimensional Maps
- Lecture 14 - Introduction to Fractals
- Lecture 15 - Mandelbrot Sets and Julia Sets
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- Lecture 17 - Interactive Function Systems
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- Lecture 19 - Fractal Image Compression
- Lecture 20 - Stable and Unstable Manifolds
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- Lecture 22 - Statistics of Chaotic Attractors
- Lecture 23 - Matrix Times Circle : Ellipse
- Lecture 24 - Lyapunov Exponent
- Lecture 25 - Frequency Spectra of Orbits
- Lecture 26 - Dynamics on a Torus
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- Lecture 30 - Lyapunou Function and Centre Manifold Theory
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Lecture 8 - Tutorial on Discrete Time Signals & Their Transforms

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Lecture 12 - Discrete Fourier Transform (DFT) (Continued...)

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Lecture 20 - Tutorial & Introduction to Computer Aided Design of Filters

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Lecture 7 - Using the lagrangian Equation to Obtain Differential Equations (Part-IV)

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Lecture 2 - Quality of Energy

Lecture 3 - Complete Cycle Analysis of Fossil Fuels

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Lecture 9 - Thermal Power Plants

Lecture 10 - Hydroelectric Power

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Lecture 13 - Nuclear Fusion Reactors

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- Lecture 2 - Probability Theory
- Lecture 3 - Random Variables
- Lecture 4 - Function of Random Variable Joint Density
- Lecture 5 - Mean and Variance
- Lecture 6 - Random Vectors Random Processes
- Lecture 7 - Random Processes and Linear Systems
- Lecture 8 - Some Numerical Problems
- Lecture 9 - Miscellaneous Topics on Random Process
- Lecture 10 - Linear Signal Models
- Lecture 11 - Linear Mean Sq.Error Estimation
- Lecture 12 - Auto Correlation and Power Spectrum Estimation
- Lecture 13 - Z-Transform Revisited Eigen Vectors/Values
- Lecture 14 - The Concept of Innovation
- Lecture 15 - Last Squares Estimation Optimal IIR Filters
- Lecture 16 - Introduction to Adaptive Filters
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- Lecture 18 - Kalman Filter-Model and Derivation
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- Lecture 20 - Estimator Properties
- Lecture 21 - The Time-Invariant Kalman Filter
- Lecture 22 - Kalman Filter-Case Study
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- Lecture 24 - Linear Regression-Recursive Least Squares
- Lecture 25 - Variants of LSE
- Lecture 26 - Least Square Estimation
- Lecture 27 - Model Order Selection Residual Tests
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- Lecture 30 - Conclusion

NPTEL : Illumination Engineering (Electrical Engineering)

Co-ordinators : Prof. N.K. Kishore

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- Lecture 6 - Photometry
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- Lecture 8 - Discharge Lamps - I
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- Lecture 11 - Illumination Systems - I
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- Lecture 13 - Glare
- Lecture 14 - Color
- Lecture 15 - Interior Lighting
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- Lecture 18 - Lighting Calculations
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Lecture 12 - P-I-D Control

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Lecture 14 - Feedforward Control Ratio Control

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Lecture 16 - Special Control Structures

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Lecture 20 - Sequence Control. More RLL Elements, RLL Syntax

Lecture 21 - A Structured Design Approach to Sequence

Lecture 22 - PLC Hardware Environment

Lecture 23 - Introduction To CNC Machines

Lecture 24 - Contour generation and Motion Control

Lecture 25 - Flow Control Valves

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Lecture 20 - Graph Theory (Continued.)

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- Lecture 2 - Introduction to Single Line Diagram
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- Lecture 4 - Inductance Calculation (Three Phase)
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NPTEL : NOC:Digital Control in Switched Mode Power Converters and FPGA-based Prototyping (Electrical Engineering)

Co-ordinators : Prof. Santanu Kapat

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NPTEL : Digital Integrated Circuits (Electrical Engineering)

Co-ordinators : Prof. Amitava Dasgupta

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NPTEL : Electromagnetic Fields (Electrical Engineering)

Co-ordinators : Prof. Harishankar Ramachandran

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DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Fundamentals of Electric Vehicles: Technology and Economics (Electrical Engineering)

Co-ordinators : Prof. Ashok Jhunjunwala, Prof. Prabhjot Kaur, Prof. Kaushal Kumar Jha, Prof. L Kannan

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- Lecture 2 - Classical Vs Quantum Mechanics
- Lecture 3 - Electrons in infinite and finite 1D potential well
- Lecture 4 - 3D potential well model of atom and Bohr's model
- Lecture 5 - Covalent bonds and inter-atomic interactions in Silicon
- Lecture 6 - Energy band formation
- Lecture 7 - Electron hole pair generation
- Lecture 8 - Direct and Indirect bandgap semiconductors
- Lecture 9 - Energy levels in infinite and finite potential wells (short demo)
- Lecture 10 - Effective mass in Semiconductors
- Lecture 11 - Intrinsic carrier density
- Lecture 12 - Doping and extrinsic semiconductors
- Lecture 13 - Fermi level in extrinsic semiconductors
- Lecture 14 - Temperature dependence of Fermi level
- Lecture 15 - Temperature dependence of Fermi level
- Lecture 16 - Charge neutrality relationship
- Lecture 17 - Drift current and energy band representation of kinetic energy of carriers
- Lecture 18 - Semiconductor bands in a electric field
- Lecture 19 - Diffusion current
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- Lecture 21 - Equilibrium Vs Nonequilibrium carrier response
- Lecture 22 - Minority carrier diffusion equation (MCDE) - Example problems
- Lecture 23 - Quasi Fermi level in nonequilibrium conditions
- Lecture 24 - Quasi Fermi level and minority carrier diffusion length
- Lecture 25 - Semiconductor device fabrication
- Lecture 26 - PN Junctions - An introduction
- Lecture 27 - PN Junction electrostatics
- Lecture 28 - Energy band diagram of PN junction
- Lecture 29 - Depletion width and peak electric field
- Lecture 30 - PN junction electrostatics - examples
- Lecture 31 - Demo of PN Junction Lab on Nanohub

- Lecture 32 - Forward and reverse biased PN junctions
- Lecture 33 - Minority carrier injection in PN junctions
- Lecture 34 - Current in forward biased PN junction
- Lecture 35 - Current in reverse biased PN junction
- Lecture 36 - Depletion capacitance in PN junction
- Lecture 37 - Non-idealities in PN junction diode
- Lecture 38 - Nanohub Demo - PN Junction with applied bias
- Lecture 39 - Schottky barrier in metal-semiconductor junction
- Lecture 40 - Current flow across a Schottky barrier
- Lecture 41 - Ohmic vs rectifying contacts
- Lecture 42 - An Ideal MOS Capacitor
- Lecture 43 - Operating regimes of a MOSCAP
- Lecture 44 - Simplified band diagrams of accumulation and depletion in MOSCAP
- Lecture 45 - Inversion in a MOSCAP
- Lecture 46 - NMOSCAP in accumulation mode
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- Lecture 48 - NMOSCAP in inversion mode
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- Lecture 50 - Threshold voltage in a MOSCAP
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- Lecture 52 - Non-ideal MOS Capacitor
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- Lecture 55 - Impact of doping, oxide thickness and temperature on CV
- Lecture 56 - Nanohub Demo - MOS CV
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- Lecture 59 - IV Characteristics of a long channel MOSFET
- Lecture 60 - Example problems with MOSFETs
- Lecture 61 - MOSFET device metrics
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- Lecture 63 - MOSFET Scaling and technology nodes
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DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Electric Vehicles and Renewable Energy (Electrical Engineering)

Co-ordinators : Prof. Ashok Jhunjunwala, Prof. Prabhjot Kaur, Prof. Kaushal Kumar Jha, Prof. L Kannan

Lecture 1 - Electric Vehicle Introduction

Lecture 2 - The drive Torque, Power, Speed and Energy

Lecture 3 - Energy Source

Lecture 4 - Vehicle Auxillary, Petrol pumps and Charging stations

Lecture 5 - Introduction to Electric Vehicles in India

Lecture 6 - Can India Drive its EV program Innovatively and Differently and scale

Lecture 7 - Battery Cost reduction strategy

Lecture 8 - A bit about Batteries, Charging and Swapping Infrastructure

Lecture 9 - Where will we get Lithium for batteries and EV Subsystems

Lecture 10 - Forces acting when a vehicle move

Lecture 11 - Aerodynamic drag, Rolling Resistance and Uphill Resistance

Lecture 12 - Power and torque to accelerate

Lecture 13 - Putting it all together - 1

Lecture 14 - Putting it all together - 2

Lecture 15 - Concept of drive cycle - 1

Lecture 16 - Concept of drive cycle - 2

Lecture 17 - Drive Cycles and Energy used per km - Part 1

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Lecture 19 - EV Subsystem: Design of EV Drive Train - Part 1

Lecture 20 - EV Subsystem: Design of EV Drive Train - Part 2

Lecture 21 - Introduction to Battery Parameters - Part 1

Lecture 22 - Introduction to Battery Parameters - Part 2

Lecture 23 - Why Lithium Ion Battery? - Part 1

Lecture 24 - Why Lithium Ion Battery? - Part 2

Lecture 25 - Batteries in Future

Lecture 26 - Li-Ion Battery Cells

Lecture 27 - SoH and SoC estimation and Self Discharge - Part 1

Lecture 28 - SoH and SoC estimation and Self Discharge - Part 2

Lecture 29 - Battery Pack Development - Part 1

Lecture 30 - Battery Pack Development - Part 2

Lecture 31 - Computation of Effective cost of battery - Part 1

- Lecture 32 - Computation of Effective cost of battery - Part 2
- Lecture 33 - Charging Batteries
- Lecture 34 - Fundamentals of Battery Pack Design
- Lecture 35 - Electrical Design of Battery Pack - Part 1
- Lecture 36 - Electrical Design of Battery Pack - Part 2
- Lecture 37 - Electrical Design of Battery Pack - Part 3
- Lecture 38 - Mechanical Design of Battery Pack - Part 1
- Lecture 39 - Mechanical Design of Battery Pack - Part 2
- Lecture 40 - Mechanical Design of Battery Pack - Part 3
- Lecture 41 - Mechanical Design of Battery Pack - Part 4
- Lecture 42 - Thermal Design of Battery Pack - Part 1
- Lecture 43 - Thermal Design of Battery Pack - Part 2
- Lecture 44 - Thermal Design of Battery Pack - Part 3
- Lecture 45 - Thermal Design of Battery Pack - Part 4
- Lecture 46 - BMS Design and Embedded System - Part 1
- Lecture 47 - BMS Design and Embedded System - Part 2
- Lecture 48 - BMS Design and Embedded System - Part 3
- Lecture 49 - BMS Design and Embedded System - Part 4
- Lecture 50 - BMS Design and Embedded System - Part 5
- Lecture 51 - Cell Testing and Characterization - Part 1
- Lecture 52 - Cell Testing and Characterization - Part 2
- Lecture 53 - EV Motors and Controllers - Vehicle Dynamics - Part 1
- Lecture 54 - EV Motors and Controllers - Vehicle Dynamics - Part 2
- Lecture 55 - EV Motors and Controllers - Understanding Flow - Part 1
- Lecture 56 - EV Motors and Controllers - Understanding Flow - Part 2
- Lecture 57 - Power and Efficiency
- Lecture 58 - Torque Production - Part 1
- Lecture 59 - Torque Production - Part 2
- Lecture 60 - Torque Production - Part 3
- Lecture 61 - Speed and Back EMF
- Lecture 62 - The d-q Equivalent circuit - Part 1
- Lecture 63 - The d-q Equivalent circuit - Part 2
- Lecture 64 - Field-oriented Control

- Lecture 65 - Three phase AC - Part 1
- Lecture 66 - Three phase AC - Part 2
- Lecture 67 - Thermal Design - Part 1
- Lecture 68 - Thermal Design - Part 2
- Lecture 69 - Thermal Design - Part 3
- Lecture 70 - Engineering Considerations - Part 1
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- Lecture 72 - Engineering Considerations - Part 3 and Future Frontiers
- Lecture 73 - EV Charger Introduction
- Lecture 74 - Charger Parameters and Types
- Lecture 75 - Slow Fast chargers and Swapping
- Lecture 76 - Swapping
- Lecture 77 - Standardization and on board chargers
- Lecture 78 - Public chargers
- Lecture 79 - Public charger economics in Indian Context
- Lecture 80 - Bulk Chargers, Swapping stations and data analytics
- Lecture 81 - Introduction to Energy Scenario in India - Part 1
- Lecture 82 - Introduction to Energy Scenario in India - Part 2
- Lecture 83 - A novel Approach towards 100% RE in India - Part 1
- Lecture 84 - A novel Approach towards 100% RE in India - Part 2
- Lecture 85 - Going Beyond solar, wind, Li Ion and chilled water storage
- Lecture 86 - Solar Photovoltaic
- Lecture 87 - Solar Cell and its Characteristics
- Lecture 88 - Solar Cells to Modules
- Lecture 89 - Wind Energy
- Lecture 90 - The War of Currents
- Lecture 91 - The Birth of Solar - DC
- Lecture 92 - Storage Options for Energy - Part 1
- Lecture 93 - Storage Options for Energy - Part 2
- Lecture 94 - Storage Options for Energy - Part 3
- Lecture 95 - Storage Options for Energy - Part 4
- Lecture 96 - The EV Ecosystem - Part 1
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NPTEL : Phase-locked loops (Electrical Engineering)

Co-ordinators : Dr. Saurabh Saxena

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Lecture 3 - Basic Operation of a Phase Locked Loop

Lecture 4 - Simple Implementation of a Phase Locked Loop

Lecture 5 - Input Output Characteristics of Basic PLL Blocks

Lecture 6 - Time Domain Analysis of a Simple PLL

Lecture 7 - Time Domain Versus Small Signal Analysis of a Simple PLL

Lecture 8 - Type and Order of PLL

Lecture 9 - Small Signal Analysis of Type-I/II/III PLLs for Phase Step, Frequency Step and Frequency Ramp

Lecture 10 - Frequency Acquisition Range for PLLs

Lecture 11 - Frequency Acquisition in Type-I PLLs

Lecture 12 - Frequency Acquisition Limits in Type-I PLLs

Lecture 13 - Frequency Acquisition in Type II PLLs

Lecture 14 - Frequency Acquisition Ranges in Type II PLLs with Ideal and Non Ideal Integrator

Lecture 15 - Frequency Domain Insight in Frequency Acquisition for Type II PLLs

Lecture 16 - Introduction to Clock Multipliers

Lecture 17 - Analog Phase Error Detectors - Part I

Lecture 18 - Analog Phase Error Detectors - Part II

Lecture 19 - Digital Phase Error Detectors - Part I

Lecture 20 - Digital Phase Error Detectors - Part II

Lecture 21 - Range Extension for Phase Error Detectors

Lecture 22 - Phase Frequency Detector

Lecture 23 - Digital Frequency Detector

Lecture 24 - Charge Pump PLL

Lecture 25 - Small Signal and Stability Analysis of Type II Order 2 Charge Pump PLL

Lecture 26 - Problems in Charge Pump PLL - Dead Zone in PFD

Lecture 27 - Problems in Charge Pump PLL - Reference Spur

Lecture 28 - Design Procedure for Type-II Order 3 Charge Pump PLL

Lecture 29 - Design Procedure for Charge Pump Clock Multiplier

Lecture 30 - Sources of Non-Linearities in CP-PLL - Part I

Lecture 31 - Sources of Non-Linearities in CP-PLL - Part II

- Lecture 32 - Noise Analysis in CP-PLL - Part I
- Lecture 33 - Noise Analysis in CP PLL - Part II
- Lecture 34 - Noise Analysis in CP-PLL - Part III
- Lecture 35 - Noise Simulations for CP-PLL Blocks
- Lecture 36 - Introduction to Oscillators
- Lecture 37 - Low Swing Ring Oscillator - Part I
- Lecture 38 - Low-Swing Ring Oscillator - Part II
- Lecture 39 - Large-Swing Ring Oscillator - Part I
- Lecture 40 - Large-Swing Ring Oscillator - Part II
- Lecture 41 - Large-Swing Ring Oscillator - Part III
- Lecture 42 - Large-Swing Ring Oscillator - Part IV
- Lecture 43 - Large-Swing Ring Oscillator - Part V
- Lecture 44 - Supply Regulated VCO - Part I
- Lecture 45 - Supply Regulated VCO - Part II
- Lecture 46 - Supply Regulated VCO - Part III
- Lecture 47 - Phase Noise in Ring Oscillators
- Lecture 48 - Circuit level Design of PFD - Part I
- Lecture 49 - Circuit level Design of PFD - Part II
- Lecture 50 - Circuit level Design of PFD - Part III
- Lecture 51 - Circuit level Design of Charge Pump - Part I
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- Lecture 53 - Circuit-level Design of Charge Pump - Part III
- Lecture 54 - Circuit-level Design of Charge Pump - Part IV
- Lecture 55 - Circuit-level Design of Charge Pump - Part V
- Lecture 56 - Circuit-level Design of Charge Pump - Part VI
- Lecture 57 - Circuit-level Design of Clock Frequency Divider
- Lecture 58 - Techniques for Wide Frequency Range Clock Multiplier
- Lecture 59 - Introduction to Digital PLL
- Lecture 60 - Design of Time-to-Digital Converter
- Lecture 61 - Small Signal Analysis of Digital PLL
- Lecture 62 - Noise Analysis in Digital PLL
- Lecture 63 - Analog/Digital Hybrid PLL - Part I
- Lecture 64 - Analog/Digital Hybrid PLL - Part II

Lecture 1 - Review of Maxwell's Equations

Lecture 2 - Wave Equation

Lecture 3 - Dispersion Relation

Lecture 4 - Propagating and Evanescent Waves

Lecture 5 - Diffraction Limit and Spatial Frequencies

Lecture 6 - Plane Waves

Lecture 7 - Optical Response of Materials

Lecture 8 - Lorentz Model

Lecture 9 - Properties of Lorentz Oscillator Model

Lecture 10 - Drude-Lorentz Model for Metals

Lecture 11 - Kramers-Kronig Relation

Lecture 12 - Engineering Optical Response of Materials

Lecture 13 - Low dimensional systems

Lecture 14 - Absorption in Semiconductors

Lecture 15 - Optical gain in semiconductors

Lecture 16 - Absorption in low-dimensional semiconductors

Lecture 17 - Selection rules for optical processes

Lecture 18 - Scattering of EM radiation

Lecture 19 - LSPR: Quasi-static approximation

Lecture 20 - Size dependence of Plasmon Resonance

Lecture 21 - Tuning Plasmonic Resonances

Lecture 22 - Surface Plasmon Polariton(SPP)

Lecture 23 - Understanding SPP Dispersion Diagram

Lecture 24 - Exciting Surface Plasmon Polaritons

Lecture 25 - Analytical Calculation of Scattering Coefficients - IPython code overview

Lecture 26 - EM Waves in Multilayer Stack - T Matrix formulation

Lecture 27 - Photonic Bandgap in 1D

Lecture 28 - EM Waves in 1D Photonic Crystal

Lecture 29 - Diffracton Grating

Lecture 30 - Applications of Photonic Crystals

Lecture 31 - PhC in 1D - T-matrix examples

- Lecture 32 - Introduction to Metamaterials
- Lecture 33 - Metamaterials at GHz and THz frequencies
- Lecture 34 - Negative index materials at optical frequencies
- Lecture 35 - Plasmonic Metasurfaces
- Lecture 36 - Dielectric Metasurfaces
- Lecture 37 - Tunable and Active Metamaterials
- Lecture 38 - Radiative Absorption and Emission
- Lecture 39 - Miniaturization of Integrated Photonic Devices
- Lecture 40 - Recent trends in nanoscale lasers
- Lecture 41 - Non-Hermitian Systems
- Lecture 42 - Resonant light-atom interactions
- Lecture 43 - Experimental observation of Rabi oscillations
- Lecture 44 - Atom-Cavity Interaction - Weak and strong coupling regimes
- Lecture 45 - Experimental observation of weak and strong coupling
- Lecture 46 - Fabrication of nanophotonic structures - 1
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- Lecture 48 - Measuring light quanta
- Lecture 49 - Photon Statistics
- Lecture 50 - Photodetection and shot noise limit
- Lecture 51 - Second order correlation function
- Lecture 52 - Hanbury Brown-Twiss Experiment with Photons
- Lecture 53 - EM Waves as harmonic oscillator
- Lecture 54 - Vacuum fluctuations
- Lecture 55 - Coherent and squeezed states
- Lecture 56 - Squeezed and photon number states
- Lecture 57 - Application of squeezed states
- Lecture 58 - Preliminaries for quantum theory of light
- Lecture 59 - Quantum theory of light
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- Lecture 63 - Uncertainty relations for quantum light
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- Lecture 1 - Introduction Linear and Nonlinear Network
- Lecture 2 - Small Signal Analysis of Nonlinear Networks
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- Lecture 4 - Incremental Model for Common Two Terminal Element Passive Two Terminal Elements
- Lecture 5 - Linear and Nonlinear Two Ports and the Incremental Y Matrix
- Lecture 6 - Graphical Representation of the Y Matrix
- Lecture 7 - Nonlinear Two Ports With Incremental Gain
- Lecture 8 - IV Characteristic of a Nonlinear 2 port with Incremental Gain
- Lecture 9 - The MOSFET and its Characteristics
- Lecture 10 - Deriving the Common V Source Amplifier - Part 1
- Lecture 11 - The Common Source Amplifier
- Lecture 12 - Large Signal Behaviour of the Common Source Amplifier
- Lecture 13 - The Common Source Amplifier Swing Limits
- Lecture 14 - Introduction to Robust Biasing
- Lecture 15 - Robust Biasing Part 1 Common Source Amplifier with DC Drain Feedback
- Lecture 16 - Robust Biasing with the Current Mirror and Drain Gate Resistor
- Lecture 17 - Robust Biasing With Source Feedback - Part 1
- Lecture 18 - Robust Biasing with Source Feedback - Part 2
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- Lecture 20 - Introduction to Negative Feedback
- Lecture 21 - The Ideal Operational Amplifier
- Lecture 22 - Negative Feedback (Continued...)
- Lecture 23 - Robust Biasing with Drain Measurement and Source Feedback
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- Lecture 25 - The Incremental Voltage Controlled Voltage Source The Common drain Amplifier Incremental Picture
- Lecture 26 - Biasing of the Common Drain Amplifier and Signal Swings
- Lecture 27 - The VCVS Continued, the Incremental
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- Lecture 30 - The Transimpedance amplifier (Continued...)
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Lecture 33 - Effect of Finite Output Resistance on the Basic Building Blocks - Part 1

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Lecture 36 - Finite output Effect in current Mirrors the Cascode Current Mirror

Lecture 37 - Comparison of Current Mirrors The High Swing Cascode

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Lecture 44 - The Active Load

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Lecture 47 - The CMOS Inverter (Continued...)

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Lecture 50 - The Different Amplifier with Active Load - Part 1

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Lecture 55 - The Two Stage Opamp (Continued...)

Lecture 56 - Swing Limits of the Two Stage OTA

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- [Lecture 80 - Bipolar Junction Transistor Circuits-Device Equations and Small Signal Model](#)
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Co-ordinators : Prof. Avik Bhattacharya

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- [Lecture 42 - Three-Phase Load Flow \(Classification of Unknown Quantities\)](#)
- [Lecture 43 - Three-Phase Load Flow \(Classification of Known Quantities\)](#)
- [Lecture 44 - Three-Phase Load Flow \(Equations Relating Known and Unknown Quantities\)](#)
- [Lecture 45 - Three-Phase Load Flow \(NRLF Polar Method\)](#)
- [Lecture 46 - Three-Phase Load Flow \(General Definitions and Dimensions of Jacobian Submatrices\)](#)
- [Lecture 47 - Three-Phase Load Flow \(Derivation of J1\)](#)
- [Lecture 48 - Three-Phase Load Flow \(Derivation of J1\) \(Continued...\)](#)
- [Lecture 49 - Three-Phase Load Flow \(Derivation of J2\)](#)
- [Lecture 50 - Three-Phase Load Flow \(Derivation of J3\)](#)
- [Lecture 51 - Three-Phase Load Flow \(Derivation of J3\) \(Continued...\)](#)
- [Lecture 52 - Three-Phase Load Flow \(Derivation of J4, J5, J6, J7, J8\)](#)
- [Lecture 53 - Three-Phase Load Flow \(Derivation of J9\)](#)
- [Lecture 54 - Three-Phase Load Flow \(Derivation of J9, J10\)](#)
- [Lecture 55 - Three-Phase Load Flow \(Derivation of J11, J12\)](#)
- [Lecture 56 - Three-Phase Load Flow \(Derivation of J13, J14, J15 and J16, Algorithm and Example\)](#)
- [Lecture 57 - Three-Phase State Estimation \(Revision of WLS State Estimation Method for Balanced Systems\)](#)
- [Lecture 58 - Three-Phase State Estimation \(Derivation of Measurement Functions for Unbalanced Systems\)](#)
- [Lecture 59 - Three-Phase State Estimation \(Derivation of Measurement Functions for Unbalanced Systems\)](#)
- [Lecture 60 - Three-Phase State Estimation \(General Structure of Jacobian Matrix, Example\)](#)

Lecture 1 - Introduction and Objectives of the course

Lecture 2 - Definition of a system and history of semiconductors

Lecture 3 - Products and levels of packaging

Lecture 4 - Packaging aspects of handheld products; Case studies in applications

Lecture 5 - Case Study (continued); Definition of PWB, summary and Questions for review

Lecture 6 - Basics of Semiconductor and Process flowchart; Video on "Sand-to-Silicon"

Lecture 7 - Wafer fabrication, inspection and testing

Lecture 8 - Wafer packaging; Packaging evolution; Chip connection choices

Lecture 9 - Wire bonding, TAB and flipchip-1

Lecture 10 - Wire bonding, TAB and flipchip-2; Tutorials

Lecture 11 - Why packaging? & Single chip packages or modules (SCM)

Lecture 12 - Commonly used packages and advanced packages; Materials in packages

Lecture 13 - Advances packages (continued); Thermal mismatch in packages; Current trends in packaging

Lecture 14 - Multichip modules (MCM)-types; System-in-package (SIP); Packaging roadmaps; Hybrid circuits; Quiz on packages

Lecture 15 - Electrical Issues " I; Resistive Parasitic

Lecture 16 - Electrical Issues " II; Capacitive and Inductive Parasitic

Lecture 17 - Electrical Issues " III; Layout guidelines and the Reflection problem

Lecture 18 - Electrical Issues " IV; Interconnection

Lecture 19 - Quick Tutorial on packages; Benefits from CAD; Introduction to DFM, DFR & DFT

Lecture 20 - Components of a CAD package and its highlights

Lecture 21 - Design Flow considerations; Beginning a circuit design with schematic work and component layout

Lecture 22 - Demo and examples of layout and routing; Technology file generation from CAD; DFM check list and design rules; Design for Reliability

Lecture 23 - Review of CAD output files for PCB fabrication; Photo plotting and mask generation

Lecture 24 - Process flow-chart; Vias; PWB substrates

Lecture 25 - Substrates continued; Video highlights; Surface preparation

Lecture 26 - Photoresist and application methods; UV exposure and developing; Printing technologies for PWBs

Lecture 27 - PWB etching; Resist stripping; Screen-printing technology

Lecture 28 - Through-hole manufacture process steps; Panel and pattern plating methods

Lecture 29 - Video highlights on manufacturing; Solder mask for PWBs; Multilayer PWBs; Introduction to microvias

Lecture 30 - Microvia technology and Sequential build-up technology process flow for high-density interconnects

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

Lecture 31 - Conventional Vs HDI technologies; Flexible circuits; Tutorial session

Lecture 32 - SMD benefits; Design issues; Introduction to soldering

Lecture 33 - Reflow and Wave Soldering methods to attach SMDs

Lecture 34 - Solders; Wetting of solders; Flux and its properties; Defects in wave soldering

Lecture 35 - Vapour phase soldering, BGA soldering and Desoldering/Repair; SMT failures

Lecture 36 - SMT failure library and Tin Whiskers

Lecture 37 - Tin-lead and lead-free solders; Phase diagrams; Thermal profiles for reflow soldering; Lead-free alloys

Lecture 38 - Lead-free solder considerations; Green electronics; RoHS compliance and e-waste recycling issues

Lecture 39 - Thermal Design considerations in systems packaging

Lecture 40 - Introduction to embedded passives; Need for embedded passives; Design Library; Embedded resistor processes

Lecture 41 - Embedded capacitors; Processes for embedding capacitors; Case study examples; Summary of materials in packaging

Lecture 42 - Chapter-wise summary

Lecture 1 - Course introduction and overview

Lecture 2 - Distributed generation technologies

Lecture 3 - Distributed storage technologies

Lecture 4 - Distribution system protection

Lecture 5 - Circuit breaker coordination

Lecture 6 - Symmetrical component analysis and sequence excitation

Lecture 7 - Modeling of distribution system components

Lecture 8 - Protection components

Lecture 9 - Impact of distributed generation of distribution protection

Lecture 10 - Consumption and distribution grounding

Lecture 11 - Islanding of distribution systems

Lecture 12 - Modeling of islanded distribution systems

Lecture 13 - Distribution system problems and examples

Lecture 14 - Distribution system problems and examples continued

Lecture 15 - Anti-islanding methods

Lecture 16 - Solid state circuit switching

Lecture 17 - Relaying for distributed generation

Lecture 18 - Feeder voltage regulation

Lecture 19 - Grounding, distribution protection coordination problems and examples

Lecture 20 - Ring and network distribution

Lecture 21 - Economic evaluation of DG systems

Lecture 22 - Design for effective initial cost

Lecture 23 - Single phase inverters

Lecture 24 - DC bus design in voltage source inverter

Lecture 25 - Electrolytic capacitor reliability and lifetime

Lecture 26 - Inverter switching and average model

Lecture 27 - Common mode and differential mode model of inverters

Lecture 28 - Two leg single phase inverter

Lecture 29 - Distribution system problems, and examples

Lecture 30 - DG evaluation problems and examples

Lecture 31 - Switch selection in two level voltage source inverters and loss evaluation

[Lecture 32 - Thermal model, management and cycling failure of IGBT modules](#)

[Lecture 33 - Semiconductor switch design reliability considerations](#)

[Lecture 34 - AC filters for grid connected inverters](#)

[Lecture 35 - AC inductor design and need for LCL filter](#)

[Lecture 36 - LCL filter design](#)

[Lecture 37 - Examples in power electronic design for DG systems](#)

[Lecture 38 - Examples in power electronic design for DG systems continued](#)

[Lecture 39 - Higher order passive damping design for LCL filters](#)

[Lecture 40 - Balance of hardware component for inverters in DG systems](#)

Lecture 1 - Electronic switches

Lecture 2 - DC - DC converters

Lecture 3 - DC - AC converters

Lecture 4 - Multilevel converters - I

Lecture 5 - Multilevel converters - II

Lecture 6 - Applications of voltage source converter - I

Lecture 7 - Applications of voltage source converter - II

Lecture 8 - Applications of voltage source converter - III

Lecture 9 - Purpose of PWM - I

Lecture 10 - Purpose of PWM - II

Lecture 11 - Low switching frequency PWM - I

Lecture 12 - Low switching frequency PWM - II

Lecture 13 - Selective harmonic elimination

Lecture 14 - Off-line optimized pulsewidth modulation

Lecture 15 - Sine-triangle pulsewidth modulation

Lecture 16 - Harmonic injection pulsewidth modulation

Lecture 17 - Bus-clamping pulsewidth modulation

Lecture 18 - Triangle-comparison based PWM for three-phase inverter

Lecture 19 - Concept of space vector

Lecture 20 - Conventional space vector PWM

Lecture 21 - Space vector based bus-clamping PWM

Lecture 22 - Space vector based advanced bus-clamping PWM

Lecture 23 - Harmonic analysis of PWM techniques

Lecture 24 - Analysis of RMS line current ripple using the notion of stator flux ripple

Lecture 25 - Evaluation of RMS line current ripple using the notion of stator flux ripple

Lecture 26 - Analysis and design of PWM techniques from line current ripple perspective

Lecture 27 - Instantaneous and average dc link current in a voltage source inverter

Lecture 28 - DC link current and DC capacitor current in a voltage source inverter

Lecture 29 - Analysis of torque ripple in induction motor drives - I

Lecture 30 - Analysis of torque ripple in induction motor drives - II

Lecture 31 - Evaluation of conduction loss in three-phase inverter

[Lecture 32 - Evaluation of switching loss in three-phase inverter](#)

[Lecture 33 - Design of PWM for reduced switching loss in three-phase inverter](#)

[Lecture 34 - Effect of dead-time on inverter output voltage for continuous PWM schemes](#)

[Lecture 35 - Effect of dead-time on inverter output voltage for bus-clamping PWM schemes](#)

[Lecture 36 - Analysis of overmodulation in sine-triangle PWM from space vector perspective](#)

[Lecture 37 - Overmodulation in space vector modulated inverter](#)

[Lecture 38 - PWM for three-level neutral-point-clamped inverter - I](#)

[Lecture 39 - PWM for three-level neutral-point-clamped inverter - II](#)

[Lecture 40 - PWM for three-level neutral-point-clamped inverter - III](#)

Lecture 1 - Introduction to DC-DC converter

Lecture 2 - Diode

Lecture 3 - Controlled Switches

Lecture 4 - Prior Art

Lecture 5 - Inductor

Lecture 6 - Transformer

Lecture 7 - Capacitor

Lecture 8 - Issues related to switches

Lecture 9 - Energy storage - Capacitor

Lecture 10 - Energy storage - Inductor

Lecture 11 - Primitive Converter

Lecture 12 - Non-Isolated converter - I

Lecture 13 - Non-Isolated converter - II

Lecture 14 - Isolated Converters - I

Lecture 15 - Isolated Converters - II

Lecture 16 - Conduction Mode

Lecture 17 - Problem set - I

Lecture 18 - Problem set - II

Lecture 19 - Modeling DC-DC converters

Lecture 20 - State space representation - I

Lecture 21 - State Space representation - II

Lecture 22 - Circuit Averaging - I

Lecture 23 - Circuit Averaging - II

Lecture 24 - State Space Model of Boost Converter

Lecture 25 - DC-DC converter controller

Lecture 26 - Controller Structure

Lecture 27 - PID Controller - I

Lecture 28 - PID Controller - II

Lecture 29 - PID Controller - III

Lecture 30 - Implementation of PID controller

Lecture 31 - Pulse Width Modulator

[Lecture 32 - Controller Design - I](#)

[Lecture 33 - Controller Design - II](#)

[Lecture 34 - Controllers and Sensing Circuit](#)

[Lecture 35 - Regulation of Multiple outputs - I](#)

[Lecture 36 - Regulation of Multiple outputs - II](#)

[Lecture 37 - Current Control](#)

[Lecture 38 - Unity Power Factor Converter](#)

[Lecture 39 - Magnetic Design](#)

[Lecture 40 - DC-DC Converter Design](#)

Lecture 1 - Basic Electrical Technology

Lecture 2 - Passive Components

Lecture 3 - Sources

Lecture 4 - Kirchoff's Law

Lecture 5 - Modelling of Circuit - Part 1

Lecture 6 - Modelling of Circuit - Part 2

Lecture 7 - Analysis Using MatLab

Lecture 8 - Sinusoidal steady state

Lecture 9 - Transfer Function and Pole Zero domain

Lecture 10 - Transfer function & pole zero

Lecture 11 - The Sinusoid

Lecture 12 - Phasor Analysis - Part 1

Lecture 13 - Phasor Analysis - Part 2

Lecture 14 - Power Factor

Lecture 15 - Power ports

Lecture 16 - Transformer Basics - Part 1

Lecture 17 - Transformer Basics - Part 2

Lecture 18 - Transformer Basics - Part 3

Lecture 19 - The Practical Transformer - Part 1

Lecture 20 - The Practical Transformer - Part 2

Lecture 21 - The Practical Transformer - Part 3

Lecture 22 - DC Machines - Part 1

Lecture 23 - DC Machines - Part 2

Lecture 24 - DC Generators - Part 1

Lecture 25 - DC Generators - Part 2

Lecture 26 - DC Motors - Part 1

Lecture 27 - DC Motors - Part 2

Lecture 28 - DC Motors - Part 3

Lecture 29 - Three Phase System - Part 1

Lecture 30 - Three Phase System - Part 2

Lecture 31 - Three Phase System - Part 3

[Lecture 32 - Three Phase System - Part 4](#)

[Lecture 33 - Three Phase Transformer - Part 1](#)

[Lecture 34 - Three Phase Transformer - Part 2](#)

[Lecture 35 - Induction Motor - Part 1](#)

[Lecture 36 - Induction Motor - Part 2](#)

[Lecture 37 - Induction Motor - Part 3](#)

[Lecture 38 - Induction Motor - Part 4](#)

[Lecture 39 - Synchronous Machine](#)

Lecture 1 - Electric Drive

Lecture 2 - Controlled Rectifier - Part-1

Lecture 3 - Controlled Rectifier - Part-2 (Three phase)

Lecture 4 - Controlled Rectifier - Part-3 (Three phase)

Lecture 5 - Controlled Rectifier - Part-4 (Three Phase)

Lecture 6 - Controlled Rectifier - Part-5 (Three Phase)

Lecture 7 - Power Electronics Improvements

Lecture 8 - Four Quadrant Dc to Dc Converter

Lecture 9 - Sine Triangle PWM Control of Converter

Lecture 10 - Front-end Ac-Dc Converter with harmonic control

Lecture 11 - Ac to Dc Converter Close Loop Control Schematic

Lecture 12 - Ac-Dc Converter Close loop Control Block Diagram

Lecture 13 - Design of the Converter Controller & AC to DC

Lecture 14 - Front-End Ac to Dc Converter-Design

Lecture 15 - Front-End Ac to Dc Converter - Simulation study

Lecture 16 - Dc Motor Speed Control - Introduction

Lecture 17 - Dc Motor Speed Control - Block Diagram

Lecture 18 - Dc Motor Speed Control Current Control & S C L

Lecture 19 - Dc-Motor Speed Control Controller Design - Part-1

Lecture 20 - Dc Motor Speed Control Controller Design - Part-2

Lecture 21 - Dc Motor Speed Control Controller Design - Part-3

Lecture 22 - Basics of DC to AC Converter - Part-1

Lecture 23 - Basics of DC to AC Converter - Part-2

Lecture 24 - Inverter Sine Triangle PWM

Lecture 25 - Inverter - Current Hysteresis Controlled PWM

Lecture 26 - C H controlled & Basics of space vector PWM

Lecture 27 - Space Vector PWM - Part-2

Lecture 28 - Space Vector PWM - Part-3

Lecture 29 - Space Vector PWM Signal Generation

Lecture 30 - Speed Control of Induction Motor - Part-1

Lecture 31 - Speed Control of Induction Motor - Part-2

[Lecture 32 - High dynamic performance of I M Drive](#)

[Lecture 33 - Dynamic Model of Induction Motor - Part-1](#)

[Lecture 34 - Dynamic Model of Induction Motor - Part-2](#)

[Lecture 35 - Vector Control of Induction Motor](#)

[Lecture 36 - Effect of Switching Time lag in Inverter](#)

[Lecture 37 - Power Switch Protection - Snubbers](#)

Lecture 1 - Introduction to IOTs - Part I

Lecture 2 - Introduction to IOTs - Part II

Lecture 3 - Introduction to IOTs - Examples

Lecture 4 - IOT applications - I

Lecture 5 - IOT applications - II

Lecture 6 - Power management in IOT device

Lecture 7 - Introduction to LDO

Lecture 8 - Design with an LDO

Lecture 9 - Introduction to switching regulators

Lecture 10 - Designing with LDO's, switching regulators and case studies - Part I

Lecture 11 - Designing with LDO's, switching regulators and case studies - Part II

Lecture 12 - Designing with LDO's, switching regulators and case studies - Part II

Lecture 13 - Designing with LDO's, switching regulators and case studies - Part IV

Lecture 14 - Power Conditioning with Energy Harvesters - I

Lecture 15 - Power Conditioning with Energy Harvesters - II

Lecture 16 - Power Conditioning with Energy Harvesters - III

Lecture 17 - Battery less power supply and battery life calculation for embedded devices - I

Lecture 18 - Battery less power supply and battery life calculation for embedded devices - II

Lecture 19 - Battery less power supply and battery life calculation for embedded devices - III

Lecture 20 - Introduction to MQTT

Lecture 21 - Quality of Service in MQTT

Lecture 22 - Standards and Security in MQTT

Lecture 23 - Introduction and Implementation of AMQP

Lecture 24 - Implementation of CoAP and MDNS

Lecture 25 - Basics of RFID

Lecture 26 - RFID protocol and applications

Lecture 27 - BLE Security

Lecture 28 - LPWAN technologies

Lecture 29 - Choice of Microcontrollers

Lecture 30 - Case Study 1 - Joule Jotter

Lecture 31 - Case Study 2 - Cloud Based Systems

Lecture 1 - Advantages of HVAC/DC Transmission, Introduction to Grid Management

Lecture 2 - Transmission system development, Important components of transmission system

Lecture 3 - Insulation coordination, over voltage in power systems

Lecture 4 - Design/selection of insulators, Importance of grading/cc rings

Lecture 5 - Non ceramic insulators performance-service experience

Lecture 6 - Failure of apparatus in the field, importance of reliability and testing

Lecture 7 - Pollution flashover phenomena, modeling etc

Lecture 8 - Planning of High Voltage laboratories

Lecture 9 - Importance of High Voltage testing and techniques employed

Lecture 10 - Basic philosophy of HV testing, tests for various HV apparatus

Lecture 11 - HV testing techniques for various apparatus

Lecture 12 - HV testing on Composite Insulators

Lecture 13 - Surface degradation studies on composite insulators

Lecture 14 - Surface morphological techniques for composite insulators

Lecture 15 - Conductors used for EHV/UHV transmission

Lecture 16 - Corona and interference on transmission lines

Lecture 17 - Introduction of HTLS conductors and their advantages

Lecture 18 - Mechanical considerations for HV conductors

Lecture 19 - Introduction to Towers and importance of foundations

Lecture 20 - Selection/Design of clearances for HV towers

Lecture 21 - Design Optimization for UHV towers

Lecture 22 - Introduction to 1100kV HVDC

Lecture 23 - Introduction to HV Substations

Lecture 24 - Types of Substations, comparison

Lecture 25 - Insulation coordination, Components in a typical substation

Lecture 26 - Preventive maintenance of Substation

Lecture 27 - Electric and magnetic fields, mitigations techniques

Lecture 28 - Importance of Grounding, reducing Earthing resistance

Lecture 29 - Introduction to the use of Fiber optic cables, OPGW

Lecture 30 - Introduction to communication and SCADA

Lecture 31 - Precautions and safety measures in substation

[Lecture 32 - Electrical hazards, minimum clearances in substation](#)

[Lecture 33 - Importance of Generation of HVDC in the laboratory](#)

[Lecture 34 - Importance of Generation of HVAC, Impulse Voltage and Currents in the laboratory](#)

[Lecture 35 - Measurements of High Voltages](#)

[Lecture 36 - Measurements of High Voltages \(Continued...\)](#)

[Lecture 37 - Introduction to digital recorders, measurement](#)

[Lecture 38 - Upgradation/uprating of transmission lines- advantages](#)

[Lecture 39 - Upgradation/uprating of transmission lines- advantages \(Continued...\)](#)

[Lecture 40 - Summary of the course](#)

- Lecture 1 - Introduction to signal processing
- Lecture 2 - Basics of signals and systems
- Lecture 3 - Linear time-invariant systems
- Lecture 4 - Modes in a linear system
- Lecture 5 - Introduction to state space representation
- Lecture 6 - State space representation
- Lecture 7 - Non-uniqueness of state space representation
- Lecture 8 - Introduction to vector space
- Lecture 9 - Linear independence and spanning set
- Lecture 10 - Unique representation theorem
- Lecture 11 - Basis and cardinality of basis
- Lecture 12 - Norms and inner product spaces
- Lecture 13 - Inner products and induced norm
- Lecture 14 - Cauchy Schwartz inequality
- Lecture 15 - Orthonormality
- Lecture 16 - Problem on sum of subspaces
- Lecture 17 - Linear independence of orthogonal vectors
- Lecture 18 - Hilbert space and linear transformation
- Lecture 19 - Gram Schmidt orthonormalization
- Lecture 20 - Linear approximation of signal space
- Lecture 21 - Gram Schmidt orthogonalization of signals
- Lecture 22 - Problem on orthogonal complement
- Lecture 23 - Problem on signal geometry (4-QAM)
- Lecture 24 - Basics of probability and random variables
- Lecture 25 - Mean and variance of a random variable
- Lecture 26 - Introduction to random process
- Lecture 27 - Statistical specification of random processes
- Lecture 28 - Stationarity of random processes
- Lecture 29 - Problem on mean and variance
- Lecture 30 - Problem on MAP Detection
- Lecture 31 - Fourier transform of dirac comb sequence

[Lecture 32 - Sampling theorem](#)

[Lecture 33 - Basics of multirate systems](#)

[Lecture 34 - Frequency representation of expanders and decimators](#)

[Lecture 35 - Decimation and interpolation filters](#)

[Lecture 36 - Fractional sampling rate alterations](#)

[Lecture 37 - Digital filter banks](#)

[Lecture 38 - DFT as filter bank](#)

[Lecture 39 - Noble Identities](#)

[Lecture 40 - Polyphase representation](#)

[Lecture 41 - Efficient architectures for interpolation and decimation filters](#)

[Lecture 42 - Problems on simplifying multirate systems using noble identities](#)

[Lecture 43 - Problem on designing synthesis bank filters](#)

[Lecture 44 - Efficient architecture for fractional decimator](#)

[Lecture 45 - Multistage filter design](#)

[Lecture 46 - Two-channel filter banks](#)

[Lecture 47 - Amplitude and phase distortion in signals](#)

[Lecture 48 - Polyphase representation of 2-channel filter banks, signal flow graphs and perfect reconstruction](#)

[Lecture 49 - M-channel filter banks](#)

[Lecture 50 - Polyphase representation of M-channel filter bank](#)

[Lecture 51 - Perfect reconstruction of signals](#)

[Lecture 52 - Nyquist and half band filters](#)

[Lecture 53 - Special filter banks for perfect reconstruction](#)

[Lecture 54 - Introduction to wavelets](#)

[Lecture 55 - Multiresolution analysis and properties](#)

[Lecture 56 - The Haar wavelet](#)

[Lecture 57 - Structure of subspaces in MRA](#)

[Lecture 58 - Haar decomposition - 1](#)

[Lecture 59 - Haar decomposition - 2](#)

[Lecture 60 - Wavelet Reconstruction](#)

[Lecture 61 - Haar wavelet and link to filter banks](#)

[Lecture 62 - Demo on wavelet decomposition](#)

[Lecture 63 - Problem on circular convolution](#)

[Lecture 64 - Time frequency localization](#)

[Lecture 65 - Basic analysis: Pointwise and uniform continuity of functions](#)

[Lecture 66 - Basic Analysis : Convergence of sequence of functions](#)

[Lecture 67 - Fourier series and notions of convergence](#)

[Lecture 68 - Convergence of Fourier series at a point of continuity](#)

[Lecture 69 - Convergence of Fourier series for piecewise differentiable periodic functions](#)

[Lecture 70 - Uniform convergence of Fourier series of piecewise smooth periodic function](#)

[Lecture 71 - Convergence in norm of Fourier series](#)

[Lecture 72 - Convergence of Fourier series for all square integrable periodic functions](#)

[Lecture 73 - Problem on limits of integration of periodic functions](#)

[Lecture 74 - Matrix Calculus](#)

[Lecture 75 - KL transform](#)

[Lecture 76 - Applications of KL transform](#)

[Lecture 77 - Demo on KL Transform](#)

[Lecture 78 - Live Session](#)

[Lecture 79 - Live Session 2](#)

Lecture 1 - Electronic Equipment Thermal issues

Lecture 2 - Practical Examples - 1

Lecture 3 - Practical Examples - 2

Lecture 4 - CEDT worked examples - 1

Lecture 5 - CEDT worked examples - 2

Lecture 6 - Text book theory

Lecture 7 - Sample heat sinks

Lecture 8 - Published correlations - 1

Lecture 9 - Published correlations - 2

Lecture 10 - Parallel combined effects

Lecture 11 - Mounting of packages

Lecture 12 - Combined Rth of devices

Lecture 13 - Schonholzer moduls

Lecture 14 - 1972 model paper

Lecture 15 - Jensen model

Lecture 16 - Thermal management - 1

Lecture 17 - Thermal management - 2

Lecture 18 - Round up of full model

Lecture 19 - Fan cooling

Lecture 20 - Thermo-electric cooling

Lecture 21 - On-the-net DIY work

Lecture 22 - Practical video

Lecture 23

Lecture 24

Lecture 25

Lecture 26

Lecture 27 - Real packages

Lecture 28 - Prior art

Lecture 29 - OTS standard profiles

Lecture 30 - CAD detailed design of profiles

Lecture 31 - Round up

[Lecture 32 - 4X Peltier Cooler](#)

[Lecture 33 - Manufacturing Video](#)

[Lecture 34 - Peltier heat sink](#)

- Lecture 1 - Introduction to Integrated Circuits (IC) Technology
- Lecture 2 - Introduction to fabrication of IC: Substrates
- Lecture 3 - Introduction to IC fabrication
- Lecture 4 - Introduction to IC fabrication (Continued...)
- Lecture 5 - Introduction to the fabrication of sensors
- Lecture 6 - Introduction to fabrication technology
- Lecture 7 - Introduction to fabrication technology (Continued...)
- Lecture 8 - Introduction to fabrication technology (Continued...)
- Lecture 9 - Introduction to fabrication technology (Continued...)
- Lecture 10 - Introduction to fabrication technology (Continued...)
- Lecture 11 - Process flow for Fabrication of MOSFETs
- Lecture 12 - Operation of Enhancement type MOSFET
- Lecture 13 - Operation of Depletion type MOSFET
- Lecture 14 - MOSFETs Characteristics and Applications (Current Mirrors)
- Lecture 15 - Introduction to Operational Amplifiers
- Lecture 16 - Operational Amplifier Characteristics
- Lecture 17 - Operational Amplifier Characteristics (Continued...)
- Lecture 18 - Characteristics of an op-amp (Continued...)
- Lecture 19 - Operational Amplifier Configurations
- Lecture 20 - Operational Amplifier Configurations (Continued...)
- Lecture 21 - Applications of Operational Amplifier: Differential Amplifier
- Lecture 22 - Applications of Operational Amplifier: Integerator
- Lecture 23 - Applications of Operational Amplifier: Differentiator
- Lecture 24 - Introduction to Passive and Active Filters and op-amp as Low Pass Filter
- Lecture 25 - Operational Amplifier as a High Pass Filter
- Lecture 26 - Operational Amplifier as a Band Pass and Band Reject Filter
- Lecture 27 - Introduction to Oscillator
- Lecture 28 - RC Phase Shift Oscillator using Op-amp
- Lecture 29 - Wein Bridge Oscillator using Op-amp
- Lecture 30 - Hartley and Colpitts Oscillator using Op-amp
- Lecture 31 - Working of Crystal Oscillators

- Lecture 32 - Construction and Operation of UJT Relaxation Oscillators
- Lecture 33 - Introduction to Noise and its Types
- Lecture 34 - Analysis of Data Sheets of an Op-Amp
- Lecture 35 - Analysis of Data Sheets of an Op-Amp (Continued...)
- Lecture 36 - Analysis of Data Sheets of an Op-Amp (Continued...)
- Lecture 37 - Experiment - Introduction to Laboratory Equipment
- Lecture 38 - Experiment - Measurement of Active and Passive elements using Multimeter
- Lecture 39 - Experiment - Working with Laboratory Equipment: Power Supply
- Lecture 40 - Experiment - Working with Laboratory Equipment: Function Generator, Oscilloscope
- Lecture 41 - Experiment - Op-Amp Characteristics: Input Bias Current
- Lecture 42 - Experiment - Op-Amp Characteristics: Input Offset Current
- Lecture 43 - Experiment - Op-Amp Characteristics: Input Offset Voltage
- Lecture 44 - Experiment - Op-Amp as Inverting Amplifier
- Lecture 45 - Experiment - Op-Amp as Non-Inverting Amplifier
- Lecture 46 - Experiment - To study input and output voltage range of an Op-Amp
- Lecture 47 - Experiment - Differential amplifier using op-amp
- Lecture 48 - Experiment - To study the gain of instrumentation amplifier
- Lecture 49 - Experiment - Summing amplifier using op-amp
- Lecture 50 - Experiment - To study op-amp based comparator
- Lecture 51 - Experiment - To study op-amp based integrator and differentiator
- Lecture 52 - Experiment - Study of passive low pass filter
- Lecture 53 - Experiment - Op-amp based active low pass filter
- Lecture 54 - Experiment - Passive and active high pass filter
- Lecture 55 - Experiment - Introduction to experimental set-up of band pass filter
- Lecture 56 - Experiment - Passive and active band pass filter
- Lecture 57 - Experiment - Introduction to experimental set-up for band reject filter
- Lecture 58 - Experiment - Active band reject filter
- Lecture 59 - Experiment - Peak detector circuit using Op-Amp

Lecture 1 - Quantum Mechanics: Concept of Wave Particle, Schrodingers Equation

Lecture 2 - Quantum Mechanics: Particle in a Box

Lecture 3 - Quantum Mechanics: Particle in a Box (Continued...), Harmonic Oscillator

Lecture 4 - Solids: Formation of Bands, Kronig-Penny Model

Lecture 5 - Solids: Kronig-Penny Model (Continued...)

Lecture 6 - Solids: Electrons and Holes

Lecture 7 - Solids: Electrons and Holes (Continued...)

Lecture 8 - Solids: Crystals

Lecture 9 - Density of States

Lecture 10 - Density of States (Continued...), Fermi Function

Lecture 11 - Fermi Function - Carrier Concentration

Lecture 12 - Doping

Lecture 13 - Doping (Continued...)

Lecture 14 - Recombination and Generation

Lecture 15 - Recombination and Generation (Continued...)

Lecture 16 - Recombination and Generation (Continued...), Charge Transport

Lecture 17 - Charge Transport (Continued...)

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DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Mathematical Aspects of Biomedical Electronic System Design (Electrical Engineering)

Co-ordinators : Prof. Chandramani Singh

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Lecture 2 - MATLAB Demo on Signal Types and Moving Average System

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Lecture 6 - Continuous Time Fourier Transform

Lecture 7 - Biological Tissues as disordered systems

Lecture 8 - Introduction to electrical equivalent circuit models for biological systems

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Lecture 15 - Magnetic Fields in DC Machines - 1

Lecture 16 - Magnetic Fields in AC Machines - 1

Lecture 17 - Magnetic Fields in AC Machines - 2

Lecture 18 - Magnetic Fields in AC Machines - 3

Lecture 19 - MMFDistribution ofAC Machines

Lecture 20 - Basics of Electrical Machine Windings

Lecture 21 - Stator winding design-single layer winding

Lecture 22 - Stator winding design-double layer winding

Lecture 23 - Stator Winding Design-Fractional Slot Double Layer Winding

Lecture 24 - Variable Pole Machine Stator Winding Design (Pole-Phase Modulation) - 1

Lecture 25 - Variable Pole Machine Stator Winding Design (Pole-Phase Modulation) - 2

Lecture 26 - Importance of Motor Design and Standards of Electric Motors

Lecture 27 - Electric Machine Sizing Equations-Output Power and Volume (D2L) Product Equation

Lecture 28 - Lab Session on Re-winding of Induction Motor (Example: Double Layer Winding)

Lecture 29 - The Figure of Merits for Electric Motors and Aspect Ratio to Decouple the D2L Product

Lecture 30 - Electric Machine Sizing Equations-Output Power Equation in terms of D3L Product - 1

Lecture 31 - Electric Machine Sizing Equations-Output Power Equation in terms of D3L Product - 2

- Lecture 32 - Analysis of Copper Function and Output Function w r t the Electric Machine D3L Product Eqn
- Lecture 33 - Example Problems on Output Power Equation in terms of D3L Product
- Lecture 34 - Electric Machine Sizing Equations-Output Power Equation in terms of D the power 2.5 L Product
- Lecture 35 - Design Procedure of an Electric Machine
- Lecture 36 - Name Plate Details and Datasheets of Induction Motor
- Lecture 37 - Design of Induction Machine- Stator Design - 1 (Stator Core design)
- Lecture 38 - Design of Induction Machine- Stator Design - 2 (Stator Winding Design)
- Lecture 39 - Design of Induction Machine- Stator Design - 3 (Stator Slot Geometry)
- Lecture 40 - Design of Induction Machine- Rotor Design - 1 (Rotor Slots Selection)
- Lecture 41 - Design of Induction Machine- Rotor Design - 2 (Rotor MMF and Bar Currents)
- Lecture 42 - Design of Induction Machine- Rotor Design - 3 (Rotor Slot Geometry)
- Lecture 43 - Design of Induction Machine- Rotor Design - 4 (Skewing of Rotor)
- Lecture 44 - Design of Induction Machine- Rotor Design - 4 (Resistance of Rotor Winding)
- Lecture 45 - Carter's Coefficient of Electrical Machines
- Lecture 46 - Effective Length Equations of the Machine Core with Different Stator and Rotor Lengths
- Lecture 47 - Stator MMF and Magnetizing Current Equations of Induction Machine
- Lecture 48 - Magnetizing Inductance of Induction Machine
- Lecture 49 - Stator and Rotor Leakage Inductances of Induction Machine
- Lecture 50 - Equivalent Circuit Parameters of Induction Machine
- Lecture 51 - Loss Calculation of Induction Machine - 1
- Lecture 52 - Loss Calculation of Induction Machine - 2 and Performance Parameters of Induction Motor
- Lecture 53 - Switched Reluctance Machine Sizing Equations-Output Power and Volume (D2L) Product Equation
- Lecture 54 - The Figure of Merits for SRM and Example Problem on Output Power Equation i t f D2L Product
- Lecture 55 - Design of Switched Reluctance Machine: Stator Design - 1
- Lecture 56 - Design of Switched Reluctance Machine: Stator Design - 2 and Rotor Design
- Lecture 57 - Procedure for Calculation of SRM Inductance: Aligned Inductance - 1
- Lecture 58 - Calculation of SRM Inductance: Aligned Inductance - 2
- Lecture 59 - Efficiency and Loss Calculation of SRM
- Lecture 60 - Importance of Thermal Design and Thermal Limits for Electrical Machines
- Lecture 61 - Electric and Thermal Circuits Interface
- Lecture 62 - Heat Transfer Methods and Basic Equations for Thermal Resistance
- Lecture 63 - Heat Flow in Electrical Machines
- Lecture 64 - Cooling Methods and Standards for Electrical Machines

[Lecture 65 - Basics of Thermal Equivalent Circuits](#)

[Lecture 66 - Thermal Equivalent Circuit - 1](#)

[Lecture 67 - Thermal Equivalent Circuit - 2](#)

- Lecture 1 - An Introduction to the course and outline of the course
- Lecture 2 - Historical overview of the development of microwave devices
- Lecture 3 - Applications of semiconductor microwave devices
- Lecture 4 - Applications of semiconductor microwave devices (Continued...)
- Lecture 5 - Heterojunction device physics
- Lecture 6 - Heterojunction device physics (Continued...) and III-nitrides
- Lecture 7 - III-nitrides and polarization
- Lecture 8 - III-nitride high electron mobility transistors
- Lecture 9 - Varactors and Schottky multipliers
- Lecture 10 - Varactors and Schottky multipliers (Continued...)
- Lecture 11 - Diodes for microwave applications
- Lecture 12 - IMPATT diode
- Lecture 13 - Tunnel diodes and Introduction to Gunn diodes
- Lecture 14 - Gunn diode and its modes
- Lecture 15 - Introduction to MESFETs
- Lecture 16 - Advanced concepts of GaAs MESFETs
- Lecture 17 - GaAs MESFET fabrication and practical aspects
- Lecture 18 - Practical aspects of FET design and small-signal model
- Lecture 19 - GaAs MESFETs: cut-off frequency and aspects of power devices
- Lecture 20 - GaAs MESFETs for power amplifiers
- Lecture 21 - Modulation doping in compound semiconductors
- Lecture 22 - Band diagram of MODFETs/HEMTs
- Lecture 23 - Design issues and methodology for microwave HEMTs
- Lecture 24 - Small-signal model and noise in HEMTs
- Lecture 25 - The concept of pseudomorphic or pHEMTs
- Lecture 26 - Multi-finger HEMTs
- Lecture 27 - pHEMTs for low noise and introduction to InP HEMT
- Lecture 28 - InP HEMTs for power and the concept of metamorphic HEMTs
- Lecture 29 - AlGaIn/GaN HEMT: applications, structure, substrates and FOM
- Lecture 30 - AlGaIn/GaN HEMT: device basics, current collapse and passivation
- Lecture 31 - AlGaIn/GaN HEMT: gate process, field-plate and trade-offs in design

- Lecture 32 - AlGaIn/GaN HEMT: Practical aspects and commercial HEMTs
- Lecture 33 - GaN RF HEMT on eval board, and emerging topics of research
- Lecture 34 - Linearity in GaN HEMTs - A device perspective
- Lecture 35 - Nanoscale MOSFETs and short channel effects
- Lecture 36 - Parasitic resistances and capacitances in nanoscale MOSFETs
- Lecture 37 - RF MOSFET Layout and RF Silicon-on-insulator
- Lecture 38 - Noise in MOSFETs and Introduction to LDMOS
- Lecture 39 - Working of LDMOS and VDMOS
- Lecture 40 - LDMOS: Parasitics, and the concept of RESURF
- Lecture 41 - LDMOS: HCI, snapback, finger layout and some aspects of commercial devices
- Lecture 42 - BJT: common base and common emitter from the device point of view
- Lecture 43 - BJT: Kirk effect, Ebers-Moll model and base transit time
- Lecture 44 - BJT: small-signal model, gain and cut-off frequency
- Lecture 45 - BJT: Emitter and base designs and drift transistor
- Lecture 46 - Collector design in modern BJT and Introduction to HBTs
- Lecture 47 - HBT: base current and collapse of the current gain
- Lecture 48 - High-frequency HBT and Introduction to SiGe HBT
- Lecture 49 - SiGe HBT: various resistances and capacitances, scaling and aspects of BiCMOS
- Lecture 50 - Basics of microwave: transmission line theory
- Lecture 51 - Waveguides, T-lines and introduction to 2-port networks
- Lecture 52 - S-parameters and the basics of Smith Chart
- Lecture 53 - Smith chart and matching
- Lecture 54 - Impedance matching using Smith Chart and stub line
- Lecture 55 - Passives in microwave circuits
- Lecture 56 - Inductors in microwave circuits
- Lecture 57 - More on passive elements in microwave circuits
- Lecture 58 - On-wafer measurement and S-parameters
- Lecture 59 - On-wafer de-embedding
- Lecture 60 - On-wafer and fixture-based measurements and calibration
- Lecture 61 - More on fixtures and basic transistor concepts for power amplifiers

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : Adv. Digital Signal Processing - Multirate and wavelets (Electronics and Communication Engineering)

Co-ordinators : Prof. V.M. Gadre

Lecture 1 - Introduction

Lecture 2 - The Haar Wavelet

Lecture 3 - The Haar Multiresolution Analysis

Lecture 4 - Wavelets And Multirate Digital Signal Processing

Lecture 5 - Equivalence - Functions And Sequences

Lecture 6 - The Haar Filter Bank

Lecture 7 - Haar Filter Bank Analysis And Synthesis

Lecture 8 - Relating ψ , ϕ and the Filters

Lecture 9 - Iterating the filter bank from Ψ , Φ

Lecture 10 - Z-Domain Analysis Of Multirate Filter Bank

Lecture 11 - Two Channel Filter Bank

Lecture 12 - Perfect Reconstruction - Conjugate Quadrature

Lecture 13 - Conjugate Quadrature Filters - Daubechies Family of MRA

Lecture 14 - Daubechies' Filter Banks - Conjugate Quadrature Filters

Lecture 15 - Time And Frequency Joint Perspective

Lecture 16 - Ideal Time Frequency Behaviour

Lecture 17 - The Uncertainty Principle

Lecture 18 - Time Bandwidth Product Uncertainty

Lecture 19 - Evaluating and Bounding $\sqrt{t} \sqrt{\omega}$

Lecture 20 - The Time Frequency Plane & its Tilings

Lecture 21 - Short time Fourier Transform & Wavelet Transform in General

Lecture 22 - Reconstruction & Admissibility

Lecture 23 - Admissibility in Detail Discretization of Scale

Lecture 24 - Logarithmic Scale Discretization, Dyadic Discretization

Lecture 25 - The Theorem of (DYADIC) Multiresolution Analysis

Lecture 26 - Proof of the Theorem of (DYADIC) Multiresolution Analysis

Lecture 27 - Introducing Variants of The Multiresolution Analysis Concept

Lecture 28 - JPEG 2000 5/3 FilterBank & Spline MRA

Lecture 29 - Orthogonal Multiresolution Analysis with Splines

Lecture 30 - Building Piecewise Linear Scaling Function, Wavelet

Lecture 31 - The Wave Packet Transform

- Lecture 32 - Nobel Identities & The Haar Wave Packet Transform
- Lecture 33 - The Lattice Structure for Orthogonal Filter Banks
- Lecture 34 - Constructing the Lattice & its Variants
- Lecture 35 - The Lifting Structure & Polyphase Matrices
- Lecture 36 - The Polyphase Approach - The Modulation Approach
- Lecture 37 - Modulation Analysis and The 3-Band Filter Bank, Applications
- Lecture 38 - The Applications *Data Mining, *Face Recognition
- Lecture 39 - Proof that a non-zero function can not be both time and band-limited
- Lecture 40 - M-Band Filter Banks and Looking Ahead
- Lecture 41 - Tutorial -Session 1
- Lecture 42 - Student's Presentation
- Lecture 43 - Tutorial on Uncertainty Product
- Lecture 44 - Tutorial on Two band Filter Bank
- Lecture 45 - Tutorial -Frequency Domain Analysis of Two band Filter Bank
- Lecture 46 - Zoom in and Zoom out using Wavelet Transform
- Lecture 47 - More Thoughts on Wavelets : Zooming In
- Lecture 48 - Towards selecting Wavelets through vanishing moments
- Lecture 49 - In Search of Scaling Coefficients
- Lecture 50 - Wavelet Applications

Lecture 1 - Introduction

Lecture 2 - Basics of Light

Lecture 3 - Ray Model - I

Lecture 4 - Ray Model - II

Lecture 5 - Wave Model - I

Lecture 6 - Wave Model - II

Lecture 7 - Wave Model - III

Lecture 8 - Signal Distortion - I

Lecture 9 - Signal Distortion - II

Lecture 10 - Signal Distortion - III

Lecture 11 - Practical issues in Implementation of Fiber link

Lecture 12 - Optical Sources

Lecture 13 - Light Emitting Diodes - I

Lecture 14 - Light Emitting Diodes - II

Lecture 15 - Laser - I

Lecture 16 - Laser - II

Lecture 17 - Laser - III

Lecture 18 - Laser - IV

Lecture 19 - Laser - V + Photon Detector

Lecture 20 - Photo Diodes and Detector Noise

Lecture 21 - Photo Detector

Lecture 22 - Optical Receivers - I

Lecture 23 - Optical Receivers - II

Lecture 24 - Receiver Sensitivity Degradation

Lecture 25 - Fiber Optic Link Design

Lecture 26 - Wavelength Division Multiplexed Systems

Lecture 27 - EDFA

Lecture 28 - Integrated Optics - I

Lecture 29 - Integrated Optics - II

Lecture 30 - Tutorials - I

Lecture 31 - Tutorials - II

[Lecture 32 - Introduction to Non-Linear Fiber Optics](#)

[Lecture 33 - Non-linear Schrodinger Equation](#)

[Lecture 34 - Group Velocity Dispersion \(GVD\)](#)

[Lecture 35 - Self Phase Modulation \(SPM\)](#)

[Lecture 36 - Solitonic Communication](#)

[Lecture 37 - Raman Amplifier](#)

[Lecture 38 - Cross Phase Modulation and four wave mixing](#)

[Lecture 39 - Laboratory Experiments - I](#)

[Lecture 40 - Laboratory Experiments - II](#)

[Lecture 41 - Laboratory Experiments - III](#)

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : Advanced VLSI Design (Electronics and Communication Engineering)

Co-ordinators : Prof. A.N. Chandorkar, Prof. D.K. Sharma, Prof. Sachin Patkar, Prof. Virendra Singh

Lecture 1 - Historical Perspective and Future Trends in CMOS VLSI Circuit and System Design - Part I

Lecture 2 - Historical Perspective and Future Trends in CMOS VLSI Circuit and System Design - Part II

Lecture 3 - Logical Effort - A way of Designing Fast CMOS Circuits - Part I

Lecture 4 - Logical Effort - A way of Designing Fast CMOS Circuits - Part II

Lecture 5 - Logical Effort - A way of Designing Fast CMOS Circuits - Part III

Lecture 6 - Power Estimation and Control in CMOS VLSI circuits - Part I

Lecture 7 - Power Estimation and Control in CMOS VLSI circuits - Part II

Lecture 8 - Low Power Design Techniques - Part I

Lecture 9 - Low Power Design Techniques - Part II

Lecture 10 - Arithmetic Implementation Strategies for VLSI - Part I

Lecture 11 - Arithmetic Implementation Strategies for VLSI - Part II

Lecture 12 - Arithmetic Implementation Strategies for VLSI - Part III

Lecture 13 - Arithmetic Implementation Strategies for VLSI - Part IV

Lecture 14 - Interconnect aware design: Impact of scaling, buffer insertion and inductive peaking

Lecture 15 - Interconnect aware design: Low swing and Current mode signaling

Lecture 16 - Interconnect aware design: capacitively coupled interconnects

Lecture 17 - Introduction to Hardware Description Languages

Lecture 18 - Managing concurrency and time in Hardware Description Languages

Lecture 19 - Introduction to VHDL

Lecture 20 - Basic Components in VHDL

Lecture 21 - Structural Description in VHDL

Lecture 22 - Behavioral Description in VHDL

Lecture 23 - Introduction to Verilog

Lecture 24 - FSM + datapath (GCD example)

Lecture 25 - FSM + datapath (Continued...)

Lecture 26 - Single Cycle MMIPS

Lecture 27 - Multicycle MMIPS

Lecture 28 - Multicycle MMIPS – FSM

Lecture 29 - Brief Overview of Basic VLSI Design Automation Concepts

Lecture 30 - Netlist and System Partitioning

Lecture 31 - Timing Analysis in the context of Physical Design Automation

[Lecture 32 - Placement algorithm](#)

[Lecture 33 - Introduction to VLSI Testing](#)

[Lecture 34 - VLSI Test Basics - I](#)

[Lecture 35 - VLSI Test Basics - II](#)

[Lecture 36 - VLSI Testing: Automatic Test Pattern Generation](#)

[Lecture 37 - VLSI Testing: Design for Test \(DFT\)](#)

[Lecture 38 - VLSI Testing: Built-In Self-Test \(BIST\)](#)

[Lecture 39 - VLSI Design Verification: An Introduction](#)

[Lecture 40 - VLSI Design Verification: An Introduction](#)

[Lecture 41 - VLSI Design Verification: Equivalence/Model Checking](#)

[Lecture 42 - VLSI Design Verification: Model Checking](#)

- Lecture 1 - Introduction to Broadband Networks
- Lecture 2 - Qos in Packet Switching and ATM
- Lecture 3 - ATM Networks
- Lecture 4 - Effective Bandwidth - I
- Lecture 5 - Effective Bandwidth - II
- Lecture 6 - Traffic Descriptor in ATM
- Lecture 7 - Calculus for QOS - I
- Lecture 8 - Calculus For Qos - II
- Lecture 9 - Packet Scheduling Algorithm Introduction
- Lecture 10 - Fluid Fair Queueing and Weighted Fair Queueing
- Lecture 11 - Virtual Time In Scheduling
- Lecture 12 - Fairness of WFO and SCFO Scheduling Algorithms
- Lecture 13 - Rate Proportional Servers
- Lecture 14 - Latency Rate Servers - I
- Lecture 15 - Latency Rate Servers - II And Delay Bounds
- Lecture 16 - QOS In Best Effort Internet
- Lecture 17 - TCP Congestion Control
- Lecture 18 - Analysis of TCP
- Lecture 19 - TCP Throughput
- Lecture 20 - Buffer Management
- Lecture 21 - IP Addressing Scheme
- Lecture 22 - IP Addressing Lookup And Packet Classification
- Lecture 23 - IP Over ATM
- Lecture 24 - Multiple Label Switching (MPLS)
- Lecture 25 - MPLS and Traffic Engineering
- Lecture 26 - Optical Network and MPLS
- Lecture 27 - Integrated Service Internet (IntServ) and RSVP
- Lecture 28 - Differentiated Services Internet
- Lecture 29 - Voice over IP
- Lecture 30 - RTP
- Lecture 31 - Metro Ethernet Access Networks

Lecture 1 - Introduction to Digital Communication

Lecture 2 - Sampling

Lecture 3 - Quantization, PCM and Delta Modulation

Lecture 4 - Probability and Random Processes (Part-1)

Lecture 5 - Probability and Random Processes (Part-2)

Lecture 6 - Channels and their Models (Part-1)

Lecture 7 - Channels and their Models (Part-2)

Lecture 8 - Information Theory (Part-1)

Lecture 9 - Information Theory (Part-2)

Lecture 10 - Bandpass Signal Representation (Part-1)

Lecture 11 - Bandpass Signal Representation (Part-2)

Lecture 12 - Digital Modulation Techniques (Part-1)

Lecture 13 - Digital Modulation Techniques (Part-2)

Lecture 14 - Digital Modulation Techniques (Part-3)

Lecture 15 - Digital Modulation Techniques (Part-4)

Lecture 16 - Digital Modulation Techniques (Part-5)

Lecture 17 - Digital Modulation Techniques (Part-6)

Lecture 18 - Digital Modulation Techniques (Part-7)

Lecture 19 - Digital Modulation Techniques (Part-8)

Lecture 20 - Digital Modulation Techniques (Part-9)

Lecture 21 - Digital Modulation Techniques (Part-10)

Lecture 22 - Probability of Error Calculation

Lecture 23 - Calculation of Probability of Error

Lecture 24 - Calculation of Probability of Error

Lecture 25 - Equalizers

Lecture 26 - Source Coding (Part-1)

Lecture 27 - Source Coding (Part-2)

Lecture 28 - Source Coding (Part-3)

Lecture 29 - Source Coding (Part-4)

Lecture 30 - Channel Coding

Lecture 31 - Fundamentals of OFDM

Lecture 1 - Introduction to Information Theory and Coding

Lecture 2 - Definition of Information Measure and Entropy

Lecture 3 - Extension of An Information Source and Markov Source

Lecture 4 - Adjoint of An Information Source, Joint and Conditional Information Measure

Lecture 5 - Properties of Joint and Conditional Information Measures and A Markov Source

Lecture 6 - Asymptotic Properties of Entropy and Problem Solving in Entropy

Lecture 7 - Block Code and its Properties

Lecture 8 - Instantaneous Code and Its Properties

Lecture 9 - Kraft-McMillan Equality and Compact Codes

Lecture 10 - Shannon's First Theorem

Lecture 11 - Coding Strategies and Introduction to Huffman Coding

Lecture 12 - Huffman Coding and Proof of Its Optimality

Lecture 13 - Competitive Optimality of The Shannon Code

Lecture 14 - Non-Binary Huffman Code and Other Codes

Lecture 15 - Adaptive Huffman Coding - Part-I

Lecture 16 - Adaptive Huffman Coding - Part-II

Lecture 17 - Shannon-Fano-Elias Coding and Introduction to Arithmetic Coding

Lecture 18 - Arithmetic Coding - Part-I

Lecture 19 - Arithmetic Coding - Part-II

Lecture 20 - Introduction to Information Channels

Lecture 21 - Equivocation and Mutual Information

Lecture 22 - Properties of Different Information Channels

Lecture 23 - Reduction of Information Channels

Lecture 24 - Properties of Mutual Information and Introduction to Channel Capacity

Lecture 25 - Calculation of Channel Capacity for Different Information Channels

Lecture 26 - Shannon's Second Theorem

Lecture 27 - Discussion On Error Free Communication Over Noisy Channel

Lecture 28 - Error Free Communication Over A Binary Symmetric Channel and Introduction to Continuous Sources and Channels

Lecture 29 - Differential Entropy and Evaluation of Mutual Information for Continuous Sources and Channels

Lecture 30 - Channel Capacity of A BandLimited Continuous Channel

Lecture 31 - Introduction to Rate-Distortion Theory

[Lecture 32 - Definition and Properties of Rate-Distortion Functions](#)

[Lecture 33 - Calculation of Rate-Distortion Functions](#)

[Lecture 34 - Computational Approach for Calculation of Rate-Distortion Functions](#)

[Lecture 35 - Introduction to Quantization](#)

[Lecture 36 - Lloyd-Max Quantizer](#)

[Lecture 37 - Companded Quantization](#)

[Lecture 38 - Variable Length Coding and Problem Solving in Quantizer Design](#)

[Lecture 39 - Vector Quantization](#)

[Lecture 40 - Transform Coding - Part-I](#)

[Lecture 41 - Transform Coding - Part-II](#)

- Lecture 1 - Introduction to EM waves and various techniques of communication
- Lecture 2 - Equations of Voltage and Current on TX line
- Lecture 3 - Propagation constant, Characteristic impedance and reflection coefficient
- Lecture 4 - Impedance Transformation
- Lecture 5 - Loss-less and Low loss Transmission line and VSWR
- Lecture 6 - Power transfer on TX line
- Lecture 7 - Smith Chart
- Lecture 8 - Admittance Smith Chart
- Lecture 9 - Experimental setup for transmission line measurements
- Lecture 10 - Applications of transmission lines
- Lecture 11 - Applications of transmission lines-II
- Lecture 12 - Impedance Matching
- Lecture 13 - Lossy Transmission Line
- Lecture 14 - Problems on Transmission line
- Lecture 15 - Types of transmission line
- Lecture 16 - Basics of Vectors
- Lecture 17 - Vector calculus
- Lecture 18 - Basic laws of Electromagnetics
- Lecture 19 - Maxwell's Equations
- Lecture 20 - Boundary conditions at Media Interface
- Lecture 21 - Uniform plane wave
- Lecture 22 - Propagation of wave
- Lecture 23 - Wave polarization
- Lecture 24 - Pioncere's Sphere
- Lecture 25 - Wave propagation in conducting medium
- Lecture 26 - Wave propagation and phase velocity
- Lecture 27 - Power flow and Poynting vector
- Lecture 28 - Surface current and power loss in a conductor
- Lecture 29 - Plane wave in arbitrary direction
- Lecture 30 - Plane wave at dielectric interface
- Lecture 31 - Reflection and refraction at media interface

- Lecture 32 - Total internal reflection
- Lecture 33 - Polarization at media interface
- Lecture 34 - Reflection from a conducting boundary
- Lecture 35 - Parallel plane waveguide
- Lecture 36 - Wave propagation in parallel plane waveguide
- Lecture 37 - Analysis of waveguide general approach
- Lecture 38 - Rectangular waveguide
- Lecture 39 - Modal propagation in rectangular waveguide
- Lecture 40 - Surface currents on the waveguide walls
- Lecture 41 - Field visualization and Attenuation in waveguide
- Lecture 42 - Attenuation in waveguide continued
- Lecture 43 - Radiation (Antenna)
- Lecture 44 - Solution for potential function
- Lecture 45 - Radiation form the Hertz dipole
- Lecture 46 - Power radiated by hertz dipole
- Lecture 47 - Thin linear antenna
- Lecture 48 - Radiation Parameters of antenna
- Lecture 49 - Receiving antenna
- Lecture 50 - Monopole and Dipole antenna
- Lecture 51 - Fourier transform relation between current and radiation pattern
- Lecture 52 - Antenna arrays
- Lecture 53 - Uniform Linear array
- Lecture 54 - Uniform Linear array continued
- Lecture 55 - Synthesis of array
- Lecture 56 - Binomial array and general array synthesis
- Lecture 57 - Problems on uniform plane wave
- Lecture 58 - Problems on uniform plane wave in a meduim
- Lecture 59 - Problems on waveguides
- Lecture 60 - Problems on Antennas and radiation

- Lecture 1 - Introduction to CMOS Analog VLSI Design
- Lecture 2 - Introduction to CMOS Analog VLSI Design (Continued...)
- Lecture 3 - MOS Fundamentals
- Lecture 4 - MOS Fundamentals (Continued...)
- Lecture 5 - Basic of MOS Amplifier (Part-1)
- Lecture 6 - Basic of MOS Amplifier (Part-2)
- Lecture 7 - Basic of MOS Amplifier (Part-3)
- Lecture 8 - Cascode Amplifier
- Lecture 9 - Types of MOSFET Amplifier
- Lecture 10 - Types of MOSFET Amplifier
- Lecture 11 - Differential Amplifier
- Lecture 12 - Differential Amplifier
- Lecture 13 - Current Sources
- Lecture 14 - Current Sources
- Lecture 15 - Current Sources
- Lecture 16 - Frequency Response of Amplifier
- Lecture 17 - Basic of CMOS OPAMP
- Lecture 18 - OPAMP Design Issues
- Lecture 19 - OPAMP Design
- Lecture 20 - OPAMP Design
- Lecture 21 - Operational Transconductance Amplifier
- Lecture 22 - OTA Operation Transconductance Amplifier and Application
- Lecture 23 - Fully Differential Amplifier and Noise
- Lecture 24 - Noise
- Lecture 25 - Noise (Continued...)
- Lecture 26 - Layout of Analog Circuit
- Lecture 27 - Oscillators
- Lecture 28 - Oscillators (Continued...)
- Lecture 29 - Oscillators (Continued...)

Lecture 1 - Introduction to Analog Circuits - An Overview

Lecture 2 - Two Parts of Review of Analog Filter Approximation

Lecture 3 - BJT Small Signal Model

Lecture 4 - BJT Small Signal Model [Continuation from Lecture 3]

Lecture 5 - MOS Circuit Model

Lecture 6 - Biasing of Circuits

Lecture 7 - Amplifiers

Lecture 8 - MOS Amplifiers

Lecture 9 - Cascode Amplifier

Lecture 10 - Frequency Response of Amplifier

Lecture 11 - Frequency Response of Amplifier

Lecture 12 - Frequency Response of Amplifier

Lecture 13 - Frequency Response of Amplifier

Lecture 14 - Differential Amplifier

Lecture 15 - Differential Amplifier

Lecture 16 - Differential Amplifier

Lecture 17 - Feedback Theory

Lecture 18 - Feedback Theory

Lecture 19 - OPAMP Circuits

Lecture 20 - OPAMP Circuits

Lecture 21 - Active RC Filters

Lecture 22 - Active Filters

Lecture 23 - Oscillators

Lecture 24 - Oscillators

Lecture 25 - DAC/ADC

Lecture 1 - Introduction

Lecture 2 - Reflection Coefficient, VSWR, Smith Chart

Lecture 3 - Reflection Coefficient, VSWR

Lecture 4 - Smith Chart

Lecture 5 - Application of the Smith Chart

Lecture 6 - Microwave Components

Lecture 7 - Broadband Impedance Matching

Lecture 8 - Multi-section transformer

Lecture 9 - Maximally flat (binomial) transformer, Chebyshev transformer

Lecture 10 - Non-uniform transmission line (Tapers)

Lecture 11 - Scattering Parameters

Lecture 12 - Properties of Scattering Parameters

Lecture 13 - Properties of Scattering Parameters (Continued...)

Lecture 14 - Signal flow graph, ABCD parameters

Lecture 15 - 1 and 2 Port passive Components

Lecture 16 - 3 Port Microwave Components

Lecture 17 - Couplers

Lecture 18 - Coupled Line Couplers

Lecture 19 - Resonators and narrow band filters

Lecture 20 - Narrow-band filters

Lecture 21 - Filter design: Image parameter method, Insertion loss method

Lecture 22 - Filter synthesis, Kuroda's Identity

Lecture 23 - Impedance Matching Circuits for Amplifiers

Lecture 24 - Microstrip Matching (Continued...), Masons Rule, Power Gain Equations

Lecture 25 - Amplifier Gain Stability

Lecture 26 - Amplifier Gain Stability (Continued...)

Lecture 27 - Gain Circles

Lecture 28 - Gain Circles (Continued...)

Lecture 29 - Noise

Lecture 30 - Noise Figure Circles (Continued...)

Lecture 31 - DC Bias

[Lecture 32 - Amplifier Classes, Frequency Compensation](#)

[Lecture 33 - Linearity](#)

[Lecture 34 - Oscillator Design](#)

Lecture 1 - Introduction

Lecture 2 - Origin of wavelets

Lecture 3 - Haar wavelet

Lecture 4 - Dyadic wavelet

Lecture 5 - Dilates and translates of Haar wavelet

Lecture 6 - L2 norm of a function

Lecture 7 - Piecewise constant representation of a function

Lecture 8 - Ladder of subspaces

Lecture 9 - Scaling function of Haar wavelet

Lecture 10 - Demonstration: Piecewise constant approximation of functions

Lecture 11 - Vector representation of sequences

Lecture 12 - Properties of norm

Lecture 13 - Parsevals theorem

Lecture 14 - Equivalence of functions and sequences

Lecture 15 - Angle between Functions and their Decomposition

Lecture 16 - Additional Information on Direct-Sum

Lecture 17 - Introduction to filter banks

Lecture 18 - Haar Analysis filter bank in Z-domain

Lecture 19 - Haar Synthesis filter bank in Z-domain

Lecture 20 - Moving from Z-domain to frequency domain

Lecture 21 - Frequency Response of Haar Analysis Low pass Filter bank

Lecture 22 - Frequency Response of Haar Analysis High pass Filter bank

Lecture 23 - Ideal Two-band Filter bank

Lecture 24 - Disqualification of Ideal Filter bank

Lecture 25 - Realizable Two-band Filter bank

Lecture 26 - Demonstration: DWT of images

Lecture 27 - Relating Fourier transform of scaling function to filter bank

Lecture 28 - Fourier transform of scaling function

Lecture 29 - Construction of scaling and wavelet functions from filter bank

Lecture 30 - Demonstration: Constructing scaling and wavelet functions.

Lecture 31 - Conclusive Remarks and Future Prospects

- Lecture 1 - RF system basic architectures
- Lecture 2 - Transmission media reflection
- Lecture 3 - Maximum power transfer
- Lecture 4 - Parallel RLC tank
- Lecture 5 - Matching
- Lecture 6 - Other matching networks
- Lecture 7 - Resistors capacitors
- Lecture 8 - Inductors
- Lecture 9 - Inductors and wires
- Lecture 10 - Wires
- Lecture 11 - Transmission lines
- Lecture 12 - Device review
- Lecture 13 - MOS capacitances
- Lecture 14 - Bandwidth estimation constants
- Lecture 15 - Bandwidth estimation constants (Continued.)
- Lecture 16 - Bandwidth estimation using short circuit
- Lecture 17 - Bandwidth groupdelay and peaking
- Lecture 18 - Shunt series amplifier
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Lecture 6 - Inverse Systems, Stability, FIR & IIR

Lecture 7 - FIR & IIR; Recursive & Non Recursive

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Lecture 9 - Discrete Fourier Transform (DFT)

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Lecture 11 - DFT (Continued.) Introduction to Z Transform

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Lecture 12 - Diode Datasheet Examples

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- Lecture 4 - Load diversity
- Lecture 5 - Different load indices
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- Lecture 8 - Brief overview of power distribution substation
- Lecture 9 - Substation bus schemes and primary distribution network topology
- Lecture 10 - Voltage drop and power loss computations for typical radial distribution feeders
- Lecture 11 - Generalized expression for voltage drop for radial distribution feeder
- Lecture 12 - Derivation of K-constant for voltage drop computation
- Lecture 13 - Different reliability indices used in distribution networks
- Lecture 14 - Different reliability indices with numerical examples
- Lecture 15 - Mathematical concept of reliability
- Lecture 16 - Reliability evaluation of multiple units connected to series and/or parallel
- Lecture 17 - Numerical problems on reliability evaluation
- Lecture 18 - Power quality problems in distribution systems
- Lecture 19 - Forward backward load flow approach for power distribution systems
- Lecture 20 - Forward backward load flow approach for power distribution systems
- Lecture 21 - Reactive power compensation: Basic idea
- Lecture 22 - Reactive power compensation: Numerical examples
- Lecture 23 - Capacitor placement at distribution feeder: Analytical approach
- Lecture 24 - Power distribution system planning: Economic aspects
- Lecture 25 - Power distribution system planning: Different models and solution strategies
- Lecture 26 - Mono-objective power distribution system planning approach
- Lecture 27 - Multi-objective power distribution system planning approach
- Lecture 28 - Multi-objective planning incorporating sectionalizing switches and tie-lines
- Lecture 29 - Reconfiguration of power distribution networks
- Lecture 30 - Distribution networks with the integration of Distributed Generation
- Lecture 31 - Concept of microgrids

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DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Nanophotonics, Plasmonics, and Metamaterials (Electronics and Communication Engineering)

Co-ordinators : Dr. Debabrata Sikdar, Dr. Debabrata Sikdar

Lecture 1 - Introduction to Nanophotonics and Plasmonics

Lecture 2 - Introduction to Metamaterials and Metasurfaces

Lecture 3 - Overview and current status

Lecture 4 - Electromagnetic theory of light

Lecture 5 - Electromagnetic properties of material

Lecture 6 - Electromagnetic waves in dielectric media

Lecture 7 - Polarization of light

Lecture 8 - Reflection and refraction: Fresnel equations

Lecture 9 - Absorption, dispersion and scattering of light

Lecture 10 - Matrix theory of dielectric layered media

Lecture 11 - 1D Photonic crystals

Lecture 12 - Dispersion relation and photonic band structure

Lecture 13 - Real and reciprocal lattices

Lecture 14 - 2D and 3D Photonic crystals

Lecture 15 - Emerging Applications of Photonic Crystals

Lecture 16 - Optical properties of metals

Lecture 17 - Surface Plasmon Polaritons (SPP): Fundamentals

Lecture 18 - Applications of SPPs

Lecture 19 - Localized surface plasmon resonance (LSPR)

Lecture 20 - Plasmonic nanoparticles: Antenna and Waveguides

Lecture 21 - Applications of LSPR

Lecture 22 - Fundamentals of metamaterials

Lecture 23 - Effective medium theories

Lecture 24 - Single and Double-Negative Metamaterials

Lecture 25 - Metamaterial Perfect absorbers

Lecture 26 - Super lens, Hyperbolic Metamaterials and Hyper lens

Lecture 27 - Tunable photonic metamaterial based devices

Lecture 28 - Metasurfaces and Frequency selective surfaces

Lecture 29 - Guided mode resonances (GMR)

Lecture 30 - Applications of metasurfaces and GMR devices

Lecture 31 - Transformation Optics (TO) and Invisibility Cloaks

[Lecture 32 - Carpet cloaking and TO metamaterials](#)

[Lecture 33 - Introduction to alternative materials](#)

[Lecture 34 - Nanofabrication: Physical and Chemical methods](#)

[Lecture 35 - Lithography and Pattern transfer](#)

[Lecture 36 - Nanophotonic characterization methods](#)

- Lecture 1 - Basic Concepts of active and reactive power
- Lecture 2 - Basic Concepts of reactive power compensation
- Lecture 3 - Basic mathematical modelling of power transmission systems
- Lecture 4 - Derivation of the relation of sending and receiving end voltages and currents - Part A
- Lecture 5 - Derivation of the relation of sending and receiving end voltages and currents - Part B
- Lecture 6 - Derivations of power flow expressions
- Lecture 7 - Numerical example showing determination of power flow
- Lecture 8 - Generalized expression for active and reactive power at any point of a long line
- Lecture 9 - Mid-point voltage and current for long, lossless transmission lines
- Lecture 10 - Plot of mid-point voltage vs line loading
- Lecture 11 - Numerical example of mid-point compensation - Part A
- Lecture 12 - Numerical example of mid-point compensation - Part B
- Lecture 13 - Effect of Mid-point compensation on power flow of transmission lines
- Lecture 14 - Thyristor controlled reactor (TCR)
- Lecture 15 - Harmonics in TCR and Three-phase TCR configuration
- Lecture 16 - Operating Characteristics of TCR
- Lecture 17 - Categorization of different types of SVC and Fixed capacitor TCR (FC-TCR)
- Lecture 18 - Mechanically Switched Capacitor TCR (MSC-TCR) and Thyristor Switch Capacitor (TSC)
- Lecture 19 - Thyristor Switch Capacitor (TSC)
- Lecture 20 - Design of TSC-TCR: Numerical Example
- Lecture 21 - SVC in enhancement of steady-state power transmission capacity
- Lecture 22 - SVC in enhancement of transient stability of power systems
- Lecture 23 - SVC in enhancement of synchronizing power coefficient
- Lecture 24 - SVC in and power system oscillation damping
- Lecture 25 - SVC in voltage control of power systems: Modelling
- Lecture 26 - SVC in voltage control of power systems: Control characteristics
- Lecture 27 - SVC in voltage control of power systems: Numerical example
- Lecture 28 - Basic operating principle of TCSC
- Lecture 29 - Basic mathematical modelling of TCSC - Part 1
- Lecture 30 - Basic mathematical modelling of TCSC - Part 2
- Lecture 31 - TCSC reactance and harmonics analysis

[Lecture 32 - Applications of TCSC in power systems](#)

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Lecture 1 - Introduction to 3G/4G Standards

Lecture 2 - Wireless Channel and Fading

Lecture 3 - Rayleigh Fading and BER of Wired Communication

Lecture 4 - BER for Wireless Communication

Lecture 5 - Introduction to Diversity

Lecture 6 - Multi-antenna Maximal Ratio Combiner

Lecture 7 - BER with Diversity

Lecture 8 - Spatial Diversity and Diversity Order

Lecture 9 - Wireless Channel and Delay Spread

Lecture 10 - Coherence Bandwidth of the Wireless Channel

Lecture 11 - ISI and Doppler in Wireless Communications

Lecture 12 - Doppler Spectrum and Jakes Model

Lecture 13 - Introduction to CDMA, Spread Spectrum and LFSR

Lecture 14 - Generation and Properties of PN Sequences

Lecture 15 - Correlation of PN Sequences and Jammer Margin

Lecture 16 - CDMA Advantages and RAKE Receiver

Lecture 17 - Multi-User CDMA Downlink Part I

Lecture 18 - Multi-User CDMA Downlink Part II

Lecture 19 - Multi-User CDMA Uplink and Asynchronous CDMA

Lecture 20 - CDMA Near-Far Problem and Introduction to MIMO

Lecture 21 - MIMO System Model and Zero-Forcing Receiver

Lecture 22 - MIMO MMSE Receiver and Introduction to SVD

Lecture 23 - SVD Based Optimal MIMO Transmission and Capacity

Lecture 24 - SVD Based Optimal MIMO Transmission and Capacity

Lecture 25 - OSTBCs and Introduction to V-BLAST Receiver

Lecture 26 - V-BLAST (Continued) and MIMO Beamforming

Lecture 27 - Introduction to OFDM and Multi-Carrier Modulation

Lecture 28 - IFFT Sampling for OFDM

Lecture 29 - OFDM Schematic and Cyclic Prefix

Lecture 30 - OFDM Based Parallelization and OFDM Example

Lecture 31 - OFDM Example (Continued) and Introduction to MIMO-OFDM

[Lecture 32 - MIMO-OFDM \(Continued\)](#)

[Lecture 33 - Impact of Carrier Frequency Offset \(CFO\) in OFDM](#)

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[Lecture 35 - SC-FDMA \(Continued\) and Introduction of Wireless Propagation Models](#)

[Lecture 36 - Ground Reflection and Okumura Models](#)

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NPTEL : NOC:Principles of Modern CDMA-MIMO-OFDM Wireless Communications (Electronics and Communication Engineering)

Co-ordinators : Prof. Aditya K. Jagannatham

- Lecture 1 - Evolution of Wireless Communication Technologies
- Lecture 2 - Modeling Wireless Channel
- Lecture 3 - Wireless Fading Channel Model
- Lecture 4 - Fading Channel Distribution
- Lecture 5 - Rayleigh Fading Channel
- Lecture 6 - Bit Error Rate (BER) Performance
- Lecture 7 - Bit Error Rate (BER) of AWGN Channels
- Lecture 8 - Bit Error Rate of Rayleigh Fading Wireless Channel
- Lecture 9 - Exact BER Expression for Rayleigh Fading Wireless Channel
- Lecture 10 - Deep Fade Analysis of Wireless Communication
- Lecture 11 - Principle of Diversity
- Lecture 12 - Multiple Antenna Diversity
- Lecture 13 - Maximal-Ratio Combining
- Lecture 14 - BER of Multiple Antenna Wireless Systems
- Lecture 15 - Approximate BER for Multiple Antenna Wireless System
- Lecture 16 - Examples for BER of Wireless Communication
- Lecture 17 - Deep Fade in Multi Antenna Systems
- Lecture 18 - Intuition for Deep Fade in Multi-Antenna System
- Lecture 19 - Definition of Diversity Order
- Lecture 20 - Max Delay Spread
- Lecture 21 - RMS Delay Spread
- Lecture 22 - Delay Spread and Inter Symbol Interference
- Lecture 23 - Coherence Bandwidth of Wireless Channel
- Lecture 24 - Mobility and Doppler Effect in Wireless Channels
- Lecture 25 - Impact of Doppler Effect on Wireless Channel
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NPTEL : NOC:Estimation for Wireless Communications, MIMO, OFDM Cellular and Sensor Networks (Electronics and Communication Engineering)

Co-ordinators : Prof. Aditya K. Jagannatham

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**NPTEL : NOC:Bayesian, MMSE Estimation for Wireless Communications MIMO, OFDM Cellular and Sensor Networks
(Electronics and Communication Engineering)**

Co-ordinators : Prof. Aditya K. Jagannatham

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Lecture 5 - Nodal analysis of a network with conductances and current sources; Setting up the equations; Conductance matrix; Superposition

Lecture 6 - Circuit analysis; Number of KCL and KVL equations in a circuit; Nodal analysis of a network with conductances and current sources; Setting up the equations; Conductance matrix;

Lecture 7 - Nodal analysis with voltage sources and controlled sources; Brief introduction to modified nodal analysis; Use of supernode to solve circuits with voltage sources; Superposition theorem

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Lecture 9 - Choice of nodal versus mesh analysis; Circuit theorems: Pushing a voltage source through a node, splitting a current source, substitution theorem, superposition

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Lecture 18 - Step response of RC circuit with loops of voltage sources and capacitors; RL circuits; RLC circuits

Lecture 19 - Second order(RLC circuit) natural response; Series and parallel RLC circuits; Differential equation-characteristic equation and solutions; Forced response of a second order circuit

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- Lecture 125 - Does a capacitor block DC?
- Lecture 126 - Finding the order of a circuit
- Lecture 127 - First order RC circuits with discontinuous capacitor voltages
- Lecture 128 - Summary: Computing first order circuit response with discontinuities
- Lecture 129 - First order RL circuits
- Lecture 130 - First order RL circuit with discontinuous inductor current-Example

- [Lecture 131 - First order RC circuit with an exponential input](#)
- [Lecture 132 - First order RC response to its own natural response](#)
- [Lecture 133 - First order RC response to a sinusoidal input](#)
- [Lecture 134 - First order RC response to a sinusoidal input-via the complex exponential](#)
- [Lecture 135 - Summary: Linear circuit response to sinusoidal input via the complex exponential](#)
- [Lecture 136 - Three methods of calculating the sinusoidal steady state response](#)
- [Lecture 137 - Calculating the total response including initial conditions](#)
- [Lecture 138 - Why are sinusoids used in measurement?](#)
- [Lecture 139 - Second order system natural response](#)
- [Lecture 140 - Second order system as a cascade of two first order systems](#)
- [Lecture 141 - Second order system natural response-critically damped and underdamped](#)
- [Lecture 142 - Generalized form of a second order system](#)
- [Lecture 143 - Numerical example](#)
- [Lecture 144 - Series and parallel RLC circuits](#)
- [Lecture 145 - Forced response of a second order system](#)
- [Lecture 146 - Steady state response calculation and Phasors](#)
- [Lecture 147 - Phasors \(Continued...\)](#)
- [Lecture 148 - Magnitude and Phase plots](#)
- [Lecture 149 - Magnitude and phase plots of a second order system](#)
- [Lecture 150 - Maximum power transfer and Conjugate matching](#)

Lecture 1 - MOS Transistor

Lecture 2 - MOS Transistor - Detailed Study

Lecture 3 - Combinational Circuits and layout

Lecture 4 - Delay

Lecture 5 - Sequential Circuits

Lecture 6 - Logical Effort

Lecture 7 - Circuit Families

Lecture 8 - Lab-01

Lecture 9 - Lab-02

Lecture 10 - Lab-03

Lecture 11 - Lab-04

Lecture 12 - Introduction to Synthesis

Lecture 13 - Libraries

Lecture 14 - RTL Coding for Synthesis

Lecture 15 - Reading Design in DC

Lecture 16 - Design Environment

Lecture 17 - Design Constraints

Lecture 18 - Compile Flow and strategies

Lecture 19 - Analysis and Reporting

Lecture 20 - Lab-05

Lecture 21 - Advanced Synthesis Techniques

Lecture 22 - Datapath Extraction Guidelines

Lecture 23 - Power - Methodology and Analysis

Lecture 24 - Lab-06

Lecture 25 - Lab-07

Lecture 26 - Lab-08

Lecture 27 - Lab-09

Lecture 28 - Static Timing Analysis - Concepts and Flow

Lecture 29 - Interconnects and Delay calculation

Lecture 30 - Clock and Exceptions

Lecture 31 - On Chip Variation

[Lecture 32 - Introduction to Crosstalk](#)

[Lecture 33 - Gaussian / Normal Distribution](#)

[Lecture 34 - Equivalence Checking / Formal Verification](#)

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : ARM Based Development (Electronics and Communication Engineering)

Co-ordinators : Mr. S. Chandramouleeswaran

Lecture 1 - Types of computer Architectures, ISA's and ARM History

Lecture 2 - Embedded System Software and Hardware, stack implementation in ARM, Endianness, condition codes

Lecture 3 - Processor core VS CPU core, ARM7TDMI Interface signals, Memory Interface, Bus Cycle types, Register set, Operational Modes

Lecture 4 - Instruction Format, ARM Core Data Flow Model, ARM 3 stage Pipeline, ARM family attribute comparison

Lecture 5 - ARM 5 stage Pipeline, Pipeline Hazards, Data forwarding - a hardware solution

Lecture 6 - ARM ISA and Processor Variants, Different Types of Instructions, ARM Instruction set, data processing instructions

Lecture 7 - Shift Operations, shift Operations using RS lower byte, Immediate value encoding

Lecture 8 - Dataprocessing Instructions

Lecture 9 - Addressing Mode-1, Addressing Mode-2

Lecture 10 - Addressing Mode-2, LDR/STR, Addressing mode-3 with examples

Lecture 11 - Instruction Timing, Addressing Mode-4 with Examples

Lecture 12 - Swap Instructions, Swap Register related Instructions, Loading Constants

Lecture 13 - Program Control Flow, Control Flow Instructions, B & BL instructions, BX instruction

Lecture 14 - Interrupts and Exceptions, Exception Handlers, Reset Handling

Lecture 15 - Aborts, software Interrupt Instruction, undefined instruction exception

Lecture 16 - Interrupt Latency, Multiply Instructions, Instruction set examples

Lecture 17 - Thumb state, Thumb Programmers model, Thumb Implementation, Thumb Applications

Lecture 18 - Thumb Instructions, Interrupt processing

Lecture 19 - Interrupt Handelling schemes, Examples of Interrupt Handlers

Lecture 20 - Coprocessors

Lecture 21 - Coprocessor Instructions, data Processing Instruction, data transfers, register transfers

Lecture 22 - Number representations, floating point representation

Lecture 23 - Flynn's Taxonomy, SIMD and Vector Processors, Vector Floating Point Processor (VFP), VFP and ARM interactions, An example vector operation

Lecture 24 - Memory Technologies, Need for memory Hierarchy, Hierarchical Memory Organization, Virtual Memory

Lecture 25 - Cache Memory, Mapping Functions

Lecture 26 - Cache Design, Unified or split cache, multiple level of caches, ARM cache features, coprocessor 15 for system control

Lecture 27 - Processes, Memory Map, Protected Systems, ARM systems with MPU, memory Protection Unit (MPU)

Lecture 28 - Physical Vs Virtual Memory, Paging, Segmentation

Lecture 29 - MMU Advantage, virtual memory translation, Multitasking with MMU, MMU organization, Tightly coupled Memory (TCM)

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Lecture 30 - ARM Development Environment, Arm Procedure Call Standard (APCS),

Lecture 31 - Example C program

Lecture 32 - Embedded software Development, Image structure, linker inputs and outputs, memory map, application startup

Lecture 33 - AMBA Overview, Typical AMAB Based Microcontroller, AHB bus features, AHB Bus transfers, APB bus transfers, APB bridge

Lecture 34 - DMA, Peripherals, Programming Peripherals in ARM

Lecture 35 - DMA:Direct Memory Access

Lecture 36 - Protocols (I2c, SPI), UART, GPIO

Lecture 37 - ARM ISAs, ARMv5, ARMv6, ARM v7, big.little technology, ARMv8

[Lecture 1 - Embedded Systems Basics Session 1](#)

[Lecture 2 - Embedded Systems Basics Session 1 \(Continued...\)](#)

[Lecture 3 - Prerequisites for Embedded Systems Testing](#)

[Lecture 4 - Test Case Design and procedures](#)

[Lecture 5 - Test Standards](#)

[Lecture 6 - Depicting Levels of Testing](#)

[Lecture 7 - Depicting Levels of Testing \(Continued...\)](#)

[Lecture 8 - Software Life Cycle](#)

[Lecture 9 - Embedded V-Model Life Cycle](#)

[Lecture 10 - Embedded V-Model Life Cycle \(Continued...\)](#)

[Lecture 11 - Master Test Planning](#)

[Lecture 12 - Dynamic Testing](#)

[Lecture 13 - Black Box Testing](#)

[Lecture 14 - Black Box Testing \(Continued...\)](#)

[Lecture 15 - Black Box Testing \(Continued...\)](#)

[Lecture 16 - Black Box Testing \(Continued...\)](#)

[Lecture 17 - Model based Design Introduction](#)

[Lecture 18 - Dynamic Testing](#)

[Lecture 19 - Dynamic Testing \(Continued...\)](#)

[Lecture 20 - White Box Testing](#)

[Lecture 21 - White Box Testing \(Continued...\)](#)

[Lecture 22 - Grey-box testing](#)

[Lecture 23 - Static Testing](#)

[Lecture 24 - Static Analysis](#)

[Lecture 25 - Static Analysis \(Continued...\)](#)

[Lecture 26 - Static Analysis \(Continued...\)](#)

[Lecture 27 - Test Metrics](#)

[Lecture 28 - Software Testing Metrics](#)

[Lecture 29 - Integration Test Strategy](#)

[Lecture 30 - Integration Tests Environment](#)

[Lecture 31 - Use Case Diagram](#)

[Lecture 32 - Depicting Levels of Testing \(Continued...\)](#)

[Lecture 33 - Configure Management Elements](#)

[Lecture 34 - SCM Activities](#)

[Lecture 35 - Test Management Tool](#)

[Lecture 36 - SCM Activities \(Continued...\)](#)

[Lecture 37 - Overview Lecture 1](#)

[Lecture 38 - Unit Testing](#)

[Lecture 39 - Unit Testing \(Continued...\)](#)

[Lecture 40 - Understanding C++](#)

[Lecture 41 - Unit Testing \(Continued...\)](#)

[Lecture 42 - Level Testing](#)

[Lecture 43 - Identify Test Cases](#)

[Lecture 44 - Test Link Work Flow](#)

[Lecture 1 - Linux Basics - I](#)

[Lecture 2 - Linux Basics - II](#)

[Lecture 3 - Linux Basics - III](#)

[Lecture 4 - Linux Basics - IV](#)

[Lecture 5 - Linux Networking - I](#)

[Lecture 6 - Linux Networking - II](#)

[Lecture 7 - File Transfer Protocol](#)

[Lecture 8 - Domain Name System](#)

[Lecture 9 - DNS \(Continued...\)](#)

[Lecture 10 - DFS](#)

[Lecture 11 - AFS and NIS](#)

[Lecture 12 - PERL 1](#)

[Lecture 13 - PERL 2](#)

[Lecture 14 - PERL 3](#)

[Lecture 15 - PERL 4](#)

[Lecture 16 - PERL 5](#)

[Lecture 17 - PERL 6](#)

[Lecture 18 - PERL 7](#)

[Lecture 19 - PERL 8](#)

[Lecture 20 - PERL 9](#)

[Lecture 21 - Using sort](#)

[Lecture 22 - PERL 10](#)

[Lecture 23 - Programming Using Tcl/Tk - I](#)

[Lecture 24 - Programming Using Tcl/Tk - II](#)

[Lecture 25 - Programming Using Tcl/Tk - III](#)

[Lecture 26 - More about Procedures](#)

[Lecture 27 - TCP, Ports and Sockets](#)

[Lecture 28 - I/O and Processes](#)

[Lecture 29 - Bindings](#)

[Lecture 30 - Programming Using Tcl/Tk - IV](#)

[Lecture 31 - Furniture Arranger](#)

[Lecture 32 - Bindtags](#)

[Lecture 33 - Tcl in Synopsys Tools](#)

[Lecture 34 - Python Programming](#)

[Lecture 35 - Scope](#)

[Lecture 36 - Iteration](#)

[Lecture 37 - More about Regexp](#)

[Lecture 38 - Advanced Functions](#)

[Lecture 39 - Exception Handling](#)

[Lecture 40 - Examples of file Parsing](#)

[Lecture 41 - Program on If Statement](#)

[Lecture 42 - Program on Lists](#)

[Lecture 43 - Makefiles](#)

Lecture 1 - Introduction

Lecture 2 - Basic Boolean Logic

Lecture 3 - Boolean Theorems

Lecture 4 - Definitions, SoP and Pos

Lecture 5 - Algebraic Minimization Examples

Lecture 6 - Introduction to Verilog

Lecture 7 - Universality, Rearranging Truth Tables

Lecture 8 - Karnaugh Maps

Lecture 9 - K-Map Minimization

Lecture 10 - K-Map with Don't cares

Lecture 11 - Multiple Output Functions

Lecture 12 - Number Systems

Lecture 13 - Encoders and Decoders

Lecture 14 - Multiplexers

Lecture 15 - Multiplexer based Circuit Design

Lecture 16 - Verilog

Lecture 17 - Compiling and Running Verilog - A Demonstration

Lecture 18 - Sequential Elements

Lecture 19 - Gated Latches

Lecture 20 - Flipflops

Lecture 21 - Verilog - Assign Statement and Instantiation

Lecture 22 - Sequential Circuits

Lecture 23 - CMOS+Electrical Properties

Lecture 24 - Delays

Lecture 25 - Sequential Element Delays

Lecture 26 - More Sequential Circuits

Lecture 27 - Introduction to State Machines

Lecture 28 - Always Statement in Verilog

Lecture 29 - Sequential Logic Synthesis

Lecture 30 - FSM Design Problems

Lecture 31 - State Minimization

[Lecture 32 - State Assignment](#)

[Lecture 33 - Timing Sequential Circuits](#)

[Lecture 34 - Verilog Styles + Sequential Elements](#)

[Lecture 35 - GCD Algorithm](#)

[Lecture 36 - GCD Machines Datapath](#)

[Lecture 37 - GCD State Machine](#)

[Lecture 38 - GCD Top Level Module](#)

[Lecture 39 - Datapath in Verilog](#)

[Lecture 40 - Datapath Elements in Verilog](#)

[Lecture 41 - FSM in Verilog](#)

[Lecture 42 - Putting it all together](#)

[Lecture 43 - Pipelining](#)

[Lecture 44 - K-stage Pipeline](#)

[Lecture 45 - Interleaving and Parallelism](#)

[Lecture 46 - Blocking and Non-blocking Statements](#)

[Lecture 47 - Modeling Circuits with Pipelining](#)

[Lecture 48 - Signed Number Representation](#)

[Lecture 49 - Signed Number Addition](#)

[Lecture 50 - Adder/Subtractor](#)

[Lecture 51 - Fast Adders](#)

[Lecture 52 - Multiplication](#)

[Lecture 53 - Closing](#)

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Networks and Systems (Electronics and Communication Engineering)

Co-ordinators : Prof. V.G.K. Murti, Mr. C. S. Ramalingam, Dr. Andrew Thangaraj

Lecture 1 - Functions in circuits - constant and sinusoidal functions

Lecture 2 - Functions in circuits - Exponential function

Lecture 3 - Complex numbers and other topics

Lecture 4 - Systems, Signals, Networks

Lecture 5 - Representation and Classification of Systems

Lecture 6 - Linear systems

Lecture 7 - Time-invariance and causality

Lecture 8 - Signals, Elementary continuous signals

Lecture 9 - Complex frequencies of signals

Lecture 10 - Discontinuous signals - step, ramp

Lecture 11 - Unit impulse or delta function

Lecture 12 - Basic discrete-time signals

Lecture 13 - Examples of Signals

Lecture 14 - Introduction to Systems, Complementary Functions, Initial Conditions

Lecture 15 - Special initial conditions

Lecture 16 - Characterization of a linear system

Lecture 17 - Impulse Response

Lecture 18 - Evaluating the Convolution Integral

Lecture 19 - Worked-out Problems

Lecture 20 - Introduction and Motivation

Lecture 21 - Evaluating Fourier series coefficients

Lecture 22 - Symmetry conditions

Lecture 23 - Symmetry Condition Examples

Lecture 24 - Application to Network Analysis

Lecture 25 - Exponential Fourier Series

Lecture 26 - Frequency Spectrum

Lecture 27 - Examples

Lecture 28 - Signal Power and Related Ideas

Lecture 29 - Convergence of Fourier Series

Lecture 30 - Week 1 Solutions

Lecture 31 - Hints for Assignment 2

[Lecture 32 - Hints for Assignment 3](#)

[Lecture 33 - Additional Properties of Fourier Series](#)

[Lecture 34 - Exercises on Fourier Series](#)

[Lecture 35 - Lab Demo](#)

[Lecture 36 - From Fourier Series to Fourier Transform](#)

[Lecture 37 - Continuous Time Fourier Transform](#)

[Lecture 38 - Fourier Transform Examples](#)

[Lecture 39 - Examples and Some Properties of Fourier Transform](#)

[Lecture 40 - Properties of Fourier Transform \(contd.\)](#)

[Lecture 41 - More Fourier Transform Properties](#)

[Lecture 42 - Energy Considerations](#)

[Lecture 43 - Energy Considerations II](#)

[Lecture 44 - Helpful Relationships for Inverse Fourier Transform](#)

[Lecture 45 - Fourier transform of signals that are not absolutely integrable](#)

[Lecture 46 - Fourier Transform of Periodic Signals, Unit Step and Signum Function](#)

[Lecture 47 - Truncated Sine wave and Convolution properties](#)

[Lecture 48 - Integration in Time domain](#)

[Lecture 49 - Application of continuous-time Fourier transform to system analysis](#)

[Lecture 50 - Comments about transient analysis](#)

[Lecture 51 - Sampling Theorem and Exercises on Fourier Transforms](#)

[Lecture 52 - Introduction to Laplace Transform](#)

[Lecture 53 - Laplace transforms of important functions](#)

[Lecture 54 - Recap, Poles / Zeros and Laplace Transform Notation](#)

[Lecture 55 - Properties: Linearity, differentiation in the time domain](#)

[Lecture 56 - Application and properties of Laplace transform](#)

[Lecture 57 - More properties of Laplace transform: Shift in frequency domain](#)

[Lecture 58 - More properties of Laplace transform](#)

[Lecture 59 - Properties: Division by \$t\$, Initial value theorem, Final value theorem](#)

[Lecture 60 - Properties: Convolution in time domain](#)

[Lecture 61 - Complex convolution and periodic functions](#)

[Lecture 62 - Examples of Laplace transform](#)

[Lecture 63 - Laplace transform examples](#)

[Lecture 64 - Inverse Laplace transform](#)

[Lecture 65 - Partial fractions: general case](#)

[Lecture 66 - Inverse Laplace Transform and Contour Integration](#)

[Lecture 67 - Relating Fourier and Laplace Transform](#)

[Lecture 68 - Exercises](#)

[Lecture 69 - Applications of Laplace transform to network transients](#)

[Lecture 70 - Laplace transform for resistor and system analysis](#)

[Lecture 71 - Laplace transform method for mutual inductance](#)

[Lecture 72 - Mutual Inductance Continued](#)

[Lecture 73 - Examples and Advantages of L-transform](#)

[Lecture 74 - General LTI systems and more about H\(s\)](#)

[Lecture 75 - Many facets of the system function \(contd\)](#)

[Lecture 76 - Frequency response and stability](#)

[Lecture 77 - Full circuit example](#)

[Lecture 78 - Exercises](#)

Lecture 1 - Course Introduction and Motivation

Lecture 2 - Kirchoff's Current and Voltage Laws, and the Incidence Matrix

Lecture 3 - Power Conservation and Tellegen's Theorem

Lecture 4 - Intuition behind Tellegen's Theorem

Lecture 5 - Tellegen's Theorem and reciprocity in linear resistive networks

Lecture 6 - Why is reciprocity useful in practice?

Lecture 7 - Inter-reciprocity in linear time-invariant networks

Lecture 8 - Inter-reciprocity in linear time-invariant networks (Continued...)

Lecture 9 - Inter-reciprocity in networks with ideal operational amplifiers

Lecture 10 - Review of Modified Nodal Analysis (MNA) of linear networks

Lecture 11 - MNA stamps of controlled sources - the VCCS and VCVS

Lecture 12 - MNA stamps of controlled sources - the CCCS and CCVS

Lecture 13 - Inter-reciprocity in linear networks - using the MNA stamp approach

Lecture 14 - The Adjoint Network

Lecture 15 - MNA stamp of an ideal opamp

Lecture 16 - Properties of circuits with multiple ideal opamps

Lecture 17 - Introduction to Analog Active Filters

Lecture 18 - Magnitude approximation principles

Lecture 19 - The maximally flat (Butterworth) approximation

Lecture 20 - The Butterworth Approximation (Continued...)

Lecture 21 - Connection between magnitude response and pole locations in an all-pole filter

Lecture 22 - Cascade-of-biquads, realization of stray-insensitive first-order section

Lecture 23 - Opamp-RC biquadratic sections

Lecture 24 - Active-RC biquads and Impedance scaling

Lecture 25 - Opamp-RC biquadratic sections (Continued...)

Lecture 26 - High-order filters using cascade of biquads, Dynamic range scaling in opamp-RC filters

Lecture 27 - The finite gain-bandwidth model of nonideal opamps

Lecture 28 - Effect of finite opamp bandwidth on an active-RC integrator

Lecture 29 - Effect of finite opamp bandwidth on an active-RC biquad

Lecture 30 - Visualization and mitigation of the effect of Q-enhancement

Lecture 31 - Transconductance-Capacitance integrators

- Lecture 32 - Introduction to noise in electrical networks
- Lecture 33 - Noise processed by a linear time-invariant system
- Lecture 34 - kT/C noise in a sample-and-hold circuit
- Lecture 35 - Noise in RLC networks
- Lecture 36 - Total integrated noise in RLC Networks
- Lecture 37 - Bode's Noise Theorem - Frequency domain
- Lecture 38 - Input referred noise in electrical networks - Part 1
- Lecture 39 - Input referred noise in electrical networks - Part 2
- Lecture 40 - Input referred noise and the noise factor
- Lecture 41 - Noise Factor Examples
- Lecture 42 - Introduction to distributed networks, the ideal transmission line
- Lecture 43 - Solving the wave equation in an ideal transmission line
- Lecture 44 - Transmission line circuit analysis : The short circuited and open circuited line
- Lecture 45 - Transmission line circuit analysis, the reflection coefficient, open and short-circuited lines
- Lecture 46 - Transmission line driven by a source, power in a transmission line
- Lecture 47 - The Smith chart
- Lecture 48 - The need for scattering parameters
- Lecture 49 - Scattering Parameters: Introduction
- Lecture 50 - Example scattering matrix calculations
- Lecture 51 - Scattering matrices properties
- Lecture 52 - Measuring the S-parameters of a one-port
- Lecture 53 - The one-port vector network analyzer
- Lecture 54 - The two-port vector network analyzer
- Lecture 55 - Weak nonlinearity in electronic circuits, second-order harmonic distortion, HD2 and IM2
- Lecture 56 - Weak nonlinearity in electronic circuits, second-order intermodulation distortion
- Lecture 57 - Gain compression and third-order harmonic distortion
- Lecture 58 - Third-order intermodulation distortion
- Lecture 59 - Weak nonlinearities in circuits: Intuition behind the method of current injection
- Lecture 60 - Weak nonlinearities in circuits: Calculating nonlinear components
- Lecture 61 - Current-injection analysis of distortion in a negative feedback system
- Lecture 62 - Current-injection analysis of distortion in a negative feedback system (Continued...)
- Lecture 63 - Course summary and recap

Lecture 1 - Understanding Silicon

Lecture 2 - Introduction to NMOS

Lecture 3 - NMOS Transistor Working

Lecture 4 - PMOS Transistor

Lecture 5 - MOS Capacitances

Lecture 6 - Non Ideal MOS model

Lecture 7 - Short channel current model

Lecture 8 - Short channel current model analysis

Lecture 9 - Channel Length modulation index

Lecture 10 - DC characteristics of Inverter

Lecture 11 - Transfer characteristics of Inverter

Lecture 12 - Skewed Inverter

Lecture 13 - Skewed Inverter and threshold voltage

Lecture 14 - Equivalent of transistors in series

Lecture 15 - Transmission Gate

Lecture 16 - Bad CMOS Buffer - Part 1

Lecture 17 - Bad CMOS Buffer - Part 2

Lecture 18 - Noise margin characteristics of inverter

Lecture 19 - Noise margin parameters

Lecture 20 - Introduction to Delay in CMOS

Lecture 21 - Transient analysis of CMOS Inverter

Lecture 22 - RC approximated delay

Lecture 23 - Switching Resistance

Lecture 24 - CMOS Inverter approximated to RC Circuit

Lecture 25 - Elmore delay

Lecture 26 - Delay of FO4 inverter

Lecture 27 - Extracting capacitances of 3-Nand gate for delay estimation

Lecture 28 - Characterizing Delay of NOR gate

Lecture 29 - Linear Delay model

Lecture 30 - Logical effort and Parasitic delay

Lecture 31 - Logical effort and Parasitic delay for different gates

- Lecture 32 - Logical effort for short-channel current model
- Lecture 33 - Ring Oscillator design
- Lecture 34 - Optimizing Gate Size
- Lecture 35 - Optimizing Gate Sizes Example
- Lecture 36 - Optimizing the Stages for an inverter path
- Lecture 37 - Optimizing the Stages for a General Circuit
- Lecture 38 - Decoder Design
- Lecture 39 - Introduction to Combinational Circuit and assymmetric gates
- Lecture 40 - Assymmetric Gates analysis
- Lecture 41 - Assymmetric Gates analysis using short-channel current model
- Lecture 42 - Introduction to Skewed gates
- Lecture 43 - Skewed gates and best P/N ratio
- Lecture 44 - vIntroduction to Pseudo NMOS
- Lecture 45 - Psudeo NMOS gates
- Lecture 46 - Other Logic Family
- Lecture 47 - Dynamic Logic and Domino logic
- Lecture 48 - Domino gates
- Lecture 49 - Introduction to Stick Diagram
- Lecture 50 - Stick Diagram for different gates
- Lecture 51 - Applying Eulers path for stick diagram representations
- Lecture 52 - Multiplexer design and layout
- Lecture 53 - Introduction to Interconnects
- Lecture 54 - Interconnects - RC delay, and Energy
- Lecture 55 - Introduction to crosstalks in interconnects
- Lecture 56 - Transient analysis in Crosstalk
- Lecture 57 - Introduction to Repeaters in Interconnect Engineering
- Lecture 58 - Repeater Design
- Lecture 59 - Energy and delay analysis for interconnectwith repeaters
- Lecture 60
- Lecture 61 - Introduction to Power
- Lecture 62 - Switching Power and Energy Estimation
- Lecture 63 - Activity factor and estimating dynamic power for a combinational circuit design
- Lecture 64 - Analyzing Dynamic Power

[Lecture 65 - Energy estimation through driving factor](#)

[Lecture 66 - Energy expression in terms of delay](#)

[Lecture 67 - Voltage Scaling](#)

[Lecture 68 - DVFS](#)

[Lecture 69 - Introduction to subthreshold leakage current model](#)

[Lecture 70 - Subthreshold leakage current and Gate leakage current](#)

[Lecture 71 - Estimating Static Power](#)

[Lecture 72 - Introduction to CMOS Latch design](#)

[Lecture 73 - CMOS Latch Design](#)

[Lecture 74 - CMOS Latch and flipflop design](#)

[Lecture 75 - Static Timing Analysis](#)

[Lecture 76 - Static Timing Analysis \(Continued...\)](#)

[Lecture 77 - Static Timing Analysis - Part 2](#)

[Lecture 78 - Static Timing Analysis - Part 2.1](#)

[Lecture 79 - Static Timing Analysis - Part 3](#)

[Lecture 80 - TPDQ and TPCQ](#)

[Lecture 81 - Static Timing Analysis - Part 4](#)

[Lecture 82 - Static Timing Analysis - Part 5](#)

[Lecture 83 - Static Timing Analysis - Part 6](#)

[Lecture 84 - SET and CLEAR enabled Latch and Flipflop Design](#)

[Lecture 85 - 1-bit Adder design](#)

[Lecture 86 - Adder-Part2](#)

[Lecture 87 - PG architecture - Part 1](#)

[Lecture 88 - PG architecture - Part 2](#)

[Lecture 89 - Carry Skip Adder](#)

[Lecture 90 - Carry Look Ahead and Carry Increment Adder](#)

[Lecture 91 - Other Adder Subsystems](#)

[Lecture 92 - Approximate Multipliers - Part 1](#)

[Lecture 93 - Approximate Multipliers - Part 2](#)

[Lecture 94 - Approximate Adder](#)

Lecture 1 - Introduction - Part 1

Lecture 2 - Introduction - Part 2

Lecture 3 - Ordinary Differential Equations - Part 1

Lecture 4 - Ordinary Differential Equations - Part 2

Lecture 5 - ODE Solutions via Examples

Lecture 6 - Solutions to ODEs

Lecture 7 - Existence and Uniqueness Theorems

Lecture 8 - Asymptotic Behaviour of Dynamical Systems - Part 1

Lecture 9 - Asymptotic Behaviour of Dynamical Systems - Part 2

Lecture 10 - Asymptotic Behaviour of Dynamical Systems - Part 3

Lecture 11 - Stability Theory: Definitions - Part 1

Lecture 12 - Stability Theory: Definitions - Part 2

Lecture 13 - Stability Theory: Lyapunov Methods - Part 1

Lecture 14 - Stability Theory: Lyapunov Methods - Part 2

Lecture 15 - Lyapunov Function Examples

Lecture 16 - LaSalle's Invariance Theorem

Lecture 17 - Stability Theory: Converse Lyapunov and Instability Theorems

Lecture 18 - Solved Problems - Part 1

Lecture 19 - Solved Problems - Part 2

Lecture 20 - Linear Systems - Part 1

Lecture 21 - Linear Systems - Part 2

Lecture 22 - Linearization of Nonlinear Systems

Lecture 23 - Linear Systems and Linearization: Solved Problems - Part 1

Lecture 24 - Linear Systems and Linearization: Solved Problems - Part 2

Lecture 25 - Nonlinear Analysis: Key Concepts and Results - Part 1

Lecture 26 - Nonlinear Analysis: Key Concepts and Results - Part 2

Lecture 27 - Construction of Lyapunov Functions - Part 1

Lecture 28 - Construction of Lyapunov Functions - Part 2

Lecture 29 - Further Topics - Part 1

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- [Lecture 32 - Robust Stability for Structured Uncertainty - Part 1](#)
- [Lecture 33 - Robust Stability for Structured Uncertainty - Part 2](#)
- [Lecture 34 - Robust Stability for Structured Uncertainty - Part 3](#)
- [Lecture 35 - The Absolute Stability \(Lure\) Problem](#)
- [Lecture 36 - Robust Stability: A Solved Problem](#)
- [Lecture 37 - Dissipativity Theory - Part 1](#)
- [Lecture 38 - Dissipativity Theory - Part 2](#)
- [Lecture 39 - Dissipativity: Solved Problems](#)
- [Lecture 40 - Feedback Interconnection of Dissipative Systems - Part 1](#)
- [Lecture 41 - Feedback Interconnection of Dissipative Systems - Part 2](#)
- [Lecture 42 - Stable Adaptive Control - Part 1](#)
- [Lecture 43 - Stable Adaptive Control - Part 2](#)
- [Lecture 44 - Examples and Generalizations - Part 1](#)
- [Lecture 45 - Examples and Generalizations - Part 2](#)
- [Lecture 46 - Optimization - Part 1](#)
- [Lecture 47 - Optimization - Part 2](#)
- [Lecture 48 - Functional Optimization - Part 1](#)
- [Lecture 49 - Functional Optimization - Part 2](#)
- [Lecture 50 - Optimal Control - Part 1](#)
- [Lecture 51 - Optimal Control - Part 2](#)
- [Lecture 52 - Optimal Control - Part 3](#)
- [Lecture 53 - Stability Margins of Feedback Controllers](#)
- [Lecture 54 - Control Lyapunov Functions](#)
- [Lecture 55 - Disturbance Rejection - Part 1](#)
- [Lecture 56 - Disturbance Rejection - Part 2](#)
- [Lecture 57 - Revision through Solved Problems - I](#)
- [Lecture 58 - Revision through Solved Problems - I \(Continued...\)](#)
- [Lecture 59 - Revision through Solved Problems II](#)
- [Lecture 60 - Revision through Solved Problems III - Part 1](#)
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Lecture 2 - Introduction to Digital Relays - II

Lecture 3 - Components of Digital Relays

Lecture 4 - Fundamentals of Digital Relays

Lecture 5 - Phasor Estimation Algorithm - I

Lecture 6 - Phasor Estimation Algorithm - II

Lecture 7 - Phasor Estimation Algorithm - III

Lecture 8 - Phasor Estimation Algorithm - IV

Lecture 9 - Phasor Estimation Algorithm - V

Lecture 10 - Frequency Estimation Algorithm

Lecture 11 - Digital Protection of Transformer - I

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Lecture 13 - Digital Protection of Transformer - III

Lecture 14 - Digital Protection of Transformer - IV

Lecture 15 - Digital Protection of Transformer - V

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Lecture 17 - Digital Protection of Induction Motors - II

Lecture 18 - Digital Protection of Induction Motors - III

Lecture 19 - Digital Protection of Generators - I

Lecture 20 - Digital Protection OF Generators - II

Lecture 21 - Coordination of Overcurrent Relays for Distribution Network - I

Lecture 22 - Coordination of Overcurrent Relays for Distribution Network - II

Lecture 23 - Coordination of Overcurrent Relays for Distribution Network - III

Lecture 24 - Coordination of Overcurrent Relays for Distribution Network - IV

Lecture 25 - Coordination of Overcurrent Relays for Distribution Network - V

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Lecture 27 - Load Shedding and Frequency Relaying - I

Lecture 28 - Load Shedding and Frequency Relaying - II

Lecture 29 - Islanding Detection

Lecture 30 - Digital Distance Relaying Scheme for transmission Line - I

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[Lecture 35 - Introduction to IEC 61850 - I](#)

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[Lecture 37 - Application of Big-Data Analytics in Power System Protection](#)

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Lecture 2 - Introduction and Course Overview

Lecture 3 - Basics of Quantum Mechanics

Lecture 4 - Electron in a Potential Well

Lecture 5 - Electrons in Solids

Lecture 6 - KP Model

Lecture 7 - KP Model, Effective Mass

Lecture 8 - Bands, Effective Mass, DOS

Lecture 9 - Effective Mass, DOS

Lecture 10 - Density of States

Lecture 11 - Density of States

Lecture 12 - Density of States - 3D, 2D

Lecture 13 - Density of States - 2D, 1D, 0D

Lecture 14 - DOS, Fermi Function

Lecture 15 - Fermi- Dirac Distribution

Lecture 16 - Fermi Function, General Model of Transport

Lecture 17 - General Model of Transport - I

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Lecture 19 - General Model of Transport - III

Lecture 20 - General Model of Transport, Modes

Lecture 21 - Modes - I

Lecture 22 - Modes - II

Lecture 23 - Modes, Diffusive Transport

Lecture 24 - Diffusive Transport

Lecture 25 - Diffusive Transport, Conductance

Lecture 26 - Conductance, Bulk Transport - I

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Lecture 30 - Resistance: Ballistic and Diffusive Cases - III

Lecture 31 - Resistance: Diffusive Case

- Lecture 32 - The Idea of Mobility
- Lecture 33 - Voltage Drop in Ballistic Conductor
- Lecture 34 - 1D and 2D Realistic Conductors
- Lecture 35 - Introduction to MOSFET - I
- Lecture 36 - Introduction to MOSFET - II
- Lecture 37 - MOSFET: A Barrier Controlled Device
- Lecture 38 - MOSFET Electrical Characteristics
- Lecture 39 - MOSFET IV Characteristics - I
- Lecture 40 - MOSFET IV Characteristics - II
- Lecture 41 - MOSFET IV Characteristics - III
- Lecture 42 - MOSFET IV Characteristics - Traditional Approach
- Lecture 43 - MOSFET: Transport - I
- Lecture 44 - MOSFET: Transport - II
- Lecture 45 - MOSFET: Landauer Transport
- Lecture 46 - Landauer Transport and Ballistic MOSFET
- Lecture 47 - Ballistic MOSFET
- Lecture 48 - Ballistic Injection Velocity
- Lecture 49 - Velocity Saturation in Ballistic MOSFET and Electrostatics
- Lecture 50 - MOS Electrostatics
- Lecture 51 - MOS Electrostatics
- Lecture 52 - MOSFET: Electrostatics, Threshold Voltage
- Lecture 53 - MOSFET: 2D Electrostatics
- Lecture 54 - MOSFET: 2D Electrostatics and Quantum Confinement
- Lecture 55 - ETSOI MOSFETs, Quantum Confinement, Strain Engineering
- Lecture 56 - Strain Engineering, Thermoelectric Effects
- Lecture 57 - Thermoelectric Effects
- Lecture 58 - Thermoelectric Effects, Quantum Dot Devices
- Lecture 59 - Quantum Dot Devices
- Lecture 60 - Quantum Dot Devices - IV Characteristics, DFT, Course Summary

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Lecture 3 - Review of MOSFET operation - II

Lecture 4 - Basic charge model - I

Lecture 5 - Basic charge model - II

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Lecture 7 - Basic charge model - IV

Lecture 8 - Basic charge model - V

Lecture 9 - Basic charge model - VI

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Lecture 13 - Basic charge model - X

Lecture 14 - Minimum energy point - I

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Lecture 16 - Minimum energy point - III

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Lecture 18 - Transistor sizing for combinational circuit - II

Lecture 19 - Transistor sizing for asymmetric combinational circuits

Lecture 20 - Charging and discharging mechanism in NTV combinational gates

Lecture 21 - Effective current for NTV inverter

Lecture 22 - Effective current for NTV combinational gates - I

Lecture 23 - Effective current for NTV combinational gates - II

Lecture 24 - Effective current for NTV combinational gates - III

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Lecture 26 - Combinational circuit design considering variations - II

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Lecture 29 - Flip-flop operation

Lecture 30 - Warning flip-flops design and operation

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[Lecture 36 - Stability and Reliability Issues in 6T SRAM](#)

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[Lecture 38 - Physical Insights into Channel Charge Distribution](#)

[Lecture 39 - FinFET based Standard Cell Design](#)

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Lecture 2 - Transistor Op-amp and Transistor Based Voltage Regulator

Lecture 3 - Some applications of transistor - I

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Lecture 5 - Transformer design & Heat sink design

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Lecture 7 - Short circuit protection for linear power supply

Lecture 8 - Temperature indicator design using Op-amp

Lecture 9 - On & off Temperature controller design

Lecture 10 - Proportional Temperature Controller Design

Lecture 11 - PID - Temperature Controller Design

Lecture 12 - Heater Drive for Various Temperature Controllers

Lecture 13 - Short Circuit Protection of Power MOSFET

Lecture 14 - Error budgeting for temperature Indicator

Lecture 15 - PID Temperature Controllers with Error Budgeting

Lecture 16 - Error Budgeting for Constant Current Sources

Lecture 17 - Error Budgeting for Thermo Couple Amplifier

Lecture 18 - Error Budgeting for Op amp Circuits

Lecture 19 - Gain Error Calculation in Op amp Circuits

Lecture 20 - Input Resistance Calculations for Op amp

Lecture 21 - Output Resistance Calculations for Op amp

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Lecture 23 - 4-20 mA current Transmitter design

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Lecture 30 - Ratio Transformer Technique to Measure Resistance and capacitance

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[Lecture 32 - Capacitive Sensor Circuit With High Impedance Amplifier](#)

[Lecture 33 - AC- applications of the Op-Amp and Lock in Amplifier Design](#)

[Lecture 34 - Design of lock in Amplifier Circuit with example](#)

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[Lecture 36 - Dual Slope ADC and Successor approximation ADC](#)

[Lecture 37 - MC based ADC](#)

[Lecture 38 - Digital to analog Converter design and working, Flash ADC](#)

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DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : Digital System design with PLDs and FPGAs (Electronics and Communication Engineering)

Co-ordinators : Prof. Kuruvilla Varghese

Lecture 1 - Course Contents, Objective

Lecture 2 - Revision of Prerequisite

Lecture 3 - Design of Synchronous Sequential Circuits

Lecture 4 - Analysis of Synchronous Sequential Circuits

Lecture 5 - Top-down Design

Lecture 6 - Controller Design

Lecture 7 - Control algorithm and State diagram

Lecture 8 - Case study 1

Lecture 9 - FSM issues 1

Lecture 10 - FSM Issues 2

Lecture 11 - FSM Issues 3

Lecture 12 - FSM Issues 4

Lecture 13 - FSM Issues 5

Lecture 14 - Synchronization 1

Lecture 15 - Synchronization 2

Lecture 16 - Case study 2

Lecture 17 - Case study on FPGA Board

Lecture 18 - Entity, Architecture and Operators

Lecture 19 - Concurrency, Data flow and Behavioural models

Lecture 20 - Structural Model, Simulation

Lecture 21 - Simulating Concurrency

Lecture 22 - Classes and Data types

Lecture 23 - Concurrent statements and Sequential statements

Lecture 24 - Sequential statements and Loops

Lecture 25 - Modelling flip-flops, Registers

Lecture 26 - Synthesis of Sequential circuits

Lecture 27 - Libraries and Packages

Lecture 28 - Operators, Delay modelling

Lecture 29 - Delay modelling

Lecture 30 - VHDL Examples

Lecture 31 - VHDL coding of FSM

[Lecture 32 - VHDL Test bench](#)

[Lecture 33 - VHDL Examples, FSM Clock](#)

[Lecture 34 - Evolution of PLDs](#)

[Lecture 35 - Simple PLDs](#)

[Lecture 36 - Simple PLDs: Fitting](#)

[Lecture 37 - Complex PLDs](#)

[Lecture 38 - FPGA Introduction](#)

[Lecture 39 - FPGA Interconnection, Design Methodology](#)

[Lecture 40 - Xilinx Virtex FPGA's CLB](#)

[Lecture 41 - Xilinx Virtex Resource Mapping, IO Block](#)

[Lecture 42 - Xilinx Virtex Clock Tree](#)

[Lecture 43 - FPGA Configuration](#)

[Lecture 44 - Altera and Actel FPGAs](#)

Lecture 1 - Course Overview & Basics

Lecture 2 - Example Codes and their Parameters

Lecture 3 - Mathematical Preliminaries: Groups

Lecture 4 - Subgroups and Equivalence Relations

Lecture 5 - Cosets, Rings & Fields

Lecture 6 - Vector Spaces, Linear Independence and Basis

Lecture 7 - Linear Codes, & Linear independence

Lecture 8 - Spanning & Basis

Lecture 9 - The Dual Code

Lecture 10 - Systematic Generator Matrix

Lecture 11 - Minimum Distance of a Linear Code

Lecture 12 - Bounds on the size of a Code

Lecture 13 - Asymptotic Bounds

Lecture 14 - Standard Array Decoding

Lecture 15 - Performance Analysis of the SAD

Lecture 16 - State and Trellis

Lecture 17 - The Viterbi Decoder

Lecture 18 - Catastrophic Error Propagation

Lecture 19 - Path Enumeration

Lecture 20 - Viterbi Decoder over the AWGN Channel

Lecture 21 - Generalized Distributive Law

Lecture 22 - The MPF Problem

Lecture 23 - Further Examples of the MPF Problem

Lecture 24 - Junction Trees

Lecture 25 - Example of Junction Tree Construction

Lecture 26 - Message passing on the Junction tree

Lecture 27 - GDL Approach to Decoding Convolutional Codes

Lecture 28 - ML Code-Symbol Decoding of the Convolutional Code

Lecture 29 - LDPC Codes

Lecture 30 - LDPC Code Terminology

Lecture 31 - Gallager Decoding Algorithm A

[Lecture 32 - BP Decoding of LDPC Codes](#)

[Lecture 33 - BP Decoding \(Continued\)](#)

[Lecture 34 - Density Evolution under BP decoding](#)

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[Lecture 36 - A Construction for Finite Fields](#)

[Lecture 37 - Finite Fields: A Deductive Approach](#)

[Lecture 38 - Deductive Approach to Finite Fields](#)

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[Lecture 42 - Decoding Cyclic Codes](#)

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NPTEL : Nanoelectronics: Devices and Materials (Electronics and Communication Engineering)

Co-ordinators : Dr. Navakanta Bhat, Prof. K.N. Bhat, Dr. S.A. Shivashankar

Lecture 1 - Introduction to Nanoelectronics

Lecture 2 - CMOS Scaling Theory

Lecture 3 - Short Channel Effects

Lecture 4 - Subthreshold Conduction

Lecture 5 - Drain Induced Barrier Lowering

Lecture 6 - Channel and Source / Drain Engineering

Lecture 7 - CMOS Process Flow

Lecture 8 - Gate oxide scaling and reliability

Lecture 9 - High-k gate dielectrics

Lecture 10 - Metal gate transistor

Lecture 11 - Industrial CMOS Technology

Lecture 12 - Ideal MOS C-V Characteristics

Lecture 13 - Effect of non idealities on C-V

Lecture 14 - MOS Parameter Extraction from C-V Characteristics

Lecture 15 - MOS Parameter Extraction from I-V Characteristics

Lecture 16 - MOSFET Analysis, sub-threshold swing $\hat{A}^{\hat{S}\hat{A}}$

Lecture 17 - Interface state density effects on $\hat{A}^{\hat{S}\hat{A}}$. Short Channel Effects (SCE) and Drain Induced Barrier Lowering (DIBL)

Lecture 18 - Velocity Saturation, Ballistic transport, and Velocity Overshoot Effects and Injection Velocity

Lecture 19 - SOI Technology and comparisons with Bulk Silicon CMOS technology

Lecture 20 - SOI MOSFET structures, Partially Depleted (PD) and Fully Depleted (FD) SOI MOSFETs

Lecture 21 - FD SOI MOSFET: Operation Modes and Threshold Voltages and Electric Fields

Lecture 22 - Sub-threshold Slope & SCE suppression in FD SOI MOSFET, Volume Inversion and Ultra thin (UTFD) SOI MOSFET and quantization Effect, FINFET

Lecture 23 - Need for MS contact Source/Drain Junction in Nano scale MOSFETs

Lecture 24 - Rectifying and Ohmic contacts and challenges in MS junction source drain MOSFET Technology

Lecture 25 - Effect of Interface states and Fermi level pinning on MS contacts on Si and passivation techniques for MS S/D MOSFETS

Lecture 26 - Germanium as an alternate to silicon for high performance MOSFETs and the challenges in Germanium Technology

Lecture 27 - Germanium MOSFET technology and recent results on surface passivated Ge MOSFETS

Lecture 28 - Compound semiconductors and hetero junction FETs for high performance

Lecture 29 - GaAs MESFETs: Enhancement and depletion types. Velocity Overshoot effects in GaAs MESFETs

Lecture 30 - Hetero-junctions and High Electron Mobility Transistors (HEMT)

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[Lecture 31 - Introduction to Nanomaterials](#)

[Lecture 32 - Basic Principles of Quantum Mechanics](#)

[Lecture 33 - Basic Principles of Quantum Mechanics \(Continued...\)](#)

[Lecture 34 - Energy bands in crystalline solids](#)

[Lecture 35 - Quantum structures and devices](#)

[Lecture 36 - Crystal growth and nanocrystals](#)

[Lecture 37 - Nanocrystals and nanostructured thin films](#)

[Lecture 38 - Nanowires and other nanostructures](#)

[Lecture 39 - Carbon Nanostructures and CVD](#)

[Lecture 40 - Atomic layer deposition \(ALD\)](#)

[Lecture 41 - Characterisation of nanomaterials](#)

Lecture 1 - Introduction to Statistical Pattern Recognition

Lecture 2 - Overview of Pattern Classifiers

Lecture 3 - The Bayes Classifier for minimizing Risk

Lecture 4 - Estimating Bayes Error; Minimax and Neymann-Pearson classifiers

Lecture 5 - Implementing Bayes Classifier; Estimation of Class Conditional Densities

Lecture 6 - Maximum Likelihood estimation of different densities

Lecture 7 - Bayesian estimation of parameters of density functions, MAP estimates

Lecture 8 - Bayesian Estimation examples; the exponential family of densities and ML estimates

Lecture 9 - Sufficient Statistics; Recursive formulation of ML and Bayesian estimates

Lecture 10 - Mixture Densities, ML estimation and EM algorithm

Lecture 11 - Convergence of EM algorithm; overview of Nonparametric density estimation

Lecture 12 - Convergence of EM algorithm, Overview of Nonparametric density estimation

Lecture 13 - Nonparametric estimation, Parzen Windows, nearest neighbour methods

Lecture 14 - Linear Discriminant Functions; Perceptron -- Learning Algorithm and convergence proof

Lecture 15 - Linear Least Squares Regression; LMS algorithm

Lecture 16 - AdaLinE and LMS algorithm; General nonlinear least-squares regression

Lecture 17 - Logistic Regression; Statistics of least squares method; Regularized Least Squares

Lecture 18 - Fisher Linear Discriminant

Lecture 19 - Linear Discriminant functions for multi-class case; multi-class logistic regression

Lecture 20 - Learning and Generalization; PAC learning framework

Lecture 21 - Overview of Statistical Learning Theory; Empirical Risk Minimization

Lecture 22 - Consistency of Empirical Risk Minimization

Lecture 23 - Consistency of Empirical Risk Minimization; VC-Dimension

Lecture 24 - Complexity of Learning problems and VC-Dimension

Lecture 25 - VC-Dimension Examples; VC-Dimension of hyperplanes

Lecture 26 - Overview of Artificial Neural Networks

Lecture 27 - Multilayer Feedforward Neural networks with Sigmoidal activation functions;

Lecture 28 - Backpropagation Algorithm; Representational abilities of feedforward networks

Lecture 29 - Feedforward networks for Classification and Regression; Backpropagation in Practice

Lecture 30 - Radial Basis Function Networks; Gaussian RBF networks

Lecture 31 - Learning Weights in RBF networks; K-means clustering algorithm

Lecture 32 - Support Vector Machines -- Introduction, obtaining the optimal hyperplane

Lecture 33 - SVM formulation with slack variables; nonlinear SVM classifiers

Lecture 34 - Kernel Functions for nonlinear SVMs; Mercer and positive definite Kernels

Lecture 35 - Support Vector Regression and ϵ -insensitive Loss function, examples of SVM learning

Lecture 36 - Overview of SMO and other algorithms for SVM; ν -SVM and ν -SVR; SVM as a risk minimizer

Lecture 37 - Positive Definite Kernels; RKHS; Representer Theorem

Lecture 38 - Feature Selection and Dimensionality Reduction; Principal Component Analysis

Lecture 39 - No Free Lunch Theorem; Model selection and model estimation; Bias-variance trade-off

Lecture 40 - Assessing Learnt classifiers; Cross Validation;

Lecture 41 - Bootstrap, Bagging and Boosting; Classifier Ensembles; AdaBoost

Lecture 42 - Risk minimization view of AdaBoost

- Lecture 1 - Introduction to Sensors, Signals and Systems
- Lecture 2 - Role of Analog Signal Processing in Electronic Products - Part I
- Lecture 3 - Role of Analog Signal Processing in Electronic Products - Part II
- Lecture 4 - Analog Signal Processing using One Port Networks
- Lecture 5 - Analog Signal Processing using One Port Networks, Passive Two Ports and Ideal amplifiers
- Lecture 6 - Synthesis of Amplifiers using Nullators and Norators
- Lecture 7 - Passive Electronic Devices for Analog Signal Processing
- Lecture 8 - Active Devices for Analog Signal Processing Systems
- Lecture 9 - Electronic Devices for Analog Circuits - Part I
- Lecture 10 - Electronic Devices for Analog Circuits - Part II
- Lecture 11 - Feedback in Systems
- Lecture 12 - Static Characteristic of Feedback Systems
- Lecture 13 - Dynamic Behaviour of Feedback Systems - Part I
- Lecture 14 - Dynamic Behavior of Feedback Systems - Part II
- Lecture 15 - Design of Feedback Amplifiers - Part I
- Lecture 16 - Design of Feedback Amplifiers - Part II
- Lecture 17 - Design of Feedback Amplifiers and Instrumentation Amplifiers
- Lecture 18 - Instrumentation Amplifiers, Integrators and Differentiators
- Lecture 19 - Non-linear Analog Signal Processing
- Lecture 20 - DC Voltage Regulators
- Lecture 21 - Filters - Approximations to ideal filter functions
- Lecture 22 - Passive Filters - Part I
- Lecture 23 - Passive Filters - Part II
- Lecture 24 - Active Filters - Part I
- Lecture 25 - Active Filters - Part II
- Lecture 26 - Active Filters: Q-enhancement
- Lecture 27 - State Space Filters
- Lecture 28 - Universal Active Filter - Effect of Active Device GB
- Lecture 29 - State-Space Filters (Tuning of Filters)
- Lecture 30 - Automatic Tuning of Filters (PLL) and Review of Filter Design
- Lecture 31 - Waveform Generation

[Lecture 32 - LC Oscillator - Effect of Non-idealities](#)

[Lecture 33 - Transconductor based Oscillator](#)

[Lecture 34 - Regenerative Comparators and Non-Sinusoidal Oscillators](#)

[Lecture 35 - Non-Sinusoidal Oscillators and VCO \(FM & FSK Generators\)](#)

[Lecture 36 - Phase and Frequency Followers](#)

[Lecture 37 - Frequency Locked Loop \(Popularly known as PLL\)](#)

[Lecture 38 - Design of PLL and FLL](#)

[Lecture 39 - Analog System Design](#)

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NPTEL : NOC:Design and Simulation of DC-DC converters using Open Source Tools (Electronics and Communication Engineering)

Co-ordinators : Prof. L. Umanand

Lecture 1 - System Overview

Lecture 2 - Understanding Rectifier with C-filter

Lecture 3 - Setting up gEDA, ngSpice and Octave

Lecture 4 - Simulation walk-through : Rectifier C-filter example

Lecture 5 - Designing the rectifier capacitor filter circuit

Lecture 6 - Startup surge limiting

Lecture 7 - DC-DC converter concepts

Lecture 8 - Buck, Boost and Buck-Boost Converters

Lecture 9 - Simulation Example of Buck Converter

Lecture 10 - Understanding Buck Converter

Lecture 11 - Understanding Boost and Buck-Boost

Lecture 12 - Forward Converter Topology

Lecture 13 - Waveforms and Design

Lecture 14 - Simulation of Forward Converter

Lecture 15 - Forward Converter with Lossless Core Reset

Lecture 16 - Transformer Design

Lecture 17 - Inductor Design

Lecture 18 - Flyback Converter Topology

Lecture 19 - Pushpull Converter

Lecture 20 - Half and Full Bridge Converters

Lecture 21 - Close Loop Operation of Converters

Lecture 22 - Simulation examples

Lecture 23 - Multi-Output Converters

Lecture 24 - Concluding Remarks

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NPTEL : NOC:Enclosure Design of Electronics Equipment (Electronics and Communication Engineering)

Co-ordinators : Prof. N. V Chalapathi Rao

Lecture 1 - Enclosure design for Electronics Equipment Introduction

Lecture 2 - Aspects and features that are non electrical and are essential to Electronic Product Realisation

Lecture 3 - Enclosure Design in electronic equipment

Lecture 4 - Design as applied to small electronics products and projects

Lecture 5 - Sketching in design for communication

Lecture 6 - Sketching as a tool with example and exercise

Lecture 7 - Sketching Part 2

Lecture 8 - Enclosures to Product design

Lecture 9 - Examples of product enclosures ID_PD

Lecture 10 - Enclosures with detailing: Examples

Lecture 11 - Alternate Designs in an everyday item

Lecture 12 - Sheet metal in small equipment (PSU)

Lecture 13 - Layouts and Materials of small equipment

Lecture 14 - Materials used for construction

Lecture 15 - Materials choice

Lecture 16 - Aluminium for common equipment

Lecture 17 - Use of Aluminium extrusions

Lecture 18 - Application of Sheet metal

Lecture 19 - Sheet Metal bending

Lecture 20 - Development of enclosures for bending

Lecture 21 - Video of Fabrication

Lecture 22 - What can be done in the lab Bending

Lecture 23 - Issues in bending and folding

Lecture 24 - Making a quick model

Lecture 25 - Detailing in plastic

Lecture 26 - Fabricating with flat plastic

Lecture 27 - Video in ID Lab

Lecture 28 - Off the shelf enclosures

Lecture 29 - Ready made enclosures

Lecture 30 - Application documentation and Selection

Lecture 31 - Index of protection, Safety

- Lecture 32 - NEMA and related
- Lecture 33 - Testing for IP class
- Lecture 34 - Sealed Enclosures Video
- Lecture 35 - Public utility boxes
- Lecture 36 - EMI Sealing
- Lecture 37 - Sealed Enclosures 2
- Lecture 38 - Gasketing practice
- Lecture 39 - Gasketing Basics
- Lecture 40 - Off the shelf Aluminum enclosures
- Lecture 41 - Understanding
- Lecture 42 - Heat sink enclosures
- Lecture 43 - Detailing of Built in Heat sink boxes
- Lecture 44 - Connector basics
- Lecture 45 - Connectors - Part 2
- Lecture 46 - Common connectors
- Lecture 47 - Connectors (multi way) and CoAx
- Lecture 48 - MIL C connectors
- Lecture 49 - CAD in Layout Drawing
- Lecture 50 - Types of CAD
- Lecture 51 - CAD for enclosure Design
- Lecture 52 - Egpt layout with CAD
- Lecture 53 - CAD sample Example
- Lecture 54 - CAD Layout
- Lecture 55 - Detailing with CAD
- Lecture 56 - Integrating Products with CAD
- Lecture 57 - Product Detailing
- Lecture 58 - Components CAD Physical Models
- Lecture 59 - Sheet Metal and Plastic common details
- Lecture 60 - Sample of Simple Organic Shapes
- Lecture 61 - Conclusion

Lecture 1 - A historical perspective

Lecture 2 - PV cell characteristics and equivalent circuit

Lecture 3 - Model of PV cell

Lecture 4 - Short Circuit, Open Circuit and peak power parameters

Lecture 5 - Datasheet study

Lecture 6 - Cell efficiency

Lecture 7 - Effect of temperature

Lecture 8 - Temperature effect calculation example

Lecture 9 - Fill factor

Lecture 10 - PV cell simulation

Lecture 11 - Identical cells in series

Lecture 12 - Load line

Lecture 13 - Non-identical cells in series

Lecture 14 - Protecting cells in series

Lecture 15 - Interconnecting modules in series

Lecture 16 - Simulation of cells in series

Lecture 17 - Identical cells in parallel

Lecture 18 - Non-identical cells in parallel

Lecture 19 - Protecting cells in parallel

Lecture 20 - Interconnecting modules

Lecture 21 - Simulation of cells in parallel

Lecture 22 - Practicals - Measuring i-v characteristics

Lecture 23 - Practicals - PV source emulation

Lecture 24 - Introduction

Lecture 25 - Insolation and irradiance

Lecture 26 - Insolation variation with time of day

Lecture 27 - Earth centric viewpoint and declination

Lecture 28 - Solar geometry

Lecture 29 - Insolation on a horizontal flat plate

Lecture 30 - Energy on a horizontal flat plate

Lecture 31 - Sunrise and sunset hour angles

Lecture 32 - Examples

Lecture 33 - Energy on a tilted flat plate

Lecture 34 - Energy plots in octave

Lecture 35 - Atmospheric effects

Lecture 36 - Airmass

Lecture 37 - Energy with atmospheric effects

Lecture 38 - Clearness index

Lecture 39 - Clearness index and energy scripts in Octave

Lecture 40 - Sizing PV for applications without batteries

Lecture 41 - Sizing PV Examples

Lecture 42 - Batteries - intro

Lecture 43 - Batteries - Capacity

Lecture 44 - Batteries - C-rate

Lecture 45 - Batteries - Efficiency

Lecture 46 - Batteries - Energy and power densities

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NPTEL : NOC:Analog Circuits and Systems (Electronics and Communication Engineering)

Co-ordinators : Prof. K Radhakrishna Rao

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NPTEL : NOC:Product Design and Innovation (Engineering Design)

Co-ordinators : Prof. Debayan Dhar, Prof.Swati Pal, Prof. Supradip Das

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NPTEL : Vehicle Dynamics (Engineering Design)

Co-ordinators : Dr. R. Krishnakumar

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- Lecture 41 - Brake System - Part 1
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- Lecture 43 - Components of a Brake System and Drum Brake - Part 1
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Lecture 19 - DC Motor Control Regions and Principles of Power Electronics

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Lecture 3 - RBE-Framework continuation and Major Procedural Elements

Lecture 4 - RBE-Major Procedural Elements (Continued...)

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Lecture 6 - Reliability Characterization and Probability Distributions-Discrete Distribution

Lecture 7 - Probability Distributions - Continuous Distribution

Lecture 8 - Statistical Estimation in Probability Theory

Lecture 9 - Probability and Confidence Interval

Lecture 10 - Regression Analysis

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Lecture 12 - Life Prediction : Related Aspects

Lecture 13 - Life Prediction and Assessment Approaches

Lecture 14 - Life Prediction : Accelerated Screening and Life Testing

Lecture 15 - Probabilistic Fracture Mechanic Approach

Lecture 16 - Introduction and Reliability Block Diagram (RBD)

Lecture 17 - RBD - System Redundancies

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Lecture 19 - Fault Tree Analysis Continuation and Event Tree Analysis

Lecture 20 - Markov Model

Lecture 21 - Dynamic Fault Tree

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Lecture 24 - Importance and Sensitivity Analysis

Lecture 25 - Maintainability

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Lecture 27 - PRA-Organizational and Quality Aspects

Lecture 28 - PRA-Qualitative Modeling and Analysis

Lecture 29 - PRA-Quantification of the PRA model

Lecture 30 - Monte Carlo Simulation, Root Cause Analysis

Lecture 31 - Low Power and Shutdown PRA

Lecture 32 - Internal Flood PRA

Lecture 33 - Level 1 Fire PRA

Lecture 34 - Seismic PRA

Lecture 35 - Level 2 and Level 3 PRA

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Lecture 37 - State of the Art in Human-Reliability

Lecture 38 - Technique for Human Error Rate Prediction (THERP)

Lecture 39 - Human Cognitive Reliability (HCR) Method

Lecture 40 - CQB - Method Consciousness, Cognition, Conscience and Brain

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Lecture 42 - Uncertainty: Overview, preliminary discussions considering selected approaches

Lecture 43 - Parametric Approach to Uncertainty

Lecture 44 - Uncertainty Modelling using Fuzzy Approach in RBE

Lecture 45 - Uncertainty – Bayesian, and Monte-Carlo technique

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Lecture 47 - PoF and FMMECA

Lecture 48 - Failure Mechanism and Models

Lecture 49 - Virtual Qualification

Lecture 50 - Physical qualification and Prognostics

Lecture 51 - PHM Introduction

Lecture 52 - Prognostics and Health Management in RBE

Lecture 53 - Major AI and ML Techniques and Algorithms in PHM

Lecture 54 - Role of ANN technique in RUL Estimation

Lecture 55 - Uncertainty Management in PHM

Lecture 56 - RBE-Introduction

Lecture 57 - RBE for Life Extension in support of regulatory relicensing

Lecture 58 - RBE-Risk Monitor

Lecture 59 - RBE-Inservice-Inspection

Lecture 60 - RB Operator Support System

Lecture 1 - Introduction to Japanese scripts

Lecture 2 - Jiko shoukai (Self introduction)

Lecture 3 - Dochira kara desu ka (Where are you from?)

Lecture 4 - Senmon wa nan desu ka (What is your specialization?)

Lecture 5 - Kore wa hon desu (This is a book)

Lecture 6 - Ikura desu ka (How much is it?)

Lecture 7 - Ima nan-ji desu ka (What is the time now?)

Lecture 8 - Kaigi wa roku-ji-han kara desu (The meeting is from 6:30)

Lecture 9 - Ashita Tokyo e ikimasu. (I will go to Tokyo tomorrow)

Lecture 10 - Watashi wa mainichi roku-ji ni okimasu (I wake up at 6â€™oclock everyday)

Lecture 11 - Itsu Kanpur e kimashita ka (When did you come to Kanpur?)

Lecture 12 - Y?binkyoku wa asoko ni arimasu (The post office is over there)

Lecture 13 - Rao san wa doko ni imasu ka (Where is Mr. Rao?)

Lecture 14 - Pikuniku e ikimash? (Letâ€™s go for a picnic)

Lecture 15 - Kesa pan to tamago o tabemashita (I ate eggs and bread for breakfast)

Lecture 16 - Depa-to no tonari no biru wa gink? desu (The building next to the department store is the bank)

Lecture 17 - Taj hoteru wa ookii hoteru desu(Hotel Taj is a big hotel)

Lecture 18 - Hoteru de nani o tabemashita ka (What did you eat at the hotel?)

Lecture 19 - Tokyo wa ?kikute kirei desu (Tokyo is big and beautiful)

Lecture 20 - Ko-hi- wa oishiku arimasen(Coffee is not tasty)

Lecture 21 - Hantai kotoba (Opposites)

Lecture 22 - Watashi wa mainichi miruku o nomimasu (I drink milk everyday)

Lecture 23 - Watashi wa oniisan ni kamera o moratta(I received a camera from my brother)

Lecture 24 - Nani o tabetai desu ka(What do you want to eat?)

Lecture 25 - Nani o sashiagemasu ka (Giving and Receiving)

Lecture 26 - Sensei wa watashi ni hon o kuremashita (My teacher gave me a book)

Lecture 27 - Chotto matte kudasai (Just a minute please)

Lecture 28 - Ke-ki o tabete mite kudasai (Eat and see how is the cake)

Lecture 29 - Nani o shite imasu ka(What are you doing?)

Lecture 30 - Tokyo ni sunde imasu (I live in Tokyo)

Lecture 31 - Kanji ga kakemasu (I can write Kanji)

[Lecture 32 - Im?to wa ningy? o hoshigatte imasu \(My sister wants a doll\)](#)

[Lecture 33 - Aisukuri-mu ga ke-ki yori suki desu \(I like ice-cream more than cakes\)](#)

[Lecture 34 - Kutsu o kai ni ikimasu \(I am going to buy shoes\)](#)

[Lecture 35 - Ashita motto atsuku narimasu \(It is going to become very hot tomorrow\)](#)

[Lecture 36 - Rainen Tokyo e iku to omoimasu \(I think I will go to Tokyo next year\)](#)

[Lecture 37 - Pen de kaite mo ii desu ka\(Is it alright to write in pen?\)](#)

[Lecture 38 - Comprehensions and Expressions](#)

[Lecture 39 - Basic Kanji](#)

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[Lecture 1 - Introduction](#)

[Lecture 2 - Pre Siddhantic Astronomy](#)

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[Lecture 5 - Introduction to Telescopic Astronomy and Concluding remarks](#)

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Carbon Accounting and Sustainable Designs in Product Lifecycle Management (General)

Co-ordinators : Prof. Amandeep Singh Oberoi, Prof. Deepu Philip, Prof. Prabal Pratap Singh

Lecture 1 - Productivity and Sustainability - Part 1

Lecture 2 - Measuring Productivity

Lecture 3 - Measures Affecting Productivity

Lecture 4 - Productivity and Sustainability - Part 2

Lecture 5 - Environmental Management system

Lecture 6 - Green System

Lecture 7 - Carbon Footprint

Lecture 8 - Carbon Credit Trading

Lecture 9 - Industrial Ecology and Carbon Footprint

Lecture 10 - Examples of Carbon Footprint Calculations

Lecture 11 - Examples of Carbon Footprint Calculations

Lecture 12 - Some More Green Thoughts and Footprints

Lecture 13 - Green Manufacturing

Lecture 14 - Partnership for a New Generation of Vehicles (PNGV)

Lecture 15 - Smart Design and Engineering

Lecture 16 - Road to Product Lifecycle Management - Part 1

Lecture 17 - Road to Product Lifecycle Management - Part 2

Lecture 18 - Road to Product Lifecycle Management - Part 3

Lecture 19 - Sustainability and Green Supply Chain - Part 1

Lecture 20 - Sustainability and Green Supply Chain - Part 2

Lecture 21 - Energy Transformations

Lecture 22 - PLM Components and levels - Part 1

Lecture 23 - PLM Components and levels - Part 2

Lecture 24 - PLM integration - Part 1

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Lecture 26 - Facility carbon accounting

Lecture 27 - Activities of emission - Part 1

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- [Lecture 49 - Database Schema - Part 2](#)
- [Lecture 50 - Database Normalization - Part 1](#)
- [Lecture 51 - Database Normalization - Part 2](#)
- [Lecture 52 - Carbon Accounting User Interface - Part 1](#)
- [Lecture 53 - Carbon Accounting User Interface - Part 2](#)
- [Lecture 54 - Carbon Accounting User Interface - Part 3](#)

NPTEL : NOC:Stress Management (General)

Co-ordinators : Prof. Rajlakshmi Guha

- Lecture 1 - What is Stress
- Lecture 2 - Sources of stress
- Lecture 3 - Types of Stress
- Lecture 4 - Personality Factors and Stress
- Lecture 5 - Stress and the College Student
- Lecture 6 - Stress and Nervous System
- Lecture 7 - Hypothalamic-Pituitary-Adrenal (HPA) Axis
- Lecture 8 - Effect of Stress on Immune System
- Lecture 9 - Health Risk Associated with Chronic Stress
- Lecture 10 - Stress and Major Psychiatric Disorders
- Lecture 11 - Understanding your stress level
- Lecture 12 - Role of Personality Pattern, Self Esteem, Locus of Control
- Lecture 13 - Role of Thoughts Beliefs and Emotions - I
- Lecture 14 - Role of Thoughts Beliefs and Emotions - II
- Lecture 15 - Life Situation Intrapersonal : (Assertiveness, Time Management)
- Lecture 16 - Developing Cognitive Coping Skills
- Lecture 17 - Autogenic Training, Imagery and Progressive Relaxation
- Lecture 18 - Other Relaxation Techniques
- Lecture 19 - Exercise and Health
- Lecture 20 - DIY Strategies Stress Management

[Lecture 1 - Introduction to Need of 21st Century Education](#)

[Lecture 2 - Accreditation](#)

[Lecture 3 - Outcome based Learning](#)

[Lecture 4 - Approach to Design Outcome based Learning](#)

[Lecture 5 - Approach to Design Outcome based Learning \(Continued...\)](#)

[Lecture 6 - Instructional Design for Active Learning](#)

[Lecture 7](#)

[Lecture 8](#)

[Lecture 9](#)

[Lecture 10](#)

[Lecture 11](#)

[Lecture 12](#)

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[Lecture 18](#)

[Lecture 19](#)

[Lecture 20](#)

NPTEL : Ayurvedic Inheritance of India (General)

Co-ordinators : Dr. M.S. Valiathan

Lecture 1 - Roots of Ayurveda

Lecture 2 - Traditional Medicine in Buddhist India

Lecture 3 - Period of Systematization

Lecture 4 - Philosophical ideas in Ayurveda

Lecture 5 - Human Body in Health

Lecture 6 - Human Body in Disease

Lecture 7 - Food and Drinks

Lecture 8 - Code for Healthy Living

Lecture 9 - Diseases

Lecture 10 - Diagnosis and Prognosis

Lecture 11 - Medical Treatment of Diseases

Lecture 12 - Materia Medica

Lecture 13 - Surgical Treatment of Diseases

Lecture 14 - Surgical Instruments

Lecture 15 - Treatment of fractures; some surgical procedures

Lecture 16 - Principles and methods of rejuvenation: enhancement of sexual potency and fertility

Lecture 17 - Selection of Students: Oath at initiation: Process of Training

Lecture 18 - A Science Initiative in Ayurveda (ASIIA)

Lecture 19 - Ayurvedic Biology: Illustrative Studies

Lecture 20 - Conclusion: An Ayurvedic View of Life

Co-ordinators : Dr. G. Phanikumar, Prof. C. Balaji, Dr. Arun K.Tangirala, Dr. Abhijit P. Deshpande, Prof. M.S. Ananth, Dr. Prathap Haridoss

Lecture 1 - Insight into research

Lecture 2 - Role of Guide and Student

Lecture 3 - Art of Re-Search

Lecture 4 - Persistent small steps towards success

Lecture 5 - Overview of research

Lecture 6 - Overview of Literature Survey

Lecture 7 - Literature Survey using Web of Science

Lecture 8 - Literature Survey using Scopus

Lecture 9 - Writing Up

Lecture 10 - Tutorial on using BibTeX with LaTeX to add references to a document

Lecture 11 - Tutorial on using Microsoft Word with Bibliographic Sources

Lecture 12 - Tutorial on using Microsoft Word with endnote entries

Lecture 13 - Experimental skills

Lecture 14 - Data analysis - Part 1

Lecture 15 - Data analysis - Part 2

Lecture 16 - Modelling skills - Part 1

Lecture 17 - Modelling skills - Part 2

Lecture 18 - Safety in laboratory

Lecture 19 - How to make Technical presentation

Lecture 20 - Technical Writing

Lecture 21 - Creativity in research - Part 1

Lecture 22 - Creativity in research - Part 2

Lecture 23 - Creativity in Research - Part 3

Lecture 24 - Group discussion on Ethics in Research

Lecture 25 - Intellectual property - Part 1

Lecture 26 - Intellectual property - Part 2

Lecture 27 - DOE Part 1

Lecture 28 - DOE part 2

Lecture 29 - DOE part 3

Lecture 30 - DOE part 4

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[Lecture 31 - DOE part 5](#)

[Lecture 32 - Research in Applied Mechanics](#)

[Lecture 33 - Research in Chemical Engineering](#)

[Lecture 34 - Research in Civil Engineering](#)

[Lecture 35 - Research in Computer Science and Engineering](#)

[Lecture 36 - Research in Engineering Design](#)

[Lecture 37 - Research in Humanities and Social Sciences](#)

[Lecture 38 - Research in Mechanical Engineering](#)

[Lecture 39 - Research in Metallurgical and Materials Engineering](#)

[Lecture 40 - Research in Ocean Engineering](#)

[Lecture 41 - Research in Management Studies](#)

[Lecture 42 - Research in Aerospace Engineering](#)

[Lecture 43 - Research in Biotechnology](#)

[Lecture 44 - Research in Chemistry](#)

[Lecture 45 - Research in Electrical Engineering](#)

[Lecture 46 - Research in Mathematics](#)

[Lecture 47 - Research in Physics](#)

[Lecture 48 - Discussion with Research Scholars](#)

Lecture 1 - Introduction

Lecture 2 - Origin of Life

Lecture 3 - Evolution

Lecture 4 - Cells

Lecture 5 - Biomolecules: Lipids

Lecture 6 - Biomolecules: Carbohydrates, Water

Lecture 7 - Biomolecules: Amino acids, Proteins

Lecture 8 - Biomolecules: Enzymes

Lecture 9 - Biomolecules: Nucleotides

Lecture 10 - Cell structure and function – Prokaryotes

Lecture 11 - Cell structure and function – Eukaryotes

Lecture 12 - Cell cycle

Lecture 13 - Cell division – mitosis

Lecture 14 - Cell division – meiosis

Lecture 15 - Culture growth

Lecture 16 - Mendelian genetics: Genetic disorders

Lecture 17 - Mendelian genetics: Mendelian inheritance principles

Lecture 18 - Mendelian genetics: Pedigree analysis

Lecture 19 - Mendelian genetics: Non-Mendelian inheritance

Lecture 20 - DNA replication

Lecture 21 - Transcription

Lecture 22 - Translation

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NPTEL : NOC:Digital and the Everyday - from Codes to Cloud (General)

Co-ordinators : Prof. Amit Prakash, Prof. Bidisha Chaudhuri

Lecture 1 - Introduction to the Course

Lecture 2 - Introduction to the Winter School

Lecture 3 - Socio-algorithmic processes and the Everyday - Part 1

Lecture 4 - Socio-algorithmic processes and the Everyday - Part 2

Lecture 5 - Socio-algorithmic processes and the Everyday - Part 3

Lecture 6 - Data Protection and Privacy Regulation in the Digital Era - Part 1

Lecture 7 - Data Protection and Privacy Regulation in the Digital Era - Part 2

Lecture 8 - Data Protection and Privacy Regulation in the Digital Era - Part 3

Lecture 9 - Data-driven Identities - Part 1

Lecture 10 - Data-driven Identities - Part 2

Lecture 11 - Data-driven Identities - Part 3

Lecture 12 - Promises and Challenges of e-Health - Part 1

Lecture 13 - Promises and Challenges of e-Health - Part 2

Lecture 14 - Promises and Challenges of e-Health - Part 3

Lecture 15 - Digital Finance - Part 1

Lecture 16 - Digital Finance - Part 2

Lecture 17 - Digital and our everyday interactions with the state - Part 1

Lecture 18 - Digital and our everyday interactions with the state - Part 2

Lecture 19 - Digital and our everyday interactions with the state - Part 3

Lecture 20 - Creating a Machine Zone through Affected Feedback: Leisure and Entertainment on Social Media - Part 1

Lecture 21 - Creating a Machine Zone through Affected Feedback: Leisure and Entertainment on Social Media - Part 2

Lecture 22 - Creating a Machine Zone through Affected Feedback: Leisure and Entertainment on Social Media - Part 3

- Lecture 1 - Introduction to the course
- Lecture 2 - An Inexperienced Engineering Teacher's View
- Lecture 3 - From traditional lecturing to helping students learn - 1
- Lecture 4 - From traditional lecturing to helping students learn - 2
- Lecture 5 - Better learning (Bloom's Taxonomy)
- Lecture 6 - Problem based learning (PBL) and Problem Solving - Part 1
- Lecture 7 - Problem based learning (PBL) and Problem Solving - Part 2
- Lecture 8 - Writing Learning Outcomes for a Course
- Lecture 9 - Active Learning
- Lecture 10 - Cooperative Group Learning
- Lecture 11 - Flipped Classroom
- Lecture 12 - Effective Laboratory Courses
- Lecture 13 - Assessment - Part 1
- Lecture 14 - Assessment - Part 2
- Lecture 15 - How can we use research in education? - Part A1
- Lecture 16 - How can we use research in education? - Part A2
- Lecture 17 - The Class, as a Whole - Part A3
- Lecture 18 - Psychological Type (Orientation) and Learning - Part B
- Lecture 19 - Cognitive Development Theories - Two Main Examples - Part C
- Lecture 20 - Learning Theories - Part D
- Lecture 21 - Feedback and Reflection - Part 1
- Lecture 22 - Feedback and Reflection - Part 2
- Lecture 23 - Feedback and Reflection - Part 3
- Lecture 24 - Live Session 1
- Lecture 25 - Live Session 2

Lecture 1 - Course mechanics

Lecture 2 - Goals and VR definitions

Lecture 3 - Historical perspective

Lecture 4 - Birds-eye view (general)

Lecture 5 - Birds-eye view (general) (Continued...)

Lecture 6 - Birds-eye view (hardware)

Lecture 7 - Birds-eye view (software)

Lecture 8 - Birds-eye view (sensation and perception)

Lecture 9 - Geometric modeling

Lecture 10 - Transforming models

Lecture 11 - Matrix algebra and 2D rotations

Lecture 12 - 3D rotations and yaw, pitch, and roll

Lecture 13 - 3D rotations and yaw, pitch, and roll (Continued...)

Lecture 14 - Axis-angle representations

Lecture 15 - Quaternions

Lecture 16 - Converting and multiplying rotations

Lecture 17 - Converting and multiplying rotations (Continued...)

Lecture 18 - Homogeneous transforms

Lecture 19 - The chain of viewing transforms

Lecture 20 - Eye transforms

Lecture 21 - Eye transforms (Continued...)

Lecture 22 - Canonical view transform

Lecture 23 - Viewport transform

Lecture 24 - Viewport transform (Continued...)

Lecture 25 - Three interpretations of light

Lecture 26 - Refraction

Lecture 27 - Simple lenses

Lecture 28 - Diopters

Lecture 29 - Imaging properties of lenses

Lecture 30 - Lens aberrations

Lecture 31 - Optical system of eyes

Lecture 32 - Photoreceptors

Lecture 33 - Sufficient resolution for VR

Lecture 34 - Light intensity

Lecture 35 - Eye movements

Lecture 36 - Eye movements (Continued...)

Lecture 37 - Eye movement issues for VR

Lecture 38 - Neuroscience of vision

Lecture 39 - Three Psychophysical Laws

Lecture 40 - Sensation and Perception

Lecture 41 - Psychophysics of Visual Perception

Lecture 42 - Gamma Encoding

Lecture 43 - Limiting Resolution

Lecture 44 - Depth perception

Lecture 45 - Depth perception (Continued...)

Lecture 46 - Motion perception from Visual System

Lecture 47 - Frame rates and displays

Lecture 48 - Frame rates and displays (Continued...)

Lecture 49 - Psychophysics of Depth Perception

Lecture 50 - Overview

Lecture 51 - Orientation tracking

Lecture 52 - Tilt drift correction

Lecture 53 - Yaw drift correction

Lecture 54 - Tracking with a camera

Lecture 55 - Perspective n-point problem

Lecture 56 - Filtering

Lecture 57 - Lighthouse approach

Lecture 58 - Visual Rendering-Overview

Lecture 59 - Visual Rendering-overview (Continued...)

Lecture 60 - Shading models

Lecture 61 - Rasterization

Lecture 62 - Pixel shading

Lecture 63 - VR-specific problems

Lecture 64 - Distortion shading

[Lecture 65 - Post-rendering image warp](#)

[Lecture 66 - Why Haptics?](#)

[Lecture 67 - What is Haptics?](#)

[Lecture 68 - Branches of Haptics](#)

[Lecture 69 - Human Haptics - Tactile System](#)

[Lecture 70 - Kinesthetic System](#)

[Lecture 71 - Motor System](#)

[Lecture 72 - Haptic Devices and Interfaces - Kinesthetic Devices](#)

[Lecture 73 - Haptic Devices and Interfaces - Tactile Devices](#)

[Lecture 74 - Physics and Physiology](#)

[Lecture 75 - Auditory perception](#)

[Lecture 76 - Auditory localization](#)

[Lecture 77 - Rendering](#)

[Lecture 78 - Spatialization and display](#)

[Lecture 79 - Combining other senses](#)

[Lecture 80 - Interfaces -overview](#)

[Lecture 81 - Evaluation of VR Systems](#)

[Lecture 82 - Social interaction](#)

[Lecture 83 - System control](#)

[Lecture 84 - Manipulation](#)

[Lecture 85 - Locomotion](#)

[Lecture 86 - Principles of Perception](#)

[Lecture 87 - Introduction to Kalman Filter](#)

[Lecture 88 - Introduction to Extended Kalman Filter](#)

[Lecture 89 - Grand Challenges in VR/AR](#)

[Lecture 90 - Ultimate VR/AR System](#)

- Lecture 1 - Renewable Energy Technologies
- Lecture 2 - Energy Usage by Humans - Estimate of Impact on Atmosphere
- Lecture 3 - Conventional Sources of Energy
- Lecture 4 - Non-Conventional Sources of Energy - An Overview
- Lecture 5 - Energy consumption
- Lecture 6 - Details of Energy usage in each sector
- Lecture 7 - Consequences of Energy consumption
- Lecture 8 - Solar Energy incident on Earth, Solar Spectrum
- Lecture 9 - The Solar Energy Budget
- Lecture 10 - Electromagnetic Radiation - The Solar Spectrum
- Lecture 11 - Solar flat plate collector
- Lecture 12 - Solar Radiator
- Lecture 13 - Solar Energy - The Semiconductor
- Lecture 14 - Solar energy - The p-n junction
- Lecture 15 - Solar Cell - Growing the single crystal and making the p-n junction
- Lecture 16 - Solar Energy - Interaction of p-n junction with radiation
- Lecture 17 - Solar Energy - Solar cell characteristics and usage
- Lecture 18 - Solar Energy - Solar cell construction
- Lecture 19 - Solar Energy - Solar Photocatalysis
- Lecture 20 - Wind Energy - Overview
- Lecture 21 - Wind Energy - Energy Considerations
- Lecture 22 - Wind Energy - Efficiency
- Lecture 23 - Wind Energy - Parts and Materials
- Lecture 24 - Wind Energy - Design Considerations
- Lecture 25 - Ocean Thermal Energy - Conversion (OTEC)
- Lecture 26 - Geothermal Energy
- Lecture 27 - Geothermal Energy Technological aspects
- Lecture 28 - Biomass Usage and Issues
- Lecture 29 - Battery Basics
- Lecture 30 - Battery Testing and Performance
- Lecture 31 - Lithium ion Batteries

[Lecture 32 - Common Battery Structures and Types](#)

[Lecture 33 - Types of Fuel Cells](#)

[Lecture 34 - Fuel Processing for PEM Fuel Cells](#)

[Lecture 35 - Fuel Cells : Concept to Product](#)

[Lecture 36 - Characterization of Electrochemical Devices](#)

[Lecture 37 - Fuel Cells : Parts and Assembly](#)

[Lecture 38 - Supercapacitors](#)

[Lecture 39 - Flywheels](#)

[Lecture 40 - Magnetohydrodynamic Power Generation](#)

NPTEL : NOC:Introduction to Remote Sensing (General)

Co-ordinators : Dr.Arun K.Saraf

Lecture 1 - What is satellite based remote sensing?

Lecture 2 - Development of remote sensing technology and advantages

Lecture 3 - Different platforms of remote sensing.

Lecture 4 - Electromagnetic Spectrum, solar reflection and thermal emission

Lecture 5 - Interaction of EM radiation with atmosphere including atmospheric scattering, absorption and emission

Lecture 6 - Interaction mechanism of EM radiation with ground and spectral response curve

Lecture 7 - Principles of image interpretation

Lecture 8 - Multi-spectral scanners and imaging devices

Lecture 9 - Salient characteristics of Landsat, IRS, Cartosat, Resourcesat sensors

Lecture 10 - Image characteristics and different resolutions in Remote Sensing

Lecture 11 - Image interpretation of different geological landforms, rock types and structures

Lecture 12 - Remote Sensing Integration with GIS and GPS

Lecture 13 - Geo-referencing Technique

Lecture 14 - Basic Image Enhancement Techniques

Lecture 15 - Spatial Filtering, Band ratio and Principal Component Analysis techniques

Lecture 16 - Image Classification Techniques

Lecture 17 - InSAR Techniques in its applications

Lecture 18 - Hyperspectral Remote Sensing

Lecture 19 - Integrated applications of RS and GIS in groundwater studies

Lecture 20 - Limitations of Remote Sensing Techniques

Lecture 1 - Introduction to Technical Communications and their types

Lecture 2 - Title and an abstract

Lecture 3 - An abstract vs extended abstract vs summary

Lecture 4 - Keywords and Introduction sections

Lecture 5 - Background and review work

Lecture 6 - Data inputs and analytical methods

Lecture 7 - Results and discussion

Lecture 8 - Conclusions and acknowledgement

Lecture 9 - Letters, Email, SMS and WhatsApp message

Lecture 10 - Key components of a chart and types of plots

Lecture 11 - Key components of a chart and types of plots

Lecture 12 - Tables and captions

Lecture 13 - Key elements of a map figure

Lecture 14 - Power Point Presentations - 1

Lecture 15 - Power Point Presentations - 2

Lecture 16 - Power Point Presentations - 3

Lecture 17 - Project Proposals

Lecture 18 - References and bibliography

Lecture 19 - What is Plagiarism - 1

Lecture 20 - What is Plagiarism - 2

- Lecture 1 - Introduction to the course
- Lecture 2 - Introduction to ultrasound imaging
- Lecture 3 - Basics of wave propagation
- Lecture 4 - Scattering and acoustic wave equation
- Lecture 5 - Intensity, Reflection, Transmission
- Lecture 6 - Recap of Week 1
- Lecture 7 - Introduction to Imaging modes
- Lecture 8 - Imaging artifacts
- Lecture 9 - Ultrasound imaging systems
- Lecture 10 - Transducers and transducer arrays
- Lecture 11 - Recap of Week 2
- Lecture 12 - Introduction to Microfabrication
- Lecture 13 - Silicon and Silicon Dioxide
- Lecture 14 - Numericals on Ultrasound
- Lecture 15 - Introduction to Cleanroom
- Lecture 16 - Silicon and Silicon Dioxide - II
- Lecture 17 - Thermal Oxidation - I
- Lecture 18 - Thermal Oxidation - II
- Lecture 19 - Thermal Evaporation theory
- Lecture 20 - Thermal Evaporation lab demonstration
- Lecture 21 - E beam Deposition theory
- Lecture 22 - E beam deposition lab demonstration
- Lecture 23 - Sputtering theory
- Lecture 24 - Sputtering lab demonstration
- Lecture 25 - Chemical Vapor Deposition - I
- Lecture 26 - Chemical Vapor Deposition - II
- Lecture 27 - Lithography
- Lecture 28 - Lithography lab demonstration
- Lecture 29 - Lithography optics - I
- Lecture 30 - Lithography optics - II
- Lecture 31 - Introduction to Beamforming

- Lecture 32 - Beamforming Pt 2
- Lecture 33 - Beamforming and Signal Processing
- Lecture 34 - Intro to Field II simulation - impulse response, beam pattern
- Lecture 35 - Recap of week 7
- Lecture 36 - Ultrasound image quality metrics
- Lecture 37 - Contrast agents
- Lecture 38 - Contrast-enhanced imaging
- Lecture 39 - Nonlinear acoustics and imaging
- Lecture 40 - Recap of week 8
- Lecture 41 - Field II imaging simulations
- Lecture 42 - Doppler ultrasound
- Lecture 43 - Color and Power Doppler ultrasound
- Lecture 44 - Quantitative Ultrasound
- Lecture 45 - Recap of week 9
- Lecture 46 - Ultrasound bioeffects
- Lecture 47 - Bioeffects and safety
- Lecture 48 - Ultrasound elastography
- Lecture 49 - Shear wave imaging
- Lecture 50 - Recap of week 10
- Lecture 51 - RIE and DRIE
- Lecture 52 - Wet etching and Miller Indices - I
- Lecture 53 - Wet etching and Miller Indices - II
- Lecture 54 - Wet bench lab demonstration
- Lecture 55 - PCB (Printed Circuit Board)
- Lecture 56 - Ultrasonic Sensor
- Lecture 57 - Material Characterisation : STM and AFM
- Lecture 58 - Wire bonding lab demo
- Lecture 59 - Piezoelectric polymers
- Lecture 60 - Characterisation of materials - I
- Lecture 61 - Characterisation of materials - II
- Lecture 62 - Characterisation of materials - III

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NPTEL : Contemporary Issues in Philosophy of Mind and Cognition (Humanities and Social Sciences)

Co-ordinators : Dr. Rajakishore Nath, Dr. Ranjan K. Panda

Lecture 1 - Introduction

Lecture 2 - Transcendental Consciousness

Lecture 3 - Plato's Theory of Mind

Lecture 4 - Parable of Cave : Plato's

Lecture 5 - Aristotle's Concept Mind

Lecture 6 - The Concept of Mind in Upanishadas

Lecture 7 - Dualism - I

Lecture 8 - Dualism - II

Lecture 9 - Dualism - III

Lecture 10 - Against Dualism

Lecture 11 - Property Dualism

Lecture 12 - Varieties of Materialism

Lecture 13 - Mind-Body Identity Theory

Lecture 14 - Functionalism

Lecture 15 - Different Models of Cognitive Mind

Lecture 16 - Connectionism and Folk - Psychology

Lecture 17 - Representation - I

Lecture 18 - Representation - II

Lecture 19 - Artificial Intelligence - I

Lecture 20 - Artificial Intelligence - II

Lecture 21 - Artificial Intelligence - III

Lecture 22 - The Limit of Artificial Intelligence - I

Lecture 23 - The Limit of Artificial Intelligence - II

Lecture 24 - Biological Naturalism

Lecture 25 - The Concept of Intentionality

Lecture 26 - The Structure of Consciousness - I

Lecture 27 - The Structure of Consciousness - II

Lecture 28 - Phenomenal Consciousness - I

Lecture 29 - Phenomenal Consciousness - II

Lecture 30 - Language, Representation & Meaning - I

Lecture 31 - Language & Meaning - II

[Lecture 32 - Language & Mind](#)

[Lecture 33 - Language & World - I](#)

[Lecture 34 - Language & World - II](#)

[Lecture 35 - Emergentism & Supervenience](#)

[Lecture 36 - Reduction & Realization - I](#)

[Lecture 37 - Reduction & Realization - II](#)

[Lecture 38 - The Cartesian Mind Revisited](#)

[Lecture 39 - Personal Identity - I](#)

[Lecture 40 - Personal Identity - II](#)

[Lecture 41 - Creativity : Human Vs Machine - I](#)

[Lecture 42 - Creativity : Human Vs Machine - II](#)

- Lecture 1 - Overview
- Lecture 2 - In Conversation with Richard Schechner
- Lecture 3 - Multilingual Plurality: Our Environment - Part I
- Lecture 4 - Multilingual Plurality: Our Environment - Part II
- Lecture 5 - Interplay of Languages and Forms of Writing - Part I
- Lecture 6 - Interplay of Languages and Forms of Writing - Part II
- Lecture 7 - Creativity and Cultures
- Lecture 8 - Notion of Play and The Three Domain Activities
- Lecture 9 - Theory of Enjoyment: Critical Assessment
- Lecture 10 - Divergences and Convergences - Part I
- Lecture 11 - Divergences and Convergences - Part II
- Lecture 12 - Creative and Cultural Spaces for Students
- Lecture 13 - Being and Doing: Writing as Performance
- Lecture 14 - Writers and Writing: The Dialogic Process
- Lecture 15 - Creativity, Writing, Creative Writing: Recent Viewpoints
- Lecture 16 - Issues Related to the Teaching of Creative Writing
- Lecture 17 - Writers on Writing: Albert Camus
- Lecture 18 - Critical Reading of Great Writers: Albert Camus
- Lecture 19 - Critical Reading of Important Writers: Margaret Atwood
- Lecture 20 - Reading and Writing
- Lecture 21 - Indian Writing: Writers/Narrators
- Lecture 22 - Contemporary Indian Writers: The Search for Creativity - Part I
- Lecture 23 - Contemporary Indian Writers: The Search for Creativity - Part II
- Lecture 24 - Mosaic Patterns: Module 2
- Lecture 25 - Introduction to Drama
- Lecture 26 - Performance and Script Writing: Mime
- Lecture 27 - Western Classical Theory
- Lecture 28 - Student Response - I
- Lecture 29 - Indian Drama: Classical Theory and Practice
- Lecture 30 - Interacting Continuum: Classical, Folk and Modern Drama
- Lecture 31 - From The Perspective of Playwriting: Monologue

[Lecture 32 - From The Playwright's Perspective - Part I](#)

[Lecture 33 - From The Playwright's Perspective - Part II](#)

[Lecture 34 - From The Perspective of Playwriting: Anton Chekhov](#)

[Lecture 35 - Drama in the Classroom: Experience and Writing](#)

[Lecture 36 - Student Response - II](#)

[Lecture 37 - Performative Reading of the Cherry Orchard](#)

[Lecture 38 - Short Story as a Genre](#)

[Lecture 39 - Short Stories by Indian Women Writers](#)

[Lecture 40 - Modern Western Short Story](#)

[Lecture 41 - Varieties of Writing Processes](#)

Lecture 1 - Energy Flow Diagram

Lecture 2 - Global Trends in Energy Use

Lecture 3 - Energy Use in India: Some Calculations

Lecture 4 - Energy and Environment

Lecture 5 - The Kaya Identity

Lecture 6 - Emission Factor

Lecture 7 - Energy and Quality of Life

Lecture 8 - Energy Inequality

Lecture 9 - Energy Security

Lecture 10 - Introduction to Country Energy Balance assignment

Lecture 11 - Energy balance of Japan

Lecture 12 - Energy balance of Australia

Lecture 13 - Energy balance of Mexico

Lecture 14 - Energy Economics - Part 1

Lecture 15 - Energy Economics - Part 2

Lecture 16 - Energy Economics - Part 3

Lecture 17 - Energy Economics - Tutorial

Lecture 18 - Energy resources - Part 1

Lecture 19 - Energy resources - Part 2

Lecture 20 - Renewable Energy Sources - Part 1

Lecture 21 - Renewable Energy Sources - Part 2

Lecture 22 - Materials for Energy

Lecture 23 - Non Renewable Resource Economics - Part 1

Lecture 24 - Non Renewable Resource Economics - Part 2

Lecture 25 - Non Renewable Resource Economics - Part 3

Lecture 26 - Preferences and Utility

Lecture 27 - Utility and Social Choice - Part 1

Lecture 28 - Utility and Social Choice - Part 2

Lecture 29 - Utility and Social Choice - Part 3

Lecture 30 - Utility and Social Choice - Part 4

Lecture 31 - Revision Paper-1 - Part 1

[Lecture 32 - Public and Private Good/Bads](#)

[Lecture 33 - Aggregation of Demand Curves](#)

[Lecture 34 - Externalities](#)

[Lecture 35 - Revision Paper-1 - Part 2](#)

[Lecture 36 - Revision paper-1 - Part 3](#)

[Lecture 37 - Energy Project Financing - Part 1](#)

[Lecture 38 - Energy Project Financing - Part 2](#)

[Lecture 39 - Energy Project Financing - Tutorial](#)

[Lecture 40 - Input Output Analysis - Part 1](#)

[Lecture 41 - Input Output Analysis - Part 2](#)

[Lecture 42 - Input Output Analysis - Part 3](#)

[Lecture 43 - Input Output Analysis - Tutorial](#)

[Lecture 44 - Primary Energy Analysis - Part 1](#)

[Lecture 45 - Primary Energy Analysis - Part 2](#)

[Lecture 46 - Net Energy Analysis - Part 1](#)

[Lecture 47 - Net Energy Analysis - Part 2](#)

[Lecture 48 - Net Energy Analysis - Part 3](#)

[Lecture 49 - Net Energy Analysis - Part 4](#)

[Lecture 50 - Energy Policy - Part 1](#)

[Lecture 51 - Energy Policy - Part 2](#)

[Lecture 52 - Energy Policy Examples - Part 1](#)

[Lecture 53 - Energy Policy Examples - Part 2](#)

[Lecture 54 - Revision Paper-2 - Part 1](#)

[Lecture 55 - Revision Paper-2 - Part 2](#)

[Lecture 56 - Future Energy Systems](#)

Lecture 1 - Aims and objectives of the course

Lecture 2 - Systemic and Textual approaches to study Pāṇinian grammar

Lecture 3 - Pāṇini and his linguistic background

Lecture 4 - Scholars and texts in the Pāṇinian grammatical tradition and their contribution

Lecture 5 - Non-Pāṇinian grammatical traditions

Lecture 6

Lecture 7

Lecture 8

Lecture 9

Lecture 10

Lecture 11

Lecture 12

Lecture 13

Lecture 14

Lecture 15

Lecture 16

Lecture 17

Lecture 18

Lecture 19

Lecture 20

Lecture 21

Lecture 22

Lecture 23

Lecture 24

Lecture 25

Lecture 26

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- Lecture 1 - Introduction to the contents of the course
- Lecture 2 - General features of the tatpuruśa compound
- Lecture 3 - Basics of the theory of compound formation in PĀṅīnīan grammar
- Lecture 4 - Meaning of the term samĀsa
- Lecture 5 - Sanskrit, samĀsa and the process of speech production as described in the PĀṅīnīan grammar
- Lecture 6 - ... artha and introduction to ... karaka
- Lecture 7 - 6 ...s karakas
- Lecture 8 - Introduction to ... samartha
- Lecture 9 - Explanation of ... samartha
- Lecture 10 - ... sĀmarthya
- Lecture 11 - ... ekĀrthābhāva and its three features
- Lecture 12 - ... asamarthasamĀsa
- Lecture 13 - Basic terms and processes of compounding
- Lecture 14 - Steps in the process of Compounding
- Lecture 15 - Rules of compounding in PĀṅīnīan grammar - 1
- Lecture 16 - Rules of compounding in PĀṅīnīan grammar - 2
- Lecture 17 - Rules of compounding in PĀṅīnīan grammar - 3
- Lecture 18 - Rules of compounding in PĀṅīnīan grammar - 4
- Lecture 19 - Rules of compounding in PĀṅīnīan grammar - 5
- Lecture 20 - General remarks on compounding and historical development of Sanskrit Language
- Lecture 21 - ... vibhakti-tatpuruśa
- Lecture 22 - ... vibhakti-tatpuruśa - 1
- Lecture 23 - ... vibhakti-tatpuruśa - 2
- Lecture 24 - ... vibhakti-tatpuruśa
- Lecture 25 - ... vibhakti-tatpuruśa
- Lecture 26 - ... vibhakti-tatpuruśa - 1
- Lecture 27 - ... vibhakti-tatpuruśa - 2

[Lecture 59 - अक्षरसंज्ञा - सवराक्षर](#) svarakĀrya

[Lecture 60 - Examples](#)

- Lecture 1 - Introduction to the contents of the course
- Lecture 2 - General features of the àç... àçµàçàç- àç- àçàçàç/àçµ avyayĀ«bhĀva, àç- àçàçàçµàçàç- àçàçàç, bahuvrĀ«hi
- Lecture 3 - Basics of the theory of compound formation in PĀś'īinīan grammar
- Lecture 4 - Meaning of the term àç, àç@àç/àç, samĀsa
- Lecture 5 - àç, àç@àç/àç, samĀsa and the process of speech production as described in the PĀś'īinīan grammar
- Lecture 6 - àç... àç°àçàç artha and introduction to àç•àç/àç°àç• karaka
- Lecture 7 - 6 àç•àç/àç°àç•s karakas
- Lecture 8 - Introduction to àç, àç@àç°àçàç samartha
- Lecture 9 - Explanation of àç, àç@àç°àçàç samartha
- Lecture 10 - àç, àç/àç@àç°àçàç sĀmarthya
- Lecture 11 - àçàç•àç/àç°àçàçàçàçàçàçàçµ ekĀrthĀ«bhĀva and its three features
- Lecture 12 - àç... àç, àç@àç°àçàçàç, àç@àç/àç, asamarthasamĀsa
- Lecture 13 - Basic terms and processes of compounding
- Lecture 14 - Steps in the process of Compounding
- Lecture 15 - Rules of compounding in PĀś'īinīan grammar - 1
- Lecture 16 - Rules of compounding in PĀś'īinīan grammar - 2
- Lecture 17 - Rules of compounding in PĀś'īinīan grammar - 3
- Lecture 18 - Rules of compounding in PĀś'īinīan grammar - 4
- Lecture 19 - Rules of compounding in PĀś'īinīan grammar - 5
- Lecture 20 - General remarks on compounding and historical development of Sanskrit Language
- Lecture 21 - àç... àçµàçàç- àç- àçàçàç/àçµ àç, àç@àç/àç, avyayĀ«bhĀva samĀsa àç“ Genral information
- Lecture 22 - àç... àçµàçàç- àç- àçàçàç/àçµ àç, àç@àç/àç, àçµàçàçàçàç/àç“ avyayĀ«bhĀva samĀsa vidhĀna
- Lecture 23 - àç... àçµàçàç- àç- àçàçàç/àçµ àç, àç@àç/àç, àçµàçàçàçàç/àç“ avyayĀ«bhĀva samĀsa vidhĀna
- Lecture 24 - àç... àçµàçàç- àç- àçàçàç/àçµ àç, àç@àç/àç, àçµàçàçàçàç/àç“ avyayĀ«bhĀva samĀsa vidhĀna
- Lecture 25 - àç... àçµàçàç- àç- àçàçàç/àçµ àç, àç@àç/àç, àçµàçàçàçàç/àç“ avyayĀ«bhĀva samĀsa vidhĀna
- Lecture 26 - àç... àçµàçàç- àç- àçàçàç/àçµ àç, àç@àç/àç, àçµàçàçàçàç/àç“ avyayĀ«bhĀva samĀsa vidhĀna
- Lecture 27 - àç... àçµàçàç- àç- àçàçàç/àçµ àç, àç@àç/àç, àçµàçàçàçàç/àç“ avyayĀ«bhĀva samĀsa vidhĀna
- Lecture 28 - àç... àçµàçàç- àç- àçàçàç/àçµ àç, àç@àç/àç, àçµàçàçàçàç/àç“ avyayĀ«bhĀva samĀsa vidhĀna
- Lecture 29 - àç... àçµàçàç- àç- àçàçàç/àçµ àç, àç@àç/àç, àçµàçàçàçàç/àç“ avyayĀ«bhĀva samĀsa vidhĀna
- Lecture 30 - àç... àçµàçàç- àç- àçàçàç/àçµ àç, àç@àç/àç, àçµàçàçàçàç/àç“ avyayĀ«bhĀva samĀsa vidhĀna
- Lecture 31 - àç... àçµàçàç- àç- àçàçàç/àçµ àç, àç@àç/àç, àçµàçàçàçàç/àç“ avyayĀ«bhĀva samĀsa vidhĀna

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Text, Sexuality and Digital Media (Humanities and Social Sciences)

Co-ordinators : Prof. Arjun Ghosh

Lecture 1 - Introduction to the course

Lecture 2 - Marshall McLuhan : The Medium is the Message

Lecture 3 - Marshall McLuhan : The Gutenberg Galaxy - Part 1

Lecture 4 - Marshall McLuhan : The Gutenberg Galaxy - Part 2

Lecture 5 - Walter Ong: Orality and Literacy - Part 1

Lecture 6 - Walter Ong: Orality and Literacy - Part 2

Lecture 7 - Walter Ong: Orality and Literacy - Part 3

Lecture 8 - Dastangoi : History - Part 1

Lecture 9 - Dastangoi : Chouboli - Part 2

Lecture 10 - Manuscript Culture: Europe

Lecture 11 - Manuscript Culture: India

Lecture 12 - Feudalism to Capitalism

Lecture 13 - Febre and Martin: ["The Discovery of Printing"](#) and ["The Chinese Precedent"](#)

Lecture 14 - Gutenberg and Revolution 15th Century

Lecture 15 - Consequences of Print 16-17 Century

Lecture 16 - John Dryden: [macFlecknoe]

Lecture 17 - Robert Darnton: ["What is the History of Books?"](#)

Lecture 18 - Benedict Anderson: ["The Origins of National Consciousness"](#)

Lecture 19 - Colonialism

Lecture 20 - Print in Bengal

Lecture 21 - Surveillance and Censorship

Lecture 22 - Rise of the Telugu Novel

Lecture 23 - Publishing in Hindi and Urdu

Lecture 24 - Walter Benjamin: 'The Work of Art in the Age of Mechanical Reproduction'

Lecture 25 - Raymond Williams: 'Television'

Lecture 26 - Jay David Bolter: Seeing and Writing

Lecture 27 - Robert Coover: The End of Books - Part 1

Lecture 28 - Robert Coover: The End of Books - Part 2

Lecture 29 - N. Katherine Hayles: Electronic Literature

Lecture 30 - Richard Stallman: The GNU Manifesto

Lecture 31 - Lawrence Lessig: Free Cultures

[Lecture 32 - Copyright - Part 1](#)

[Lecture 33 - Copyright - Part 2](#)

[Lecture 34 - Nicholas Carr: Juggler's Brain](#)

[Lecture 35 - Scott Galloway: Google](#)

[Lecture 36 - Zeynep Tufekci: Twitter and Facebook - Part 1](#)

[Lecture 37 - Zeynep Tufekci: Twitter and Facebook - Part 2](#)

[Lecture 38 - Conclusion](#)

Lecture 1 - Introduction to Psychology

Lecture 2 - Introduction to Positive Psychology

Lecture 3 - Research Methods

Lecture 4 - Character Strengths and Virtues/Positive Personality Traits - Part 1

Lecture 5 - Character Strengths and Virtues/Positive Personality Traits - Part 2

Lecture 6 - Character Strengths and Virtues/Positive Personality Traits - Part 3

Lecture 7 - Happiness and Well-Being - Part 1

Lecture 8 - Happiness and Well-Being - Part 2

Lecture 9 - Happiness and Well-Being - Part 3

Lecture 10 - Positive Emotional States and Processes - Part 1

Lecture 11 - Positive Emotional States and Processes - Part 2

Lecture 12 - Hope and Optimism

Lecture 13 - Self and related Concepts

Lecture 14 - Resilience

Lecture 15 - Flow

Lecture 16 - Mindfulness

Lecture 17 - Spirituality, Grit and Mindset

Lecture 18 - Mindfulness and Compassion

Lecture 19 - Forgiveness, Humanity and Gratitude

Lecture 20 - Love, Empathy and Altruism

Lecture 21 - Recent Trends and Directions In Positive Psychology - Part 1

Lecture 22 - Recent Trends and Directions In Positive Psychology - Part 2

Lecture 23 - Recent Trends and Directions In Positive Psychology - Part 3

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NPTEL : NOC:Science Communication: Research Productivity and Data Analytics using Open Source Software (Humanities and Social Sciences)

Co-ordinators : Prof. Nabi Hasan, Prof. Mohit Garg

Lecture 1 - Introduction to Science Communication

Lecture 2 - Channels of Science Communication

Lecture 3 - Open Science and Open Access

Lecture 4 - Open Research Data and Open Peer Review

Lecture 5 - Overview of Tools for Maximizing Academic Visibility and Impact of Research Output

Lecture 6 - Understanding Research Metrics: Author, Journal and Article Level Metrics

Lecture 7 - Abstract and Citation Database Scopus

Lecture 8 - Abstract and Citation Database: Web of Science

Lecture 9 - Health Science Database: PubMed

Lecture 10 - Free Academic Search Engine: Google Scholar

Lecture 11 - Installation of R

Lecture 12 - Installation of RStudio

Lecture 13 - Object and different types

Lecture 14 - Vector and Data Frame

Lecture 15 - Lists, Matrices, Factor, Array

Lecture 16 - Packages and Help

Lecture 17 - Science communication and different metrics

Lecture 18 - Lotka's law

Lecture 19 - Bradford's law

Lecture 20 - Zipf's Law

Lecture 21 - Descriptive Analysis - I

Lecture 22 - Descriptive Analysis - II

Lecture 23 - Descriptive Analysis - III

Lecture 24 - Analysis of Bradford and Lotka Law

Lecture 25 - Science Mapping - I

Lecture 26 - Science Mapping - II

Lecture 27 - Data Visualization: An overview, history and skills for researchers

Lecture 28 - Data Visualization: Types, tools and technologies

Lecture 29 - Visualization of Scientific Research Patterns and Trends with VOSviewer and CiteSpace

Lecture 30 - Text Mining - Introduction

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[Lecture 31 - Regular Expression](#)

[Lecture 32 - Text Pre-processing](#)

[Lecture 33 - Topic Modeling](#)

[Lecture 34 - THE, QS, Sanghai \(ARWU\) and \(NIRF\) Ranking](#)

[Lecture 35 - Academic Integrity and Ethical Guidelines in Science Communication](#)

[Lecture 36 - IPR/Copyright Issues and Practices in Print and Digital Environment](#)

[Lecture 37 - Predatory Publishing: Issues, Challenges and the Road Ahead](#)

[Lecture 38 - Case Study #1 Subject Domain](#)

[Lecture 39 - Case Study #2 Author](#)

[Lecture 40 - Case Study #3 Journal and Institution](#)

[Lecture 1 - Understanding Cultural Studies - Part 1](#)

[Lecture 2 - Understanding Cultural Studies - Part 2](#)

[Lecture 3 - Evolution and Culture](#)

[Lecture 4 - Evolutionary Psychology](#)

[Lecture 5 - The Modern Mind: Its Origins](#)

[Lecture 6 - Memetics](#)

[Lecture 7 - Cultural Theory: Structuralism](#)

[Lecture 8 - Marxism - Part 1](#)

[Lecture 9 - Marxism - Part 2](#)

[Lecture 10 - Poststructuralism](#)

[Lecture 11 - Subjectivity](#)

[Lecture 12 - Identity](#)

[Lecture 13 - Ideology - Part 1](#)

[Lecture 14 - Ideology - Part 2](#)

[Lecture 15 - Representation - Part 1](#)

[Lecture 16 - Representation - Part 2](#)

[Lecture 17 - Power](#)

[Lecture 18 - Discourse](#)

[Lecture 19 - Gender - Part 1](#)

[Lecture 20 - Gender - Part 2](#)

[Lecture 21 - The Body](#)

[Lecture 22 - Space](#)

[Lecture 23 - Time](#)

[Lecture 24 - Development](#)

[Lecture 25 - Language](#)

[Lecture 26 - Ethnicity, Race and Nation](#)

[Lecture 27 - Globalisation](#)

[Lecture 28 - Consumption - Part 1](#)

[Lecture 29 - Consumption - Part 2](#)

[Lecture 30 - Biology](#)

[Lecture 31 - Culture Industry](#)

[Lecture 32 - Commodity](#)

[Lecture 33 - Media](#)

[Lecture 34 - Television](#)

[Lecture 35 - New Media](#)

[Lecture 36 - Science, Technology and Culture](#)

[Lecture 37 - Cyberculture](#)

[Lecture 38 - Cultural Policy](#)

[Lecture 39 - Critiquing Cultural Studies](#)

[Lecture 40 - Conclusion](#)

Lecture 1 - Introduction

Lecture 2 - The Scope of English Studies

Lecture 3 - The English Language

Lecture 4 - International English

Lecture 5 - The Globalization of English

Lecture 6 - World Englishes

Lecture 7 - The Rise of Cultural Studies

Lecture 8 - Old English

Lecture 9 - Middle English

Lecture 10 - Early Modern English

Lecture 11 - Modern English - 1

Lecture 12 - Modern English - 2

Lecture 13 - The Age of Chaucer

Lecture 14 - The Age of Shakespeare

Lecture 15 - Milton and his Times

Lecture 16 - The Augustans

Lecture 17 - The Romantics

Lecture 18 - The Victorians

Lecture 19 - Modern Literature

Lecture 20 - The Novel

Lecture 21 - Poetry

Lecture 22 - Drama

Lecture 23 - Essay

Lecture 24 - Short story

Lecture 25 - Biography

Lecture 26 - Autobiography

Lecture 27 - History Of English Language

Lecture 28 - Marxist Literary Criticism

Lecture 29 - Feminist Criticism

Lecture 30 - Structuralist Criticism

Lecture 31 - Poststructuralism

[Lecture 32 - Postcolonialism](#)

[Lecture 33 - Cognitive Approaches To Literature](#)

[Lecture 34 - Classical Criticism](#)

[Lecture 35 - Liberal Humanism](#)

[Lecture 36 - Reader-response Criticism](#)

[Lecture 37 - New Historicism](#)

[Lecture 38 - Ecocriticism](#)

Lecture 1 - Definition of Game Theory and Rational Choice

Lecture 2 - Interacting Decision Makers

Lecture 3 - Strategic Games : Examples

Lecture 4 - Matching Pennies, Stag Hunt and Nash Equilibrium

Lecture 5 - Examples of Nash Equilibrium

Lecture 6 - Altruism and Prisoner's Dilemma

Lecture 7 - Variants Stag Hunt Game, Hawk Dove and Coordination Game

Lecture 8 - Public Good Provision, Strict Nash Equilibrium

Lecture 9 - Best Response Functions

Lecture 10 - Strictly and Weakly Dominated Action

Lecture 11 - Application of Weak Domination: Voting

Lecture 12 - Symmetric Games and Symmetric Equilibrium

Lecture 13 - Cournot Model of Oligopoly

Lecture 14 - Different Aspects of Cournot Model

Lecture 15 - Further Aspects of Cournot Model

Lecture 16 - Cournot & Bertrand Models

Lecture 17 - Different Aspects of Bertrand Model

Lecture 18 - Electoral Competition 1

Lecture 19 - Different Aspects of Hotelling Model

Lecture 20 - Hotelling Model: Concluding Remarks

Lecture 21 - War of Attrition

Lecture 22 - Second Price Sealed Bid Auction

Lecture 23 - Further Aspects of Second Price Auction

Lecture 24 - First Price Auction

Lecture 25 - All Pay Auction, Multi Unit Auction

Lecture 26 - Accident Laws

Lecture 27 - Mixed Strategy Nash Equilibrium: Introduction

Lecture 28 - Mixed Strategy, Mixed Strategy Equilibrium

Lecture 29 - Mixed Strategy Equilibrium: Concept and Examples

Lecture 30 - Characterisation of Mixed Strategy Equilibrium

Lecture 31 - Dominated Actions and Iterated Elimination

[Lecture 32 - Rationalisability and Beliefs](#)

[Lecture 33 - Extensive Games: Introduction](#)

[Lecture 34 - Strategy and Equilibrium](#)

[Lecture 35 - Nash Equilibrium and Its Problems](#)

[Lecture 36 - Subgame Perfect Nash Equilibrium](#)

[Lecture 37 - Backward Induction](#)

[Lecture 38 - Backward Induction: Exercises](#)

[Lecture 39 - Ultimatum Game](#)

[Lecture 40 - Stackelberg Duopoly Model](#)

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NPTEL : NOC:Digital Human Modeling and Simulation for Virtual Ergonomics Evaluation (Humanities and Social Sciences)

Co-ordinators : Dr. Sougata Karmakar

Lecture 1 - Introduction to Ergonomics

Lecture 2 - Notes 1

Lecture 3 - Use of percentile anthropometric and biomechanical data for product design - Part I

Lecture 4 - Use of percentile anthropometric and biomechanical data for product design - Part II

Lecture 5 - Use of percentile anthropometric and biomechanical data for product design - Part III

Lecture 6 - Use of percentile anthropometric and biomechanical data for product design - Part IV

Lecture 7 - Notes 2

Lecture 8 - Virtual Ergonomics and its Advantages

Lecture 9 - Notes 3

Lecture 10 - Introduction of Digital Human Modeling (DHM) and Simulation

Lecture 11 - Notes 4

Lecture 12 - Techniques/Process of virtual ergonomics evaluation using DHMs - Part A (Part I)

Lecture 13 - Notes 5

Lecture 14 - Techniques/Process of virtual ergonomics evaluation using DHMs - Part B (Part I)

Lecture 15 - Techniques/Process of virtual ergonomics evaluation using DHMs - Part B (Part II)

Lecture 16 - Techniques/Process of virtual ergonomics evaluation using DHMs - Part B (Part III)

Lecture 17 - Notes 6

Lecture 18 - Application of Digital Human Modeling and Simulation in various Industrial Sectors - Part I

Lecture 19 - Application of Digital Human Modeling and Simulation in various Industrial Sectors - Part II

Lecture 20 - Notes 7

Lecture 21 - Future research avenues and steps to be taken towards widespread - Part I

Lecture 22 - Future research avenues and steps to be taken towards widespread - Part II

Lecture 23 - Future research avenues and steps to be taken towards widespread - Part III

Lecture 24 - Notes 8

- Lecture 1 - Cognitive Dimensions - I
- Lecture 2 - Cognitive Dimensions - II
- Lecture 3 - Ethical Dimensions
- Lecture 4 - Inductivism and Hypothesisism - I
- Lecture 5 - Inductivism and Hypothesisism - II
- Lecture 6 - Positivism - I
- Lecture 7 - Positivism - II
- Lecture 8 - Karl Popper - I
- Lecture 9 - Karl Popper - II
- Lecture 10 - Thomas Kuhn
- Lecture 11 - Popper versus Kuhn
- Lecture 12 - Paul Feyerabend
- Lecture 13 - Rewards and Recognitions - I
- Lecture 14 - Rewards and Recognitions - II
- Lecture 15 - Rewards and Recognitions - III
- Lecture 16 - Cumulative Advantage and Symbolism of Intellectual Property - I
- Lecture 17 - Cumulative Advantage and Symbolism of Intellectual Property - II
- Lecture 18 - Cumulative Advantage and Symbolism of Intellectual Property - III
- Lecture 19 - Max Weber
- Lecture 20 - Preliminary Exercise and Explanation
- Lecture 21 - Edwin Layton Jr.
- Lecture 22 - Langdon Winner - I
- Lecture 23 - Langdon Winner - II
- Lecture 24 - Langdon Winner - III
- Lecture 25 - Donald MacKenzie and Judy Wajcman - I
- Lecture 26 - Donald MacKenzie and Judy Wajcman - II
- Lecture 27 - Thomas Edison
- Lecture 28 - Capitalism, class, gender, city, machine, workplace - I
- Lecture 29 - Capitalism, class, gender, city, machine, workplace - II
- Lecture 30 - Capitalism, class, gender, city, machine, workplace - III
- Lecture 31 - Alvin Toffler and Daniel Bell

[Lecture 32 - Themes and Factors of Information Technology](#)

[Lecture 33 - Information Technology and Reconceptualization of Class](#)

[Lecture 34 - Reception of Modern Science in India](#)

[Lecture 35 - Science Policies in India](#)

[Lecture 36 - Summary of the Course](#)

Lecture 1 - A Brief Overview of the Course

Lecture 2 - Performativity and Embodiment

Lecture 3 - The Chess Players - Part 1

Lecture 4 - The Chess Players - Part 2

Lecture 5 - Shooting an Elephant - Part 1

Lecture 6 - Shooting an Elephant - Part 2

Lecture 7 - Heart of Darkness - Part 1

Lecture 8 - Heart of Darkness - Part 2

Lecture 9 - Heart of Darkness - Part 3

Lecture 10 - The Fly - Part 1

Lecture 11 - The Fly - Part 2

Lecture 12 - Look Back in Anger - Part 1

Lecture 13 - Look Back in Anger - Part 2

Lecture 14 - Look Back in Anger - Part 3

Lecture 15 - Look Back in Anger - Part 4

Lecture 16 - Look Back in Anger - Part 5

Lecture 17 - Look Back in Anger - Part 6

Lecture 18 - Gender and Popular Culture Lecture - 1

Lecture 19 - Gender and Popular Culture Lecture - 2

Lecture 20 - Gender and Popular Culture Lecture - 3

Lecture 21 - Gender and Popular Culture Final Lecture

Lecture 1 - Ecology and Society - 1

Lecture 2 - Ecology and Society - 2

Lecture 3 - Culture and Cultural Ecology

Lecture 4 - Cultural Ecology and Economic

Lecture 5 - Cultural Ecological Theory

Lecture 6 - Human Ecology: Concept and Meaning

Lecture 7 - Human Ecology - Theoretical Approach

Lecture 8 - Ecological Anthropology

Lecture 9 - Ecosystem-based and Actor-based Model of Human Ecology

Lecture 10 - Nature and Culture Debate

Lecture 11 - Nature - A Contested Concept

Lecture 12 - Conceptions of Nature

Lecture 13 - Contested Domains and Boundaries of Culture

Lecture 14 - MCQs Discussion

Lecture 15 - Paradigms in Human-Environmental Relations - Part I

Lecture 16 - Paradigms in Human-Environmental Relations - Part II

Lecture 17 - Nature, Culture, Magic and Science

Lecture 18 - Religion, Nature and Environment

Lecture 19 - Religion, Nature and Environment Continue

Lecture 20 - The Historical Roots of our Ecological Crisis

Lecture 21 - Biodiversity Conservation Ethics in Buddhism

Lecture 22 - Hinduism and Nature Conservation, Christian Religion Response to Ecological Crisis

Lecture 23 - Hinduism and Nature Conservation, Christian Religion Response to Ecological Crisis

Lecture 24 - Deep Ecology

Lecture 25 - Social Ecology

Lecture 26 - Ecological Feminist Philosophies

Lecture 27 - Indigenous Knowledge

Lecture 28 - Ecological Journey

Lecture 29 - Kuki Jhumming Practices

Lecture 30 - Debates on Shifting Cultivation

Lecture 31 - Course Summary

- Lecture 1 - Thematic Preliminaries - I
- Lecture 2 - Thematic Preliminaries - II
- Lecture 3 - Thematic Preliminaries - III
- Lecture 4 - Sociological Modernism: Karl Marx - I
- Lecture 5 - Sociological Modernism: Karl Marx - II
- Lecture 6 - Sociological Modernism: Karl Marx - III
- Lecture 7 - Sociological Modernism: Max Weber - I
- Lecture 8 - Sociological Modernism: Max Weber - II
- Lecture 9 - Sociological Modernism: Max Weber - III
- Lecture 10 - Sociological Modernism: Max Weber - IV
- Lecture 11 - Sociological Modernism: Marx vs. Weber
- Lecture 12 - Structuralist Interpretation - I
- Lecture 13 - Structuralist Interpretation - II
- Lecture 14 - Structuralist Interpretation - III
- Lecture 15 - Western Marxism - I
- Lecture 16 - Western Marxism - II
- Lecture 17 - Modernity and Social Theory - I
- Lecture 18 - Modernity and Social Theory - II
- Lecture 19 - Modernity and Social Theory - III
- Lecture 20 - Modernity and Social Theory - IV
- Lecture 21 - Deconstruction of Modernity: The Feminist Challenge - I
- Lecture 22 - Deconstruction of Modernity: The Feminist Challenge - II
- Lecture 23 - Deconstruction of Modernity: Towards Cultural Studies - I
- Lecture 24 - Deconstruction of Modernity: Towards Cultural Studies - II
- Lecture 25 - Deconstruction of Modernity: The Postmodernist Critique - I
- Lecture 26 - Deconstruction of Modernity: The Postmodernist Critique - II
- Lecture 27 - A New Totality - I
- Lecture 28 - A New Totality - II
- Lecture 29 - Modernity in India
- Lecture 30 - What have we discussed?

Lecture 1 - A Brief History of Cognitive Psychology - 1

Lecture 2 - A Brief History of Cognitive Psychology - 2

Lecture 3 - Studying Cognition

Lecture 4 - Perception:Basic Principles

Lecture 5 - Models of Perception - 1

Lecture 6 - Models of Perception - 2

Lecture 7 - Basic Attention Processes

Lecture 8 - Models of Attention

Lecture 9 - Automization and Attention

Lecture 10 - Memory Introduction

Lecture 11 - Short Term Memory

Lecture 12 - Working Memory

Lecture 13 - Long-Term Memory Encoding

Lecture 14 - Retrieval from Long-Term Memory

Lecture 15 - Semantic Memory Basics

Lecture 16 - Models of Semantic Memory

Lecture 17 - Introducing Concepts and Categories - 1

Lecture 18 - Introducing Concepts and Categories - 2

Lecture 19 - Basics of Visual Memory

Lecture 20 - Object Transformation in Visual Memory

Lecture 21 - Basic Issues in Language

Lecture 22 - Comprehension and Understanding of Language

Lecture 23 - Introduction to Problem Solving

Lecture 24 - Factors Influencing Problem Solving

Lecture 25 - Insight and Creativity

Lecture 26 - Reasoning - 1

Lecture 27 - Reasoning - 2

Lecture 28 - Classical Theory of Decision Making

Lecture 29 - Prospect Theory of Decision Making

Lecture 30 - Course Summary

- Lecture 1 - Introduction to the course
- Lecture 2 - Raja Rammohan Roy : Religious reforms
- Lecture 3 - Raja Rammohan Roy : Modern education
- Lecture 4 - Raja Rammohan Roy : Freedom of Press
- Lecture 5 - Rabindranath Tagore : Nationalism
- Lecture 6 - Rabindranath Tagore : Cosmopolitanism
- Lecture 7 - Rabindranath Tagore : Idea of man
- Lecture 8 - Aurobindo Ghosh : Self
- Lecture 9 - Aurobindo Ghosh : Community and Religion
- Lecture 10 - Vivekananda : Introduction
- Lecture 11 - Vivekananda : Revitalisation of Indian life
- Lecture 12 - Mahatma Gandhi : Introduction
- Lecture 13 - Mahatma Gandhi : Hind swaraj and Critique of Modern Civilisation
- Lecture 14 - Mahatma Gandhi : India of His Dreams
- Lecture 15 - Muhammad Iqbal : Community
- Lecture 16 - Muhammad Iqbal : Religion and Nation
- Lecture 17 - Savarkar : Introduction
- Lecture 18 - Savarkar : Hinduism and Hindutva
- Lecture 19 - Jawaharlal Nehru : Discovery of India
- Lecture 20 - Jawaharlal Nehru : Secularism
- Lecture 21 - Jawaharlal Nehru : Internationalism
- Lecture 22 - B.R.Ambedkar : Introduction
- Lecture 23 - B.R.Ambedkar : Caste
- Lecture 24 - B.R.Ambedkar : Liberal Democracy and Constitutional Morality
- Lecture 25 - Pandita Ramabai : Introduction
- Lecture 26 - Pandita Ramabai : Gender and Caste
- Lecture 27 - Rammanohar Lohia : Introduction
- Lecture 28 - Rammanohar Lohia : Caste and Class
- Lecture 29 - Rammanohar Lohia : Views on Indian Languages
- Lecture 30 - Conclusion

Lecture 1 - Introduction to Consumer Psychology - I

Lecture 2 - Introduction to Consumer Psychology - II

Lecture 3 - Problem Recognition - I

Lecture 4 - Problem Recognition - II

Lecture 5 - Alternate Evaluation - I

Lecture 6 - Alternate Evaluation - II

Lecture 7 - Alternate Evaluation - III

Lecture 8 - Post Purchase and Consumption - I

Lecture 9 - Post Purchase and Consumption - II

Lecture 10 - Perception and Cognition - I

Lecture 11 - Perception and Cognition - II

Lecture 12 - Memory and Learning - I

Lecture 13 - Memory and Learning - II

Lecture 14 - Emotion Motivation and Mood - I

Lecture 15 - Emotion Motivation and Mood - II

Lecture 16 - Attitude and Attitude Change - I

Lecture 17 - Attitude and Attitude Change - II

Lecture 18 - Communication and Persuasion - I

Lecture 19 - Communication and Persuasion - II

Lecture 20 - Summary

Lecture 1 - Sanskrit and National Theatre

Lecture 2 - History of Parsi Theatre and Female Impersonation

Lecture 3 - Female Impersonation and Indian Folk Traditions

Lecture 4 - Early Indian Playwrights

Lecture 5 - Silence! The Court is in Session

Lecture 6 - A Friend's Story

Lecture 7 - Ghashiram Kotwal

Lecture 8 - Kanyadaan

Lecture 9 - Hayavadana

Lecture 10 - Tughlaq

Lecture 11 - The Dreams of Tipu Sultan

Lecture 12 - The Fire and the Rain

Lecture 13 - Broken Images

Lecture 14 - Summary

Lecture 15 - Introduction and Garbo

Lecture 16 - Old Stone Mansion

Lecture 17 - Desire in the Rocks

Lecture 18 - Sonata

Lecture 19 - Summary of Mahesh Elkunchwar

Lecture 20 - Introduction and Final Solutions

Lecture 21 - Bravely Fought the Queen

Lecture 22 - Dance Like a Man

Lecture 23 - Summary of Mahesh Dattani

Lecture 24 - Introduction and Procession

Lecture 25 - Bhoma

Lecture 26 - Stale News and Summary

Lecture 27 - Conclusion

- Lecture 1 - General Outline and methods
- Lecture 2 - Political theories and ideologies
- Lecture 3 - Liberty: republican conception of freedom
- Lecture 4 - Freedom as autonomy; Positive and negative liberty
- Lecture 5 - Freedom as Swaraj, Free speech and hate speech
- Lecture 6 - Introduction: Equity and egalitarianism
- Lecture 7 - Equality of opportunity; preferential treatment
- Lecture 8 - Luck Egalitarianism and its critiques; Equality and Liberty
- Lecture 9 - Introduction and forms of rights
- Lecture 10 - Conflicts between rights
- Lecture 11 - Rights and Duties
- Lecture 12 - Justice : A distributive concept
- Lecture 13 - Justice : Procedural and Substantive; Justice as fairness
- Lecture 14 - Justice : Capability approach; libertarian, communitarian conception of Justice
- Lecture 15 - Justice : Feminist conceptions of justice; Global justice
- Lecture 16 - Introduction to Power and authority
- Lecture 17 - Power, legitimacy and hegemony
- Lecture 18 - Power and knowledge; different conceptions of power
- Lecture 19 - Introduction and different conceptions of state and sovereignty
- Lecture 20 - Modern nation state; liberal, Marxist and feminist conceptions of state
- Lecture 21 - State and governmentality
- Lecture 22 - Introduction: Procedural and Substantive Democracy
- Lecture 23 - Various models of democracy
- Lecture 24 - Challenges and Limits of Democracy; Free press and Democracy
- Lecture 25 - Citizenship: Subject and Citizen
- Lecture 26 - T H Marshal and liberal conceptions of citizenship as legal and equal member
- Lecture 27 - Multiculturalism and Cosmopolitan Citizenship
- Lecture 28 - Introduction; Doom and Gloom; Democracy and environmental crisis
- Lecture 29 - Climate change and environmental justice
- Lecture 30 - Revisiting some key themes and concepts

Lecture 1 - Introduction to the Science of Human Behavior - I

Lecture 2 - Introduction to the Science of Human Behavior - II

Lecture 3 - Sensation - I

Lecture 4 - Sensation - II

Lecture 5 - Perception - I

Lecture 6 - Perception - II

Lecture 7 - Learning - I

Lecture 8 - Learning - II

Lecture 9 - Memory - I

Lecture 10 - Memory - II

Lecture 11 - Language - I

Lecture 12 - Language - II

Lecture 13 - Intelligence - I

Lecture 14 - Intelligence - II

Lecture 15 - Emotion - I

Lecture 16 - Emotion - II

Lecture 17 - Personality - I

Lecture 18 - Personality - II

Lecture 19 - Social Influence and Cognition - I

Lecture 20 - Social Influence and Cognition - II

Lecture 21 - Summary

Lecture 1 - Communication and Language - I

Lecture 2 - Communication and Language - II

Lecture 3 - Science of Language - I

Lecture 4 - Science of Language - II

Lecture 5 - Speech Perception - I

Lecture 6 - Speech Perception - II

Lecture 7 - Speech Production - I

Lecture 8 - Speech Production - II

Lecture 9 - Words - I

Lecture 10 - Words - II

Lecture 11 - Words - III

Lecture 12 - Sentences - I

Lecture 13 - Sentences - II

Lecture 14 - Discourse - I

Lecture 15 - Discourse - II

Lecture 16 - Reading and Writing - I

Lecture 17 - Reading and Writing - II

Lecture 18 - Bilingualism - I

Lecture 19 - Bilingualism - II

Lecture 20 - Overall Review

Lecture 1 - Reflections on Development Studies and Development Research

Lecture 2 - Types, Forms, and Processes of Development Studies Research

Lecture 3 - The Rigour in Development Studies Research

Lecture 4 - Paradigms of Development Research

Lecture 5 - Development Research-Development Work Continuum and Action Research in Development Studies

Lecture 6 - Ethics in Development Studies and Development Research

Lecture 7 - Literature Study

Lecture 9 - Introducing Qualitative Research Methods

Lecture 10 - Introducing Qualitative Research Methods (Continued...)

Lecture 11 - Interviews and Focus Group Discussions

Lecture 12 - Participatory Methods and Approaches

Lecture 13 - Conducting Case Studies and Maintaining Field Diaries

Lecture 14 - Introducing Quantitative Research Methods

Lecture 15 - An Overview of Mixed Methods Research

Lecture 16 - Field Surveys and Inventories

Lecture 17 - Logical Framwork and SWOT Analysis

Lecture 18 - The importance of Census and other Secondary Data in Development Studies

Lecture 19 - Communicating Research

Lecture 20 - Operationalizing Rights-based Approaches to Development

Lecture 21 - Poverty Measures and Analysis

Lecture 22 - Gender-sensitive Indicators and Gender Analysis

Lecture 23 - Social Capital Assessment Tools

Lecture 24 - Moitoring and Evaluation

Lecture 25 - A Final Note

Lecture 1 - Introduction and General Outline

Lecture 2 - Sources and Methodology to Study Indian Business History

Lecture 3 - East India Company's early ventures in India

Lecture 4 - Agency Houses: Jagat Seths and Early Banking operations

Lecture 5 - Emergence of Bombay and Cotton Trade, 1750-1850

Lecture 6 - Indian Business: Changes and Styles

Lecture 7 - Emergence of Calcutta: Impact on Industries

Lecture 8 - Swadeshi Movement: Impact on Indian Industries

Lecture 9 - Case Studies: Indian Business Houses: TATAs

Lecture 10 - Indian Economy and Business during WW I

Lecture 11 - Impact of the Second World War WW II

Lecture 12 - Political Economy of the Global wars for India; Case Study: Hindustan Aeronautics Limited (HAL)

Lecture 13 - Impact of Independence and Partition: Evolution of the Railways in India

Lecture 14 - Planning, Statistics and Industrialization Policies

Lecture 15 - Global Currents of economic Thought, 1947-1960

Lecture 16 - Industrial Licensing Policies, Institutions 1947-1964

Lecture 17 - Industrial Licensing Policies, 1966-1980

Lecture 18 - Case Study: Amul and Rural Cooperatives

Lecture 19 - Liberalisation of the Indian Economy, 1990s

Lecture 20 - Business Developments in India; India's Energy Diplomacy through ONGC

Lecture 21 - Indian Business History: Trends and Prospects

Lecture 22 - Learning Outcomes from Indian Business History

Lecture 1 - General Outline and Method

Lecture 2 - Method: Text and Context

Lecture 3 - Intro and Justice

Lecture 4 - State and Philosopher King

Lecture 5 - Communism of Wives and Property and Critical Assessment of his Thought

Lecture 6 - Intro and Ethics or Virtue

Lecture 7 - Politics and His Ideal State

Lecture 8 - Aristotle-III: Citizenship, Views on Revolution and Critical Assessment of his Thought

Lecture 9 - Machiavelli-I: Intro and Virtu and Fortuna

Lecture 10 - Machiavelli-II: Politics, Violence, and Religion

Lecture 11 - Machiavelli-III: Republicanism and Critical Assessment of his Thought

Lecture 12 - Intro and Human Nature

Lecture 13 - The Leviathan or Sovereign

Lecture 14 - Political Obligation and Critical Assessment of his Thought

Lecture 15 - Intro, State of Nature and Natural Rights

Lecture 16 - Limited Government

Lecture 17 - Right to Dissent and Critical Assessment of his Thought

Lecture 18 - Rousseau-I: Intro and Social Contract

Lecture 19 - Rousseau-II: General Will and Critical Assessment of his Thought

Lecture 20 - Kant-I: Intro and What is Enlightenment?

Lecture 21 - Kant-II: Morality, Autonomy and Freedom

Lecture 22 - Kant-III: Kingdom of Ends and Critical Assessment of his Thought

Lecture 23 - Hegel-I: Intro and Freedom

Lecture 24 - Hegel-II: Civil Society and State

Lecture 25 - Hegel-III: Rights and Critical Assessment of his Thought

Lecture 26 - Marx-I: Intro and Historical Materialism

Lecture 27 - Marx-II: State and Class

Lecture 28 - Marx-III: Views on Politics, Communism and Critical Assessment of his Thought

Lecture 29 - Mill-I: Intro, Utilitarianism and Subjection of Women

Lecture 30 - Mill-II: On Liberty, Representative Government and Critical Assessment of his Thought

Lecture 1 - The Nature of Stress - 1

Lecture 2 - The Nature of Stress - 2

Lecture 3 - The Biology of Stress

Lecture 4 - Stress, Health, and Non-infectious Diseases

Lecture 5 - Stress and Infectious Diseases

Lecture 6 - Stress and Psychological Disorders

Lecture 7 - Stress, Trauma and Posttraumatic growth - 1

Lecture 8 - Stress, Trauma and Posttraumatic growth - 2

Lecture 9 - Factors Influencing Stress Tolerance

Lecture 10 - Coping Strategies: Definition and Types

Lecture 11 - Unconscious mind and defensive coping

Lecture 12 - Characteristics of constructive coping; Physical ways of coping

Lecture 13 - Coping with relaxation exercises

Lecture 14 - Mental ways of coping

Lecture 15 - Coping with social support

Lecture 16 - Coping with meditation and mindfulness

Lecture 17 - Positive mental health and well-being

Lecture 18 - Well-being and resilience

Lecture 19 - What is happiness? What makes us happy?

Lecture 20 - Socio-demographic factors and happiness

Lecture 21 - Positive emotions

Lecture 22 - Genetic set point and hedonic adaptation

Lecture 23 - Sustainable happiness model

Lecture 24 - Sustainable happiness with intentional activities

Lecture 25 - Cultivating happiness with gratitude

Lecture 26 - Cultivating happiness with acts of kindness

Lecture 27 - Social comparison and happiness

Lecture 28 - Cultivating happiness with signature strengths 1 (VIA character strengths)

Lecture 29 - Cultivating happiness with signature strengths 2 (Gallup's/Clifton strength finder)

Lecture 30 - Cultivating happiness with Flow

Lecture 31 - Humanistic psychology and self-actualization

[Lecture 32 - Self-determination, motivation, and well-being](#)

[Lecture 33 - Meaning in life and well-being](#)

[Lecture 34 - Life goals and well-being](#)

Lecture 1 - Articulation of consonants - 1

Lecture 2 - Articulation of consonants - 2

Lecture 3 - Articulation of vowels

Lecture 4 - Language endangerment and linguistic diversity

Lecture 5 - Linguistic diversity - consonants in the languages of the world

Lecture 6 - Linguistic diversity - consonants and vowels in the languages of the world

Lecture 7 - Linguistic diversity - conclusion

Lecture 8 - Acoustic analysis: sound waves

Lecture 9 - Acoustic analysis: source filter theory and spectrograms

Lecture 10 - Acoustic analysis: vowels and formants

Lecture 11 - Acoustic analysis: formant calculation

Lecture 12 - Perceptual cues, variability in the speech signal, acoustic-phonetic invariance

Lecture 13 - Segmentation problem, categorical perception, cp in infants and animals

Lecture 14 - Measuring perceptual distinctiveness, multidimensional scaling, speech perception theories

Lecture 15 - development of the ideas of phonemes and features

Lecture 16 - phonemes as categories, phonemes in different languages, allophonic rules

Lecture 17 - problems in phonemic analysis, context and phonotactics

Lecture 18 - Psychological reality of phonemes

Lecture 19 - Distinctive features and natural classes

Lecture 20 - Phonological rule application

Lecture 21 - Distinctive features, feature economy and markedness

Lecture 22 - Morphophonological rules

Lecture 23 - Syllables

Lecture 24 - Stress

Lecture 25 - Phonetics and phonology of intonation, microprosody, stylization

Lecture 26 - Nuclear tone, pitch accent and boundary tones

Lecture 27 - Focus, givenness

Lecture 1 - Empiricism and Rationalism

Lecture 2 - Comte and Positivism; Epistemology and Ontology

Lecture 3 - The Rules of Sociological Method

Lecture 4 - Sociology of Knowledge

Lecture 5 - Religion and the Division of Labour in Society

Lecture 6 - Positivism and Neo-Kantianism

Lecture 7 - Methodology of the Social Sciences

Lecture 8 - Interpretive Sociology

Lecture 9 - Methodological Individualism and Interpretative Understanding of Social Action

Lecture 10 - Weberian Social Sciences: Methodological Implications

Lecture 11 - Materialist Conception of History

Lecture 12 - Dialectic

Lecture 13 - Nature, Ideology and Science

Lecture 14 - Systematic Falsification

Lecture 15 - Hypothetico - Deductive Model

Lecture 16 - The Structure of Scientific Revolutions

Lecture 17 - Popper Versus Kuhn

Lecture 18 - Positivism Versus Hermeneutics - I

Lecture 19 - Positivism Versus Hermeneutics - II

Lecture 20 - Philosophy of Social Sciences: Taking Stock

Lecture 21 - End of the Philosophy of the Social Sciences

Lecture 22 - Return of Grand Theory in the Human Sciences

Lecture 23 - An Overview of the Course

Lecture 1 - Sociology of development: An overview

Lecture 2 - Development historically

Lecture 3 - Decolonization, nationalism and development - I

Lecture 4 - Decolonization, nationalism and development - II

Lecture 5 - Decolonization, nationalism and development - III

Lecture 6 - Social evolution and social change

Lecture 7 - Social change and progress

Lecture 8 - Modernization Theory: An Overview

Lecture 9 - State and Class under Peripheral Capitalism

Lecture 10 - Critique of Samuel Huntington

Lecture 11 - Class, State and Revolution

Lecture 12 - The Empirical Peasantry and the Hypothetical Proletariat

Lecture 13 - Class and Classness: Substitutes and Realities

Lecture 14 - Modernization and Huntington's Argument

Lecture 15 - Huntington, Social Sciences and Ideology

Lecture 16 - The Ideological, Empirical and Methodological Critiques - I

Lecture 17 - The Ideological, Empirical and Methodological Critiques - II

Lecture 18 - Dependency Theory: Intellectual Antecedents

Lecture 19 - The Latin American Debates on Underdevelopment - I

Lecture 20 - The Latin American Debates on Underdevelopment - II

Lecture 21 - Dependency Theory in Transition - I

Lecture 22 - Dependency Theory in Transition - II

Lecture 23 - Critiques of Dependency Theory - I

Lecture 24 - Critiques of Dependency Theory - II

Lecture 25 - Limits to Growth - I

Lecture 26 - Limits to Growth - II

Lecture 27 - E. F. Schmacher's Small is Beautiful

Lecture 28 - Ivan Illich's Towards a History of Needs

Lecture 29 - Paradigms Lost, Paradigms Regained: Development studies in the 21st century - I

Lecture 30 - Paradigms Lost, Paradigms Regained: Development studies in the 21st century - II

Lecture 1 - Development, Economic Growth and Sustainable Development

Lecture 2 - Basic Ecosystem Ecology

Lecture 3 - Environmentalism

Lecture 4 - Environmental movement

Lecture 5 - Environmentalism in the global south

Lecture 6 - Ecofeminism

Lecture 7 - Feminist political ecology

Lecture 8 - Marx and ecology

Lecture 9 - Deep ecology

Lecture 10 - Gandhi and ecology

Lecture 11 - Social ecology

Lecture 12 - Religion, environment and historical roots of ecological crisis

Lecture 13 - Biodiversity conservation ethics in Buddhism and Hinduism

Lecture 14 - Christian religion in the age of ecological crisis

Lecture 15 - Natural resource management

Lecture 16 - Common property vs. private property

Lecture 17 - Livelihoods, forests, and conservation

Lecture 18 - Conservation-induced displacement

Lecture 19 - Environment impact assessment and national rehabilitation and resettlement policy

Lecture 20 - Dispossession and land acquisition

Lecture 21 - Mining, development, and indigenous people

Lecture 22 - Competing visions of development along the Narmada

Lecture 23 - Dams, development, and resistance: Case studies

Lecture 24 - Development theory and gendered approach to development

Lecture 25 - Gender, environment and sustainable development

Lecture 26 - Climate change interventions and policy framework

Lecture 27 - Eastern Himalayas and climate change

Lecture 28 - Ecological knowledge, biodiversity conservation and sustainability

Lecture 29 - Traditional religion and conservation of nature in Northeast India: Case study

Lecture 30 - Indigenous knowledge, environment and development

Lecture 31 - Relevance of indigenous knowledge: Case study

- Lecture 1 - Introduction to Industrial Organization, Preferences
- Lecture 2 - Utility maximization and derivation of demand curve
- Lecture 3 - Examples of utility maximization, demand curve and market demand curve
- Lecture 4 - Tutorial Module 1
- Lecture 5 - Production Function
- Lecture 6 - Cost minimization problem
- Lecture 7 - Derivation of cost curves
- Lecture 8 - Tutorial on Production and cost curves
- Lecture 9 - Optimal output and supply curve of a firm
- Lecture 10 - Derivation of Market price in competitive market
- Lecture 11 - Long run market price and Pareto optimality
- Lecture 12 - Tutorial on Perfectly Competitive Market
- Lecture 13 - Monopoly price
- Lecture 14 - Price Discrimination - I
- Lecture 15 - Price Discrimination - II
- Lecture 16 - Tutorial on Monopoly
- Lecture 17 - Introduction to Game Theory, Iterated Elimination of Dominated Strategy
- Lecture 18 - Pure Strategy Nash Equilibrium
- Lecture 19 - Mixed Strategy Nash Equilibrium
- Lecture 20 - Existence of Nash Equilibrium in Games with 2 Players and 2 Strategies
- Lecture 21 - Tutorial on Normal Form Games
- Lecture 22 - Dynamic Games, Backward Induction
- Lecture 23 - Subgame Perfect Nash Equilibrium
- Lecture 24 - Tutorial on Dynamic Games
- Lecture 25 - Cournot Duopoly
- Lecture 26 - Cournot Oligopoly
- Lecture 27 - Tutorial on Cournot Competition
- Lecture 28 - Bertrand Competition with and without fixed cost
- Lecture 29 - Bertrand Competition with capacity constraint
- Lecture 30 - Bertrand Competition with capacity constraint
- Lecture 31 - Tutorial on Bertrand Competition

[Lecture 32 - Bertrand Competition with Decreasing returns to scale](#)

[Lecture 33 - Stackelberg Quantity Competition](#)

[Lecture 34 - Tutorial on Bertrand Competition and Stackelberg Quantity Competition](#)

[Lecture 35 - Stackelberg Price Competition](#)

[Lecture 36 - Simultaneous move Hotelling Model](#)

[Lecture 37 - Tutorial on Stackelberg Price Competition](#)

[Lecture 38 - Sequential Move Hotelling Model](#)

[Lecture 39 - Dixit's Model of Entry Deterrence](#)

[Lecture 40 - Tutorial on Sequential move Hotelling Model](#)

[Lecture 41 - Dixit's Model of Entry Deterrence](#)

[Lecture 42 - Bundling and Tying](#)

[Lecture 43 - Tutorial on Dixit's Model of Entry Deterrence](#)

Lecture 1 - Aim of the course, real numbers

Lecture 2 - Logic, proof

Lecture 3 - Definitions

Lecture 4 - Set operations

Lecture 5 - Definitions

Lecture 6 - Linear functions

Lecture 7 - Quadratic functions

Lecture 8 - Exponential functions, etc.

Lecture 9 - Differentiation: preliminaries

Lecture 10 - Rules of differentiation

Lecture 11 - Partial differentiation

Lecture 12 - Higher order differentiations

Lecture 13 - Approximations and elasticities

Lecture 14 - Differentiability, series, PDV

Lecture 15 - NPV, evaluation of investment projects

Lecture 16 - Exponential, logarithmic functions

Lecture 17 - Tutorials - 1a

Lecture 18 - Tutorials - 1b

Lecture 19 - Tutorials - 1c

Lecture 20 - Extreme, stationary points, first derivative test

Lecture 21 - Global and local extreme points

Lecture 22 - Second derivative test

Lecture 23 - Inflection points

Lecture 24 - Profit maximizations

Lecture 25 - Area under a curve, indefinite integral

Lecture 26 - Definite integral

Lecture 27 - Oil extraction, income distribution, PDV

Lecture 28 - Integration by parts, substitution, Lorenz curve

Lecture 29 - First order difference equations, solution

Lecture 30 - Dynamic stability, Cobweb model

Lecture 31 - Market model with inventory, Phase diagrams, Higher order equations

[Lecture 32 - Multiplier-acceleration model](#)

[Lecture 33 - Tutorials - 2a](#)

[Lecture 34 - Tutorials - 2b](#)

Lecture 1 - Nature of human thought - I

Lecture 2 - Brain and cognition, Seat of thought - II

Lecture 3 - Language, meaning, reality - III

Lecture 4 - Categorization

Lecture 5 - Categorization: (Continued...)

Lecture 6 - Frames: another way to understand categories

Lecture 7 - Metaphor

Lecture 8 - Metaphor and Metonymy

Lecture 9 - Image schema

Lecture 10 - Image schema (Continued...)

Lecture 11 - Language acquisition

Lecture 12 - Language acquisition (Continued...)

Lecture 13 - Language in the brain

Lecture 14 - Language in the brain (Continued...)

Lecture 15 - Language and attention

Lecture 16 - Language and visual attention

Lecture 17 - Attention in Sentence processing

Lecture 18 - Executive control/function and its facets

Lecture 19 - Role of executive function in language processing

Lecture 20 - Mental simulation and its relation with language; summary of the course

Lecture 1 - Becoming and being bilingual

Lecture 2 - Attitude, Acculturation and Bilingualism

Lecture 3 - Who is a Bilingual ?

Lecture 4 - Bilingual acquisition among children: simultaneous bilingualism

Lecture 5 - Successive Bilingualism

Lecture 6 - Language and cognition among bilinguals

Lecture 7 - Bilingual cognition (Continued...)

Lecture 8 - Bilingual Memory Models

Lecture 9 - Bilingual brain: neural representation of languages

Lecture 10 - Data from processing studies on bilingual representation in brain

Lecture 11 - Speech perception and comprehension: theories

Lecture 12 - Speech perception and production studies

Lecture 13 - Lexical processing: background

Lecture 14 - Lexical processing: different experimental paradigms: comprehension and production

Lecture 15 - Sentence processing

Lecture 16 - Metalinguistic Awareness

Lecture 17 - Executive Control: bilingual advantage

Lecture 18 - cognitive reserve, new developments

Lecture 19 - New research trends in bilingualism

Lecture 20 - New models. Applied areas

Lecture 1 - Emotions: Concepts and Categories

Lecture 2 - Historical Background and Theories

Lecture 3 - Communication and Measurement of Emotions

Lecture 4 - Universals and cultural differences in emotions - 1

Lecture 5 - Universals and cultural differences in emotions - 2

Lecture 6 - Emotions and the Body

Lecture 7 - Emotions and the Brain

Lecture 8 - Self-evaluative emotions-Guilt, shame, Embarrassment, and pride

Lecture 9 - Social Comparison Emotions-Envy and Jealousy

Lecture 10 - Positive Emotions

Lecture 11 - Happiness and Subjective Well-being - 1

Lecture 12 - Happiness and Subjective Well-being - 2

Lecture 13 - Emotions in Groups - 1

Lecture 14 - Emotions in Groups - 2

Lecture 15 - Emotions and Cognitions: Introduction

Lecture 16 - Emotion and Memory

Lecture 17 - Emotion and Judgment/Decision making

Lecture 18 - Depression

Lecture 19 - Anxiety Disorders

Lecture 20 - Emotion regulation: Introduction

Lecture 21 - Adaptive emotion regulation using ABC model

Lecture 22 - Adaptive emotion regulation using mindfulness

Lecture 23 - Emotional intelligence: Introduction

Lecture 24 - Skills of EI-Self-awareness

Lecture 25 - Skills of EI-Self-regulation/Self-management

Lecture 26 - Skills of EI-Self-Motivation

Lecture 27 - Skills of EI-Empathy

Lecture 28 - Skills of EI-Social intelligence and social skills

Lecture 29 - Emotional intelligence and workplace

Lecture 30 - Emotional intelligence, health and well-being

Lecture 31 - Development of emotional intelligence

- Lecture 1 - Links of Health and Education Achievements to Human Development
- Lecture 2 - Health and Education: Human Capital or Human Right?
- Lecture 3 - Unique Aspects of Health Economics
- Lecture 4 - Perfect Competition and Healthcare Markets
- Lecture 5 - Demand for Health-1 (Grossman model)
- Lecture 6 - Demand for Health-2 (Is demand for health downward sloping)
- Lecture 7 - Demand for Health-3 (Comparative statics)
- Lecture 8 - Demand for Health-4 (Health disparities and hypothesis)
- Lecture 9 - Economics of Healthcare: Supply side
- Lecture 10 - Demand for Insurance
- Lecture 11 - Adverse Selection and Moral Hazard
- Lecture 12 - Demand for Education
- Lecture 13 - A Basic Model of Human Capital Investment and A Few Influential Thinkers
- Lecture 14 - Production of Education and Returns to Education - based on global data
- Lecture 15 - Fiscal functions of budget policy and the concept of public good
- Lecture 16 - Public goods, private goods, merit goods; Market failures and corrections
- Lecture 17 - Is higher education a public good, a quasi-public good or a merit good?
- Lecture 18 - Inequalities of Outcomes and Opportunities
- Lecture 19 - Equity in Healthcare
- Lecture 20 - Education Inequalities in Developing Countries and India
- Lecture 21 - India's Health Policy
- Lecture 22 - India's Education Policy
- Lecture 23 - Right to Health and Universal Health Care - The Indian Context
- Lecture 24 - Global Disease Burdens
- Lecture 25 - How ASER is addressing the problem of Learning Crisis in India
- Lecture 26 - The PROBE reports - Public Report on Basic Education
- Lecture 27 - Indian Morbidity and Mortality surveys
- Lecture 28 - Indian Official Statistics on school education and higher education
- Lecture 29 - Health financing
- Lecture 30 - Education financing
- Lecture 31 - Health Workforce

[Lecture 32 - Women in India's Labour Market](#)

[Lecture 33 - Summary and Conclusions](#)

Lecture 1 - Introduction - 1

Lecture 2 - Introduction - 2

Lecture 3 - Research Methods - 1

Lecture 4 - Research Methods - 2

Lecture 5 - Visual and tactile displays - 1

Lecture 6 - Visual and tactile displays - 2

Lecture 7 - Auditory display - 1

Lecture 8 - Auditory display - 2

Lecture 9 - Methods of evaluation - 1

Lecture 10 - Methods of evaluation - 2

Lecture 11 - Multitasking - 1

Lecture 12 - Multitasking - 2

Lecture 13 - Decision Making - 1

Lecture 14 - Decision Making - 2

Lecture 15 - Motor skill and control - 1

Lecture 16 - Motor skill and control - 2

Lecture 17 - Environmental design - 1

Lecture 18 - Environmental design - 2

Lecture 19 - Human error - 1

Lecture 20 - Human error - 2

Lecture 21 - Course Review

Lecture 1 - Introduction

Lecture 2 - Barriers to Communication - 1

Lecture 3 - Barriers to Communication - 2

Lecture 4 - Barriers to Communication - 3

Lecture 5 - Non-Verbal Communication - 1

Lecture 6 - Non-Verbal Communication - 2

Lecture 7 - Non-Verbal Communication - 3

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NPTEL : Money and Banking (Humanities and Social Sciences)

Co-ordinators : Prof. Surajit Sinha

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NPTEL : Selected Topics in Psychology (Humanities and Social Sciences)

Co-ordinators : Prof. Manas K Mandal, Prof. JBP Sinha, Prof. Alok Bajpai, Prof. Rakesh K. Gupta, Prof. Ramadhar Singh, Prof. Braj Bhushan, Prof. Vivek Benegal, Prof. Ajit Dalal, Prof. Girishwar Misra

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- Lecture 2 - Psychology: Emerging of a discipline
- Lecture 3 - Psychology: Emerging of a discipline
- Lecture 4 - Beginning, growth and decline of Western psychology in India
- Lecture 5 - The core and context of Indian psychology
- Lecture 6 - The indigenization of psychology in India
- Lecture 7 - Weaving culture into psychology
- Lecture 8 - Culture and Self: Implications for Social Behaviour
- Lecture 9 - Cultural and organizational behaviour
- Lecture 10 - How do similar attitudes determine attraction?
- Lecture 11 - Why do similar attitudes determine attraction?
- Lecture 12 - A beautiful mind? Perspective on brain , mind and it's challenges
- Lecture 13 - Emotion and well?being
- Lecture 14 - Mental health and illness - Part 1
- Lecture 15 - Mental health and illness - Part 2
- Lecture 16 - Folk Healing Traditions in India
- Lecture 17 - To sleep or not
- Lecture 18 - Issues and challenges in psychological assessment
- Lecture 19 - Nontraditional research in behavioural sciences
- Lecture 20 - What a surprise: My results are nonsignificant
- Lecture 21 - Neuropsychology and cognitive neuroscience research
- Lecture 22 - Functional MRI in psychology - Part 1
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- Lecture 24 - Side bias in human behaviour
- Lecture 25 - Brain microstructural correlates of cognition in Cerebral Palsy
- Lecture 26 - Brain microstructural correlates of cognition in vitamin B12 deficiency
- Lecture 27 - The neuroscience of addictive behaviour
- Lecture 28 - Who is at risk and why? The neurogenetics of vulnerability to addiction - Part 1
- Lecture 29 - Who is at risk and why? The neurogenetics of vulnerability to addiction - Part 2
- Lecture 30 - The gambler's lament: Behavioural addictions? gambling, internet and porn addictions

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Lecture 11 - Unconventional Space, Visual Riddle

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Lecture 26 - Character Specific Use of Line in Visual Representation

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Lecture 10 - Last lecture on Portfolio Optimization

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Lecture 6 - Nan sai desu ka?

Lecture 7 - Ikura desu ka?

Lecture 8 - Irasshaimase

Lecture 9 - Nan-ji desu ka?

Lecture 10 - Kyou wa getsuyoubi desu

Lecture 11 - Doko desu ka?

Lecture 12 - Tanjoubi wa itsu desu ka?

Lecture 13 - Nan-ji ni okimasu ka?

Lecture 14 - Tokyo e ikimasu

Lecture 15 - Expressions

Lecture 16 - Itsu Nihon ni kimashita ka?

Lecture 17 - Hon wa asoko ni arimasu

Lecture 18 - Yuubinkyoku wa hon-ya no tonari ni arimasu

Lecture 19 - Nan nin imasu ka?

Lecture 20

Lecture 21 - Ashita kurabu e ikimasen ka?

Lecture 22 - Kocha wa oishii desu

Lecture 23 - Iroiro na hito ni aimashita

Lecture 24 - Tanaka san onegaishimasu

Lecture 25 - Tanaka san irashshaimasu ka?

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- Lecture 32 - Sensei ni pen o sashiagemashita
- Lecture 33 - Tomodachi wa hana o kuremashita
- Lecture 34 - Hawaii e ikitakunai desu
- Lecture 35 - Nanika tabetai desu ka?
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- Lecture 37 - Chotto matte kudasai
- Lecture 38 - Mata irashite kudasai
- Lecture 39 - Omiyage o tsutsumanaide kudasai
- Lecture 40 - Watashi wa aisukurimu ga suki desu
- Lecture 41 - Nihongo no jishou ga hoshii desu
- Lecture 42 - Rainen kuni e kaeru tsumori desu
- Lecture 43 - Hikouki to shinkansen to dochira no houga hayai desu ka?
- Lecture 44 - Kurasu no naka de dare ga ichiban kashikoi desu ka?
- Lecture 45 - Kore wa tanaka san no jishou da to omoimasu
- Lecture 46 - Kasa wa eigo de nan to iimasu ka?
- Lecture 47 - Watashi ha Nihongo ga yomemasen
- Lecture 48 - Watashi wa kanji o kaku koto ga dekimasu
- Lecture 49 - Sonna koto iwanaide kudasai
- Lecture 50 - Watashiwa kuruma o unten suru toki ongaku o kikimasu
- Lecture 51 - Kanji o kaku koto ga dekimasu
- Lecture 52 - Shousetsu o yomu tame ni toshoukan e ikimasu
- Lecture 53 - Shashin o totte mo ii desu ka?
- Lecture 54 - Mainichi kaisha ni ikanakereba narimasen
- Lecture 55 - Tanaka san wa yoku hatarakimasu

Lecture 1 - Kore wa watashi no hon desu (This is my book)

Lecture 2 - Ima nan ji desu ka? (What is the time now?)

Lecture 3 - Hon wa tsukue no ue ni arimasu (The book is on the table)

Lecture 4 - Ashita kurabu e ikimasen ka? (Will you please come to the club tomorrow?)

Lecture 5 - Kodoma-tachi wa ima asonde imasu (Children are playing now)

Lecture 6 - Kodomotachi wa asonde kara benkyou shimasu (Children will study after playing)

Lecture 7 - Douzo meshiagatte kudasai (Please eat it)

Lecture 8 - Tabete mite kudasai (Please eat and see)

Lecture 9 - Koko de tabenaide kudasai (Please do not eat here)

Lecture 10 - Hitori de ikimasu ka? (Will you go alone?)

Lecture 11 - Irasshaimase ! (Welcome !)

Lecture 12 - Shiken wa dou deshita ka? (How was the exam?)

Lecture 13 - Tomodachi wa tanjoubi ni hana o kuremashita (My friend gave me flowers on my birthday)

Lecture 14 - Tomodachi wa ke-ki o tsukutte kuremashita (My friend made a cake and gave it to me)

Lecture 15 - Kimura to moushimasu (I am Kimura)

Lecture 16 - O-genki desu ka ? (How are you ?)

Lecture 17 - Kare wa 'happyou wa ashita desu' to iimashita (He said, 'the presentation is tomorrow)

Lecture 18 - Tanaka to iu hito ni aimashita (I met a person called Tanaka)

Lecture 19 - Tomodachi ga kuru to omoimasu (I think my friend will come)

Lecture 20 - Watashi wa hitori de ikemasu (I can go alone)

Lecture 21 - Ikka-getsu de dekimasu (I can do it in one month)

Lecture 22 - Kare wa Indo no shuukan no koto o yoku shitte imasu (He know a lot about Indian customs)

Lecture 23 - Aisatsu (Greetings)

Lecture 24 - Aisatsu (Greetings)

Lecture 25 - Chokore-to yori aisukuri-mu ga suki desu (I like ice cream more than chocolate)

Lecture 26 - Dochira ga suki desu ka ? (Which do you like ?)

Lecture 27 - Mira san asobi ni irashite kudasai (Mira san please visit us)

Lecture 28 - Houmon (Visiting)

Lecture 29 - Pen de kaite mo ii desu ka ? (Can I write with a pen?)

Lecture 30 - Konakute mo ii desu ka ? (Is is alright if I do not come ?)

Lecture 31 - Nani mo tabetakunai desu (I do not want to eat anything)

Lecture 32 - Watashi wa eiwa jiten ga hoshii desu (I want an English-Japanese dictionary)

Lecture 33 - Rainen kekkon suru tsumori desu (I intend to get married next year)

Lecture 34 - Soto wa kuraku narimashita (It has become dark outside)

Lecture 35 - Kyuujitai and Shinjitai

Lecture 36 - Nihon e itta koto ga arimasu (I have been to Japan)

Lecture 37 - Minikui ahiru no ko - I (Ugly duckling - I)

Lecture 38 - Minikui ahiru no ko - II (Ugly duckling - II)

Lecture 39 - Working in Japan

Lecture 40 - Haru ni naru to sakura ga saku (When it is spring cherry blossoms will bloom)

Lecture 41 - Mira wa konai kamoshirenai (Mira may not come)

Lecture 42 - Okane ga attara uchi o kaimasu (If I have money I will buy a house)

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DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Computer Aided Decision Systems - Industrial Practices using Big Analytics (Humanities and Social Sciences)

Co-ordinators : Prof. Deepu Philip, Prof. Amandeep Singh Oberoi

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Lecture 2 - Characteristics and Capabilities of DSS

Lecture 3 - Misconception and Components of DSS

Lecture 4 - Decision Process

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Lecture 6 - Introduction to Modelbase Management Systems

Lecture 7 - Introduction to User Interface System

Lecture 8 - Principles of Graphical User Interface

Lecture 9 - Introduction to Database

Lecture 10 - Reasons behind using DBMS

Lecture 11 - Concepts and Architecture of Database Systems

Lecture 12 - Entity Relationship

Lecture 13 - Entity Relationship Diagrams

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Lecture 18 - Big Data Analytics Team

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Lecture 20 - Big Data Analytics Lifecycle - Phase 2

Lecture 21 - Big Data Analytics Lifecycle - Phase 3 and 4

Lecture 22 - Big Data Analytics Lifecycle - Phase 5 and 6

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- Lecture 14 - Law Relating to Non-Profit Company
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- Lecture 17 - Raising fund through Private Equity and Venture Capital
- Lecture 18 - Raising fund from Financial Institution
- Lecture 19 - Types of Instruments for raising the fund
- Lecture 20 - Issue of the Instruments

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Soft Skill Development (Humanities and Social Sciences)

Co-ordinators : Prof. Priyadarshi Patnaik, Prof. V.N. Giri, Prof. D. Suar

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DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Introduction on Intellectual Property to Engineers and Technologists (Humanities and Social Sciences)

Co-ordinators : Prof. Tapas Kumar Bandyopadhyay

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Lecture 18 - Copy Right Registration

Lecture 19 - Copyright Infringement and Fair Use

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Lecture 22 - Industrial Design Registration

Lecture 23 - Utility Patent Vs Industrial Design

Lecture 24 - Trademark Basic

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NPTEL : NOC:Elements of Literature and Creative Communication (Humanities and Social Sciences)

Co-ordinators : Prof. H.S. Komalesha

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NPTEL : NOC:Training and Development (Humanities and Social Sciences)

Co-ordinators : Prof. Susmita Mukhopadhyay, Prof. Sangeeta Sahney, Prof. S.Srinivasan

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Lecture 3 - Globalization, technology and the Growth of Cities

Lecture 4 - Urban Infrastructure and Governance

Lecture 5 - Urbanization in the Global South: Approaches of Understanding

Lecture 6 - Indian context and informality: Cities and slums

Lecture 7 - Urban Development and Sustainability in India

Lecture 8 - Major Policies of urban India

Lecture 9 - Gentrification, migration, inequality and urban social stratification in India.

Lecture 10 - Recent developments and emerging theories

Lecture 11 - Smart cities - global perspective and Indian perspective

Lecture 12 - Social Interactions in Publicspaces

Lecture 13 - Community, SmartCitizenship and the Digital Divide

Lecture 14 - Urban Commons

Lecture 15 - Urban Greens

Lecture 16 - Community and Identity

Lecture 17 - Gender Race and the City - Part I

Lecture 18 - Gender Race and the City - Part II

Lecture 19 - Natural and (Un)Natural Disaster in the City

Lecture 20 - Urban Subcultures

Lecture 1 - Introduction to Fixed Income Securities

Lecture 2 - Risks in Fixed Income Securities Investments

Lecture 3 - Bond Valuation - I

Lecture 4 - Bond Valuation - II

Lecture 5 - Bond Price Relations

Lecture 6 - Bond Returns - I

Lecture 7 - Bond Returns - II

Lecture 8 - Bond Returns - III

Lecture 9 - Bond Returns - IV

Lecture 10 - Level of Interest Rate Determination - I

Lecture 11 - Level of Interest Rate Determination - II

Lecture 12 - Level of Interest Rate Determination - III

Lecture 13 - The Term Structure of Interest Rates - I

Lecture 14 - The Term Structure of Interest Rates - II

Lecture 15 - The Term Structure of Interest Rates - III

Lecture 16 - The Term Structure of Interest Rates - IV

Lecture 17 - The Term Structure of Interest Rates - V

Lecture 18 - The Term Structure of Interest Rates - VI

Lecture 19 - The Term Structure of Interest Rates - VII

Lecture 20 - The Term Structure of Interest Rates - VIII

Lecture 21 - Determination of Theoretical Spot Rate and Forward Yield Curves

Lecture 22 - Interest Rate Risk

Lecture 23 - Bond Duration

Lecture 24 - Bond Convexity

Lecture 25 - Default Risk

Lecture 26 - Short-Term Government Bond Markets

Lecture 27 - Long-Term Government Bond Markets

Lecture 28 - Issuance and Trading Mechanism of Government Securities

Lecture 29 - Short-Term Corporate Bond Markets

Lecture 30 - Medium and Long-term Corporate Bond Markets

Lecture 31 - Issuance and Trading Mechanism of Corporate Securities

- Lecture 32 - Municipal Bonds - I
- Lecture 33 - Municipal Bonds - II
- Lecture 34 - Debt Securities of Commercial Banks
- Lecture 35 - International Bonds
- Lecture 36 - Bonds with Embedded Options
- Lecture 37 - Binomial Valuation of Callable Bonds - I
- Lecture 38 - Binomial Valuation of Callable Bonds - II
- Lecture 39 - Binomial Valuation of Puttable and Sinking-Fund Bonds
- Lecture 40 - Binomial Valuation of Convertible Bonds
- Lecture 41 - Estimation of Binomial Trees - I
- Lecture 42 - Estimation of Binomial Trees - II
- Lecture 43 - Estimation of Binomial Trees - III
- Lecture 44 - Estimation of Binomial Trees - IV
- Lecture 45 - Estimation of Binomial Trees - V
- Lecture 46 - Bond Investment Strategies - I
- Lecture 47 - Bond Investment Strategies - II
- Lecture 48 - Bond Investment Strategies - III
- Lecture 49 - Bond Investment Strategies - IV
- Lecture 50 - Bond Investment Strategies - V
- Lecture 51 - Mortgage Backed Securities - I
- Lecture 52 - Mortgage Backed Securities - II
- Lecture 53 - Mortgage Backed Securities - III
- Lecture 54 - Mortgage Backed Securities - IV
- Lecture 55 - Mortgage Backed Securities - V
- Lecture 56 - Fixed Income Securities Derivatives - I
- Lecture 57 - Fixed Income Securities Derivatives - II
- Lecture 58 - Fixed Income Securities Derivatives - III
- Lecture 59 - Fixed Income Securities Derivatives - IV
- Lecture 60 - Fixed Income Securities Derivatives - V

Lecture 1 - Relevance and Syllabus

Lecture 2 - Role of Oil

Lecture 3 - Energy and Sustainability

Lecture 4 - North-South conflict, Way to future

Lecture 5 - Introduction

Lecture 6 - Analysis of demand

Lecture 7 - Determinants of demand

Lecture 8 - Analysis of supply

Lecture 9 - Equilibrium

Lecture 10 - Elasticity

Lecture 11 - Revenue and price elasticity of demand

Lecture 12 - Petroleum rents and petroleum taxes

Lecture 13 - Welfare analysis

Lecture 14 - Government Intervention - I

Lecture 15 - Government Intervention - II

Lecture 16 - Introduction

Lecture 17 - Movement of oil price

Lecture 18 - Sector wise use of oil

Lecture 19 - Oil Price Movements 2010-15/16

Lecture 20 - Oil Price since 2018

Lecture 21 - Oil price in the recent times

Lecture 22 - Structure of OPEC

Lecture 23 - Cartel

Lecture 24 - Role of OPEC in explaining oil price

Lecture 25 - Role of Saudi Arabia

Lecture 26 - Petroleum as a depleting resource

Lecture 27 - Can depletion explain price development ?

Lecture 28 - Cost performance of global oil industry and Oil Spills

Lecture 29 - Structural change and resource discovery

Lecture 30 - Theory of Production: A brief overview

Lecture 31 - Production Possibility Frontier

- Lecture 32 - Labour Demand
- Lecture 33 - Theoretical model - I
- Lecture 34 - Theoretical Framework - II
- Lecture 35 - Country Experiences
- Lecture 36 - Market structure
- Lecture 37 - Oligopoly and Market structure
- Lecture 38 - Introduction to Game Theory - I
- Lecture 39 - Introduction to Game Theory - II
- Lecture 40 - Nash Equilibrium
- Lecture 41 - Competition versus collusion
- Lecture 42 - Collusive Oligopoly: Price Leadership
- Lecture 43 - Price Leadership Dominant Firm Model - I
- Lecture 44 - Price Leadership Dominant Firm Model - II
- Lecture 45 - Cartel
- Lecture 46 - Intemporal Allocation and Utility
- Lecture 47 - Optimum Choice of a Consumer: Problem of Utility Maximisation
- Lecture 48 - Optimal Division of Natural Resources
- Lecture 49 - Hotelling's rule
- Lecture 50 - Intertemporally Optimal Prices: Some observations
- Lecture 51 - Model of Economic Growth - I
- Lecture 52 - Model of Economic Growth - II
- Lecture 53 - Discovery of Natural Resources
- Lecture 54 - Model of Economic growth with uncertainty
- Lecture 55 - Exchange Rate and its Determination
- Lecture 56 - Oil Price Shock
- Lecture 57 - BoP Crisis of the Indian Economy in 1991
- Lecture 58 - Crisis and efficiency of exchange rate policies
- Lecture 59 - Concluding Remarks - I
- Lecture 60 - Concluding Remarks - II

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:The Science of Happiness and Wellbeing (Humanities and Social Sciences)

Co-ordinators : Prof. Priyadarshi Patnaik, Prof. Manas K Mandal

Lecture 1 - Introduction: Why Happiness Matters and How We Will Go About Exploring It

Lecture 2 - Can We Define Happiness?

Lecture 3 - Happiness and Wellbeing : Do Cultures and Environments Call the Shots!

Lecture 4 - Doing Happiness' - Philosophical and existential questions, and responses

Lecture 5 - Happiness - antecedents and implications

Lecture 6 - Basic Issues

Lecture 7 - Myths and Misconceptions

Lecture 8 - Happiness - the unanswered questions

Lecture 9 - Evolution of Happiness

Lecture 10 - Belief and Gene

Lecture 11 - Empathy

Lecture 12 - Happiness and Morality

Lecture 13 - Exploring the self and the other

Lecture 14 - Pro-sociality and happiness - Generosity, give and take

Lecture 15 - Pro-sociality and happiness - Virtues and strengths

Lecture 16 - Relationship - Connected and happy

Lecture 17 - Networking and its relevance for happiness and wellbeing

Lecture 18 - Money and Happiness

Lecture 19 - How does optimism affect happiness?

Lecture 20 - Sharing and Belonging

Lecture 21 - Happiness and body language

Lecture 22 - Failure and Resilience

Lecture 23 - Innovation and Happiness

Lecture 24 - Conflicts and Stress

Lecture 25 - Stress and Coping

Lecture 26 - Reconnecting happiness: beyond pandemic

Lecture 27 - Meditation and Mindfulness: An Overview

Lecture 28 - Meditation and Mindfulness: Practice Toolkit

Lecture 29 - Creativity, Intuition and Flow

Lecture 30 - Can we really not be creative and happy?

Lecture 31 - Emotional intelligence

[Lecture 32 - Happiness at work](#)

[Lecture 33 - Nudging and Decision-making](#)

[Lecture 34 - Can we measure happiness? The case of cities and states](#)

[Lecture 35 - Happiness and leadership habits](#)

[Lecture 36 - Measurement of Happiness](#)

[Lecture 37 - Consumerism, happiness and wellbeing](#)

[Lecture 38 - Technology and happiness](#)

[Lecture 39 - Doing research on happiness: Connecting dots](#)

[Lecture 40 - Summing up: Social innovation and project ideas for social transformation](#)

Lecture 1 - Major Environmental Concerns and Pollution

Lecture 2 - Population Growth Models

Lecture 3 - Resource Consumption and Pollution

Lecture 4 - Measuring Environmental Impacts - the IPAT Model and Ecological Footprint

Lecture 5 - Measuring - Earth Overshoot Day, Energy Performance Index and Lifecycle Assessment

Lecture 6 - Principles of Sustainable Development

Lecture 7 - Principles of Sustainable Development (Sustainable Development Goals)

Lecture 8 - Principles of Sustainable Development (Achieving SDGs and Sustainability Indices)

Lecture 9 - Principles of Sustainable Development (Case Study I: Sustainable Urbanization)

Lecture 10 - Principles of Sustainable Development (Case Study II: Green Buildings)

Lecture 11 - Air Pollution (Definition, Causes, Sources and Types)

Lecture 12 - Air Pollution (Influence of Meteorology)

Lecture 13 - Air Pollution (Local Effects and Mitigation Measures)

Lecture 14 - Air Pollution (Regional Issues and Mitigation Measures)

Lecture 15 - Air Pollution (Global Issues and Mitigation Measures, Indoor Air Quality)

Lecture 16 - Climate Change (Definition and Evidence)

Lecture 17 - Climate Change (Causes and Determinants)

Lecture 18 - Climate Change (Projections and Related Impacts)

Lecture 19 - Climate Change (Mitigation Options)

Lecture 20 - Climate Change (Adaption and Policy Responses)

Lecture 21 - Renewable Energy - I (Overview)

Lecture 22 - Renewable Energy - I (Solar Energy - I)

Lecture 23 - Renewable Energy - I (Solar Energy - II)

Lecture 24 - Renewable Energy - I (Solar Energy - III)

Lecture 25 - Renewable Energy - I (Wind Energy)

Lecture 26 - Renewable Energy - II (Geothermal Energy)

Lecture 27 - Renewable Energy - II (Ocean Energy - I)

Lecture 28 - Renewable Energy - II (Ocean Energy - II)

Lecture 29 - Renewable Energy - II (Hydropower)

Lecture 30 - Renewable Energy - II (Bioenergy)

Lecture 31 - Circular Economy (Introduction to the Concept)

- Lecture 32 - Circular Economy (Circular Economy Strategies - I)
- Lecture 33 - Circular Economy (Circular Economy Strategies - II)
- Lecture 34 - Circular Economy (Circular Business Models)
- Lecture 35 - Circular Economy (Industrial Symbiosis)
- Lecture 36 - Hydrologic cycle, sources of water and water pollution
- Lecture 37 - Water Quality Parameters - General
- Lecture 38 - Water Quality Parameters - Oxygendemanding wastes and Microbial
- Lecture 39 - Nitrogen species in rivers and the DO Sag Curve
- Lecture 40 - NGT, WQI and reuse and recycling of wastewater
- Lecture 41 - Importance and Integrated Solid Waste Management
- Lecture 42 - Sources of MSW, MSW Generation Rates and Composition
- Lecture 43 - MSW Composition and Collection
- Lecture 44 - MSW Treatment and Disposal
- Lecture 45 - E-Waste Management
- Lecture 46 - Sound, noise and its characteristics
- Lecture 47 - Audiometry
- Lecture 48 - Effects of noise
- Lecture 49 - Noise rating systems and modeling
- Lecture 50 - Noise control and regulations
- Lecture 51 - Fundamentals of Ecology - I
- Lecture 52 - Fundamentals of Ecology - II
- Lecture 53 - Fundamentals of Ecology - III
- Lecture 54 - Soil Pollution - I
- Lecture 55 - Soil Pollution - II
- Lecture 56 - The Environmental Movement and its global and local impacts
- Lecture 57 - Environmental Law and Rules in India
- Lecture 58 - Important legal judgments pertaining to the Environment
- Lecture 59 - NGT and its important judgments
- Lecture 60 - Rapid Environmental Impact Assessment - A case study of the River Ib Barrage

[Lecture 1 - Psychology of Learning](#)

[Lecture 2 - Psychology of Learning \(Continued...\)](#)

[Lecture 3 - Psychology of Learning \(Continued...\)](#)

[Lecture 4 - Psychology of Learning \(Continued...\)](#)

[Lecture 5 - Psychology of Learning \(Continued...\)](#)

[Lecture 6 - Major Theories of Learning](#)

[Lecture 7 - Major Theories of Learning \(Continued...\)](#)

[Lecture 8 - Major Theories of Learning \(Continued...\)](#)

[Lecture 9 - Major Theories of Learning \(Continued...\)](#)

[Lecture 10 - Major Theories of Learning \(Continued...\)](#)

[Lecture 11 - Memory and Cognition](#)

[Lecture 12 - Memory and Cognition \(Continued...\)](#)

[Lecture 13 - Memory and Cognition \(Continued...\)](#)

[Lecture 14 - Memory and Cognition \(Continued...\)](#)

[Lecture 15 - Memory and Cognition \(Continued...\)](#)

[Lecture 16 - Thinking and Cognition](#)

[Lecture 17 - Thinking and Cognition \(Continued...\)](#)

[Lecture 18 - Thinking and Cognition \(Continued...\)](#)

[Lecture 19 - Thinking and Cognition \(Continued...\)](#)

[Lecture 20 - Thinking and Cognition \(Continued...\)](#)

[Lecture 21 - Motivation of Learning](#)

[Lecture 22 - Motivation of Learning \(Continued...\)](#)

[Lecture 23 - Motivation of Learning \(Continued...\)](#)

[Lecture 24 - Motivation of Learning \(Continued...\)](#)

[Lecture 25 - Motivation of Learning \(Continued...\)](#)

[Lecture 26 - Emotional Intelligence and Learning](#)

[Lecture 27 - Emotional Intelligence and Learning \(Continued...\)](#)

[Lecture 28 - Emotional Intelligence and Learning \(Continued...\)](#)

[Lecture 29 - Emotional Intelligence and Learning \(Continued...\)](#)

[Lecture 30 - Emotional Intelligence and Learning \(Continued...\)](#)

[Lecture 31 - Learning and Instruction](#)

- [Lecture 32 - Learning and Instruction \(Continued...\)](#)
- [Lecture 33 - Learning and Instruction \(Continued...\)](#)
- [Lecture 34 - Learning and Instruction \(Continued...\)](#)
- [Lecture 35 - Learning and Instruction \(Continued...\)](#)
- [Lecture 36 - Learning and Pedagogy](#)
- [Lecture 37 - Learning and Pedagogy \(Continued...\)](#)
- [Lecture 38 - Learning and Pedagogy \(Continued...\)](#)
- [Lecture 39 - Learning and Pedagogy \(Continued...\)](#)
- [Lecture 40 - Learning and Pedagogy \(Continued...\)](#)
- [Lecture 41 - Psychology of E-Learning](#)
- [Lecture 42 - Psychology of E-Learning \(Continued...\)](#)
- [Lecture 43 - Psychology of E-Learning \(Continued...\)](#)
- [Lecture 44 - Psychology of E-Learning \(Continued...\)](#)
- [Lecture 45 - Psychology of E-Learning \(Continued...\)](#)
- [Lecture 46 - Effective Learning: Assessment and Feedback](#)
- [Lecture 47 - Effective Learning: Assessment and Feedback \(Continued...\)](#)
- [Lecture 48 - Effective Learning: Assessment and Feedback \(Continued...\)](#)
- [Lecture 49 - Effective Learning: Assessment and Feedback \(Continued...\)](#)
- [Lecture 50 - Effective Learning: Assessment and Feedback \(Continued...\)](#)
- [Lecture 51 - Learning for Sustainability](#)
- [Lecture 52 - Learning for Sustainability \(Continued...\)](#)
- [Lecture 53 - Learning for Sustainability \(Continued...\)](#)
- [Lecture 54 - Learning for Sustainability \(Continued...\)](#)
- [Lecture 55 - Learning for Sustainability \(Continued...\)](#)
- [Lecture 56 - Learning for Sustainability](#)
- [Lecture 57 - Learning for Sustainability \(Continued...\)](#)
- [Lecture 58 - Learning for Sustainability \(Continued...\)](#)
- [Lecture 59 - Learning for Sustainability \(Continued...\)](#)
- [Lecture 60 - Learning for Sustainability \(Continued...\)](#)

Lecture 1 - How do we define language?

Lecture 2 - What is knowledge of language?

Lecture 3 - How is Human communication unique?

Lecture 4 - Universal properties of language

Lecture 5 - What do we do in Linguistics?

Lecture 6 - Transdisciplinary Approach to Linguistics

Lecture 7 - Rules of Language

Lecture 8 - Competence and Performance, Langue and Parole

Lecture 9 - Universal Grammar

Lecture 10 - Faculty of Language

Lecture 11 - Introduction to Phonetics

Lecture 12 - More about Phonetics

Lecture 13 - Introduction to IPA

Lecture 14 - Introduction to Phonology

Lecture 15 - More about Phonology

Lecture 16 - Introducing Morphology

Lecture 17 - Morpheme, Morph and Allomorph

Lecture 18 - Types of Morpheme

Lecture 19 - Morphological Processes

Lecture 20 - More about Morphological Process

Lecture 21 - Morphological Typology

Lecture 22 - Introducing Syntax

Lecture 23 - Syntactic Categories and Subcategories

Lecture 24 - Constituents and Phrase Structures Rules

Lecture 25 - More about Trees

Lecture 26 - Different parts of a tree

Lecture 27 - From Transformation to GB Theory

Lecture 28 - Introducing Minimalism

Lecture 29 - Introducing Semantics

Lecture 30 - Lexical Semantics

Lecture 31 - Introducing Pragmatics

- Lecture 32 - Language and Script
- Lecture 33 - Defining Computational Linguistics
- Lecture 34 - An Introduction to Corpus Linguistics
- Lecture 35 - Introducing Linguistic Typology
- Lecture 36 - More about Linguistic Typology
- Lecture 37 - Typology through Indian Languages
- Lecture 38 - Language Families of India
- Lecture 39 - More about Language Families of India
- Lecture 40 - India as a Linguistic Area
- Lecture 41 - Introducing Sociolinguistics
- Lecture 42 - Language Maintenance and Language Shift
- Lecture 43 - Multilingualism and Varieties of Language
- Lecture 44 - Language, Dialect and Standardization
- Lecture 45 - Standard Language Ideology
- Lecture 46 - Language Variation
- Lecture 47 - Language Change
- Lecture 48 - Language and Identity
- Lecture 49 - Language Endangerment
- Lecture 50 - Different Aspects of Language Endangerment
- Lecture 51 - Language Documentation
- Lecture 52 - Language Documentation and Revitalization
- Lecture 53 - A Discussion on Field Linguistics
- Lecture 54 - Language Teaching
- Lecture 55 - More about Language Teaching
- Lecture 56 - Sociolinguistics and language teaching
- Lecture 57 - Language Policy
- Lecture 58 - Endangered Languages and its Revitization through Classrooms
- Lecture 59 - Summing up
- Lecture 60 - Summing up

Lecture 1 - Introduction

Lecture 2 - Branches of Philosophy

Lecture 3 - Philosophy and other Subjects

Lecture 4 - History of Western Philosophy

Lecture 5 - Pre Socrates-Philosopher

Lecture 6 - Pre Socrates-Philosopher

Lecture 7 - Socrates

Lecture 8 - Plato

Lecture 9 - Aristotle

Lecture 10 - Rene Descartes

Lecture 11 - Rene Descartes

Lecture 12 - Rene Descartes

Lecture 13 - Benedict Spinoza

Lecture 14 - Benedict Spinoza

Lecture 15 - John Lock

Lecture 16 - John Lock

Lecture 17 - Hume

Lecture 18 - Hume

Lecture 19 - Critical argument against empiricism

Lecture 20 - Ethics

Lecture 21 - Branches of Ethics

Lecture 22 - Virtue Ethics

Lecture 23 - Hedonism

Lecture 24 - Utilitarianism

Lecture 25 - Mill on happiness

Lecture 26 - Immanuel Kant

Lecture 27 - Immanuel Kant

Lecture 28 - Immanuel Kant

Lecture 29 - Indian Philosophy

Lecture 30 - Indian Philosophy

Lecture 31 - Indian Philosophy

[Lecture 32 - Indian Philosophy](#)

[Lecture 33 - Indian Philosophy](#)

[Lecture 34 - Sankara's philosophy](#)

[Lecture 35 - Sankara's philosophy](#)

[Lecture 36 - Sankara's philosophy](#)

[Lecture 37 - Sankara's philosophy](#)

[Lecture 38 - Sankara's philosophy](#)

[Lecture 39 - Ramanuja's Philosophy](#)

[Lecture 40 - Ramanuja's Philosophy](#)

[Lecture 41 - Ramanuja's Philosophy](#)

[Lecture 42 - Ramanuja's Philosophy](#)

[Lecture 43 - Vedanta Philosophy](#)

[Lecture 44 - Buddhist Philosophy](#)

[Lecture 45 - Buddhist Philosophy](#)

[Lecture 46 - Buddhist Philosophy](#)

[Lecture 47 - Buddhist Philosophy](#)

[Lecture 48 - Buddhist Philosophy](#)

[Lecture 49 - Samkhya Philosophy](#)

[Lecture 50 - Samkhya Philosophy](#)

[Lecture 51 - Samkhya Philosophy](#)

[Lecture 52 - Samkhya Philosophy](#)

[Lecture 53 - Samkhya Philosophy](#)

[Lecture 54 - The Jaina Philosophy](#)

[Lecture 55 - The Jaina Philosophy](#)

[Lecture 56 - The Jaina Philosophy](#)

[Lecture 57 - The Jaina Philosophy](#)

[Lecture 58 - The Jaina Philosophy](#)

Lecture 1 - Introduction

Lecture 2 - Sustainability and Happiness

Lecture 3 - Sustainability and Wellbeing

Lecture 4 - Sustainable Happiness Theory

Lecture 5 - Sustainable Happiness Process

Lecture 6 - Introduction

Lecture 7 - Positive Education

Lecture 8 - Predictors of Happiness

Lecture 9 - Contemplative Learning

Lecture 10 - ESD and Sustainable Learning

Lecture 11 - Introduction - Sustainable Happiness at Workplace

Lecture 12 - Work Culture

Lecture 13 - Work Culture and Emotional Intelligence at Work

Lecture 14 - Emotional Intelligence at Work (Continued...)

Lecture 15 - Sustainable Competences

Lecture 16 - Definition Sustainable Organisations

Lecture 17 - Corporate Sustainability

Lecture 18 - Sustainability policies and practices

Lecture 19 - Role of Technology in Sustainability

Lecture 20 - Building Resilient Organizations

Lecture 21 - Need for Sustainable Leadership

Lecture 22 - Competencies of Sustainable Leaders

Lecture 23 - Sustainable Lifestyle, Work-life balance and Wellbeing practices

Lecture 24 - Transforming Self and Other

Lecture 25 - Transforming Self and other (Continued...)

Lecture 26 - Positive Character Strengths

Lecture 27 - Positive and Creative Organizations

Lecture 28 - Nurturing Talent and Career Growth

Lecture 29 - Nudging

Lecture 30 - Habits of Mind and Life Skills

Lecture 31 - Introduction to Sustainable Wellbeing

[Lecture 32 - Good Health and Wellbeing](#)

[Lecture 33 - Sustainable Learning and Education](#)

[Lecture 34 - Green Creativity and Responsible Innovation](#)

[Lecture 35 - Consumers' Sustainability Demands and Trends](#)

[Lecture 36 - Education for Sustainable Development](#)

[Lecture 37 - ESD for Social Transformation](#)

[Lecture 38 - ESG for Value Creation](#)

[Lecture 39 - ESG for Sustainable Wellbeing](#)

[Lecture 40 - ESG and Inner Development Goals](#)

- Lecture 1 - Introduction to Logistics: Design and Management
- Lecture 2 - Logistics Stakeholders and Modern Logistics Concepts
- Lecture 3 - Manufacturing Logistics: National and International Scenario
- Lecture 4 - Storage and Warehousing
- Lecture 5 - Logistics Services Providers
- Lecture 6 - E-Logistics
- Lecture 7 - International Logistics
- Lecture 8 - International Logistics
- Lecture 9 - Logistics Key Performance Indicators (KPIs)
- Lecture 10 - Tools for Improving Logistics Efficiency
- Lecture 11 - Tools for Improving Logistics Efficiency (Continued...)
- Lecture 12 - Reverse Logistics
- Lecture 13 - Reverse Logistics (Continued...)
- Lecture 14 - Green Logistics
- Lecture 15 - Lean Logistics
- Lecture 16 - Lean Logistics (Continued...)
- Lecture 17 - Lean Logistics (Continued...)
- Lecture 18 - Trends in Logistics
- Lecture 19 - Trends in Logistics (Continued...)
- Lecture 20 - Logistics vs SCM
- Lecture 21 - Fundamentals of Supply Chain Management (SCM)
- Lecture 22 - SC Operations: Manufacturing versus Service SC
- Lecture 23 - Principle Streams of Supply Chain
- Lecture 24 - Principle Streams of Supply Chain
- Lecture 25 - Objectives of Supply Chain Networks
- Lecture 26 - Supply Chain Uncertainty and Processes
- Lecture 27 - Supply Chain Operational Views
- Lecture 28 - Supply Chain Models and Modelling Systems
- Lecture 29 - Supply Chain Drivers
- Lecture 30 - Supply Chain Drivers
- Lecture 31 - Supply Chain Impellers and Value Chain

- [Lecture 32 - Strategic Supply Chain Management](#)
- [Lecture 33 - Strategic Supply Chain Management \(Continued...\)](#)
- [Lecture 34 - Achieving Supply Chain Strategic Fit](#)
- [Lecture 35 - Achieving Supply Chain Strategic Fit \(Continued...\)](#)
- [Lecture 36 - Make or Buy Decision](#)
- [Lecture 37 - Strategic Sourcing](#)
- [Lecture 38 - Vendor Rating](#)
- [Lecture 39 - Supply Chain Coordination](#)
- [Lecture 40 - Supply Chain Performance: Balanced Scorecard Approach](#)
- [Lecture 41 - Supply Chain Performance: Balanced Scorecard Approach \(Continued...\)](#)
- [Lecture 42 - Importance of Distribution in Supply Chain](#)
- [Lecture 43 - Designing Distribution Networks in Supply Chain](#)
- [Lecture 44 - Facility Location Planning](#)
- [Lecture 45 - Demand Forecasting](#)
- [Lecture 46 - Capacity Planning](#)
- [Lecture 47 - Sequencing and Scheduling](#)
- [Lecture 48 - Transportation Management](#)
- [Lecture 49 - Transportation Problem Programming](#)
- [Lecture 50 - Transportation Problem Programming](#)
- [Lecture 51 - Assignment Problem Programming](#)
- [Lecture 52 - Inventory Management](#)
- [Lecture 53 - Inventory Management \(Continued...\)](#)
- [Lecture 54 - Supply Chain Digitalization: 21st Century Supply Chain](#)
- [Lecture 55 - Smart Supply Chains](#)
- [Lecture 56 - Robust and Resilient Supply Chain Design](#)
- [Lecture 57 - 21st Century Supply Chain](#)
- [Lecture 58 - Sustainable Supply Chain](#)
- [Lecture 59 - Emergency Supply Chain](#)
- [Lecture 60 - Assets Management in Supply Chain](#)

Lecture 1 - Introduction

Lecture 2 - Language Endangerment

Lecture 3 - Introducing Language Shift and Ethnolinguistic Vitality

Lecture 4 - More about Language Shift

Lecture 5 - Linguistic diversity, biodiversity and wellbeing

Lecture 6 - Assessing Language Vitality

Lecture 7 - Language Documentation

Lecture 8 - Language attitude and vitality

Lecture 9 - Evaluating Language Attitude

Lecture 10 - Designing Questionnaire - Part 1

Lecture 11 - Designing Questionnaire - Part 2

Lecture 12 - Documenting Oral Literature - Part 1

Lecture 13 - Documenting Oral Literature - Part 2

Lecture 14 - How to collect Ethnolinguistic Data?

Lecture 15 - Methods for Remote Data Collection

Lecture 16 - Metadata and Other related information

Lecture 17 - Different Approaches of Language Documentation

Lecture 18 - Challenges in the Indian field - Part 1

Lecture 19 - Challenges in the Indian field - Part 2

Lecture 20 - Best Practices in the Field: Dos and Don'ts

Lecture 21 - Issues related to Ethics

Lecture 22 - Sapir-Whorf hypothesis

Lecture 23 - Fieldwork Conversations: Challenges, Precautions and Solutions

Lecture 24 - Language documentation and the problem of standardization

Lecture 25 - Script and Language

Lecture 26 - Data Processing and IPA

Lecture 27 - IPA Transcription - Part I

Lecture 28 - IPA Transcription - Part II

Lecture 29 - IPA Transcription with Field Data

Lecture 30 - Glossing Rules

Lecture 31 - Language Revitalization

[Lecture 32 - Creating Dictionaries](#)

[Lecture 33 - Writing Grammar](#)

[Lecture 34 - Creating pedagogical material](#)

[Lecture 35 - More about the use of pedagogical material](#)

[Lecture 36 - Language Technology for Endangered Languages](#)

[Lecture 37 - Case Studies of Language Documentation from India](#)

[Lecture 38 - Language Documentation Across the World](#)

[Lecture 39 - Conclusion](#)

[Lecture 40 - Summing up](#)

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : Aspects of Western Philosophy (Humanities and Social Sciences)

Co-ordinators : Dr. Sreekumar Nellickappilly

Lecture 1 - Greek Philosophy: Ionians, Pythagoras, Parmenides, Heraclitus and Democritus

Lecture 2 - Sophists, Socrates; philosophy of man; relativism and subjectivism; the idea of good

Lecture 3 - Platos idealism: theory of ideas

Lecture 4 - Plato: theory of knowledge, method of dialectic; theory of soul

Lecture 5 - Aristotles criticism of Platonic idealism and the concepts of Form and Matter

Lecture 6 - Aristotles theory of causation; potentiality and actuality

Lecture 7 - Medieval philosophy: St. Augustine and the Problem of evil; St. Thomas Aquinass concepts of faith and reason; proofs for the existence of God.

Lecture 8 - Modern Philosophy: mail characteristic features; renaissance and scientific revolution; rationalism and empiricism: main features.

Lecture 9 - Descartes: the method in philosophy; the concepts of doubt and indubitable knowledge.

Lecture 10 - Descartes: the mind-body dualism; the concept of God and proofs for Gods existence

Lecture 11 - Spinoza: the concepts of Substance, attributes and modes.

Lecture 12 - Spinozas pantheism-God and nature

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NPTEL : NOC:Health Research Fundamentals (Humanities and Social Sciences)

Co-ordinators : Dr. P GaneshKumar, Dr. P. Manickam, Dr. Prabhdeep Kaur, Dr. Tarun Bhatnagar, Dr. R Ramakrishnan, Dr. Manoj V Murhekar, Dr. Sanjay Mehendale

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- Lecture 25 - Morphological Typology: Generalizations continued - Part 2
- Lecture 26 - Introduction to Phonetics - Part 1
- Lecture 27 - Introduction to Phonetics - Part 2
- Lecture 28 - Introduction to Phonetics and Speech sounds - Part 1
- Lecture 29 - Introduction to Phonetics and Speech sounds - Part 2
- Lecture 30 - Phonological typology - Part 1
- Lecture 31 - Phonological typology - Part 2

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DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Inclusion and Technology Design (Humanities and Social Sciences)

Co-ordinators : Prof. Bidisha

Lecture 1 - Introduction: Inclusive Digital Societies

Lecture 2 - Missing Women in Tech: Why Lack of Female Technologists Matters for Technology Design and Development?

Lecture 3 - Are Technologies Gender Neutral?

Lecture 4 - ICTs and Gender: Field Concerns and Project Management Approaches for Technology Design

Lecture 5 - The Political Nature of Technology Design

Lecture 6 - Accessibility Fundamentals

Lecture 7 - Accessibility Fundamentals: Disabilities, Guidelines, and Laws

Lecture 8 - Accessibility Fundamentals: Disabilities, Guidelines, and Laws

Lecture 9 - Designing an Assistive Technology Ecosystem: STEM Education for the Visually Impaired

Lecture 10 - Inclusion in Designing ICT for Development Projects: Who Should Matter - Part 1

Lecture 11 - ICTs in Agricultural Markets: Are they Inclusive

Lecture 12 - Inclusion in Designing ICT for Development Projects: Who Should Matter - Part 2

Lecture 13 - Digital Labour, Platforms and the Future of Work

Lecture 14 - Assignment Video: Design Jam

Lecture 15 - Assignment Examples Video: Students Presentations

- Lecture 1 - Energy as an Economic Resource - Introduction
- Lecture 2 - Energy as an Economic Resource - Classification of Energy Resource
- Lecture 3 - Energy as an Economic Resource - Measurement of Energy
- Lecture 4 - Energy as an Economic Resource - Energy Accounting
- Lecture 5 - Energy as an Economic Resource - Problem Discussion on Module 1
- Lecture 6 - Energy Demand - Part I - Basic concepts in Economics
- Lecture 7 - Energy Demand - Part I - Descriptive Analysis of Energy Demand
- Lecture 8 - Energy Demand - Part I - Decomposition Analysis and Parametric Approach
- Lecture 9 - Energy Demand - Part II - Demand Side Management
- Lecture 10 - Energy Demand - Part II - Load Management
- Lecture 11 - Energy Demand - Part II - Demand Side Management - Energy Efficiency
- Lecture 12 - Energy Demand - Part II - Rebound Effect
- Lecture 13 - Energy Supply - Part I - Supply Behaviour of a Producer
- Lecture 14 - Energy Supply - Part I - Energy Investment
- Lecture 15 - Energy Supply - Part I - Economics of Non-renewable Resources
- Lecture 16 - Energy Supply - Part II - Economics of Renewable Energy Supply Setting the context
- Lecture 17 - Energy Supply - Part II - Economics of Renewable Energy Supply - Part 1
- Lecture 18 - Energy Supply - Part II - Economics of Renewable Energy Supply - Part 2
- Lecture 19 - Energy Supply - Part II - Economics of Electricity Supply
- Lecture 20 - Energy Market - Perfect Competition as a Market Form
- Lecture 21 - Energy Market - Why Energy Market is not Perfectly Competitive?
- Lecture 22 - Energy Market - Market Failure and Monopoly
- Lecture 23 - Energy Market - Oil Market: Pre OPEC Era - I
- Lecture 24 - Energy Market - Oil Market: Pre OPEC Era - II
- Lecture 25 - Energy Market - Oil Market: OPEC
- Lecture 26 - Special Topics on Energy - Energy Security
- Lecture 27 - Special Topics on Energy - Energy Access
- Lecture 28 - Special Topics on Energy - Energy, Environment and Climate Change

Lecture 1 - THE GOTHIC - Literary Genre

Lecture 2 - Charles Dickens 'THE SIGNAL - MAN' - I - Close reading and the anxieties of the age

Lecture 3 - Charles Dickens 'THE SIGNAL - MAN' - II - Close reading and the anxieties of the age

Lecture 4 - Charles Dickens 'THE SIGNAL - MAN' - III - Close reading and the anxieties of the age

Lecture 5 - Charles Dickens 'THE SIGNAL - MAN' - IV - Close Reading and the anxieties of the age

Lecture 7 - Rudyard Kipling - My own true ghost story

Lecture 8 - Imperial Gothic - Major Characteristics

Lecture 9 - Rudyard Kipling 'My own true ghost story' - Close reading for implications of the imperial Gothic - I

Lecture 10 - Rudyard Kipling 'My own true ghost story' - Close reading for implications of the imperial Gothic - II

Lecture 12 - Arthur Conan Doyle - The Red-Headed League - I

Lecture 13 - Arthur Conan Doyle - The Red-Headed League - II

Lecture 14 - Arthur Conan Doyle - The Red-Headed League - III

Lecture 15 - Arthur Conan Doyle 'The Red-Headed League' - A Conversation

Lecture 16 - Arthur Conan Doyle 'The Red-Headed League' - Summary and Interview of the Author

Lecture 17 - H.G. WELLS 'THE RED ROOM' - Close Reading And Its Implications

Lecture 18 - H.G. WELLS 'THE RED ROOM' - Victorian Gothic

Lecture 19 - H.G. WELLS 'THE RED ROOM' - Close Reading And Its Ideological Implications

- Lecture 1 - Was mochten Sie dieses Semester machen?
- Lecture 2 - Wiederholung : Dativ und Präpositionen
- Lecture 3 - Wir lernen das Perfekt
- Lecture 4 - Wir üben das Perfekt
- Lecture 5 - Was hast du in den Ferien gemacht ?
- Lecture 6 - Farben und Kleidung
- Lecture 7 - Wir lernen Präpositionen
- Lecture 8 - Wir üben Präpositionen
- Lecture 9 - Präpositionen Akkusativ oder Dativ?
- Lecture 10 - Was bringt mir der Postbote?
- Lecture 11 - Gesundheit: Was fehlt Ihnen?
- Lecture 12 - Jeder freut sich
- Lecture 13 - Reflexiv - Akkusativ oder Dativ ?
- Lecture 14 - Lektion 1 und Witze und Faust
- Lecture 15 - Lektion 2, Präteritum von Modalverben, Ordinalzahlen
- Lecture 16 - Lektion 2; Detour -- Was ist Geschichte ? | Basic Tenses
- Lecture 17 - Was hast du nach der Schule gemacht?
- Lecture 18 - Lektion 3: Welche Medien hast du gestern benutzt?
- Lecture 19 - Komparativ und Superlativ
- Lecture 20 - dass-Sätze
- Lecture 21 - Wir wiederholen Komparativ und Superlativ
- Lecture 22 - Imperativ mit 'du' und 'ihr'
- Lecture 23 - Wir machen Lektion 5
- Lecture 24 - Adjektivdeklination
- Lecture 25 - Lektion 6 | Verkehr und Verkehrsmittel
- Lecture 26 - Welche Verkehrsmittel benutzt du ? | Indirekte Fragesätze
- Lecture 27 - Lektion 6 -- Aufgaben 4 und 6
- Lecture 28 - Lektion 7 -- Es geht ums Lernen
- Lecture 29 - Was hast du wann gelernt?
- Lecture 30 - Probleme beim Lernen | Verben mit dem Dativ
- Lecture 31 - Welche Probleme hast du beim Lernen ?

Lecture 32 - Perfekt von untrennbaren Verben | Wie löse ich meine Probleme beim Lernen ?

Lecture 33 - Ratschläge mit sollten | Sprache und Berufe | Wir lesen vor. (Lektion 7)

Lecture 34 - Exkurs ins Absurde! | Generationenprojekte (Lektion 7)

Lecture 35 - Generationenprojekte - wir hören die Texte

Lecture 36 - Welche Sportart möchtest du ausprobieren? | deshalb, trotzdem

Lecture 37 - Wiederholung Lektion 7 | Wir machen mit Lektion 8 weiter.

Lecture 38 - Woher entscheiden sich Sandra und Conny ? | Fragewort WO + Präposition

Lecture 39 - Alles über Fragewörter: mit und ohne Präpositionen

Lecture 40 - Eine Stadt entdecken | Wir beginnen Lektion 9

Lecture 41 - Lektion 9 | Interessante Häuser und Wohnungen

Lecture 42 - Lektion 9 | Die lieben Nachbarn

Lecture 43 - Lektion 9 | Höfliche Bitte | wenn und als

Lecture 44 - Lektion 9 | Wir üben als und wenn. | Sätze und Wortgruppen

Lecture 45 - Die Deutschen und ihre Haustiere

Lecture 46 - Wir beginnen Lektion 10 | Der Superlativ

Lecture 47 - Welche/r/s und Was für ein/e...

Lecture 48 - Lektion 10 | etwas, man, niemand, jemand...

Lecture 49 - Der Relativsatz | Wir machen Lektion 10 zu Ende

Lecture 50 - Wir machen Lektion 11. | K 2 - Verben und W-Fragen mit Präpositionen

Lecture 51 - Lektion 12 | Wir sind mit unserem Kurs fertig!

Lecture 1 - Herzlich willkommen!

Lecture 2 - Wie ist dein Name ?

Lecture 3 - Ich trinke gern Kaffee

Lecture 4 - Wir konjugieren die Verben

Lecture 5 - A bit of history and ZAHLEN

Lecture 6 - Verben, W-Fragen, Ja-Nein Fragen, Imperativ

Lecture 7 - das Alphabet, die Woche, das Jahr

Lecture 8 - Was sind deine Hobbys ? Formular ausfüllen

Lecture 9 - Mein Lehrbuch | Meine persönlichen Daten

Lecture 10 - Mein Arbeitsbuch

Lecture 11 - Wir beginnen Lektion 3

Lecture 12 - Wir lesen Lektion 3

Lecture 13 - Kein | Unregelmäßige Verben | Ein Lied

Lecture 14 - Wer ist das? | ich-mein; du-dein

Lecture 15 - Lektion 4 Guten Appetit!

Lecture 16 - Das Essen | Some revision

Lecture 17 - mag oder möchte | der Akkusativ

Lecture 18 - Ein Lesetext | die Uhr

Lecture 19 - die Uhrzeit | trennbare Verben

Lecture 20 - Familie und Possessiv

Lecture 21 - Wir machen Lektion 6 | Ordinalzahlen

Lecture 22 - Wie feierst du deinen Geburtstag?

Lecture 23 - der Akkusativ | ein Würfelspiel

Lecture 24 - das Kaffeehaus | die Kneipe | der Biergarten

Lecture 25 - Lektion 6: Freizeitprogramm

Lecture 26 - Sprache, Bundesländer, Städte | Wir beginnen Lektion 7

Lecture 27 - Akkusativ-Dativ | Annika im Büro | Wir machen Kaffee

Lecture 28 - Lektion 7 -- formeller Brief

Lecture 29 - Wie lernst du Deutsch ? Wir hören ein deutsches Lied

Lecture 30 - Wir lernen die Präpositionen

Lecture 31 - Hörverständnis | Wir beginnen Lektion 8

[Lecture 32 - Lektion 8 -- Haus-Wohnung-Möbel-Geräte](#)

[Lecture 33 - Extra Lektion on Modal Verbs](#)

[Lecture 34 - Eine E-Mail schreiben | Eine Wohnung beschreiben](#)

[Lecture 35 - Warum ist die Miete so hoch ? | Vorteile und Nachteile](#)

[Lecture 36 - Die neue Wohnung -- Was ist wo ? | Wechselpositionen](#)

[Lecture 37 - gefallen, gehen, passen, schmecken](#)

[Lecture 38 - Lektion 9 | Wir lernen das Perfekt](#)

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[Lecture 40 - Was hast du in den Ferien gemacht ?](#)

[Lecture 41 - Lektion 9 | Die Jobsuche](#)

[Lecture 42 - Lektion 9 | Telefongespräche](#)

[Lecture 43 - Im Kaufhaus | Welche/Diese](#)

[Lecture 44 - Lektion 11 | Körper und Gesundheit](#)

[Lecture 45 - Gesund und munter | Wir machen Lektion 11 zu Ende](#)

[Lecture 46 - Ab in den Urlaub | Wir machen Lektion 12](#)

Lecture 1 - Disability Definition: An Evolving Phenomenon

Lecture 2 - Medical Model of Disability

Lecture 3 - Social Model of Disability - Part 1

Lecture 4 - Social Model of Disability - Part 2

Lecture 5 - Stigma: A Universal Phenomenon

Lecture 6 - Stigma and Disability: What can we learn?

Lecture 7 - Ableism - Part 1

Lecture 8 - Ableism - Part 2

Lecture 9 - Disability Activism

Lecture 10 - Models of Disability Activism

Lecture 11 - Dependency

Lecture 12 - Interdependence

Lecture 13 - Blindness

Lecture 14 - Blindness as metaphor

Lecture 15 - Eugenics

Lecture 16 - Disability Pride

Lecture 17 - Disability Resilience

Lecture 18 - Disability Passing: The musings of the blue Jackal

Lecture 19 - Coming out: A performance in disability inhabitation

Lecture 20 - Assistive Technology: An interview with Prof. Madhusudan Rao

Lecture 21 - Disability and Ethnography: An Interview with Prof. James Staple

Lecture 22 - Schizophrenia: A Personal Account - An interview with Reshma Valliappan

Lecture 23 - Autism and the Indian Family: An interview with Dr. Shubhangi Vaidhya

Lecture 24 - Dyslexia and the Modern University: An Interview with Prof. Tanya Titchkosky

Lecture 25 - Gender and Disability: Interviews with Prof. Anita Ghai

Lecture 26 - Gender and Disability: Interviews with Prof. Nandini Ghosh

Lecture 27 - Lennard Davis, hemachandran karah, normal, normalcy, disability studies

Lecture 28 - The Normal and its End: Part 2

Lecture 29 - Literary Disability Studies: An Interview with Dr. Shilpa Anand

Lecture 30 - What is Deaf Culture? An Interview with Dr. Michele Friedner

Lecture 31 - Disability and Life Writing

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- Lecture 5 - Cinema and Semiotics - Seven (1995) - Part 1
- Lecture 6 - Cinema and Semiotics - Seven (1995) - Part 2
- Lecture 7 - Plot in Cinema - Part 1
- Lecture 8 - Plot in Cinema - Part 2
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- Lecture 10 - Plot in Cinema - Conflict as a Plot Element
- Lecture 11 - Character as a Plot Element - Part 1
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- Lecture 15 - Realism in Cinema - Part 1
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- Lecture 17 - Colour: Theory and Practice - Part 1
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- Lecture 19 - Intertextuality - Casablanca (1942) - Part 1
- Lecture 20 - Intertextuality - Casablanca (1942) - Part 2
- Lecture 21 - Intertextuality - Blade Runner (1982) - Part 1
- Lecture 22 - Intertextuality - Blade Runner (1982) - Part 2
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- Lecture 25 - Cinema and Modernism - Part 1
- Lecture 26 - Cinema and Modernism - Part 2
- Lecture 27 - Cinema and Modernism - Part 3
- Lecture 28 - Guest Lecture by Sudhish Kamath (Film Critic and Film Maker)
- Lecture 29 - The French Masters - Jean Renoir - Part 1
- Lecture 30 - The French Masters - Jean Renoir - Part 2
- Lecture 31 - The French Masters - Robert Bresson - Part 1

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NPTEL : NOC:United Nations Sustainable Development Goals (Humanities and Social Sciences)

Co-ordinators : Prof. Shiva Ji

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DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Essentials of Sports Injury Prevention and Rehabilitation (Humanities and Social Sciences)

Co-ordinators : Prof. Col (Dr) Anup Krishnan (Retd), Prof. Wg Cdr (Dr) CS Guru, Prof. Lt Col (Dr) Atul Sharma

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Lecture 2 - Rehabilitation and Reconditioning

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Lecture 5 - The Back In Sports

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- Lecture 21 - Exercise Prescription and Training principles - Part 1
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- Lecture 23 - Adaptations to aerobic and anaerobic training - Part 1
- Lecture 24 - Adaptations to aerobic and anaerobic training - Part 2
- Lecture 25 - Adaptations to aerobic and anaerobic training - Part 3
- Lecture 26 - Body temperature regulation
- Lecture 27 - Physiological response to Exercise in Heat and Cold
- Lecture 28 - Acclimation to Heat and Cold
- Lecture 29 - Health Risks during Exercise in Heat and Cold
- Lecture 30 - Exercise and Sports performance at Altitude
- Lecture 31 - Hydration and Fluid Balance - Part 1

[Lecture 32 - Hydration and Fluid Balance - Part 2](#)

[Lecture 33 - Body composition and its Implications - Part 1](#)

[Lecture 34 - Body composition and its Implications - Part 2](#)

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[Lecture 36 - Role of performance testing](#)

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DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Fundamentals of Sports Training, Load Management and Recovery (Humanities and Social Sciences)

Co-ordinators : Prof. Col (Dr) Anup Krishnan (Retd), Prof. Wg Cdr (Dr) CS Guru, Prof. Kaustubh Shedjale

Lecture 1 - Introduction to Fitness Vocabulary

Lecture 2 - Types of Fitness

Lecture 3 - Health Specific Fitness Acute Training variables - Part 1

Lecture 4 - Health Specific Fitness Acute Training variables - Part 2

Lecture 5 - Application of Acute Training variables

Lecture 6 - Principle of Training - 1

Lecture 7 - Principle of Training - 2

Lecture 8 - Principle of Training - 3

Lecture 9 - Periodization in sports - 1

Lecture 10 - Periodization in sports - 2

Lecture 11 - Concept of Load Training - 1

Lecture 12 - Concept of Load Training - 2

Lecture 13 - Concept of Load Training - 3

Lecture 14 - Load monitoring in Sports - 1

Lecture 15 - Load monitoring in Sports - 2

Lecture 16 - Aerobic Training Methods - 1

Lecture 17 - Aerobic Training Methods - 2

Lecture 18 - Aerobic Training Methods - 3

Lecture 19 - Anaerobic Training Method - 1

Lecture 20 - Anaerobic Training Method - 2

Lecture 21 - Load Monitoring Methods in HSF - 1

Lecture 22 - Load Monitoring Methods in HSF - 2

Lecture 23 - Load Monitoring Methods in SSF - 1

Lecture 24 - Load Monitoring Methods in SSF - 2

Lecture 25 - Load Monitoring Methods in SSF - 3

Lecture 26 - Fatigue in Sports Training

Lecture 27 - Overtraining and Overreaching

Lecture 28 - Diagnosis and management of OTS

Lecture 29 - Recovery in sports

Lecture 30 - Recovery Technique

Lecture 31 - Training Program Design - 1

[Lecture 32 - Training Program Design - 2](#)

[Lecture 33 - Training Program Design - 3](#)

[Lecture 34 - Training Program Design - 4](#)

[Lecture 35 - Training Program Design - 5](#)

[Lecture 36 - Technoloy in Performance Analysis](#)

[Lecture 37 - Technoloy in Performance Enchanmnet](#)

[Lecture 38 - Waerables in Sports](#)

[Lecture 39 - Future of technology in sports](#)

[Lecture 40 - Sports Training Technology and Innovation](#)

Lecture 1 - Introduction to Week 1

Lecture 2 - Evolution and concept of Linguistics

Lecture 3 - Defining Linguistics and its branches

Lecture 4 - The role of linguistics in understanding human communication

Lecture 5 - Application of linguistic theories in various fields

Lecture 6 - The Crucial Role of Linguistic Analysis in Legal Settings

Lecture 7 - Impact of Forensic Linguistics and Case Studie

Lecture 8 - Current Trends and Emerging Areas in Forensic Linguistics

Lecture 9 - Introduction to Week 2 - The Confluence of Language and Law

Lecture 10 - Exploring the Interplay Between Language and Law

Lecture 11 - Analysis of Courtroom Discourse

Lecture 12 - Impact of Linguistic Diversity on Legal Processes

Lecture 13 - Interdisciplinary Nature of Forensic Linguistics

Lecture 14 - Ethical Considerations in Forensic Linguistic Analysis

Lecture 15 - Impact on Understanding Legal and Cultural Contexts

Lecture 16 - Analysing Language as Vital Evidence in Legal Contexts

Lecture 17 - Challenges in Presenting Linguistic Evidence in Court

Lecture 18 - Introduction to Week 3

Lecture 19 - Illuminating Authorship Analysis and Its Nuances

Lecture 20 - Navigating Through Forensic Phonetics

Lecture 21 - Discourse Analysis: A Journey through Linguistic Structures

Lecture 22 - Exploring the Depths of Threat and Deception Analysis

Lecture 23 - Unveiling the Secrets of Language Profiling

Lecture 24 - Introduction to Week 4

Lecture 25 - Investigating Real-World Case Studies in Forensic Linguistics

Lecture 26 - Tackling the Challenges and Obstacles Within Forensic Linguistics

Lecture 27 - Upholding Ethics and Professionalism in Forensic Linguistics

Lecture 28 - Envisioning the Future: Prospective Pathways in Forensic Linguistics

Lecture 1 - Introduction to Hangeul

Lecture 2 - Introduction to Hangeul, Korean Consonants and Vowels

Lecture 3 - Features of Hangeul, Korean Consonants 1 and Vowels 1

Lecture 4 - Korean Vowels 2

Lecture 5 - Korean Consonants 2 and 3

Lecture 6 - Korean Vowels 3

Lecture 7 - Korean Batchim (ë°ì")

Lecture 8 - í•ë...í•ì,,ìš" Vocabulary, Grammar 1

Lecture 9 - í•ë...í•ì,,ìš" Grammar 2, Speaking 1

Lecture 10 - í•ë...í•ì,,ìš" Speaking 1, Grammar 3, 4

Lecture 11 - í•ë...í•ì,,ìš" Speaking 2, Self-Introduction

Lecture 12 - í•ë...í•ì,,ìš" Listening, Reading, Writing, Pronunciation, Culture Note, Self-Check

Lecture 13 - í•ë...í•ì,,ìš" Vocabulary, Grammar 1

Lecture 14 - í•ë...í•ì,,ìš" Grammar 2, Speaking 1

Lecture 15 - í•ë...í•ì,,ìš" Grammar 3, 4, Speaking 2

Lecture 16 - í•ë...í•ì,,ìš" Speaking 2, Listening

Lecture 17 - í•ë...í•ì,,ìš" Reading, Writing, Pronunciation, Self-Check

Lecture 18 - í•ë...í•ì,,ìš" Vocabulary, Grammar 1

Lecture 19 - í•ë...í•ì,,ìš" Grammar 2, Speaking 1

Lecture 20 - í•ë...í•ì,,ìš" Speaking 1, Grammar 3, 4

Lecture 21 - í•ë...í•ì,,ìš" Speaking 2, More practice

Lecture 22 - í•ë...í•ì,,ìš" Listening, Reading

Lecture 23 - í•ë...í•ì,,ìš" Writing, Pronunciation, Culture Note, Self-Check

Lecture 24 - í•ë...í•ì,,ìš" Vocabulary, Grammar 1

Lecture 25 - í•ë...í•ì,,ìš" Grammar 2, Speaking 1

Lecture 26 - í•ë...í•ì,,ìš" Speaking 1, Grammar 3, 4

Lecture 27 - í•ë...í•ì,,ìš" Exercise, Speaking 2

Lecture 28 - í•ë...í•ì,,ìš" Speaking 2, Listening, Reading

Lecture 29 - í•ë...í•ì,,ìš" Writing, Pronunciation, Culture Note, Self-Check

Lecture 30 - í•ë...í•ì,,ìš" Vocabulary, Grammar 1

Lecture 31 - í•ë...í•ì,,ìš" Grammar 2, Exercise, Speaking 1

Lecture 32 - [Lecture 32 - Speaking 1, Grammar 3](#)

Lecture 33 - [Lecture 33 - Grammar 4, Exercise, Speaking 2](#)

Lecture 34 - [Lecture 34 - Listening, Reading](#)

Lecture 35 - [Lecture 35 - Writing, Pronunciation, Culture Note, Self-Check](#)

Lecture 36 - [Lecture 36 - Vocabulary, Grammar 1](#)

Lecture 37 - [Lecture 37 - Grammar 2, Speaking 1](#)

Lecture 38 - [Lecture 38 - Speaking 1, Grammar 3](#)

Lecture 39 - [Lecture 39 - Grammar 3, 4, Exercise](#)

Lecture 40 - [Lecture 40 - Speaking 2, Listening](#)

Lecture 41 - [Lecture 41 - Reading, Writing, Pronunciation, Culture Note, Self-Check](#)

- Lecture 1 - A Brief Introduction To The Mahabharata
- Lecture 2 - A Brief Introduction To The Mahabharata Festivals Of Tamil Nadu
- Lecture 3 - The Idea Of The Chariot
- Lecture 4 - The Custodians Of The Festival
- Lecture 5 - The Festivals As Total Theatre
- Lecture 6 - Potturaja And The Anti-War Nature Of The Festival
- Lecture 7 - Kelai Draupadai (Listen Draupadi!) - Documentary
- Lecture 8 - A brief introduction to Koothu as a theatrical form
- Lecture 9 - Vil Valaippu, or The bending of the bow
- Lecture 10 - Draupadi Kalayanam or The Marriage ritual of Draupadi
- Lecture 11 - Subhadra Kalyanam
- Lecture 12 - Rajasuya Yaagam
- Lecture 13 - Draupadiyin Thugilum, Parandhamanin Arulum
- Lecture 14 - Arjuna's Tapas
- Lecture 15 - Kichaka Vadham
- Lecture 16 - Krishnan Thoodu
- Lecture 17 - Aravan Kalabali
- Lecture 18 - Karna Moksham
- Lecture 19 - Pathinettam Por or the Eighteenth Day's War
- Lecture 20 - Dharumarin Pattabhishekam and Ashwamedha Yaagam

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Lecture 2 - Contexts II : Humanism and its Critiques

Lecture 3 - Contexts III : the Environment and the Anthropocene

Lecture 4 - Transhumanism

Lecture 5 - Popular Posthumanism

Lecture 6 - Critical Posthumanism. Genealogies - 1 : New Materialisms

Lecture 7 - Critical Posthumanism. Genealogies - 2 : Human-Animal Studies - I

Lecture 8 - Critical Posthumanism. Genealogies - 2 : Human-Animal Studies - II

Lecture 9 - Critical Posthumanism. Genealogies - 3 : Consciousness and Cognition Studies

Lecture 10 - Critical Posthumanism. Genealogies - 4 : Feminist Epistemologies, Ethics and Posthumanism

Lecture 11 - Critical Posthumanism. Genealogies - 5 : Disability Studies

Lecture 12 - Posthuman Bodies: Cyborgs 1

Lecture 13 - Posthuman Bodies: Cyborgs 2 - Gender and Cyborgs

Lecture 14 - Posthuman Biology

Lecture 15 - Biotech, Biocapitalism and Posthuman Bodies/Biology - I

Lecture 16 - Biotech, Biocapitalism and Posthuman Bodies/Biology - II

Lecture 17 - Biopolitics and Biocapitalism in Contemporary Literature

Lecture 18 - The Question of the Nonhuman - I

Lecture 19 - The Question of the Nonhuman - II

Lecture 20 - Companion Species and Multispecies

Lecture 21 - Transcorporeal Trauma

Lecture 22 - Multispecies in Contemporary Literature

Lecture 23 - BioArt

Lecture 24 - Posthuman Performance Arts

Lecture 25 - Literary Posthumanisms I

Lecture 26 - Literary Posthumanisms 2 : Feminist Speculative Fiction

Lecture 27 - Literary Posthumanisms 3 : Group Discussion

Lecture 28 - Posthuman Subjects - I

Lecture 29 - Posthuman Subjects - II

Lecture 30 - Posthuman Subjects and Ethics - I

Lecture 31 - Posthuman Subjects and Ethics - II

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[Lecture 43 - Moral Enhancement and Contemporary Literature: Octavia Butler's Hyperempaths](#)

[Lecture 44 - Literary Posthumanism IV : Group Discussion](#)

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Lecture 2 - History and development of Popular Culture

Lecture 3 - Mass Culture

Lecture 4 - Sub Culture

Lecture 5 - Sub Cultures and Counterculture

Lecture 6 - History and Understanding of India Popular Culture

Lecture 7 - Implications of Cultural Studies in India

Lecture 8 - Desire for Cultural Studies in India

Lecture 9 - Iconography

Lecture 10 - Print Culture

Lecture 11 - Pre-history of Comics

Lecture 12 - Regional Comic Space and Web Comics

Lecture 13 - Cartoons - Emergence and History

Lecture 14 - Regional Space for Comics

Lecture 15 - Emergence of Graphic Narratives

Lecture 16 - Indian Cinema - History

Lecture 17 - Modernity and Popular

Lecture 18 - Globalization and Hindi Cinema

Lecture 19 - contemporary popular and Celebrity Culture

Lecture 20 - Celebrity Studies and Indian Cinema

Lecture 21 - Visual Narrative: Advertisements

Lecture 22 - Indianness after 1960s

Lecture 23 - Advertisement campaigns

Lecture 24 - Advertisements: Political influence of brands

Lecture 25 - Constructing the Indian Consumer

Lecture 26 - History of Television in India

Lecture 27 - Telefilms and Indian TV Serials

Lecture 28 - Television and OTT series for 21st Century

Lecture 29 - Benevolent Sexism on Screen

Lecture 30 - Ambivalent Sexism and Sexual Violence

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[Lecture 37 - Cyberculture and different types of digital divides, ethnographic methods](#)

[Lecture 38 - Features of Cyberculture and Cyberactivism](#)

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Lecture 3 - Simple interest

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Lecture 5 - Discrete annually compounding - I & II

Lecture 6 - Continuous compounding

Lecture 7 - Comparison of all compounding methods

Lecture 8 - Present value

Lecture 9 - Future Value

Lecture 10 - Annuities - I & II

Lecture 11 - Perpetuity

Lecture 12 - Amortization

Lecture 13 - Multiple cash flow - I & II

Lecture 14 - Valuation of bond - I & II

Lecture 15 - Valuation of ordinary shares

Lecture 1 - Introduction to course

Lecture 2 - Introduction to depreciation and Straight line method

Lecture 3 - Declining balance method

Lecture 4 - Double-declining balance method

Lecture 5 - Sum-of-the-digits method

Lecture 6 - Sinking fund method and Repair provision method

Lecture 7 - Accelerated cost recovery method - I

Lecture 8 - Accelerated cost recovery method - II

Lecture 9 - Introduction to alternate investment: Annual cost method-I

Lecture 10 - Introduction to alternate investment: Annual cost method

Lecture 11 - Present worth method

Lecture 12 - Rate of return method

Lecture 13 - Incremental rate of return

Lecture 14 - Perpetuity method

Lecture 15 - Minimum return as cost

Lecture 16 - Introduction to profitability analysis and Payback period

Lecture 17 - Return on investment

Lecture 18 - Net Return

Lecture 19 - Discounted cash flow - I

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Lecture 2 - Aspects of Soft Skills

Lecture 3 - Effective Communication Skills

Lecture 4 - Classification of Communication

Lecture 5 - Personality Development

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Lecture 7 - Telephonic Communication Skills - Part I

Lecture 8 - Telephonic Communication Skills - Part II

Lecture 9 - Communicating Without Words

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Lecture 11 - Proxemics

Lecture 12 - Haptics: The Language of Touch

Lecture 13 - Meta-communication

Lecture 14 - Listening Skills

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Lecture 19 - Communicating across Cultures

Lecture 20 - Organizational Communication

Lecture 21 - Communication Breakdown - Part I

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Lecture 23 - Advanced Writing Skills

Lecture 24 - Principles of Business Writing

Lecture 25 - Types of Business Writing - Part I

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Lecture 28 - Business Letters: Format and Style

Lecture 29 - Types of Business Letters - Part I

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- Lecture 32 - Types of Reports
- Lecture 33 - Strategies for Report Writing - Part I
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- Lecture 35 - Evaluation and Organization of Data
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- Lecture 38 - Report Style - Part I
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- Lecture 40 - Group Communication
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- Lecture 47 - Oral Presentations, Speeches, and Debates
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- Lecture 54 - Planning and Preparation - Part I
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- Lecture 56 - Drafting an Effective Résumé
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- Lecture 59 - Emotional Intelligence and Critical Thinking
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Lecture 8 - Rapport

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Lecture 10 - Useful NLP Techniques

Lecture 11 - Presuppositions of NLP

Lecture 12 - Four Stages of Competence

Lecture 13 - Metacognition

Lecture 14 - Outcome and Ecology

Lecture 15 - Introducing Frames : Outcome and Ecology

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Lecture 18 - Emotionality

Lecture 19 - Stage Fear - I

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Lecture 5 - Literature, Culture and Media

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Lecture 7 - Cultural Studies I: Raymond Williams

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Lecture 19 - Men's and Masculinity Studies

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Lecture 6 - Haptics - I

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Lecture 8 - Kinesics: Types and Contexts

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Lecture 10 - Macro and Micro Facial Expressions

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Lecture 12 - Cultural Differences in Smiles; Head Nods

Lecture 13 - Hand Movements

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Lecture 23 - Reducing Stage Fright - 1

Lecture 24 - Reducing Stage Fright - 2

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Lecture 33 - Damage Costs/Costs of Illness and Lost Output Approach

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Lecture 37 - Market Efficiency and Optimality - I

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Co-ordinators : Dr. Varadraj Bapat

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Co-ordinators : Dr. Trupti Mishra

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- Lecture 4 - Social Entrepreneurship
- Lecture 5 - Comparison of Various Planned Change Models
- Lecture 6 - Diagnostic for Organization Development and Change
- Lecture 7 - Steps in Successful Organizational Change
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- Lecture 9 - Individual Level OD Interventions: A Rationale
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- Lecture 65 - Seasons with Revolving Sun and Impact on Physiology
- Lecture 66 - Contemporary Knowledge about Food and Mental Health
- Lecture 67 - Food and Activities during the Cycle of the Day
- Lecture 68 - Yogasanas to Integrate Body and Emotions
- Lecture 69 - Interoception, Asanas and Well-Being
- Lecture 70 - Characteristics of Asanas
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- Lecture 72 - Asanas for Different Body Constitution
- Lecture 73 - Notes on Pranayama
- Lecture 74 - Contemporary Evidences of Prana
- Lecture 75 - Prana Vayu, Nadi System and Chakras
- Lecture 76 - Pranayama Practices and Conscious Breathing
- Lecture 77 - Process and Benefits of Diaphragmatic Breathing
- Lecture 78 - Guidelines for Pranayama
- Lecture 79 - Nadi Shodhana Pranayama (Alternate Nostril Breathing)
- Lecture 80 - Tranquilizing Pranayamas
- Lecture 81 - Organizational Suffering and Dysfunctional Behaviors
- Lecture 82 - Introduction to Pratyahara
- Lecture 83 - Indriya-Pratyahara: Control of the Senses
- Lecture 84 - Methods of Pratyahara
- Lecture 85 - Understanding Emotional Intelligence
- Lecture 86 - Emotional Intelligence and its Relation to Everyday Behavior
- Lecture 87 - How Yoga Helps in Emotional Balance
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- Lecture 92 - What Yoga does for Balancing Emotions and Cognitions
- Lecture 93 - How Yoga Impacts Student's Performance: Empirical Studies

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- Lecture 2 - Fundamentals of Supply Chain Management
- Lecture 3 - Supply Chain Drivers
- Lecture 4 - Supply Chain Processes - I
- Lecture 5 - Supply Chain Processes - II
- Lecture 6 - Supply Chain Challenges
- Lecture 7 - Need/Strategies
- Lecture 8 - Push Vs Pull
- Lecture 9 - Case Study on Product Segmentation
- Lecture 10 - Case Study on Inventory Segmentation
- Lecture 11 - Link between Corporate and Supply Chain Strategy
- Lecture 12 - Interface between Operations and Finance
- Lecture 13 - Procurement Strategy (Make Vs Buy)
- Lecture 14 - Procurement Strategy (Kraljic Matrix) - I and II
- Lecture 15 - Procurement Strategy (Kraljic Matrix) - I and II
- Lecture 16 - Introduction to Platform Economy
- Lecture 17 - Introduction to Platform Economy - Example
- Lecture 18 - Introduction to Channel Structures and Supply Chain Coordination
- Lecture 19 - Newsvendor Case Example (Deterministic Setting) - I and II
- Lecture 20 - Newsvendor Case Example (Deterministic Setting) - I and II
- Lecture 21 - Newsvendor Case (Probabilistic Setting and Contracts) - I and II
- Lecture 22 - Newsvendor Case (Probabilistic Setting and Contracts) - I and II
- Lecture 23 - Channel Structure Designs in Supply Chains (Brick and Mortar)
- Lecture 24 - Channel Structure Designs in Supply Chains (Dual Channels)
- Lecture 25 - Channel Structure Designs in Supply Chains (Multi and Omni Channels)
- Lecture 26 - Introduction to Analytics and Big Data
- Lecture 27 - Different Types of Analytics and its Applications in Supply Chain Management
- Lecture 28 - Predictive Analytics: Case Study on Predictive Maintenance
- Lecture 29 - Predictive Analytics: Classification Tree Model
- Lecture 30 - Predictive Analytics: Building Classification Tree Model using Python
- Lecture 31 - Role of AI/ML in Forecasting and Demand Analytics

- Lecture 32 - Demand Forecasting using AI/ML: A Case Study
- Lecture 33 - Demand Forecasting using AI/ML: Regression Tree Model
- Lecture 34 - Demand Forecasting using AI/ML: Building Regression Tree Model using Python
- Lecture 35 - Demand Forecasting using AI/ML: Random Forest Regression Model
- Lecture 36 - Supply Chain Network Optimization: Break even analysis
- Lecture 37 - Supply Chain Network Optimization: Facility location using Centre of Gravity
- Lecture 38 - Supply Chain Network Optimization: Case on Capacitated Plant Location Model
- Lecture 39 - Case on Supply Chain Network Design - I
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- Lecture 41 - Location of Distribution Centers using Clustering Technique: A Case Study
- Lecture 42 - Steps of building K-Means Clustering Algorithm: A Case Study
- Lecture 43 - Location of Distribution Centers: Building K-Means Clustering Model using Python
- Lecture 44 - Measuring Efficiency of Manufacturing Facilities: A DEA Model - I
- Lecture 45 - Measuring Efficiency of Manufacturing Facilities: A DEA Model - II
- Lecture 46 - Role of Product Tracking and Traceability
- Lecture 47 - Track and Trace Systems - I and II
- Lecture 48 - Track and Trace Systems - I and II
- Lecture 49 - ERP, WMS and TMS - I and II
- Lecture 50 - ERP, WMS and TMS - I and II
- Lecture 51 - Introduction to Supply Chain Digital Twin
- Lecture 52 - Supply Chain Digital Twin: Greenfield Analysis - A Case Study - I
- Lecture 53 - Supply Chain Digital Twin: Greenfield Analysis - A Case Study - II
- Lecture 54 - Supply Chain Digital Twin: Network Optimization - A Case Study
- Lecture 55 - Network Optimization with Capacity Constraints and Control Tower
- Lecture 56 - Digital Infrastructure for Supply Chains: Industry 4.0
- Lecture 57 - Industry 4.0 - IIoT, Cloud Computing, Horizontal and Vertical System Integration
- Lecture 58 - Industry 4.0 - Cybersecurity, Big Data Analytics, Simulation, AR, Robots, AM
- Lecture 59 - Blockchain
- Lecture 60 - Supply Chain and Industry 4.0

Lecture 1 - Introduction to Business Forecasting

Lecture 2 - Data Driven Decision Making and Essentials of Predictive Analytics

Lecture 3 - Data Driven Decision Making and Essentials of Predictive Analytics

Lecture 4 - Types of Forecasting: Qualitative Approaches and Quantitative Approaches

Lecture 5 - Components of a Time Series and Measures of Forecast Accuracy

Lecture 6 - Components of a Time Series and Measures of Forecast Accuracy

Lecture 7 - Moving Average Methods: Simple, Weighted, and Exponential Moving Average

Lecture 8 - Moving Average Methods: Simple, Weighted, and Exponential Moving Average

Lecture 9 - Exponential Smoothing

Lecture 10 - Trend Projections and Holt Model

Lecture 11 - Simple Linear Regression and Measure of Goodness and Standard Error

Lecture 12 - Simple Linear Regression and Measure of Goodness and Standard Error

Lecture 13 - Simple Linear Regression and Measure of Goodness and Standard Error

Lecture 14 - Multiple Linear Regression and Multicollinearity

Lecture 15 - Multiple Linear Regression and Multicollinearity

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Lecture 17 - Seasonality, Seasonal Index, and Quarterly Average Method

Lecture 18 - Seasonality, Seasonal Index, and Quarterly Average Method

Lecture 19 - Seasonality and Trend: Winter's Holt Method

Lecture 20 - Seasonality and Trend: Winter's Holt Method

Lecture 21 - Multiplicative Decomposition Method

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Lecture 23 - ARIMA: Auto-Regressive (AR) Process

Lecture 24 - ARIMA: Moving Average (MA) Process

Lecture 25 - ARIMA: Auto-Regressive Moving Average (ARMA) Process

Lecture 26 - Auto-Regressive Integrated Moving Average (ARIMA) Model

Lecture 27 - Introduction to Machine Learning

Lecture 28 - Introduction to Machine Learning

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Lecture 31 - Human Judgment in Time Series Analysis

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[Lecture 33 - Monte Carlo Simulation: Discrete Case](#)

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NPTEL : NOC:Business Fundamentals for Entrepreneurs (Part 2: External Operation) (Management)

Co-ordinators : Prof. Devdip Purkayastha

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[Lecture 11 - B2B and B2C Selling - Part 1](#)

[Lecture 12 - B2B and B2C Selling - Part 2](#)

[Lecture 13 - Customer Service Management - Part 1](#)

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[Lecture 15 - Supply Chain Management - Part 1](#)

[Lecture 16 - Supply Chain Management - Part 2](#)

[Lecture 17 - Quadrangle of Success](#)

NPTEL : Organisation Management (Management)

Co-ordinators : Prof. Vinayshil Gautam

- Lecture 1 - Introduction to Organization Management,Nature, Scope and Complexity
- Lecture 2 - Longitudinal thinking and legacy factor:Organizational Growth
- Lecture 3 - Longitudinal thinking and legacy factor:Organizational Growth (Continued...)
- Lecture 4 - Longitudinal thinking and legacy factor:Organizational Growth (Continued...)
- Lecture 5 - Theory and majors schools of Thought and Framework of Organizational Analysis
- Lecture 6 - Theory and majors schools of thought and framework of organizational analysis (Continued...)
- Lecture 7 - Theory and majors schools of thought and framework of organizational analysis (Continued...)
- Lecture 8 - Systems contingency approach to organization theory and practice; techniques of organizational diagnosis
- Lecture 9 - Systems contingency approach to organization theory and practice; techniques of organizational diagnosis (Continued...)
- Lecture 10 - Systems contingency approach to organization theory and practice; techniques of organizational diagnosis (Continued...)
- Lecture 11 - Theory of organizational structures - nature and consequence of structure
- Lecture 12 - Theory of organizational structures - nature and consequence of structure (Continued...)
- Lecture 13 - Socio-culture dimension of work and behavior
- Lecture 14 - Socio-culture dimension of work and behavior (Continued...)
- Lecture 15 - Socio-culture dimension of work and behavior (Continued...)
- Lecture 16 - Impact of environment and cultural variables on organization structure & style
- Lecture 17 - Impact of environment and cultural variables on organization structure & style (Continued...)
- Lecture 18 - Impact of environment and cultural variables on organization structure & style (Continued...)
- Lecture 19 - Organization Change and Organisation Development
- Lecture 20 - Organization Change and Organisation Development (Continued...)
- Lecture 21 - Intervention strategies for organization development - individual, Group and Interpersonal Interventions
- Lecture 22 - Intervention strategies for organization development - individual, Group & interpersonal interventions (Continued...)
- Lecture 23 - Intervention strategies for organization development - individual, Group & interpersonal interventions (Continued...)
- Lecture 24 - Total System Intervention & Stabilizing Change Management by Objectives
- Lecture 25 - Total System Intervention & Stabilizing Change Management by Objectives (Continued...)
- Lecture 26 - Total System Intervention & Stabilizing Change Management by Objectives (Continued...)
- Lecture 27 - Nature of Organisational Processes
- Lecture 28 - Nature of Organisational Processes (Continued...)
- Lecture 29 - Nature of Organisational Processes (Continued...)
- Lecture 30 - Environmental analysis Techniques and impact for organizational growth
- Lecture 31 - Environmental analysis Techniques and impact for organizational growth (Continued...)

[Lecture 32 - Environmental analysis Techniques and impact for organizational growth \(Continued...\)](#)

[Lecture 33 - Issues of Mechnisation, Automation and Computerisation](#)

[Lecture 34 - Issues of Mechnisation, Automation and Computerisation \(Continued...\)](#)

[Lecture 35 - Organisation Interdependence](#)

[Lecture 36 - Organisation Interdependence \(Continued...\)](#)

[Lecture 37 - Organisation Interdependence \(Continued...\)](#)

[Lecture 38 - Organisation Evaluation](#)

[Lecture 39 - Organisation Evaluation \(Continued...\)](#)

[Lecture 40 - Organisation Evaluation \(Continued...\)](#)

- Lecture 1 - Introduction to the subject and the course
- Lecture 2 - Understanding organizations: nature and functions
- Lecture 3 - Understanding organizations: nature and functions (Continued...)
- Lecture 4 - Concerns of organising engineering business and systems
- Lecture 5 - Concerns of organising engineering business and systems (Continued...)
- Lecture 6 - Concerns of organising engineering business and systems (Continued...)
- Lecture 7 - Structure and process issues in running organisations
- Lecture 8 - Structure and process issues in running organisations (Continued...)
- Lecture 9 - Design issues in running organisations
- Lecture 10 - Design issues in running organisations (Continued...)
- Lecture 11 - Operating organizations
- Lecture 12 - Operating organizations (Continued...)
- Lecture 13 - Operating organizations (Continued...)
- Lecture 14 - Cybernetics and systems framework
- Lecture 15 - Cybernetics and systems framework (Continued...)
- Lecture 16 - Socio-technical systems
- Lecture 17 - Socio-technical systems (Continued...)
- Lecture 18 - Socio-technical systems (Continued...)
- Lecture 19 - Dealing with efficiency and excellence
- Lecture 20 - Dealing with efficiency and excellence (Continued...)
- Lecture 21 - Dealing with efficiency and excellence (Continued...)
- Lecture 22 - Man-machine relationship
- Lecture 23 - Man-machine relationship (Continued...)
- Lecture 24 - Longitudinal Thinking
- Lecture 25 - Longitudinal Thinking (Continued...)
- Lecture 26 - Concerns of recruitment, selection, skill formation and redeployment
- Lecture 27 - Concerns of recruitment, selection, skill formation and redeployment (Continued...)
- Lecture 28 - Concerns of recruitment, selection, skill formation and redeployment (Continued...)
- Lecture 29 - Developing teams and leadership
- Lecture 30 - Developing teams and leadership (Continued...)
- Lecture 31 - Understanding motivation

[Lecture 32 - Understanding motivation \(Continued...\)](#)

[Lecture 33 - Elements of human resources planning](#)

[Lecture 34 - Elements of human resources planning \(Continued...\)](#)

[Lecture 35 - Elements of human resources planning \(Continued...\)](#)

[Lecture 36 - Indian Industrial Law and managing industrial](#)

[Lecture 37 - Indian Industrial Law and managing industrial \(Continued...\)](#)

[Lecture 38 - Indian Industrial Law and managing industrial \(Continued...\)](#)

- Lecture 1 - Concepts of Economic Growth and Development
- Lecture 2 - Structural features of developed and underdeveloped countries
- Lecture 3 - The Global North and the Global South: Why the Divide?
- Lecture 4 - Growth versus Development - some indices of economic development
- Lecture 5 - Modern Economic Growth
- Lecture 6 - Strategies of economic development and growth - I
- Lecture 7 - Strategies of economic development and growth - II
- Lecture 8 - Strategies of economic development and growth - III
- Lecture 9 - Strategies of economic development and growth - IV
- Lecture 10 - Strategies of economic development and growth - V
- Lecture 11 - Strategies of economic development and growth - VI
- Lecture 12 - Growth and Inequality
- Lecture 13 - Economic Growth and Public Support
- Lecture 14 - Measures of Inequality
- Lecture 15 - Introduction to Human Development-Putting People First
- Lecture 16 - The Human Development and Capability Approach
- Lecture 17 - Utilitarianism, Basic Needs Approach and the Capability Approach
- Lecture 18 - Measuring Human Development - I
- Lecture 19 - Measuring Human Development - II
- Lecture 20 - Other Human Development Indices
- Lecture 21 - Multidimensional Poverty, MDGs and SDGs
- Lecture 22 - Gender mainstreaming and Gender budgeting
- Lecture 23 - In Conclusion

Lecture 1 - Understanding organizational behaviour:Tracing the evolution - 1

Lecture 2 - Understanding organizational behaviour:Tracing the evolution - 2

Lecture 3 - Individual in the organization: The building blocks

Lecture 4 - Understanding individual differences - 1

Lecture 5 - Understanding individual differences - 2

Lecture 6 - Diverse workforce, inclusive mindset - 1

Lecture 7 - Diverse workforce, inclusive mindset - 2

Lecture 8 - Perception of diversity and inclusion

Lecture 9 - Ableism and inclusion

Lecture 10 - Diversity management

Lecture 11 - The perceptual process

Lecture 12 - Factors that influence perception

Lecture 13 - Perception and decision making

Lecture 14 - What affects decisions?

Lecture 15 - Ethical decision making

Lecture 16 - Affect and emotions

Lecture 17 - Affective events theory

Lecture 18 - Emotional intelligence

Lecture 19 - Understanding stress

Lecture 20 - Emotions and moods: Application at workplace

Lecture 21 - Understanding self and personality

Lecture 22 - Types and theories of personality

Lecture 23 - Measuring personality

Lecture 24 - Personality traits relevant to organization

Lecture 25 - Assessing personality: caveats and concerns

Lecture 26 - Values and its importance

Lecture 27 - Sources and types of values

Lecture 28 - Values that cut across cultures

Lecture 29 - Person-job fit

Lecture 30 - Person-organization fit

Lecture 31 - Motivation: Basic understanding and definition

- Lecture 32 - Tracing the roots: Early theories - 1
- Lecture 33 - Tracing the roots: Early theories - 2
- Lecture 34 - Keeping up with times: Contemporary theories - 1
- Lecture 35 - Keeping up with times: Contemporary theories - 2
- Lecture 36 - Job Design and job characteristics model
- Lecture 37 - Employee involvement
- Lecture 38 - Motivating the employees: Strategies for organization - 1
- Lecture 39 - Motivating the employees: Strategies for organization - 2
- Lecture 40 - Organizational justice and employee motivation
- Lecture 41 - Defining learning
- Lecture 42 - How do individuals learn?
- Lecture 43 - Theories of learning - 1
- Lecture 44 - Theories of learning - 2
- Lecture 45 - Learning in an organizational setting
- Lecture 46 - Understanding creativity
- Lecture 47 - Stages of individual creativity
- Lecture 48 - Creativity and problem solving
- Lecture 49 - Defining psychological capital
- Lecture 50 - Using Psychological capital and mindfulness at work
- Lecture 51 - Understanding knowledge sharing
- Lecture 52 - Understanding knowledge hiding - what it is and what it is not
- Lecture 53 - Individual factors affecting knowledge hiding
- Lecture 54 - Integrating knowledge sharing and hiding behavior
- Lecture 55
- Lecture 56 - Understanding employee voice and silence
- Lecture 57 - Individual factors affecting voice behavior
- Lecture 58 - Individual factors affecting silence
- Lecture 59 - Can silence be strategic?
- Lecture 60 - Strategies for fostering safe environment at work

- Lecture 1 - Background, IR in the post-independence period, functions of IR
- Lecture 2 - Approaches towards IR, models of IR
- Lecture 3 - Introduction to trade unions, labour legislations, worker's participation
- Lecture 4 - Employers' Federation and their role in IR
- Lecture 5 - Salient features of IR in India
- Lecture 6 - Birth and evolution of the trade union movement in India
- Lecture 7 - Objectives, Theories, Bases of TUs
- Lecture 8 - TU federations, Presence of local TUs, Reasons for growth, Compulsory Unionism
- Lecture 9 - Trade Unions Act 1926: Aim, scope, registration, Rights and Responsibilities of TUs
- Lecture 10 - Size and Finance of TUs, TU rivalry and recognition
- Lecture 11 - Industrial Disputes: Meaning, Causes, Interests and Right Disputes
- Lecture 12 - Strikes ,Forms, and Effects of Strike
- Lecture 13 - Industrial Dispute Act 1947: Disputes Settlement Machineries
- Lecture 14 - Statutory and Non-Statutory measures of Settlement
- Lecture 15 - Collective Bargaining : Importance, Theories, Hurdles to CB in India
- Lecture 16 - Introduction, objectives, classifications
- Lecture 17 - Intra mural labour welfare services
- Lecture 18 - Extra mural labour welfare services
- Lecture 19 - Evolution of social security measures, Mention of welfare provisions of few labour laws
- Lecture 20 - Social Security, Convention (No.102) ILO
- Lecture 21 - Social security legislations: Evolution and Growth
- Lecture 22 - Provision for old age and against unemployment and Gratuity, existing social security laws
- Lecture 23 - Issues in Labour Welfare and Social Security, Review of welfare amenities
- Lecture 24 - Role of Welfare officer, problems in enforcement of welfare amenities
- Lecture 25 - Employees Compensation Act 1923: Occupational diseases, Compensation
- Lecture 26 - Right to compensation in presence of Employees' State Insurance Act
- Lecture 27 - Evolution of Provident Fund legislation in India, Central Government Health Scheme, 1954
- Lecture 28 - Employees Provident Fund and Miscellaneous Provisions Act, 1952: scope, definitions
- Lecture 29 - Employees' Provident Fund, Deposit Linked Insurance Schemes
- Lecture 30 - Employee Pension Scheme 1995, Miscellaneous Provisions
- Lecture 31 - Payment of Gratuity Act 1972: Enactment, Scope and Coverage

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Lecture 32 - Payment of Gratuity Act 1972: Main Provisions, Compulsory Insurance, Other Provisions

Lecture 33 - Maternity Benefit Act 1961: Growth, Definitions, Main Provisions, and Other Provisions

Lecture 34 - Child labour (Prohibition& Regulation)Act,1986: Objectives

Lecture 35 - Prohibition of Employment and Regulation of Conditions of children in certain occupations

Lecture 36 - Central Board of Workers' Education Scheme : Rational, Schemes, Composition of Board

Lecture 37 - Five Year Plans and Workers' Education

Lecture 38 - Factories Act 1948: definitions, authorities

Lecture 39 - Health, safety, provisions relating to hazardous processes

Lecture 40 - Welfare, working hours of adults

Lecture 41 - Employment of young persons, annual leave with wages and Penalties and procedure,other provisions

Lecture 42 - Payment of Wages Act, 1936: Objective, Scope

Lecture 43 - Wage legalities, Authorized deductions, miscellaneous provisions

Lecture 44 - Minimum Wages Act 1948: Scope, Fixation of minimum wages

Lecture 45 - Procedure for fixing minimum wages, mode of payment, miscellaneous provisions

Lecture 46 - Equal Remuneration Act 1976: Scope, definations, provisions

Lecture 47 - Workers' Participation in Management

Lecture 48 - Degree and Forms of Labour Participation

Lecture 49 - Workers Committee, Joint management Councils

Lecture 50 - Employee's Participation in PSUs Participation in Private sector

Lecture 51 - The participation of workers in Management Bill 1990

Lecture 52 - Labour Welfare and Industrial Relations: Case Laws

Lecture 53 - Introduction, Labour reforms undertaken

Lecture 54 - Code on Wages 2019

Lecture 55 - Occupational Safety, Health and Working Conditions Code, 2020

Lecture 56 - Industrial Relations Code, 2020

Lecture 57 - Code on Social Security, 2020

Lecture 58 - Labour Welfare and Industrial Relations: A Bird's Eye View

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Lecture 1 - Introduction Examples: Markets / Politics / Auctions

Lecture 2 - Prisonersâ€™ Dilemma

Lecture 3 - Best Response and Nash Equilibrium

Lecture 4 - Another Example: Markets

Lecture 5 - Dominant Strategies

Lecture 6 - Stag Hunt â€™ Coordination and Bank Runs

Lecture 7 - Battle of Sexes and Multiple Nash Equilibria

Lecture 8 - Tragedy of Commons

Lecture 9 - Tragedy of Commons

Lecture 10 - Cournot Duopoly

Lecture 11 - Cournot Duopoly

Lecture 12 - Mixed Strategies

Lecture 13 - Battle of Sexes

Lecture 14 - Battle of Sexes: Best Response Dynamic

Lecture 15 - Paying Taxes

Lecture 16 - Portfolio Management Game

Lecture 17 - Rationality, Choice and Common Knowledge

Lecture 18 - Iterated Elimination of Domination Strategies

Lecture 19 - Auction

Lecture 20 - Auction: As a Normal Form Game

Lecture 21 - Traffic at Equilibrium and Braess Paradox

Lecture 22 - Linear Markets

Lecture 23 - Extensive Form Games

Lecture 24 - Game Tree and Information Sets

Lecture 25 - Strategies in Extensive form Games

Lecture 26 - Extensive form Games with Simultaneous Moves and Their Normal Form Representation

Lecture 27 - Sub Game Perfect Equilibrium Part-I

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NPTEL : NOC:Managing Services (Management)

Co-ordinators : Prof. Jayanta Chatterjee

- Lecture 1 - What is Service?
- Lecture 2 - Evolving Service Markets
- Lecture 3 - The Service Customers
- Lecture 4 - Product Service Systems
- Lecture 5 - The Service Act
- Lecture 6 - Seamless Service
- Lecture 7 - Service Management Elements
- Lecture 8 - Core Vs. Supplementary Services
- Lecture 9 - Intangibility of Services
- Lecture 10 - Response to IHIP Challenges
- Lecture 11 - Process & Promotion
- Lecture 12 - Process Issues in Service
- Lecture 13 - Challenges of Services-1
- Lecture 14 - Service Uniqueness-2
- Lecture 15 - Consumer in the Services Flow-1
- Lecture 16 - Service Consumer Behavior-2
- Lecture 17 - Customer Co Creation of Services-1
- Lecture 18 - Customer Co Creation of Services-2
- Lecture 19 - Current Service Map to New Service Design
- Lecture 20 - Current Service Map to New Service Design.
- Lecture 21 - Case Study on Service Excellence-1
- Lecture 22 - Case Study on Service Excellence-2
- Lecture 23 - Services Excellence - Culture
- Lecture 24 - People in Services
- Lecture 25 - Position - Value Proposition-1
- Lecture 26 - Position - Value Proposition-2
- Lecture 27 - Branding Services-1
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NPTEL : NOC:Quantitative Finance (Management)

Co-ordinators : Dr. Raghu Nandan Sengupta

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NPTEL : NOC:Marketing Management-II (Management)

Co-ordinators : Prof. Jayanta Chatterjee, Dr. Shashi Shekhar Mishra

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NPTEL : NOC:Project Management (Management)

Co-ordinators : Prof. Raghunandan Sengupta

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- Lecture 7 - Six Sigma Overview
- Lecture 8 - DMAIC for Problem Solving
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- Lecture 13 - CPM, PDPC and Introduction To House of Quality
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- Lecture 20 - Basic Understanding of R and Introduction to Control Charts
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- Lecture 2 - Theoretical Foundations I Competitive Strategy
- Lecture 3 - Theoretical Foundations II Product Strategy
- Lecture 4 - Theoretical Foundations III Understanding Customer Behaviour
- Lecture 5 - Theoretical Foundations IV Product Life Cycle (PLC) and Chasm
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- Lecture 8 - STP continued
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- Lecture 20 - The Business Model Canvas
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NPTEL : NOC:Total Quality Management-II (Management)

Co-ordinators : Prof. Raghunandan Sengupta

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Lecture 7 - Marshallian Consumer Theory (Continued...)

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Lecture 36 - Cost Minimization Analysis and Cost Effectiveness Analysis

Lecture 37 - Cost-utility Analysis

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Lecture 9 - Basic Simulation terms and Illustrative examples

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NPTEL : NOC:Management of Field Sales (Management)

Co-ordinators : Prof. Jayanta Chatterjee

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Lecture 12 - Loss Function

Lecture 13 - Balanced Loss Function

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Lecture 15 - DEA

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Lecture 18 - Decision Trees

Lecture 19 - Decision Trees

Lecture 20 - Decision Trees

Lecture 21 - AHP

Lecture 22 - AHP

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- Lecture 4 - Introduction to optimization
- Lecture 5 - Mathematical modeling example
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- Lecture 7 - Modeling with continuous variable - Part 1
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- Lecture 9 - Value Engineering Green Plan: Introduction
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Lecture 0 - How to Learn and Follow the Course

Lecture 1 - R Software and its Installation

Lecture 2 - Help, Documentation, Examples, Packages and Libraries

Lecture 3 - Command Line and Data Editor

Lecture 4 - Introduction to R Studio

Lecture 5 - R as a Calculator

Lecture 6 - Calculation with Data Vectors and Built-in Function

Lecture 7 - Matrix Operations

Lecture 8 - Matrix Operations

Lecture 9 - Univariate Data-Central Tendency and Variability

Lecture 10 - Bivariate Data

Lecture 11 - Missing Data Handling

Lecture 12 - Measuring Central Tendency with Missing Data

Lecture 13 - Measuring Variation with Missing Data

Lecture 14 - Coefficient of Variation and Summary

Lecture 15 - Boxplots and Grouped Boxplots

Lecture 16 - Bar Diagram, Subdivided and Multiple Bar Diagrams

Lecture 17 - Pie Diagram, Histogram and Multiple Histogram

Lecture 18 - Scatter Plots, Smooth Scatter Plots and Matrix Plots

Lecture 19 - Three Dimensional Plots, Star Plots and Chernoff Faces

Lecture 20 - Continuous and Discrete

Lecture 21 - Probability Functions

Lecture 22 - Probability Functions for Continuous Bivariate and Multivariate Random Variables

Lecture 23 - Theoretical Properties

Lecture 24 - Application in R Software

Lecture 25 - Bivariate Normal and Multivariate Normal Distributions in R

Lecture 26 - Chi Square (χ^2), t and F Distribution

Lecture 27 - Point and Interval Estimation

Lecture 28 - Maximum Likelihood Estimation

Lecture 29 - Basics of Tests of Hypothesis

Lecture 30 - Test and Confidence Interval for Mean in One Sample with Known Variance in Univariate Data

- Lecture 31 - Test and Confidence Interval for Mean in One Sample with Unknown Variance in Univariate Data
- Lecture 32 - Tests for Mean in Two Samples with Univariable Data
- Lecture 33 - Analysis of Variance and Homogeneity of Variances with Univariate Data
- Lecture 34 - Tests for Mean Vector with Multivariate Data in One Sample
- Lecture 35 - Tests for Mean Vector with Multivariate Data in Two Sample
- Lecture 36 - Centering, Scaling and Z-Scores
- Lecture 37 - Introduction and Basic Concepts
- Lecture 38 - Estimation of Parameters
- Lecture 39 - Model Fitting with R Software
- Lecture 40 - Test of Hypothesis and Confidence Interval Estimation on Individual Regression Coefficients
- Lecture 41 - Analysis of Variance and Implementation in R Software
- Lecture 42 - Goodness of Fit and Testing of Normality
- Lecture 43 - Logistic Regression Model
- Lecture 44 - Introduction to Classification
- Lecture 45 - Bayes Procedure for Classification
- Lecture 46 - Classification Procedure for Multivariate Normal Distributions
- Lecture 47 - Classification Procedure and Analysis in R
- Lecture 48 - Basic Concepts and Definitions
- Lecture 49 - Hierarchical Classification
- Lecture 50 - Hierarchical Classification and Analysis with R
- Lecture 51 - Hierarchical Classification with Examples in R
- Lecture 52 - Concepts and Theoretical Setup
- Lecture 53 - Principle Component and Its Graphical Analysis in R
- Lecture 54 - Canonical Variables and Concepts
- Lecture 55 - Statistical Analysis of Canonical Variables
- Lecture 56 - Canonical Variables Analysis in R

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Business Marketing - Technology Focus (Management)

Co-ordinators : Prof. Jayanta Chatterjee

Lecture 1 - Introduction to B2B Marketing

Lecture 2 - Tech Marketing

Lecture 3 - Technology life cycle, networks and platforms

Lecture 4 - Organization Markets and Competition

Lecture 5 - Organization Buying decisions

Lecture 6 - Researching Business Markets

Lecture 7 - Design and Tech Market

Lecture 8 - Customer Driven Innovation, New Product Management

Lecture 9 - Market Segments - Technology Focus

Lecture 10 - PLC and TALC

Lecture 11 - Crossing the Chasm

Lecture 12 - B2B Brands - 1

Lecture 13 - B2B Brands - 2

Lecture 14 - B2B Pricing Basics

Lecture 15 - Critical Underpinning Concepts

Lecture 16 - Pricing (Continued...)

Lecture 17 - Pricing Summary

Lecture 18 - B2B Sales

Lecture 19 - Supply Chain

Lecture 20 - Marketing Communication

Lecture 21 - Digital Marketing

Lecture 22 - Digital Relationship Management

Lecture 23 - E-Marketing Tools

Lecture 24 - E-Market Place

Lecture 25 - B2B E-Commerce

Lecture 26 - Electronic Auction

Lecture 27 - E-Procurement

Lecture 28 - Marketing as Strategy - I

Lecture 29 - Marketing as Strategy - II

Lecture 30 - LIVE Session (JCB, TATA Steel, THERMAX)

Lecture 31 - Marketing Orientation

[Lecture 32 - Marketing - R&D interaction](#)

[Lecture 33 - Marketing Metrics](#)

[Lecture 34 - Sample Question and Answers](#)

Lecture 1 - Fundamentals of R

Lecture 2 - Data cleaning

Lecture 3 - Data Visualization - Part 1

Lecture 4 - Data Visualization - Part 2

Lecture 5 - Introduction to Probability Theory

Lecture 6 - Conditional Probabilities and Bayes Theorem

Lecture 7 - Random Variables and Probability Distributions

Lecture 8 - Binomial Distribution

Lecture 9 - Continuous Random Variables and Normal Distribution

Lecture 10 - Descriptive Analytics: Measures of Central Tendency

Lecture 11 - Descriptive Analytics: Measures of Variability and Shape

Lecture 12 - Statistical Inference: Sampling

Lecture 13 - Statistical Inference: Central Limit Theorem and Confidence Intervals

Lecture 14 - Statistical Inference: Hypothesis testing

Lecture 15 - Introduction to R

Lecture 16 - Inferential statistics: R Implementation

Lecture 17 - Statistical Inference: Sampling

Lecture 18 - Hypothesis Testing: R Implementation

Lecture 19 - Regression Modelling - Part 1

Lecture 20 - Regression Modelling - Part 2

Lecture 21 - Regression Algorithm: Application - Part 1

Lecture 22 - Regression Algorithm: Application - Part 2

Lecture 23 - Classification Algorithms: Logit/Probit Regression - Part 1

Lecture 24 - Classification Algorithms: Logit/Probit Regression - Part 2

Lecture 25 - Classification Algorithms: Application - Part 1

Lecture 26 - Classification Algorithms: Application - Part 2

Lecture 27 - Advanced Data Visualization - Part 1

Lecture 28 - Advanced Data Visualization - Part 2

Lecture 29 - Introduction to Panel Data Modelling

Lecture 30 - Panel data application and implementation with R

Lecture 31 - Advanced Time-Series Models

[Lecture 32 - Introduction to ARMA process](#)

[Lecture 33 - Forecasting with ARMA models](#)

[Lecture 34 - Non-stationarity, Cointegration, and Error correction Models](#)

[Lecture 35 - Return and Volatility Modelling and Forecasting](#)

[Lecture 36 - Maximum Likelihood Estimation \(MLE\)](#)

[Lecture 37 - Quantile Regression - Part A](#)

[Lecture 38 - Quantile Regression - Part B](#)

[Lecture 39 - Solar Panel Marketing Case Study](#)

[Lecture 40 - PCA and Clustering - Part 1](#)

[Lecture 41 - PCA and clustering - Part 2](#)

[Lecture 42 - Tutorial - HR Analytics - Part 1](#)

[Lecture 43 - Tutorial - HR Analytics - Part 2](#)

[Lecture 44 - Application of Logistic Regression - Part 1](#)

[Lecture 45 - Application of logistic regression - Part 2](#)

NPTEL : Econometric Modelling (Management)

Co-ordinators : Dr. Rudra P. Pradhan

- Lecture 1 - Introduction to Econometric Modelling
- Lecture 2 - Structure of Econometric Modelling
- Lecture 3 - Univariate Econometric Modelling
- Lecture 4 - Bivariate Econometric Modelling
- Lecture 5 - Bivariate Econometric Modelling (Continued...)
- Lecture 6 - Probability
- Lecture 7 - Bivariate Econometric Modelling
- Lecture 8 - Bivariate Econometric Modelling (Continued...)
- Lecture 9 - Reliability BEM
- Lecture 10 - Reliability BEM (Continued...1)
- Lecture 11 - Reliability BEM (Continued...2)
- Lecture 12 - ANOVA for Bivariate Econometric Modelling
- Lecture 13 - Trivariate Econometric Modelling
- Lecture 14 - Trivariate Econometric Modelling (Continued...)
- Lecture 15 - Reliability of Trivariate Econometric Modelling
- Lecture 16 - Multivariate Econometric Modelling
- Lecture 17 - Multivariate Econometric Modelling (Continued...)
- Lecture 18 - Matrix Approach to Econometric Modelling
- Lecture 19 - Matrix Approach to Econometric Modelling (Continued...)
- Lecture 20 - Multicollinearity Problem
- Lecture 21 - Multicollinearity Problem (Continued...)
- Lecture 22 - Autocorrelation Problem
- Lecture 23 - Autocorrelation Problem (Continued...)
- Lecture 24 - Heteroscedasticity Problem
- Lecture 25 - Heteroscedasticity Problem (Continued...)
- Lecture 26 - Dummy Modelling
- Lecture 27 - Dummy Modelling (Continued...)
- Lecture 28 - LOGIT and PROBIT Model
- Lecture 29 - LOGIT and PROBIT Model (Continued...)
- Lecture 30 - Panel Data Modelling
- Lecture 31 - Panel Data Modelling (Continued...)

[Lecture 32 - Simultaneous Equation Modelling](#)

[Lecture 33 - Simultaneous Equation Modelling \(Continued...\)](#)

[Lecture 34 - Structural Equation Modelling](#)

[Lecture 35 - Structural Equation Modelling \(Continued...\)](#)

[Lecture 36 - Time Series Modelling](#)

[Lecture 37 - Time Series Modelling \(Continued...\)](#)

[Lecture 38 - Unit Root](#)

[Lecture 39 - Cointegration](#)

[Lecture 40 - Concluding Remarks](#)

NPTEL : Organizational Behaviour (Management)

Co-ordinators : Dr. Susmita Mukhopadhyay

- Lecture 1 - Understanding Organizational Behaviour
- Lecture 2 - Effectiveness in Organizations
- Lecture 3 - Social System and Organizational Culture
- Lecture 4 - Social System and Organizational Culture (Continued...)
- Lecture 5 - Individual differences and work behaviour
- Lecture 6 - Personality
- Lecture 7 - Personality (Continued...)
- Lecture 8 - Attitudes
- Lecture 9 - Attitudes (Continued...)
- Lecture 10 - Attitudes (Continued...)
- Lecture 11 - Perceptions and Attributions
- Lecture 12 - Perceptions and Attributions (Continued...)
- Lecture 13 - Motivation
- Lecture 14 - Motivation (Continued...)
- Lecture 15 - Job Design, Work and Motivation
- Lecture 16 - Job Design, Work and Motivation (Continued...)
- Lecture 17 - Evaluation, Feedback and Rewards
- Lecture 18 - Evaluation, Feedback and Rewards (Continued...)
- Lecture 19 - Managing Misbehaviour
- Lecture 20 - Stress
- Lecture 21 - Counseling
- Lecture 22 - Informal and Formal Groups
- Lecture 23 - Teams and Teambuilding
- Lecture 24 - Managing Conflict and Negotiation
- Lecture 25 - Managing Conflict and Negotiation (Continued...)
- Lecture 26 - Power and Politics
- Lecture 27 - Empowerment and Participation
- Lecture 28 - Assertive Behaviour and Transactional Analysis
- Lecture 29 - Communication
- Lecture 30 - Communication (Continued...)
- Lecture 31 - Decision Making

[Lecture 32 - Decision Making \(Continued...\)](#)

[Lecture 33 - Leadership](#)

[Lecture 34 - Leadership \(Continued...\)](#)

[Lecture 35 - Leadership \(Continued...\)](#)

[Lecture 36 - Organizational structure and Design](#)

[Lecture 37 - Organizational structure and Design \(Continued...\)](#)

[Lecture 38 - Organizational structure and Design \(Continued...\)](#)

[Lecture 39 - Change and Innovation](#)

[Lecture 40 - Change and Innovation \(Continued...\)](#)

[Lecture 41 - Organizational behaviour across cultures](#)

NPTEL : Security Analysis and Portfolio Management (Management)

Co-ordinators : Dr. Jitendra Mahakud, Dr. Chandra Sekhar Mishra

- Lecture 1 - Introduction to Investment Management
- Lecture 2 - Markets for Investment
- Lecture 3 - Risk and Return
- Lecture 4 - Risk and Return (Continued...)
- Lecture 5 - Organization and Function of Equity and Debt Markets
- Lecture 6 - Mutual Funds
- Lecture 7 - Market Efficiency - Concepts and forms of efficiency
- Lecture 8 - Testing Market Efficiency
- Lecture 9 - Financial Statement Analysis
- Lecture 10 - Financial Statement Analysis (Continued...)
- Lecture 11 - Valuation of Equity Shares - I
- Lecture 12 - Valuation of Equity Shares - II
- Lecture 13 - Economic Analysis - I
- Lecture 14 - Economic Analysis - II
- Lecture 15 - Industry Analysis - I
- Lecture 16 - Industry Analysis - II
- Lecture 17 - Company Analysis - I
- Lecture 18 - Company Analysis - II
- Lecture 19 - Technical Analysis - I
- Lecture 20 - Technical Analysis - II
- Lecture 21 - Introduction to Portfolio Management
- Lecture 22 - Introduction to Portfolio Management (Continued...)
- Lecture 23 - Capital Market Theory - I
- Lecture 24 - Capital Market Theory - II
- Lecture 25 - Arbitrage Pricing Theory
- Lecture 26 - Multifactor Pricing Model
- Lecture 27 - Markowitz Optimal Portfolio Selection Model
- Lecture 28 - Other Optimal Portfolio Selection Models
- Lecture 29 - Equity Portfolio Management Strategies - I
- Lecture 30 - Equity Portfolio Management Strategies - II
- Lecture 31 - Introduction to Bond Analysis

[Lecture 32 - Bond Pricing and Yield](#)

[Lecture 33 - Interest Rate: Determination & Structure](#)

[Lecture 34 - Bond Price Volatility](#)

[Lecture 35 - Bond Portfolio Management Strategies - I](#)

[Lecture 36 - Bond Portfolio Management Strategies - II](#)

[Lecture 37 - Derivatives - I](#)

[Lecture 38 - Derivatives - II](#)

[Lecture 39 - Portfolio Performance Evaluation - I](#)

[Lecture 40 - Portfolio Performance Evaluation - II](#)

NPTEL : Six Sigma (Management)

Co-ordinators : Prof. Tapan P. Bagchi

Lecture 1 - Concepts in Quality Management - I

Lecture 2 - Concepts in Quality Management - II

Lecture 3 - Concepts in Quality Management - III

Lecture 4 - Initiating Six Sigma

Lecture 5 - Review of Probability and Statistics - I

Lecture 6 - Review of Probability and Statistics - II

Lecture 7 - Review of Probability and Statistics - III

Lecture 8 - Review of Probability and Statistics - IV

Lecture 9 - QM Systems Overview

Lecture 10 - Cost of Quality and TQM Tools

Lecture 11 - QFD and ISO 9000

Lecture 12 - QS 9000 and Awards

Lecture 13 - Competing Through Service Quality

Lecture 14 - Introduction to Project Management

Lecture 15 - Project Life Cycle

Lecture 16 - Critical Path Method

Lecture 17 - Measurement System Analysis

Lecture 18 - Acceptance Sampling

Lecture 19 - Design of Sampling Plans

Lecture 20 - MIL-STD-105E Sampling Plan

Lecture 21 - Introduction to SPC

Lecture 22 - Control Chart Examples

Lecture 23 - Control Charts by Excel

Lecture 24 - Process Capability

Lecture 25 - Quality Function Deployment

Lecture 26 - Design of Experiments - Overview

Lecture 27 - Planning for DOE

Lecture 28 - Factor Effect Calculations

Lecture 29 - ANOVA in DOE

Lecture 30 - Benchmarking in Six Sigma

Lecture 31 - How to Benchmark

[Lecture 32 - Six Sigma in Supply Chains](#)

[Lecture 33 - Taguchi Methods](#)

[Lecture 34 - Robust Design](#)

[Lecture 35 - The Journey to Six Sigma](#)

[Lecture 36 - A Case Study of Defect Reduction](#)

[Lecture 37 - DFM & Reliability](#)

[Lecture 38 - Failure Modes & Effects Analysis \(FMEA\)](#)

[Lecture 39 - Implementing Six Sigma](#)

[Lecture 40 - Getting Results From Six Sigma](#)

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Co-ordinators : Dr. Sangeeta Sahney

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Co-ordinators : Dr. Arun K. Misra

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Co-ordinators : Prof. Biswajit Mahanty

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- Lecture 28 - Dynamic Inventory Problems under Risk (Continued...)
- Lecture 29 - Dynamic Inventory Problems under Risk (Continued...)
- Lecture 30 - Dynamic Inventory Problems under Risk (Continued...)
- Lecture 31 - MRP, MRP-II and DRP

- [Lecture 32 - MRP, MRP-II and DRP \(Continued...\)](#)
- [Lecture 33 - MRP, MRP-II and DRP \(Continued...\)](#)
- [Lecture 34 - MRP, MRP-II and DRP \(Continued...\)](#)
- [Lecture 35 - MRP, MRP-II and DRP \(Continued...\)](#)
- [Lecture 36 - JIT-based Approaches for Materials Management](#)
- [Lecture 37 - JIT-based Approaches for Materials Management \(Continued...\)](#)
- [Lecture 38 - JIT-based Approaches for Materials Management \(Continued...\)](#)
- [Lecture 39 - JIT-based Approaches for Materials Management \(Continued...\)](#)
- [Lecture 40 - JIT-based Approaches for Materials Management \(Continued...\)](#)
- [Lecture 41 - Basics of Purchasing Management](#)
- [Lecture 42 - Basics of Purchasing Management \(Continued...\)](#)
- [Lecture 43 - Basics of Purchasing Management \(Continued...\)](#)
- [Lecture 44 - Basics of Purchasing Management \(Continued...\)](#)
- [Lecture 45 - Basics of Purchasing Management \(Continued...\)](#)
- [Lecture 46 - Theory of Constraints and Materials Management](#)
- [Lecture 47 - Theory of Constraints and Materials Management \(Continued...\)](#)
- [Lecture 48 - Theory of Constraints and Materials Management \(Continued...\)](#)
- [Lecture 49 - Theory of Constraints and Materials Management \(Continued...\)](#)
- [Lecture 50 - Theory of Constraints and Materials Management \(Continued...\)](#)
- [Lecture 51 - Value Engineering/Analysis and Stores Management](#)
- [Lecture 52 - Value Engineering/Analysis and Stores Management \(Continued...\)](#)
- [Lecture 53 - Value Engineering/Analysis and Stores Management \(Continued...\)](#)
- [Lecture 54 - Value Engineering/Analysis and Stores Management \(Continued...\)](#)
- [Lecture 55 - Value Engineering/Analysis and Stores Management \(Continued...\)](#)
- [Lecture 56 - Logistics and Supply Chain Management](#)
- [Lecture 57 - Logistics and Supply Chain Management \(Continued...\)](#)
- [Lecture 58 - Logistics and Supply Chain Management \(Continued...\)](#)
- [Lecture 59 - Logistics and Supply Chain Management \(Continued...\)](#)
- [Lecture 60 - Logistics and Supply Chain Management \(Continued...\)](#)

- Lecture 1 - Dynamic Programming: Introduction
- Lecture 2 - Stagecoach Problem
- Lecture 3 - An Investment Problem
- Lecture 4 - An Investment Problem (Continued...)
- Lecture 5 - Further Examples
- Lecture 6 - Machine Allocation and Cargo Loading Problem
- Lecture 7 - Knapsack Problem
- Lecture 8 - Probabilistic Dynamic Programming
- Lecture 9 - Probabilistic Dynamic Programming (Continued...)
- Lecture 10 - Dijkstra's Algorithm
- Lecture 11 - Integer Programming: Introduction
- Lecture 12 - Integer Programming: Formulation
- Lecture 13 - Integer Programming: Formulation (Continued...)
- Lecture 14 - Integer Linear Programming
- Lecture 15 - Cutting Plane Method
- Lecture 16 - Exhaustive Enumeration and Branch and Bound Techniques
- Lecture 17 - Branch and Bound Technique
- Lecture 18 - Assignment and Travelling Salesman Problem
- Lecture 19 - Travelling Salesman Problem (Continued...)
- Lecture 20 - Heuristic Methods for Integer Programming
- Lecture 21 - Non-Linear Programming: Introduction
- Lecture 22 - Single-Variable Unconstrained Optimization
- Lecture 23 - Multi-variable Unconstrained NLP
- Lecture 24 - Solving Unconstrained NLP
- Lecture 25 - Numerical Methods for Unconstrained NLP
- Lecture 26 - Constrained NLP: Lagrange Multipliers
- Lecture 27 - Constrained NLP: KKT Conditions
- Lecture 28 - Constrained NLP: KKT Conditions (Continued...)
- Lecture 29 - Quadratic Programming
- Lecture 30 - Example problems on Constrained NLP
- Lecture 31 - Introduction to Metaheuristics

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[Lecture 33 - Genetic Algorithm Process](#)

[Lecture 34 - Genetic Algorithm Process \(Continued...\)](#)

[Lecture 35 - Genetic Algorithm Examples](#)

[Lecture 36 - Simulated Annealing](#)

[Lecture 37 - Tabu Search](#)

[Lecture 38 - Particle Swarm Optimization](#)

[Lecture 39 - Multi-Objective Optimization](#)

[Lecture 40 - NSGA-II Examples](#)

Lecture 1 - Introduction to Ethical Reasoning and Engineering Ethics

Lecture 2 - Introduction to Ethical Reasoning and Engineering Ethics (Continued...)

Lecture 3 - Introduction to Ethical Reasoning and Engineering Ethics (Continued...)

Lecture 4 - Professional practice in engineering

Lecture 5 - Professional practice in engineering (Continued...)

Lecture 6 - Central Professional responsibilities of engineers

Lecture 7 - Central Professional responsibilities of engineers (Continued...)

Lecture 8 - Workplace Rights and Responsibilities

Lecture 9 - Workplace Rights and Responsibilities (Continued...)

Lecture 10 - Ethics as Design doing Justice to Moral Problems

Lecture 11 - Ethics as Design doing Justice to Moral Problems (Continued...)

Lecture 12 - Intellectual Property Rights and Ethics

Lecture 13 - Intellectual Property Rights and Ethics (Continued...)

Lecture 14 - Trade related Intellectual Property Rights

Lecture 15 - Trade related Intellectual Property Rights in India

Lecture 16 - A brief on Paris Convention, 1967 and The Berne Contract, 1971

Lecture 17 - Computer Software and Digital Information

Lecture 18 - Computer Software and Digital Information (Continued...)

Lecture 19 - Engineers, Nuclear Testing and Weapons

Lecture 20 - Engineers, Nuclear Testing and Weapons (Continued...)

Lecture 21 - Responsibility to Environment

Lecture 22 - Responsibility to Environment (Continued...)

Lecture 23 - Environmental Ethics and Spirituality

Lecture 24 - Engineering as Social Experimentation

Lecture 25 - Research Ethics

Lecture 26 - Research Ethics (Continued...)

Lecture 27 - Engineers as Managers Consultants and Leaders

Lecture 28 - Engineers as Managers Consultants and Leaders (Continued...)

Lecture 29 - Engineers as Managers Consultants and Leaders (Continued...)

Lecture 30 - Key Questions - Ethical Conduct of Engineers

Lecture 31 - Key Questions - Ethical Conduct of Engineers (Continued...)

[Lecture 32 - Key Questions - Central Professional Responsibilities of Engineers](#)

[Lecture 33 - Key Questions - Central Professional Responsibilities of Engineers \(Continued...\)](#)

[Lecture 34 - Key Questions - Relating to Rights and Responsibilities regarding IPR](#)

[Lecture 35 - Key Questions - Relating to Rights and Responsibilities regarding IPR \(Continued...\)](#)

[Lecture 36 - Key Questions - Relating to Rights and Responsibilities regarding IPR \(Continued...\)](#)

[Lecture 37 - Key Questions - Related to Engineers Rights and Duties and Ethics](#)

[Lecture 38 - Key Questions - Related to Engineers Rights and Duties and Ethics \(Continued...\)](#)

[Lecture 39 - Leadership Styles and Ethical Conduct](#)

[Lecture 40 - Leadership Styles and Ethical Conduct \(Continued...\)](#)

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- Lecture 2 - Nature of Change Management (2)
- Lecture 3 - Types of Change
- Lecture 4 - Types of Change (Continued...)
- Lecture 5 - Types of Change (Continued...)
- Lecture 6 - Need for Change
- Lecture 7 - Need for Change (Continued...)
- Lecture 8 - Scope of Change
- Lecture 9 - Scope of Change (Continued...)
- Lecture 10 - Scope of Change (Continued...)
- Lecture 11 - Diagnosing Organisational Change
- Lecture 12 - Diagnosing Organisational Change (Continued...)
- Lecture 13 - Diagnosing Organisational Change (Continued...)
- Lecture 14 - Resistance to Change
- Lecture 15 - Managing Resistance
- Lecture 16 - Approaches to Implementing Change
- Lecture 17 - Approaches to Implementing Change (Continued...)
- Lecture 18 - Approaches to Implementing Change (Continued...)
- Lecture 19 - Approaches to Implementing Change (Continued...)
- Lecture 20 - Approaches to Implementing Change (Continued...)
- Lecture 21 - Implementing Change
- Lecture 22 - Vision and Change
- Lecture 23 - Vision and Change (Continued...)
- Lecture 24 - Vision and Change (Continued...)
- Lecture 25 - Vision and Change (Continued...)
- Lecture 26 - Communication and Change
- Lecture 27 - Communication and Change (Continued...)
- Lecture 28 - Communication and Change (Continued...)
- Lecture 29 - Sustaining Change
- Lecture 30 - Evaluating Change
- Lecture 31 - Innovation and Change

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[Lecture 33 - Organizational Learning](#)

[Lecture 34 - Learning Organization and Change](#)

[Lecture 35 - Learning Organization and Change \(Continued...\)](#)

[Lecture 36 - Turnaround Strategy](#)

[Lecture 37 - Strategic Convergence and Learning from Change](#)

[Lecture 38 - Change Effectiveness](#)

[Lecture 39 - Change Management Cases and Examples](#)

[Lecture 40 - Change Management Example, Trends and Dynamics](#)

Lecture 1 - Introduction to Financial System

Lecture 2 - Equilibrium in Financial Markets

Lecture 3 - Efficiency of Financial Markets

Lecture 4 - Measures of Financial Development

Lecture 5 - Financial Development and Economic Growth

Lecture 6 - Systematic risks in financial system

Lecture 7 - Unsystematic risks in financial system

Lecture 8 - Return concepts in financial system

Lecture 9 - Fundamental analysis of financial assets

Lecture 10 - Technical analysis of financial assets

Lecture 11 - Theories of interest rate determination - I

Lecture 12 - Theories of interest rate determination - II

Lecture 13 - Term structure theories of interest rate - I

Lecture 14 - Term structure theories of interest rate - II

Lecture 15 - Term structure theories of interest rate - III

Lecture 16 - Financial market regulation

Lecture 17 - RBI- structure and objective functions

Lecture 18 - Monetary policy instruments

Lecture 19 - Challenges and reforms in monetary policy and central bank autonomy

Lecture 20 - SEBI, IROA and PFRDA: structure and function

Lecture 21 - Commercial banks: Role and Services

Lecture 22 - Commercial banks: Financial statements

Lecture 23 - Commercial bank performance

Lecture 24 - Basel Accords

Lecture 25 - Measure of risk in commercial banks

Lecture 26 - Provident fund and pension fund

Lecture 27 - Insurance companies

Lecture 28 - Mutual funds - I

Lecture 29 - Mutual funds - II

Lecture 30 - NBFCs - I

Lecture 31 - NBFCs - II

- Lecture 32 - Venture capital
- Lecture 33 - Merchant banks
- Lecture 34 - Credit Rating Agencies
- Lecture 35 - Non-banking statutory financial organization
- Lecture 36 - Call Money Market - I
- Lecture 37 - Call Money Market - II
- Lecture 38 - Treasury Bills Market
- Lecture 39 - Miscellaneous short-term money market - I
- Lecture 40 - Miscellaneous short-term money market - II
- Lecture 41 - Bond Analysis - I
- Lecture 42 - Bond Analysis - II
- Lecture 43 - Bond Analysis - III
- Lecture 44 - Bond Analysis - IV
- Lecture 45 - Bond market in India
- Lecture 46 - Stock market - I
- Lecture 47 - Stock market - II
- Lecture 48 - Stock market - III
- Lecture 49 - Stock market - IV
- Lecture 50 - Stock market - V
- Lecture 51 - Derivatives Market - I
- Lecture 52 - Derivatives Market - II
- Lecture 53 - Derivatives Market - III
- Lecture 54 - Derivatives Market - IV
- Lecture 55 - Derivatives Market - V
- Lecture 56 - Foreign Exchange Market - I
- Lecture 57 - Foreign Exchange Market - II
- Lecture 58 - Foreign Exchange Market - III
- Lecture 59 - Foreign Exchange Market - IV
- Lecture 60 - Foreign Exchange Market - V

NPTEL : NOC:Sales and Distribution Management (Management)

Co-ordinators : Dr. Sangeeta Sahney

Lecture 1 - Introduction to Sales Management

Lecture 2 - Sales Management, Personal Selling, and Salesmanship

Lecture 3 - Functions of Sales Executive and Roles played by Sales Managers

Lecture 4 - Duties and Responsibilities of Sales Managers and the Effective Sales Executive

Lecture 5 - Skills required in Sales Managers and Qualities in a Sales Managers

Lecture 6 - Determining Sales related Marketing Policies

Lecture 7 - Determining Sales related Marketing Policies

Lecture 8 - Strategic Planning, Sales Objectives, Strategies and Tactics

Lecture 9 - The Sales Organization

Lecture 10 - The Sales Organization

Lecture 11 - The Sales Department Relations

Lecture 12 - The Sales Department Relations

Lecture 13 - Planning, Sales forecasting and Budgeting

Lecture 14 - Planning, Sales forecasting and Budgeting

Lecture 15 - Planning, Sales forecasting and Budgeting

Lecture 16 - Buyer-Seller Dyads

Lecture 17 - Diversity of Personal-Selling Situations

Lecture 18 - Theories of Selling

Lecture 19 - Theories of Selling

Lecture 20 - The Selling Process

Lecture 21 - The Selling Process

Lecture 22 - Sales Force Management : Job Analysis

Lecture 23 - Sales Force Management : Recruitment

Lecture 24 - Sales Force Management : Selection

Lecture 25 - Sales Force Management : Training

Lecture 26 - Sales Force Management : Training

Lecture 27 - Sales Force Management : Motivation

Lecture 28 - Sales Force Management : Compensation

Lecture 29 - Sales Force Management : Managing Expenses of Sales Personnel

Lecture 30 - Sales Force Management : Evaluation

Lecture 31 - Sales Force Management : Evaluation

[Lecture 32 - Sales Quotas](#)

[Lecture 33 - Sales Quotas](#)

[Lecture 34 - Sales Territory](#)

[Lecture 35 - Sales Territory](#)

[Lecture 36 - Distribution Channel Management : Distribution Channels - Part I](#)

[Lecture 37 - Distribution Channel Management : Distribution Channels - Part II](#)

[Lecture 38 - Channel Systems, Channel Management, Logistics and Marketing Channels - Part I](#)

[Lecture 39 - Channel Systems, Channel Management, Logistics and Marketing Channels - Part II](#)

[Lecture 40 - International Sales and Channel Management](#)

- Lecture 1 - Brief overview of the course
- Lecture 2 - Quality concepts and definition
- Lecture 3 - History of continuous improvement
- Lecture 4 - Six Sigma Principles and Focus Areas - Part 1
- Lecture 5 - Six Sigma Principles and Focus Areas - Part 2
- Lecture 6 - Six Sigma Applications
- Lecture 7 - Quality Management: Basics and Key Concepts
- Lecture 8 - Fundamentals of Total Quality Management
- Lecture 9 - Cost of quality
- Lecture 10 - Voice of customer
- Lecture 11 - Quality Function Deployment (QFD)
- Lecture 12 - Management and Planning Tools - Part 1
- Lecture 13 - Management and Planning Tools - Part 2
- Lecture 14 - Six Sigma Project Identification, Selection and Definition
- Lecture 15 - Process characteristics and Monitoring
- Lecture 16 - Process characteristics and analysis
- Lecture 17 - Process Mapping: SIPOC
- Lecture 18 - Data Collection and Summarization - Part 1
- Lecture 19 - Data Collection and Summarization - Part 2
- Lecture 20 - Measurement systems: Fundamentals
- Lecture 21 - Measurement systems analysis: Gage R&R study
- Lecture 22 - Fundamentals of statistics
- Lecture 23 - Probability theory
- Lecture 24 - Process capability analysis: Key Concepts
- Lecture 25 - Process capability analysis: Measures and Indices
- Lecture 26 - Process capability analysis: Minitab Application
- Lecture 27 - Non-normal process capability analysis
- Lecture 28 - Hypothesis testing: Fundamentals
- Lecture 29 - Hypothesis Testing: Single Population Test
- Lecture 30 - Hypothesis Testing: Two Population Test
- Lecture 31 - Hypothesis Testing: Two Population: Minitab Application

- Lecture 32 - Correlation and Regression Analysis
- Lecture 33 - Regression Analysis: Model Validation
- Lecture 34 - One-Way ANOVA
- Lecture 35 - Two-Way ANOVA
- Lecture 36 - Multi-vari Analysis
- Lecture 37 - Failure Mode Effect Analysis (FMEA)
- Lecture 38 - Introduction to Design of Experiment
- Lecture 39 - Randomized Block Design
- Lecture 40 - Randomized Block Design: Minitab Application
- Lecture 41 - Factorial Design
- Lecture 42 - Factorial Design: Minitab Application
- Lecture 43 - Fractional Factorial Design
- Lecture 44 - Fractional Factorial Design: Minitab Application
- Lecture 45 - Taguchi Method: Key Concepts
- Lecture 46 - Taguchi Method: Illustrative Application
- Lecture 47 - Seven QC Tools
- Lecture 48 - Statistical Process Control: Key Concepts
- Lecture 49 - Statistical Process Control: Control Charts for Variables
- Lecture 50 - Operating Characteristic (OC) Curve for Variable Control charts
- Lecture 51 - Statistical Process Control: Control Charts for Attributes
- Lecture 52 - Operating Characteristic (OC) Curve for Attribute Control charts
- Lecture 53 - Statistical Process Control: Minitab Application
- Lecture 54 - Acceptance Sampling: Key Concepts
- Lecture 55 - Acceptance Sampling Plans for Attributes: Key Concepts
- Lecture 56 - Design of Acceptance Sampling Plans for Attributes
- Lecture 57 - Acceptance Sampling Plans for Variables
- Lecture 58 - Acceptance Sampling: Minitab Application
- Lecture 59 - Design for Six Sigma (DFSS): DMADV, DMADOV
- Lecture 60 - Design for Six Sigma (DFSS): DFX
- Lecture 61 - Team Management
- Lecture 62 - Six Sigma: Case study
- Lecture 63 - Six Sigma: Summary of key concepts

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NPTEL : NOC:Performance and Reward Management (Management)

Co-ordinators : Dr. Susmita Mukhopadhyay

Lecture 1 - Understanding meaning of performance management and reward systems management with performance management process

Lecture 2 - Understanding meaning of performance management and reward systems management with performance management process (Continued...)

Lecture 3 - Understanding meaning of performance management and reward systems management with performance management process (Continued...)

Lecture 4 - Understanding meaning of performance management and reward systems management with performance management process (Continued...)

Lecture 5 - Understanding meaning of performance management and reward systems management with performance management process (Continued...)

Lecture 6 - Developing an understanding as to why performance management and reward management are of strategic importance and their role in strategic planning

Lecture 7 - Developing an understanding as to why performance management and reward management are of strategic importance and their role in strategic planning (Continued...)

Lecture 8 - Developing an understanding as to why performance management and reward management are of strategic importance and their role in strategic planning (Continued...)

Lecture 9 - Developing an understanding as to why performance management and reward management are of strategic importance and their role in strategic planning (Continued...)

Lecture 10 - Developing an understanding as to why performance management and reward management are of strategic importance and their role in strategic planning (Continued...)

Lecture 11 - Implementation of a performance management system, defining performance and choosing a measurement approach and understanding the meaning of results

Lecture 12 - Implementation of a performance management system, defining performance and choosing a measurement approach and understanding the meaning of results (Continued...)

Lecture 13 - Implementation of a performance management system, defining performance and choosing a measurement approach and understanding the meaning of results (Continued...)

Lecture 14 - Implementation of a performance management system, defining performance and choosing a measurement approach and understanding the meaning of results (Continued...)

Lecture 15 - Implementation of a performance management system, defining performance and choosing a measurement approach and understanding the meaning of results (Continued...)

Lecture 16 - Implementing a performance management system in your organization

Lecture 17 - Implementing a performance management system in your organization (Continued...)

Lecture 18 - Implementing a performance management system in your organization (Continued...)

Lecture 19 - Implementing a performance management system in your organization (Continued...)

Lecture 20 - Implementing a performance management system in your organization (Continued...)

Lecture 21 - Role of performance management in employee development, addressing performance management skills and team reward management

Lecture 22 - Role of performance management in employee development, addressing performance management skills and team reward management (Continued...)

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Lecture 23 - Role of performance management in employee development, addressing performance management skills and team reward management (Continued...)

Lecture 24 - Role of performance management in employee development, addressing performance management skills and team reward management (Continued...)

Lecture 25 - Role of performance management in employee development, addressing performance management skills and team reward management (Continued...)

Lecture 26 - Overview, reward system, understanding total, strategic and international reward

Lecture 27 - Overview, reward system, understanding total, strategic and international reward (Continued...)

Lecture 28 - Overview, reward system, understanding total, strategic and international reward (Continued...)

Lecture 29 - Overview, reward system, understanding total, strategic and international reward (Continued...)

Lecture 30 - Overview, reward system, understanding total, strategic and international reward (Continued...)

Lecture 31 - Understanding linkage between performance management and reward, an overview of various types of reward; financial reward, non-financial reward; contingent pay scheme; bonus scheme; team pay ; rewarding for business performance; recognition sc

Lecture 32 - Understanding linkage between performance management and reward, an overview of various types of reward; financial reward, non-financial reward; contingent pay scheme; bonus scheme; team pay ; rewarding for business performance; recognition sc

Lecture 33 - Understanding linkage between performance management and reward, an overview of various types of reward; financial reward, non-financial reward; contingent pay scheme; bonus scheme; team pay ; rewarding for business performance; recognition sc

Lecture 34 - Understanding linkage between performance management and reward, an overview of various types of reward; financial reward, non-financial reward; contingent pay scheme; bonus scheme; team pay ; rewarding for business performance; recognition sc

Lecture 35 - Understanding linkage between performance management and reward, an overview of various types of reward; financial reward, non-financial reward; contingent pay scheme; bonus scheme; team pay ; rewarding for business performance; recognition sc

Lecture 36 - Understanding linkage between performance management and reward, an overview of various types of reward; financial reward, non-financial reward; contingent pay scheme; bonus scheme; team pay ; rewarding for business performance; recognition sc

Lecture 37 - Valuing and grading jobs, understanding pay levels, job evaluation schemes, equal pay, market rate analysis, designing of grade and pay structure

Lecture 38 - Valuing and grading jobs, understanding pay levels, job evaluation schemes, equal pay, market rate analysis, designing of grade and pay structure (Continued...)

Lecture 39 - Valuing and grading jobs, understanding pay levels, job evaluation schemes, equal pay, market rate analysis, designing of grade and pay structure (Continued...)

Lecture 40 - Valuing and grading jobs, understanding pay levels, job evaluation schemes, equal pay, market rate analysis, designing of grade and pay structure (Continued...)

Lecture 41 - Valuing and grading jobs, understanding pay levels, job evaluation schemes, equal pay, market rate analysis, designing of grade and pay structure (Continued...)

Lecture 42 - Rewarding Special Groups, rewarding directors and senior executives, sales and customer service staff, knowledge workers and manual workers

Lecture 43 - Rewarding Special Groups, rewarding directors and senior executives, sales and customer service staff, knowledge workers and manual workers (Continued...)

Lecture 44 - Rewarding Special Groups, rewarding directors and senior executives, sales and customer service staff, knowledge workers and manual workers (Continued...)

Lecture 45 - Rewarding Special Groups, rewarding directors and senior executives, sales and customer service staff, knowledge workers and manual workers (Continued...)

Lecture 46 - Rewarding Special Groups, rewarding directors and senior executives, sales and customer service staff, knowledge workers and manual workers (Continued...)

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Lecture 47 - Rewarding Special Groups, rewarding directors and senior executives, sales and customer service staff, knowledge workers and manual workers (Continued...)

Lecture 48 - Understanding relevance of employee benefits and pension schemes, employee benefits, flexible benefits, pension scheme, 7th Pay Commission

Lecture 49 - Understanding relevance of employee benefits and pension schemes, employee benefits, flexible benefits, pension scheme, 7th Pay Commission (Continued...)

Lecture 50 - Understanding relevance of employee benefits and pension schemes, employee benefits, flexible benefits, pension scheme, 7th Pay Commission (Continued...)

Lecture 51 - Understanding relevance of employee benefits and pension schemes, employee benefits, flexible benefits, pension scheme, 7th Pay Commission (Continued...)

Lecture 52 - Understanding relevance of employee benefits and pension schemes, employee benefits, flexible benefits, pension scheme, 7th Pay Commission (Continued...)

Lecture 53 - Developing and Implementing Reward Systems

Lecture 54 - Developing and Implementing Reward Systems (Continued...)

Lecture 55 - Developing and Implementing Reward Systems (Continued...)

Lecture 56 - Developing and Implementing Reward Systems (Continued...)

Lecture 57 - Developing and Implementing Reward Systems (Continued...)

Lecture 58 - Understanding the implications of performance and reward management in present organizational dynamics through case studies

Lecture 59 - Understanding the implications of performance and reward management in present organizational dynamics through case studies (Continued...)

Lecture 60 - Understanding the implications of performance and reward management in present organizational dynamics through case studies (Continued...)

Lecture 61 - Understanding the implications of performance and reward management in present organizational dynamics through case studies (Continued...)

Lecture 62 - Understanding the implications of performance and reward management in present organizational dynamics through case studies (Continued...)

Lecture 63 - Understanding the implications of performance and reward management in present organizational dynamics through case studies (Continued...)

NPTEL : NOC: The Ethical Corporation (Management)

Co-ordinators : Prof. Chhanda Chakraborti

Lecture 1 - What is a Corporation

Lecture 2 - Ethical Corporation

Lecture 3 - What is Ethics

Lecture 4 - Law and Ethics, and Responsibilities

Lecture 5 - Why should a Corporation be Ethical

Lecture 6 - Normative Ethical Theories : Utilitarianism

Lecture 7 - Normative Ethical Theories : Deontological Ethics

Lecture 8 - Normative Ethical Theories : Rights and Justice

Lecture 9 - Normative Ethical Theories : Virtue Ethics

Lecture 10 - Normative Ethical Theories : Care Ethics

Lecture 11 - Managing Ethics within the Corporation

Lecture 12 - Managing Ethics within the Organization : Formal Approach

Lecture 13 - Managing Ethics within a Corporation : Formal and Informal Approach

Lecture 14 - How to Manage Inter - Personal Ethical Misconduct at Workplace

Lecture 15 - How to Apply Ethics

Lecture 16 - Understanding Corporate Governance

Lecture 17 - Conflicts and Key Elements in Corporate Governance

Lecture 18 - Specific Areas of Concern in Corporate Governance and Countermeasures - I

Lecture 19 - Specific Areas of Concern in Corporate Governance and Countermeasures - II

Lecture 20 - Concluding Session on Corporate Governance

Lecture 21 - Investing in Human relations: Employees as stakeholders and Investors of Human Capital

Lecture 22 - Employer-employee: Duties and rights from both sides

Lecture 23 - Organization model and employer-employee relation

Lecture 24 - Some specific issues in employer-employee relationship

Lecture 25 - Employees All Over the World

Lecture 26 - The Ethical Corporation : Natural Environment

Lecture 27 - Corporate Obligations to Natural Environment through the Laws

Lecture 28 - Corporate Obligations to Natural Environment through Appeal to Business Sense and Strategy

Lecture 29 - Corporate Obligations to Natural Environment on Ethical Grounds

Lecture 30 - Environmental Obligations : What Can an Ethical Corporation Do?

Lecture 31 - Consumers as Stakeholders and Consumer Protection

[Lecture 32 - Ethics of Consumer Protection](#)

[Lecture 33 - Consumer ethics: Duty of a Corporation in marketing communication and promotion](#)

[Lecture 34 - Consumer ethics: Ethical issues in Marketing Management](#)

[Lecture 35 - Consumer Ethics: Duty of the Consumers](#)

[Lecture 36 - Competitors as Stakeholders and Fair Competition](#)

[Lecture 37 - What is NOT Fair Competition](#)

[Lecture 38 - Competitors as Stakeholders; Global Competition](#)

[Lecture 39 - Suppliers as Stakeholders : Ethics in Supply Chain](#)

[Lecture 40 - Competitors and Suppliers : What can an Ethical Corporation Do?](#)

- Lecture 1 - Concept of Intellectual Property Law Patents
- Lecture 2 - Trademark
- Lecture 3 - Geographical Indications
- Lecture 4 - Copyright
- Lecture 5 - Industrial Designs
- Lecture 6 - Integrated Circuits Layout Designs
- Lecture 7 - Trade Secrets or Undisclosed Information
- Lecture 8 - Information Competition Law
- Lecture 9 - Introduction to Competition Law (Continued...)
- Lecture 10 - Introduction Competition Law Anti-Competitive Practices
- Lecture 11 - Bid-Rigging
- Lecture 12 - Introduction Competition Law - Vertical Agreements
- Lecture 13 - Abuse of Dominance, Combinations
- Lecture 14 - Regulation of Combinations
- Lecture 15 - Economic Theory of IP And Competition
- Lecture 16 - Interface Between IP And Competition
- Lecture 17 - The United States Anti-Trust Law
- Lecture 18 - Tying Arrangements And Intellectual Property Under Sherman Act
- Lecture 19 - United States Jurisprudence: Unilateral Refusal To License Or Deal
- Lecture 20 - Price Fixing And Antitrust Law
- Lecture 21 - Market Allocation And IP
- Lecture 22 - Vertical Restraints
- Lecture 23 - Vertical Restraints (Contd)
- Lecture 24 - Enforcement of Anti-Trust Law in United States
- Lecture 25 - Introduction To EU Competition Policy And IPR
- Lecture 26 - IP Based Conduct under Article 101
- Lecture 27 - IP Based Conduct under Article 102
- Lecture 28 - IP Based Conduct under Article 102
- Lecture 29 - Technology Transfer Agreements
- Lecture 30 - TTBER and safe harbor provisions
- Lecture 31 - Standard Essential Patents and FRAND Terms

[Lecture 32 - Introduction to Competition Law in India \(Continued...\)](#)

[Lecture 33 - Introduction to Competition Law in India \(Continued...\)](#)

[Lecture 34 - Introduction to Competition Law in India \(Continued...\)](#)

[Lecture 35 - IP Licensing and Indian Competition Law](#)

[Lecture 36 - IP Licensing and Indian Competition Law \(Continued...\)](#)

[Lecture 37 - IP Licensing and Indian Competition Law \(Continued...\)](#)

[Lecture 38 - IP Licensing and Indian Competition Law \(Continued...\)](#)

[Lecture 39 - Patent and Competition Law](#)

[Lecture 40 - Trademark, Copyright and Competition Law](#)

[Lecture 41 - TRIPS and Competition Law](#)

[Lecture 42 - TRIPS and Competition Law \(Continued...\)](#)

[Lecture 43 - Summary](#)

Lecture 1 - Introduction to IPR

Lecture 2 - IP-Economic Rationale

Lecture 3 - Patentability-Novelty - I

Lecture 4 - Patentability-Novelty - II

Lecture 5 - Non-Obviousness

Lecture 6 - How to read a patent document

Lecture 7 - How to read a patent document

Lecture 8 - Introduction to patent search

Lecture 9 - Introduction to patent search

Lecture 10 - Fundamentals of patent search

Lecture 11 - Fundamentals of patent search

Lecture 12 - Hands on Patent Search

Lecture 13 - Hands on Patent Search

Lecture 14 - Hands on Patent Search - Sequence Search

Lecture 15 - Hands on Patent Search - Emerging areas of Technology

Lecture 16 - Types of patent Search

Lecture 17 - Types of patent Search (Continued...)

Lecture 18 - Types of patent Search (Continued...)

Lecture 19 - Types of patent Search, Validity Search

Lecture 20 - Invalidity Search

Lecture 21 - Types of Patent Search FTO

Lecture 22 - Types of Patent Search

Lecture 23 - Introduction to patent landscape

Lecture 24 - Introduction to patent landscape (Continued...)

Lecture 25 - Introduction to patent landscape (Continued...)

Lecture 26 - Hands on Patent Landscape

Lecture 27 - Hands on Patent Landscape (Continued...)

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Lecture 30 - Hands on Patent Landscape (Continued...)

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Lecture 14 - Transportation cost - III

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Lecture 22 - Space calculation - II

Lecture 23 - Performance of the entire supply chain

Lecture 24 - Data envelopment analysis

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Lecture 26 - Concepts in inventory management - II

Lecture 27 - Concepts in inventory management - III

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Lecture 30 - Safety Stock and Reorder Level

Lecture 31 - Continuous Review System

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- [Lecture 33 - Periodic Review System](#)
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- [Lecture 36 - Transport Costing](#)
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- [Lecture 40 - Analytical Hierarchy Processing \(AHP\) Method](#)
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- [Lecture 49 - Forecasting Trend Holt's and Winters Method](#)
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- [Lecture 51 - Information Distortions; Coordination and Collaboration Modelling](#)
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- [Lecture 53 - Six Sigma and queuing in Coordination](#)
- [Lecture 54 - Queuing in Coordination; Measuring the Degree of Coordination](#)
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- [Lecture 57 - Designing the global supply chain : Tax advantages](#)
- [Lecture 58 - Designing the global supply chain : Tax advantages \(Continued... \)](#)
- [Lecture 59 - Designing the global supply chain : Transshipment](#)
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[Lecture 4 - Introduction to R programming \(Continued...\)](#)

[Lecture 5 - Introduction to R programming \(Continued...\)](#)

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[Lecture 10 - What Consumers Want \(Continued...\)](#)

[Lecture 11 - What Consumers Want \(Continued...\)](#)

[Lecture 12 - What Consumers Want \(Continued...\)](#)

[Lecture 13 - Segmentation Targeting and Positioning](#)

[Lecture 14 - Segmentation Targeting and Positioning \(Continued...\)](#)

[Lecture 15 - Segmentation Targeting and Positioning \(Continued...\)](#)

[Lecture 16 - Segmentation Targeting and Positioning \(Continued...\)](#)

[Lecture 17 - Segmentation Targeting and Positioning \(Continued...\)](#)

[Lecture 18 - Demand Forecasting and Pricing](#)

[Lecture 19 - Demand Forecasting and Pricing \(Continued...\)](#)

[Lecture 20 - Demand Forecasting and Pricing \(Continued...\)](#)

[Lecture 21 - Demand Forecasting and Pricing \(Continued...\)](#)

[Lecture 22 - Pricing](#)

[Lecture 23 - Pricing \(Continued...\)](#)

[Lecture 24 - Pricing \(Continued...\)](#)

[Lecture 25 - Pricing \(Continued...\)](#)

[Lecture 26 - Pricing \(Continued...\)](#)

[Lecture 27 - Pricing \(Continued...\)](#)

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[Lecture 64 - Social Network Analysis and Excel Dashboards \(Continued...\)](#)

[Lecture 65 - Social Network Analysis and Excel Dashboards \(Continued...\)](#)

[Lecture 66 - Social Network Analysis and Excel Dashboards \(Continued...\)](#)

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Lecture 2 - Functions, Goals and Constraints of Commercial Banks

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Lecture 6 - Bank Performance Measures - I

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Lecture 18 - Commercial Bank Risk - III

Lecture 19 - Commercial Bank Risk - IV

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Lecture 23 - Earnings Sensitivity Analysis

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- Lecture 57 - Management of Bank Capital - I
- Lecture 58 - Management of Bank Capital - II
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Lecture 1 - Introduction to Behavioral Economics and Finance

Lecture 2 - Introduction to Behavioral Economics and Finance (Continued...)

Lecture 3 - Economics of Decision Making

Lecture 4 - Economics of Decision Making (Continued...)

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Lecture 8 - Non-expected Utility Preferences (Continued...)

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Lecture 11 - Prospect Theory and Behavioral Finance (Continued...)

Lecture 12 - Beliefs, Biases and Heuristics

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Lecture 14 - Beliefs, Biases and Heuristics (Continued...)

Lecture 15 - Biases and Financial Decision-Making

Lecture 16 - Biases and Financial Decision-Making (Continued...)

Lecture 17 - Overconfidence and Investor Behavior

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Lecture 20 - Valuation of Financial Assets (Continued...)

Lecture 21 - Portfolio Return and Risk

Lecture 22 - Portfolio Return and Risk (Continued...)

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Lecture 25 - Personal Financial Statements

Lecture 26 - Taxes and Financial Planning

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Lecture 28 - Portfolios for Individual Investors

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[Lecture 34 - Consumer Credit Decisions](#)

[Lecture 35 - Loans and Amortization](#)

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[Lecture 39 - Alternative Investments \(Continued...\)](#)

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[Lecture 2 - CMR: The Strategic Imperative \(Continued...\)](#)

[Lecture 3 - CMR: The Strategic Imperative \(Continued...\)](#)

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[Lecture 5 - Co-Creation](#)

[Lecture 6 - Co-creation \(Continued...\)](#)

[Lecture 7 - Co-creation \(Continued...\)](#)

[Lecture 8 - Building Customer Relationships](#)

[Lecture 9 - Building Customer Relationships \(Continued...\)](#)

[Lecture 10 - Building Customer Relationships \(Continued...\)](#)

[Lecture 11 - Building Customer Relationships \(Continued...\)](#)

[Lecture 12 - Building Customer Relationships \(Continued...\)](#)

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[Lecture 14 - Economics of CRM](#)

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[Lecture 16 - Economics of CRM \(Continued...\)](#)

[Lecture 17 - Economics of CRM \(Continued...\)](#)

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[Lecture 19 - Economics of CRM \(Continued...\)](#)

[Lecture 20 - Economics of CRM \(Continued...\)](#)

[Lecture 21 - Social CRM](#)

[Lecture 22 - Social CRM \(Continued...\)](#)

[Lecture 23 - Social CRM \(Continued...\)](#)

[Lecture 24 - Tchibo Case Study](#)

[Lecture 25 - Tchibo Case Study \(Continued...\)](#)

[Lecture 26 - Customer Equity in CRM](#)

[Lecture 27 - Customer Equity in CRM \(Continued...\)](#)

[Lecture 28 - CRM in B2C Markets](#)

[Lecture 29 - CRM in B2C Markets \(Continued...\)](#)

[Lecture 30 - CRM in B2C Markets \(Continued...\)](#)

[Lecture 31 - CRM in B2C Markets \(Continued...\)](#)

[Lecture 32 - CRM in B2B Markets](#)

[Lecture 33 - CRM in B2B Markets \(Continued...\)](#)

[Lecture 34 - CRM in B2B Markets \(Continued...\)](#)

[Lecture 35 - CRM in B2B Markets \(Continued...\)](#)

[Lecture 36 - eCRM: Components and Strategies](#)

[Lecture 37 - eCRM: Components and Strategies \(Continued...\)](#)

[Lecture 38 - eCRM: Components and Strategies \(Continued...\)](#)

[Lecture 39 - Contact Centres for CRM](#)

[Lecture 40 - Contact Centres for CRM \(Continued...\)](#)

[Lecture 41 - Global CRM](#)

[Lecture 42 - Global CRM \(Continued...\)](#)

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NPTEL : NOC:Principles of Management (Management)

Co-ordinators : Prof. S. Srinivasan, Dr. Susmita Mukhopadhyay

Lecture 1 - Definition, Nature, Purpose and Scope of Management

Lecture 2 - Skills, Roles and Functions of Management

Lecture 3 - Principles of Management

Lecture 4 - Scientific Management

Lecture 5 - Evolution of Management Thought

Lecture 6 - Concept, Types, Importance and Process of Planning

Lecture 7 - Characteristics, Nature and Scope and Principles of Planning

Lecture 8 - Traditional objective setting and methods of Planning

Lecture 9 - Strategic Management and Planning

Lecture 10 - Premising and Forecasting of Planning

Lecture 11 - Concept, Types, Importance and Process of Decision Making

Lecture 12 - Different Models of Decision Making

Lecture 13 - Decision Making Styles and Cognitive biases in decision making

Lecture 14 - Barriers of Effective Decision Making

Lecture 15 - Group Decision Making

Lecture 16 - Concept, Importance and Steps of Management by Objectives

Lecture 17 - Concept, Importance and Steps of Management by exception

Lecture 18 - Style of Management (American, Japanese and Indian)

Lecture 19 - Approaches of management including McKinsey's approach

Lecture 20 - Introduction, strategies, techniques, benefits and rules of Self Management

Lecture 21 - Concept, Importance, Process, Nature, and Principle of Organisation

Lecture 22 - Organisational Design and Structure

Lecture 23 - Coordination in Management

Lecture 24 - Differentiation in management

Lecture 25 - Concept, Types, Importance, Steps, Factors and Advantages of Integration

Lecture 26 - Concept, Types, Importance and Process of Span of Management

Lecture 27 - Concept, types, factors, advantages and disadvantages of Centralisation and Decentralisation

Lecture 28 - Delegation

Lecture 29 - Different issues relating to authority and power

Lecture 30 - Different aspects of line and staff organisation

Lecture 31 - Concept, importance, process and methods of Staffing and HRM

[Lecture 32 - Recruitment and Selection](#)

[Lecture 33 - Recruitment and Selection \(Continued...\)](#)

[Lecture 34 - Performance Appraisal](#)

[Lecture 35 - Performance Appraisal \(Continued...\)](#)

[Lecture 36 - Concept, Types, Importance, Techniques of Career strategy](#)

[Lecture 37 - Concept, Types, Importance, Techniques of Career strategy \(Continued...\)](#)

[Lecture 38 - Concept, Types, Importance, Techniques of Career strategy \(Continued...\)](#)

[Lecture 39 - Coordination-Concept, Issues and Techniques](#)

[Lecture 40 - Coordination-Concept, Issues and Techniques \(Continued...\)](#)

[Lecture 41 - Concept, importance, elements of organisational change](#)

[Lecture 42 - Concept, importance, elements of organisational change \(Continued...\)](#)

[Lecture 43 - Forces and factors of organisational change](#)

[Lecture 44 - Resistance to change](#)

[Lecture 45 - Theories of change and resistance to change](#)

[Lecture 46 - Methods of dealing with change](#)

[Lecture 47 - Methods of dealing with change \(Continued...\)](#)

[Lecture 48 - Behavioural reaction to organisational Change](#)

[Lecture 49 - Approaches to manage organisational Change](#)

[Lecture 50 - Approaches to manage organisational Change](#)

[Lecture 51 - Action Research model to manage organisational change](#)

[Lecture 52 - Organisational development](#)

[Lecture 53 - Leadership, and Its Theories](#)

[Lecture 54 - Team and Team Work in Management](#)

[Lecture 55 - Human factors and Motivation](#)

[Lecture 56 - Communication and Its Barriers](#)

[Lecture 57 - Controlling: Issues, Types, Techniques and Importance](#)

[Lecture 58 - Budgeting, concept, importance, process and benefits](#)

[Lecture 59 - Reporting- concepts, types, importance and advantages](#)

NPTEL : NOC:Decision Support System for Managers (Management)

Co-ordinators : Prof Sujoy Bhattacharya, Prof. Anupam Ghosh, Prof. Kunal Kanti Ghosh

Lecture 1 - Introduction to decision support systems

Lecture 2 - Components of a decision support systems

Lecture 3 - Components of a decision support systems (Continued...)

Lecture 4 - Models in decision support systems

Lecture 5 - Models in decision support systems (Continued...)

Lecture 6 - Structured, Semi-Structured and Unstructured problems; Models

Lecture 7 - Purpose of models; classification of models

Lecture 8 - Solution Techniques - Optimization : Linear Programming

Lecture 9 - Solution Techniques - Optimization : Linear Programming (Continued...)

Lecture 10 - Solution Techniques - Optimization : Integer Programming

Lecture 11 - Decision Support Systems for Forecasting

Lecture 12 - Decision Support Systems for Forecasting (Continued...)

Lecture 13 - Decision Support Systems for Forecasting (Continued...)

Lecture 14 - Decision Support Systems for Forecasting (Continued...)

Lecture 15 - Decision Support Systems for Forecasting (Continued...)

Lecture 16 - Decision Making for Warehouse Location : Factor Rating and Break - Even Method

Lecture 17 - Decision Making for Warehouse Location (Continued..): Centre of gravity; Ardalan heuristic and transportation cost models

Lecture 18 - Estimation of space requirement in a warehouse and concept of economic order quantity (EOQ)

Lecture 19 - Economic order quantity (EOQ) (Continued...)

Lecture 20 - ABC-FSN-VED Analysis; space calculation in a warehouse - for Staging area

Lecture 21 - Space calculation in a warehouse : Space calculation for racks

Lecture 22 - Order Picking; Material handling equipment's

Lecture 23 - Material Safety and Safety Equipment's

Lecture 24 - Automated storage and replenishment systems (AS/RS)

Lecture 25 - Managerial Decision making in the context of warehousing and materials management

Lecture 26 - Issues in HR; Employee Selection

Lecture 27 - Employee Selection, Promotion and Deployment Method - Lp Method

Lecture 28 - Employee Selection, Promotion and Deployment Method - Rating and ranking Method ; Clustering

Lecture 29 - Employee Selection, Promotion and Deployment Method - BCG

Lecture 30 - Strategizing for Business, the SWOT and Porter's Framework Revisited

Lecture 31 - Fortune at the Bottom of the Pyramid, GE, Rule of Three

- Lecture 32 - Self Actualisation Needs, Rural Marketing Challenges
- Lecture 33 - Rural Marketing; Balanced ScoreCard
- Lecture 34 - Evaluating Investment Proposals : NPV, IRR
- Lecture 35 - Costing and Pricing for Public Transport
- Lecture 36 - Costing and Pricing for Hospitals
- Lecture 37 - Decision Support Systems for Marketing : Decision Support Systems for Media Selection Model
- Lecture 38 - Decision Support Systems for Marketing : Decision Support Systems for Media Selection Model (Continued...)
- Lecture 39 - Decision Support Systems for Marketing : Decision Support Systems for Product Pricing Model
- Lecture 40 - Pricing : Model Selection Using Cross - Validation
- Lecture 41 - Taxation and the Distribution Network
- Lecture 42 - Transshipment; Flexibility and Six Sigma
- Lecture 43 - Flexibility and Total Cost of the Network
- Lecture 44 - Risk Analysis for the Distribution Network
- Lecture 45 - Echelons in the Network
- Lecture 46 - Concept of Variability and Six Sigma
- Lecture 47 - Concept of Variability and Six Sigma (Continued...)
- Lecture 48 - Roadmap to Six Sigma; Ishikawa Diagram and SIPOC
- Lecture 49 - Service Systems : Characteristics; Failure and Recovery
- Lecture 50 - Decision Support Systems for Inventory
- Lecture 51 - Decision Support Systems for Inventory (Continued...)
- Lecture 52 - Decision Support Systems for Inventory (Continued...)
- Lecture 53 - Decision Support Systems for Inventory (Continued...)
- Lecture 54 - Decision Support Systems for Inventory (Continued...)
- Lecture 55 - Decision Support Systems for Operations Management
- Lecture 56 - Decision Support Systems for Operations Management (Continued...)
- Lecture 57 - Decision Support Systems for Operations Management (Continued...)
- Lecture 58 - Decision Support Systems for Operations Management (Continued...)
- Lecture 59 - Decision Support Systems for Operations Management (Continued...)
- Lecture 60 - DSS for Multi - Item Production - Distribution Planning

Lecture 1 - Introduction - Part 1

Lecture 2 - Introduction - Part 2

Lecture 3 - Dimensions of Information System

Lecture 4 - Information Management in the digital world

Lecture 5 - Class discussions and conclusion

Lecture 6 - Data bases and information management

Lecture 7 - Data warehouse and business intelligence

Lecture 8 - Introduction to data mining

Lecture 9 - Data analytics tools and techniques

Lecture 10 - What is ERP ?

Lecture 11 - ERP - Evolution and Benefits

Lecture 12 - Business Benrfits of ERP

Lecture 13 - ERP project management: Challenge, risks and best practices

Lecture 14 - Change management and conclusion

Lecture 15 - Customer relationship management

Lecture 16 - Supply Chain Management - Part 1

Lecture 17 - Supply Chain Management - Part 2

Lecture 18 - Supplier relationship management

Lecture 19 - Product lifecycle maintenance

Lecture 20 - Information Systems for manufacturing management

Lecture 21 - Information Systems for manufacturing management (Continued...)

Lecture 22 - Information Systems for materials management

Lecture 23 - Information Systems for quality management

Lecture 24 - Information Systems for marketing

Lecture 25 - Information Systems for marketing (Continued...)

Lecture 26 - Information Systems for sales and distribution

Lecture 27 - Information Systems for finance and accounting

Lecture 28 - Information Systems for human resource management

Lecture 29 - Information Systems for human resource management (Continued...)

Lecture 30 - Information Systems (IS) strategy

Lecture 31 - Aligning IT with business objectives

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- Lecture 32 - Balanced Score Card
- Lecture 33 - Data Centers, Virtualization and cloud computing
- Lecture 34 - Cloud computing and selection of cloud vendor
- Lecture 35 - Introduction to E-Commerce
- Lecture 36 - B2C Business Models
- Lecture 37 - B2C Business Models (Continued...)
- Lecture 38 - Unique E-Commerce Business Models
- Lecture 39 - Social Commerce and M-Commerce
- Lecture 40 - Cloud Computing - Part I
- Lecture 41 - Cloud Computing - Part II
- Lecture 42 - Internet of Things - Part I
- Lecture 43 - Internet of Things - Part II
- Lecture 44 - Internet of Things - Part III
- Lecture 45 - Big Data and other Emerging Technologies
- Lecture 46 - Knowledge Management Systems (KMS)
- Lecture 47 - Decision Support Systems
- Lecture 48 - Executive Support Systems
- Lecture 49 - Expert Systems
- Lecture 50 - Learning Management Systems (LMS)
- Lecture 51 - Ethical and Social Issues in MIS - I
- Lecture 52 - Ethical and Social Issues in MIS - II
- Lecture 53 - Security Issues in MIS - I
- Lecture 54 - Security Issues in MIS - II
- Lecture 55 - Security Issues in MIS - III
- Lecture 56 - Managing Global Organization - Globalization - Part 1
- Lecture 57 - Global Strategies and Business Organization
- Lecture 58 - Shared Services
- Lecture 59 - Offshoring/Transitioning Global IT Systems
- Lecture 60 - Globalization of Corporates in a Flat World

Lecture 1 - Overview of Module 1 and Introduction of Causality

Lecture 2 - Correlation and Causality

Lecture 3 - Correlation and Causality (Continued...)

Lecture 4 - Correlation and Causality (Continued...)

Lecture 5 - Probability Theory

Lecture 6 - Probability Theory (Continued...)

Lecture 7 - Probability Theory (Continued...)

Lecture 8 - Probability Theory (Continued...)

Lecture 9 - Posterior Probability

Lecture 10 - Bayesian Theorem

Lecture 11 - Bayesian Theorem (Continued...): Repeated Trial

Lecture 12 - Bayesian Theorem (Continued...): Example of Diamond Identification

Lecture 13 - Probability Distribution

Lecture 14 - Double Structure of Variable

Lecture 15 - Probability Distribution (Discrete/Continuous Variable) Random Variable

Lecture 16 - Probability Mass Function (PMF) Probability Density Function (PDF)

Lecture 17 - Expectation, Variance, Covariance

Lecture 18 - Expectation, Variance, Covariance (Continued...)

Lecture 19 - Covariance Rule

Lecture 20 - Bernoulli Distribution

Lecture 21 - Bernoulli Distribution (Continued...)

Lecture 22 - Normal Approximation of Bernoulli Distribution

Lecture 23 - Sampling

Lecture 24 - Sampling (Continued...)

Lecture 25 - Central Limit Theorem

Lecture 26 - Law of Large Numbers LLN

Lecture 27 - Properties of Estimator

Lecture 28 - Conflict Between Unbiasedness and Min Variance

Lecture 29 - T-Distribution

Lecture 30 - Normal Distribution

Lecture 31 - Normal Distribution (Continued...)

[Lecture 32 - Hypothesis Testing](#)

[Lecture 33 - Decision Rules](#)

[Lecture 34 - Level of Significance](#)

[Lecture 35 - P Value](#)

[Lecture 36 - Power of a Test](#)

[Lecture 37 - Confidence Interval](#)

[Lecture 38 - Confidence Interval Example](#)

[Lecture 39 - Properties of Power of a Test](#)

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[Lecture 41 - Error Term, Coefficient of Determination, Regression Coefficient](#)

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[Lecture 57 - Dummy Variable](#)

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Lecture 2 - Group Properties and Determinants of Group Behaviour

Lecture 3 - Stages, Theories and Models of Group Development

Lecture 4 - Effectiveness of Work Group Behaviour

Lecture 5 - Group Decision Making and Limitations of Group Behaviour

Lecture 6 - Concept and Types of Team

Lecture 7 - How to improve team performance, difference between Team and Group

Lecture 8 - Effectiveness of Teamwork

Lecture 9 - Teamwork Process

Lecture 10 - Teamwork and Leadership

Lecture 11 - Concept and Types of Cooperation and Competition

Lecture 12 - Factors leading to Competition and Cooperation

Lecture 13 - Functions of Cooperation and Competition

Lecture 14 - Models on Competition and Cooperation

Lecture 15 - Benefits and drawbacks of competition and cooperation

Lecture 16 - Communication

Lecture 17 - Communication (Continued...)

Lecture 18 - Communication (Continued...)

Lecture 19 - Communication (Continued...)

Lecture 20 - Communication (Continued...)

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[Lecture 36 - Leadership Concept Types and Importance](#)

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Lecture 1 - Basic Concepts of Manufacturing Systems, Evolution of Manufacturing Systems

Lecture 2 - Types of Manufacturing Systems and Role of Automation

Lecture 3 - Product-Process-Flexibility Matrices, Four-Plane Concept of Manufacturing

Lecture 4 - Product Design and Manufacturing Systems

Lecture 5 - Definitions and Design Criteria for Production Systems

Lecture 6 - Manufacturing System Components - I

Lecture 7 - Manufacturing System Components - II

Lecture 8 - Industry 4.0

Lecture 9 - Automation Principles and Strategies for Process Improvement

Lecture 10 - Automated Production System Framework

Lecture 11 - Product Development Process: Approaches and stages

Lecture 12 - Mathematical Models for Interaction between Design and Manufacturing

Lecture 13 - Sequential and Concurrent Engineering Approaches for Product Development

Lecture 14 - Characterization of Concurrent Engineering Framework

Lecture 15 - Concurrent Engineering Techniques

Lecture 16 - Introduction to Concept and Application of Numerical Control (NC) Technology

Lecture 17 - Basic Concepts of an NC System

Lecture 18 - NC Coordinate System, NC Motion Control System

Lecture 19 - Features of CNC, Configuration of CNC Machine Control System

Lecture 20 - Numerical Examples

Lecture 21 - Distributed Numerical Control (DNC) and its Configuration

Lecture 22 - NC Part Programming-I (Manual, Computer-assisted)

Lecture 23 - NC Part Programming-II (CAD/CAM, MDI)

Lecture 24 - Interpolation and Part Programming

Lecture 25 - Numerical Examples

Lecture 26 - Group Technology (GT): Concept and Definition

Lecture 27 - Methods and Implementation of GT for Automation

Lecture 28 - Part Family Formation: Tools and Techniques

Lecture 29 - Numerical Examples on Part Family Formation

Lecture 30 - Application of GT for Designing Flexible and Programmable Automation

Lecture 31 - Concept and Definition of Cellular Manufacturing System (CMS)

- Lecture 32 - Cell Formation Approaches - I
- Lecture 33 - Cell Formation Approaches - II
- Lecture 34 - Evaluation of Cell Design, Numerical Examples
- Lecture 35 - Production Planning and Control in CMS, Assessment of Solution by Heuristics
- Lecture 36 - Types and Definitions of of Flexibility in Manufacturing Systems
- Lecture 37 - Volume-Variety Relationships in Production Systems, What is FMS?
- Lecture 38 - Basic Features of FMS: PhysicalSubsystems
- Lecture 39 - Basic Features of FMS: Control Subsystems and Manufacturing Control Activities.
- Lecture 40 - Types of Problems in FMS
- Lecture 41 - Operational Problems in FMS: Tools and Techniques - 1, Problem Formulation
- Lecture 42 - Operational Problems in FMS: Tools and Techniques - 2, Numerical Examples
- Lecture 43 - Tool Allocation Policies in FMS, Numerical Examples
- Lecture 44 - Fixture and Pallet Selection Problems: Numerical Examples
- Lecture 45 - Types of FMS Layout, Relative Advantages
- Lecture 46 - Fundamentals of Robotics and its Applications
- Lecture 47 - Robot Movement and Precision
- Lecture 48 - Robot Motion Analysis, Robotic Joints and Links
- Lecture 49 - Robot Classification System, Industrial Robot Applications
- Lecture 50 - Numerical Examples
- Lecture 51 - Definition of Process Planning: Function of Process Plan
- Lecture 52 - Basic Steps in Process Plan Development
- Lecture 53 - Process Planning Approaches: Manual Experience-based Process Planning
- Lecture 54 - Process Planning Approaches: Computer-aided Process Planning
- Lecture 55 - CIN and CAPP, Process Optimization and CAPP
- Lecture 56 - Process Optimization and CAPP
- Lecture 57 - FMS and CAPP
- Lecture 58 - Process Optimization and CAPP: Numerical Examples
- Lecture 59 - Process Planning and Concurrent Engineering
- Lecture 60 - Autonomation (and other TPS Areas and Approaches)

Lecture 1 - Introduction to Corporate Finance

Lecture 2 - Corporate Finance and Corporate Governance

Lecture 3 - Sources of Finance for a Firm

Lecture 4 - Return and Risk

Lecture 5 - Return, Risk and Portfolio Theory

Lecture 6 - Time Value of Money

Lecture 7 - Valuation of Future Cash Flows

Lecture 8 - Valuation of Future Cash Flows (Continued...)

Lecture 9 - Valuation of Bonds

Lecture 10 - Valuation of Stocks

Lecture 11 - Capital Budgeting Decisions

Lecture 12 - Capital Budgeting Decisions (Continued...)

Lecture 13 - Capital Budgeting Techniques - I

Lecture 14 - Capital Budgeting Techniques - II

Lecture 15 - Capital Budgeting Techniques - III

Lecture 16 - Introduction to Cost of Capital

Lecture 17 - Cost of Capital - I

Lecture 18 - Cost of Capital - II

Lecture 19 - Cost of Capital and Firm Value - I

Lecture 20 - Cost of Capital and Firm Value - II

Lecture 21 - Measures of Leverage

Lecture 22 - Measures of Leverage (Continued...)

Lecture 23 - Theories of Capital Structure - I

Lecture 24 - Theories of Capital Structure - II

Lecture 25 - Practical Issues in Capital Structure

Lecture 26 - Working Capital Management - I

Lecture 27 - Working Capital Management - II

Lecture 28 - Measuring Liquidity - I

Lecture 29 - Measuring Liquidity - II

Lecture 30 - Inventory Management - I

Lecture 31 - Inventory Management - II

[Lecture 32 - Inventory Management - III](#)

[Lecture 33 - Credit Management - I](#)

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[Lecture 35 - Credit Management - III](#)

[Lecture 36 - Dividend Decisions - I](#)

[Lecture 37 - Dividend Decisions - II](#)

[Lecture 38 - Applications of Dividend Theories - I](#)

[Lecture 39 - Applications of Dividend Theories - II](#)

[Lecture 40 - Some Issues in Corporate Finance](#)

[Lecture 1 - Introduction to International Marketing](#)

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[Lecture 5 - International Business, Entry Modes and Theories](#)

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[Lecture 8 - International Business, Entry Modes and Theories](#)

[Lecture 9 - International Business, Entry Modes and Theories](#)

[Lecture 10 - Hofstede's Cultural Dimensions, Cross-cultural Sales Negotiations](#)

[Lecture 11 - Hofstede's Cultural Dimensions, Cross-cultural Sales Negotiations \(Continued...\)](#)

[Lecture 12 - Hofstede's Cultural Dimensions, Cross-cultural Sales Negotiations \(Continued...\)](#)

[Lecture 13 - Hofstede's Cultural Dimensions, Cross-cultural Sales Negotiations \(Continued...\)](#)

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[Lecture 17 - Import Export Procedures \(Continued...\)](#)

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[Lecture 22 - Designing a Global Marketing Program \(Continued...\)](#)

[Lecture 23 - Designing a Global Marketing Program \(Continued...\)](#)

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[Lecture 32 - Interaction with Practicing Manager - Question and Answer Session](#)

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[Lecture 36 - Interaction with Practicing Manager \(Continued...\)](#)

[Lecture 37 - Interaction with Practicing Manager \(Continued...\)](#)

[Lecture 38 - Interaction with Practicing Manager \(Continued...\)](#)

[Lecture 39 - Concluding Session](#)

NPTEL : NOC:Retail Management (Management)

Co-ordinators : Prof. Swagato Chatterjee

[Lecture 1 - Introduction to Retailing - Part 1](#)

[Lecture 2 - Introduction to Retailing - Part 2](#)

[Lecture 3 - Introduction to Retailing - Part 3](#)

[Lecture 4 - Relationship Management in Retailing](#)

[Lecture 5 - Value-based Retailing](#)

[Lecture 6 - Retailing Services](#)

[Lecture 7 - Loyalty and Reward Programs](#)

[Lecture 8 - Strategic Planning in Retailing](#)

[Lecture 9 - Global Retailing](#)

[Lecture 10 - Retail Business Models by Ownership](#)

[Lecture 11 - Franchising in Retail](#)

[Lecture 12 - Retail Institutions by Store - Based Strategy Mix](#)

[Lecture 13 - Retail Institutions by Store - Based Strategy Mix \(Continued...\)](#)

[Lecture 14 - Retail Institutions by Store - Based Strategy Mix \(Continued...\)](#)

[Lecture 15 - Retail Institutions by Store - Based Strategy Mix \(Continued...\)](#)

[Lecture 16 - Web, Non store-based and Other Forms of Nontraditional Retailing](#)

[Lecture 17 - Web, Non store-based and Other Forms of Nontraditional Retailing \(Continued...\)](#)

[Lecture 18 - Identifying and Understanding the Customers](#)

[Lecture 19 - Trading Area Analysis](#)

[Lecture 20 - Trading Area Analysis \(Continued...\)](#)

[Lecture 21 - Trading Area Analysis \(Continued...\)](#)

[Lecture 22 - Site Selection](#)

[Lecture 23 - Site ownership vs Site Leasing](#)

[Lecture 24 - Retail Supply Chain Management](#)

[Lecture 25 - Retail Supply Chain Management \(Continued...\)](#)

[Lecture 26 - Retail Operations Management - 1](#)

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[Lecture 30 - Pricing in Retail](#)

[Lecture 31 - Pricing in Retail \(Continued...\)](#)

- [Lecture 32 - Pricing in Retail \(Continued...\)](#)
- [Lecture 33 - Merchandising in Retail](#)
- [Lecture 34 - Merchandising in Retail \(Continued...\)](#)
- [Lecture 35 - Category Management and Merchandise Planning](#)
- [Lecture 36 - Retail Promotions](#)
- [Lecture 37 - Retail Promotions: non-Ad Promotions](#)
- [Lecture 38 - OBHR Issues in Retail - 1](#)
- [Lecture 39 - HR Issues in Retail](#)
- [Lecture 40 - Vendor Negotiations](#)
- [Lecture 41 - Special Merchandising Contexts - 1](#)
- [Lecture 42 - Special Merchandising Contexts - 2](#)
- [Lecture 43 - Store Layout in Retail](#)
- [Lecture 44 - Retail Operations: Financial Aspects](#)
- [Lecture 45 - Budgeting and Costing](#)
- [Lecture 46 - Financial Merchandise Management](#)
- [Lecture 47 - Merchandise Forecasting, Dollar Control](#)

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Business Law for Managers (Management)

Co-ordinators : Prof. S. Srinivasan, Prof. Kaushik Mukherjee

- Lecture 1 - Concept, Definition and Features of Company
- Lecture 2 - Various Types of Companies and Their Memberships
- Lecture 3 - Meetings of a Company and Memorandum of Associations
- Lecture 4 - Corporate Social Responsibility (CSR)
- Lecture 5 - Reporting and Various Activities under CSR
- Lecture 6 - Concept, Definition and Features of Corporate Governance
- Lecture 7 - Effect of Corporate Governance
- Lecture 8 - Major Structural Issues
- Lecture 9 - Duties and Responsibilities of Directors
- Lecture 10 - Corporate Governance a Way Forward
- Lecture 11 - Concept, Scope and Features of PIT
- Lecture 12 - Investigation and Prohibition on Dealing, Counselling
- Lecture 13 - Key Changes in PIT Amendment, 2020
- Lecture 14 - Model Code of Conduct for PIT, Trading Initiatives
- Lecture 15 - Insider trading examples, PIT Recent Cases and Insider Trading Initiatives
- Lecture 16 - Concept, Elements, Importance and Forms of Contracts
- Lecture 17 - Concept of Offer, Valid Offer and Essentials of Valid Offer
- Lecture 18 - Concept of Fraud, Misrepresentation and Consideration
- Lecture 19 - Major Issues related to Contract
- Lecture 20 - Law of Insurance
- Lecture 21 - Background, Concept and Salient Features of Factories Act
- Lecture 22 - Health and Safety
- Lecture 23 - Labour Welfare
- Lecture 24 - Working Hours
- Lecture 25 - Duties of Inspecting Officials
- Lecture 26 - Background, Concept and Importance of Legislation for Wages
- Lecture 27 - Payment of Wages
- Lecture 28 - Minimum Wages
- Lecture 29 - Payment of Bonus Act
- Lecture 30 - Equal Remuneration Act
- Lecture 31 - Social Securities

[Lecture 32 - Social securities in unorganised sector](#)

[Lecture 33 - The Employees' Provident Fund Act](#)

[Lecture 34 - Payment of Gratuity Act 1972](#)

[Lecture 35 - Employee State Insurance \(ESI\)](#)

[Lecture 36 - Concept and Salient Features of Industries](#)

[Lecture 37 - Industrial Relation](#)

[Lecture 38 - Industrial Dispute Act](#)

[Lecture 39 - Various Authorities under Industrial Dispute Act, 1947](#)

[Lecture 40 - Procedure, Power and Duties of Authorities](#)

Lecture 1 - Introduction to Safety and Risk Management

Lecture 2 - Hazard Triangle

Lecture 3 - Safety Ontology

Lecture 4 - Qualitative Risk Assessment

Lecture 5 - Quantitative Risk Assessment

Lecture 6 - Hazard and Risk Data - I

Lecture 7 - Hazard and Risk Data - II

Lecture 8 - Incident Investigation Data

Lecture 9 - Inspection and Audit Data

Lecture 10 - Behavioral and Organizational Safety Data

Lecture 11 - Data Dimensions and Information Quality

Lecture 12 - Missing Data Handling

Lecture 13 - Data Transformation - I

Lecture 14 - Data Transformation - II

Lecture 15 - Data Reduction - I

Lecture 16 - Data Reduction - II

Lecture 17 - Probability Distribution

Lecture 18 - Sample and Statistics

Lecture 19 - Safety Data Visualization Tools - I

Lecture 20 - Safety Data Visualization Tools - II

Lecture 21 - Safety Data Exploration

Lecture 22 - Leading and Lagging Indicators for Measuring Safety Performance

Lecture 23 - Control Charts for Safety Performance Evaluation and Monitoring

Lecture 24 - Safety Capability Analysis - I

Lecture 25 - Safety Capability Analysis - II

Lecture 26 - Safety Reports and Use of Text Analytics

Lecture 27 - Preprocessing of Text Data - I

Lecture 28 - Preprocessing of Text Data - II

Lecture 29 - Document Classification using KNN

Lecture 30 - Topic Modeling - Latent Dirichlet Allocation

Lecture 31 - Bow-Tie Construction

- Lecture 32 - Bow-Tie Quantification - I
- Lecture 33 - Bow-Tie Quantification - II: Accident Scenarios/Paths
- Lecture 34 - Bow-Tie Quantification - III: Accident Path Quantification
- Lecture 35 - Bow-Tie Quantification - IV: Probabilistic Approach using Monte Carlo Simulation
- Lecture 36 - Consequence Modeling and Risk Distribution
- Lecture 37 - Introduction to Predictive Safety and Risk Analytics
- Lecture 38 - Logistic Regression
- Lecture 39 - Application of Logistic Regression
- Lecture 40 - Classification and Regression Tree (CART)
- Lecture 41 - Classification and Regression Tree (CART): Case Study
- Lecture 42 - Support Vector Machine
- Lecture 43 - Support Vector Machine (Continued...)
- Lecture 44 - Application of Support Vector Machine
- Lecture 45 - Association Rule Mining
- Lecture 46 - Application of Association Rule Mining
- Lecture 47 - Statistical Measures of Safety Program Effectiveness - I
- Lecture 48 - Statistical Measures of Safety Program Effectiveness - II
- Lecture 49 - Statistical Measures of Safety Program Effectiveness - III
- Lecture 50 - Intervention Design
- Lecture 51 - Risk Based Decision Making - I
- Lecture 52 - Risk Based Decision Making - II
- Lecture 53 - Risk Based Maintenance - I
- Lecture 54 - Risk Based Maintenance - II
- Lecture 55 - Introduction to Behavioral Safety
- Lecture 56 - Behavioral Safety Data Collection and Preliminary Analysis
- Lecture 57 - Causal Modelling - I
- Lecture 58 - Causal Modelling - II: Application of Path Model
- Lecture 59 - Injury Epidemiology
- Lecture 60 - Occupational Safety, Health and Working Conditions Code, 2020 Analytics

Lecture 1 - Introduction and Concept - I

Lecture 2 - Introduction and Concept - II

Lecture 3 - Analysis of micro and macro environment - I

Lecture 4 - Analysis of micro and macro environment - II

Lecture 5 - Competition and Competitive Advantage - I

Lecture 6 - Competition and Competitive Advantage - II

Lecture 7 - Competition and Competitive Advantage - III

Lecture 8 - Framework for Internal Analysis of Firm - I

Lecture 9 - Framework for Internal Analysis of Firm - II

Lecture 10 - Value Chain Analysis

Lecture 11 - Resource-based view of firm and sustainability

Lecture 12 - Strategy Formulation - I

Lecture 13 - Strategy Formulation - II

Lecture 14 - Strategy Formulation - III

Lecture 15 - Diversification - I

Lecture 16 - Diversification - II

Lecture 17 - Mergers and Acquisitions - I

Lecture 18 - Mergers and Acquisitions - II

Lecture 19 - Portfolio Analysis and Display Matrices - I

Lecture 20 - Portfolio Analysis and Display Matrices - II

Lecture 21 - Operating and Financial Analysis

Lecture 22 - Complexities and Challenges of Competing in Global Markets - I

Lecture 23 - Complexities and Challenges of Competing in Global Markets - II

Lecture 24 - Entry Mode Strategies and Main Approaches for International Business

Lecture 25 - Building Competitive Advantage in International Markets

Lecture 26 - Strategies for competing in developing markets, and defending against global giants

Lecture 27 - Resource Allocation

Lecture 28 - 7-S Framework for Organizational Change

Lecture 29 - Strategy Implementation Issues

Lecture 30 - Matching organization structure to strategy

Lecture 31 - Forms of Organization

- Lecture 32 - Boundaryless Organization
- Lecture 33 - Strategic Leadership - I
- Lecture 34 - Strategic Leadership - II
- Lecture 35 - Universal Inner Structure of Effective Leaders
- Lecture 36 - Strategic Leadership - IV
- Lecture 37 - Business and Operational Excellence
- Lecture 38 - Strategic and Operational Control
- Lecture 39 - Balanced Scorecard Approach
- Lecture 40 - Roles and Responsibilities of Board of Directors
- Lecture 41 - Strategic Management Role and Style of the Board
- Lecture 42 - Composition, structure and other requirements of Board
- Lecture 43 - Improve Board Effectiveness, Board and Directorsâ€™ Performance Evaluation
- Lecture 44 - Corporate Governance Code
- Lecture 45 - Corporate Social Responsibility and Sustainability
- Lecture 46 - Social Auditing
- Lecture 47 - Innovation for Survival and Growth - I
- Lecture 48 - Innovation for Survival and Growth - II
- Lecture 49 - Entrepreneurship and Intrapreneurship
- Lecture 50 - Technology Management - I
- Lecture 51 - Technology Management - II
- Lecture 52 - In-house Development of Technology
- Lecture 53 - Strategic Importance of Knowledge and Organizational Learning
- Lecture 54 - Strategies for Knowledge Management
- Lecture 55 - Developing Strategic Plan of a Major Oil Company - I
- Lecture 56 - Developing Strategic Plan of a Major Oil Company - II
- Lecture 57 - Developing Strategic Plan of a Major Oil Company - III
- Lecture 58 - Summary of Modules 1-6
- Lecture 59 - Summary of Modules 7-11
- Lecture 60 - Summary of Modules 12-18

- Lecture 1 - Definition, purpose, and development of Human Factors and Ergonomics
- Lecture 2 - Types and components of worksystems, their interactions and evaluations
- Lecture 3 - Human components, machine components and environment components of worksystems
- Lecture 4 - Modern worksystems, FMJ vs FJM
- Lecture 5 - Contribution of human factors in systems design, engineering and management
- Lecture 6 - Anthropometry in product/process design, MHD, anthropometric design motto
- Lecture 7 - Types of anthropometric data, principles of applied anthropometry
- Lecture 8 - Examples of anthropometric design, numerical exercises
- Lecture 9 - Working Posture Analysis, Postural Triangle, Design for Seated and Standing Workers - Part 1
- Lecture 10 - Working Posture Analysis, Postural Triangle, Design for Seated and Standing Workers - Part 2
- Lecture 11 - Metabolism during work, Aerobic and anaerobic work, oxygen uptake
- Lecture 12 - Physical work capacity and energy expenditure, Individual differences, RWL, MOW
- Lecture 13 - MOE expenditure, Subjective measures of physical effort, Borg RPE scale, Factors
- Lecture 14 - EE of various operations in agriculture, construction and manufacturing industry - I
- Lecture 15 - EE of various operations in agriculture, construction and manufacturing industry - II
- Lecture 16 - Types of Injury Problems in Manual Handling Tasks, Types of Activities and Body Movements
- Lecture 17 - Biomechanical Modelling and Analysis of Manual Lifting
- Lecture 18 - Definitions and Standards of Lifting: NIOSH Lifting Equation
- Lecture 19 - EC Guidelines, UK Health and Safety Commission Guidelines
- Lecture 20 - Use of Material Handling Aids, Types of Material Handling Devices, Numerical Problems
- Lecture 21 - Ergonomic Problems in Computer Workstations, Design Elements of Computer Workstation
- Lecture 22 - Specifications of Computer Workstation Design Elements
- Lecture 23 - Methods to Reduce Glare/Reflection on Screen
- Lecture 24 - Design of Human-Computer Interaction
- Lecture 25 - Evolution of Technology in Computer Screen, Numerical Problems
- Lecture 26 - Work Postures and Related Complaints, Work Postures for Different Tasks, Task Analysis
- Lecture 27 - Power Law of Practice, Learning Curve, Numerical Pro
- Lecture 28 - Work Posture Assessment, Rapid Entire Body Assessment (REBA), MSDs/RMIs
- Lecture 29 - Hand tool design: Fitting the task, user and hand, Usage of hand tools and types of
- Lecture 30 - Design guidelines for hand tools
- Lecture 31 - Environment Component in Worksystems, Ergonomic Design of Physical Environment

- Lecture 32 - Ergonomic Design Framework for Environment, Importance of Illumination
- Lecture 33 - Measurement of Illuminance, Luminance, and Contrast
- Lecture 34 - Measures of Contrast, Contrast Ratio under Different Work Situations
- Lecture 35 - Direct and Indirect Glare or Reflection, Illumination for Inspection and Quality
- Lecture 36 - Problem of Heat Stress at Workplaces, Thermoregulation Process, Acclimation and
- Lecture 37 - Thermal Balance Equation and Heat Stress
- Lecture 38 - Quality of Thermal Environment, Evaluation of Thermal Environment
- Lecture 39 - Whole Body Vibration and Sources of Vibration Discomfort
- Lecture 40 - Design guidelines for hand tools
- Lecture 41 - Auditory Environment and Human Performance, Measurement of Sound and Noise Exposure
- Lecture 42 - Noise Exposure and Hearing Loss, Noise Analysis and Noise Reduction using Engineering
- Lecture 43 - Effects of Noise on Performance, Broadbent and Poulton Theories, Interference of Noise
- Lecture 44 - Octave bands and examples
- Lecture 45 - Ergonomic design of auditory environment in different workplaces
- Lecture 46 - Concepts of Design for Manufacturing (DFM), Design for Assembly (DHA), and Design
- Lecture 47 - Product Design Assessment and Important Measures, Manual Assembly Design Efficiency
- Lecture 48 - Assembly Time Determination with PMTS Methods, Human Factors Principles in DHA
- Lecture 49 - Maintenance in Manufacturing/Production System - Important Ergonomic Design Issues - Part I
- Lecture 50 - Maintenance in Manufacturing/Production System - Important Ergonomic Design Issues - Part II
- Lecture 51 - Definition of Shift Work, Problems with Shift Work, Effect on Circadian Rhythms
- Lecture 52 - Problems of shift workers, Shift Work and Human Performance
- Lecture 53 - Recommended Shift Work Schedules
- Lecture 54 - Major Ergonomic Issues and Problems in Shift Work Design - Part 1
- Lecture 55 - Major Ergonomic Issues and Problems in Shift Work Design - Part 2
- Lecture 56 - Concepts of Ergonomic Performance and its Indicators
- Lecture 57 - EPI Assessment Tool Development
- Lecture 58 - Factors and their level of assessment
- Lecture 59 - Application of EPI Model in Different Worksystems
- Lecture 60 - Epilogue

Lecture 1 - Introduction to Organizational Design

Lecture 2 - Introduction to Organizational Design

Lecture 3 - Introduction to Organizational Design

Lecture 4 - Introduction to Organizational Design

Lecture 5 - Introduction to Organizational Design

Lecture 6 - Organizational Environment

Lecture 7 - Organizational Environment

Lecture 8 - Organizational Environment

Lecture 9 - Organizational Environment

Lecture 10 - Organizational Environment

Lecture 11 - Organizational Structure

Lecture 12 - Organizational Structure

Lecture 13 - Organizational Structure

Lecture 14 - Organizational Structure

Lecture 15 - Organizational Structure

Lecture 16 - Organizational Design and Strategy in a changing Global environment

Lecture 17 - Organizational Design and Strategy in a changing Global environment

Lecture 18 - Organizational Design and Strategy in a changing Global environment

Lecture 19 - Organizational Design and Strategy in a changing Global environment

Lecture 20 - Organizational Design and Strategy in a changing Global environment

Lecture 21 - Organizational Change

Lecture 22 - Organizational Change

Lecture 23 - Organizational Change

Lecture 24 - Organizational Change

Lecture 25 - Organizational Change

Lecture 26 - Managing Conflict, Power, and Politics

Lecture 27 - Managing Conflict, Power, and Politics

Lecture 28 - Managing Conflict, Power, and Politics

Lecture 29 - Managing Conflict, Power, and Politics

Lecture 30 - Managing Conflict, Power, and Politics

Lecture 31 - Organizational culture

- Lecture 32 - Organizational culture and socialization
- Lecture 33 - Organizational culture and climate
- Lecture 34 - Managing organizational culture
- Lecture 35 - International aspects of organizational culture
- Lecture 36 - Organizational design and technology
- Lecture 37 - Technologies and organizational structure
- Lecture 38 - Technological theories and organizational design
- Lecture 39 - Organizational design and technology: Challenges
- Lecture 40 - Organizational competencies
- Lecture 41 - Decision making
- Lecture 42 - Learning
- Lecture 43 - Knowledge management
- Lecture 44 - IT and IS
- Lecture 45 - IT in Management and Organization
- Lecture 46 - Organizational Birth and Growth
- Lecture 47 - Organizational Decline and Death
- Lecture 48 - Organizational Inertia and Resilience
- Lecture 49 - Organizational Transformation
- Lecture 50 - Organizational Development and Intervention
- Lecture 51 - Innovation: Concept, Types
- Lecture 52 - Innovation Framework Model
- Lecture 53 - Intrapreneurship
- Lecture 54 - Creativity
- Lecture 55 - Creativity and Related Issues
- Lecture 56 - Creativity and Design Thinking
- Lecture 57 - Turnaround Situation: Strategic, Operational and Cultural
- Lecture 58 - IT and ICT Intervention
- Lecture 59 - Human Resource Intervention
- Lecture 60 - Organizational Culture, Transformation and Ethical Values
- Lecture 61 - Future Trends for Organizational Transformation

- Lecture 1 - Introduction to Mergers and Acquisitions - I
- Lecture 2 - Introduction to Mergers and Acquisitions - II
- Lecture 3 - Theories of Mergers and Acquisitions
- Lecture 4 - Legal Environment of M and A in India
- Lecture 5 - Case Studies - DO M and A PAY ?
- Lecture 6 - Takeover Tactics and Anti-takeover Defenses - 1
- Lecture 7 - Takeover Tactics and Anti-takeover Defenses - 1
- Lecture 8 - Takeover Tactics and Anti-takeover Defenses - 2
- Lecture 9 - Takeover Tactics and Anti-takeover Defenses - 3
- Lecture 10 - Acquisition Search and Due Diligence - 1
- Lecture 11 - Acquisition Search and Due Diligence - 2
- Lecture 12 - Valuation in M and A: Cash Flow Based Approach - 1
- Lecture 13 - Valuation in M and A: Cash Flow Based Approach - 3 (Cost of Capital)
- Lecture 14 - Valuation in M and A: Cash Flow Based Approach - 4 (Dividend Discount Model)
- Lecture 15 - Valuation in M and A: Cash Flow Based Approach - 4 (Dividend Discount Model)
- Lecture 16 - Valuation in M and A: Cash Flow Based Approach - 5 (Free Cash Flow Models)
- Lecture 17 - Valuation in M and A: Cash Flow Based Approach - 6 (Free Cash Flow Models) (Continued...)
- Lecture 18 - Valuation in M and A: Valuation of Synergies - 1
- Lecture 19 - Valuation in M and A: Valuation of Synergies - 2
- Lecture 20 - Valuation in M and A: Asset Based Valuation
- Lecture 21 - Valuation in M and A: Relative Valuation - 1
- Lecture 22 - Valuation in M and A: Relative Valuation - 2
- Lecture 23 - Alternative Exit and Restructuring Strategies - 1
- Lecture 24 - Alternative Exit and Restructuring Strategies - 2
- Lecture 25 - Alternative Exit and Restructuring Strategies - 3
- Lecture 26 - M and A Deal Structuring - 1
- Lecture 27 - M and A Deal Structuring - 2
- Lecture 28 - M and A Deal Structuring - 3
- Lecture 29 - M and A Deal Structuring - 4
- Lecture 30 - M and A Deal Structuring - 5
- Lecture 31 - Legal Aspects of M and A - 1

[Lecture 32 - Legal Aspects of M and A - 2](#)

[Lecture 33 - Legal Aspects of M and A - 3](#)

[Lecture 34 - Accounting Aspects of M and A - I](#)

[Lecture 35 - Accounting Aspects of M and A - II](#)

[Lecture 36 - Alternative Exit and Restructuring Strategies - 1](#)

[Lecture 37 - Alternative Exit and Restructuring Strategies - 2](#)

[Lecture 38 - Alternative Exit and Restructuring Strategies - 3](#)

[Lecture 39 - Leveraged Buyouts](#)

[Lecture 40 - Alternative Exit and Restructuring Strategies - Insolvency and Bankruptcy](#)

- Lecture 1 - Investment Management as a Process
- Lecture 2 - Role of Financial Markets and Institutions
- Lecture 3 - Types of Investments
- Lecture 4 - Ecology of Financial Markets
- Lecture 5 - Investment Philosophies
- Lecture 6 - Present and Future Values of Investments
- Lecture 7 - Bonds as an Investment
- Lecture 8 - Pricing and Valuation of Bonds
- Lecture 9 - Pricing and Valuation of Bonds (Continued...)
- Lecture 10 - Prices, Yields, and Duration of Bonds
- Lecture 11 - Equity as an Asset Class
- Lecture 12 - Equity Valuation Models
- Lecture 13 - Equity Valuation Models (Continued...)
- Lecture 14 - Equity Valuation Ratios
- Lecture 15 - Equity Investment Strategies
- Lecture 16 - Portfolio Theory - Primer
- Lecture 17 - Capital Asset Pricing Model
- Lecture 18 - The CAPM and Index Models
- Lecture 19 - The CAPM and Index Models (Continued...)
- Lecture 20 - Consumption-Based Asset Pricing
- Lecture 21 - Two-fund Theorem
- Lecture 22 - Mutual Fund Basics
- Lecture 23 - Mutual Fund Basics (Continued...)
- Lecture 24 - Risk Indicator of a Mutual Fund
- Lecture 25 - Risk Indicator of a Mutual Fund (Continued...)
- Lecture 26 - Market Efficiency
- Lecture 27 - Market Efficiency (Continued...)
- Lecture 28 - Fundamental Analysis of Securities
- Lecture 29 - Value Investing using PV Models
- Lecture 30 - Asset Allocation and Portfolio Strategies
- Lecture 31 - Exchange Traded Funds (ETFs)

[Lecture 32 - Forming Portfolio with ETFs](#)

[Lecture 33 - Forming Portfolio with ETFs \(Continued...\)](#)

[Lecture 34 - Cryptocurrencies](#)

[Lecture 35 - Cryptocurrencies \(Continued...\)](#)

[Lecture 36 - Behavioral Anomalies in Investments](#)

[Lecture 37 - Behavioral Anomalies in Investments \(Continued...\)](#)

[Lecture 38 - Portfolio Evaluation](#)

[Lecture 39 - Portfolio Evaluation \(Continued...\)](#)

[Lecture 40 - Wrapping up](#)

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Project Management: Planning, Execution, Evaluation and Control (Management)

Co-ordinators : Prof. Sanjib Chowdhury

Lecture 1 - Basic Concepts and Introduction

Lecture 2 - Drivers of Project Management

Lecture 3 - Linkages between Organization Strategy and Projects

Lecture 4 - Project Governance and Design of Project Portfolio System

Lecture 5 - Non-Financial and Multi-Criteria Project Selection Models

Lecture 6 - Organization Structure

Lecture 7 - Organization Culture

Lecture 8 - Project Scope of Work and Deliverables

Lecture 9 - Responsibility Matrices and Project Communication Plan

Lecture 10 - Estimating Guidelines and Methods, Top-down Estimation

Lecture 11 - Level of Details, Type of Costs and Refining Estimates

Lecture 12 - Concept of Project Network and Development Rules

Lecture 13 - Construction of Network and Computation Process

Lecture 14 - Extended Network Techniques to Represent Reality

Lecture 15 - Probability of Completion of Project on Time

Lecture 16 - Managing Risk and Risk Identification

Lecture 17 - Risk Assessment

Lecture 18 - Risk Response Development and Contingency Planning

Lecture 19 - Risk Response Control and Change Control Management

Lecture 20 - Risk Assessment of Capital projects

Lecture 21 - Classification of Scheduling Problems: Time-constrained Project

Lecture 22 - Resource-constrained Project

Lecture 23 - Time-phased Budget, Critical Chain Project Management

Lecture 24 - Rationale and Options for Project Crashing

Lecture 25 - Crashing - Reducing Project Duration

Lecture 26 - Reducing Project Duration - Solving Numerical

Lecture 27 - Project Monitoring and Control Process

Lecture 28 - Development of Performance Indexes for Monitoring

Lecture 29 - Forecasting Project Completion Time and Cost

Lecture 30 - Strategic Dimensions and Decision Logic of Outsourcing

Lecture 31 - Best Practices in Outsourcing Project Work

[Lecture 32 - Partnering and Traditional Approaches for Managing Relations](#)

[Lecture 33 - The Art of Negotiating](#)

[Lecture 34 - Customer's Satisfaction and Managing Customer Relations](#)

[Lecture 35 - Types of Contract and their Salient Features](#)

[Lecture 36 - Preparation and Evaluation of RFP: Best Practices](#)

[Lecture 37 - Project Closure Activities and Post-Implementation Evaluation](#)

[Lecture 38 - Retrospectives](#)

[Lecture 39 - Oversight Activities and Levels](#)

[Lecture 40 - Phase Gate System, Project Management Maturity Model](#)

Lecture 1 - Introduction to Commodity Market

Lecture 2 - Commodity Spot Market and Different Types of Auction

Lecture 3 - Commodity Spot Market and Different Types of Auction

Lecture 4 - Introduction to forward contract

Lecture 5 - Introduction to Futures Contract

Lecture 6 - Futures Contract Specification

Lecture 7 - Futures Contract Specification (Continued...)

Lecture 8 - Futures Contract Specification (Continued...)

Lecture 9 - Futures Contract (Different Types of Margins)

Lecture 10 - Futures Contract (Mark-to-Market/MTM Margin)

Lecture 11 - Hedgers Vs. Speculators

Lecture 12 - Measures of Speculation

Lecture 13 - Spot Price, Futures Price and Basis Risk

Lecture 14 - Spot Price, Futures Price and Basis Risk (Continued...)

Lecture 15 - Pricing of Futures

Lecture 16 - Pricing of Futures (Continued...)

Lecture 17 - Convenience Yield, Minimum Variance Hedge Ratio

Lecture 18 - Hedge Effectiveness, Cross Hedge, Stack and Roll Vs. Strip Hedge

Lecture 19 - Calendar Spread, Valuation of Futures vs. Forwards, Commodity Swaps

Lecture 20 - Commodity Swaps

Lecture 21 - Commodity Index

Lecture 22 - Commodity Index (Continued...)

Lecture 23 - Commodity options

Lecture 24 - Introduction to Commodity Options (Continued...), Hedgers vs. Speculators

Lecture 25 - Pricing of Commodity Options

Lecture 26 - Commodity Options (Continued...), Put-Call Parity and Put-Call Ratio

Lecture 27 - Put-Call Parity, Implied Volatility, Swaptions

Lecture 28 - Commodity Swaption (Continued...) and Asian Options on Commodities

Lecture 29 - Commodity Derivatives Market : Value Proposition

Lecture 30 - Commodity Derivatives Market : Value Proposition

Lecture 31 - Agricultural Commodity Price Risk Management

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- Lecture 32 - Agricultural Commodity Price Risk Management (Continued...)
- Lecture 33 - Agricommodities Price Risk, Seasonality, Crush Spread Futures
- Lecture 34 - Agri-commodity Seasonality, Crush Spread Futures, Salmon Futures
- Lecture 35 - Crush Spread Futures, Salmon Futures, Agri-commodity risk Management Practices
- Lecture 36 - Gold and other Precious Metal Derivatives
- Lecture 37 - Gold as Asset, LBMA Spot Price Fix
- Lecture 38 - Gold as Asset, ETF, Gold-Silver Ratio
- Lecture 39 - Gold Price Risk Management, Dehedge, Zero Cost Derivatives
- Lecture 40 - Gold Quanto Futures, Delta Hedge Trap
- Lecture 41 - Crude oil and Crude oil Derivatives Price Risk Management
- Lecture 42 - Crude oil and Crude oil Derivatives Price Risk Management (Continued...)
- Lecture 43 - Crack Spread Futures, Spread Options and Crude Oil Price Risk
- Lecture 44 - Crude Oil Price Risk Management: 3-Way Collar, Spread Options and Swaps
- Lecture 45 - Swaps, Calendar Spreads: Crude Oil and Natural Gas Risk Management
- Lecture 46 - Weather Derivatives
- Lecture 47 - Weather Derivatives (Continued...)
- Lecture 48 - Weather Derivatives (Snowfall, Rainfall and Hurricane)
- Lecture 49 - Weather Derivatives (Rainfall and Hurricane)
- Lecture 50 - Spot and Derivatives Contracts on Electricity
- Lecture 51 - Electricity Trading in Day Ahead Market (DAM)
- Lecture 52 - Spot and Derivatives in Electricity (System Price and Area Clearing Price)
- Lecture 53 - Spot and Derivatives in Electricity (Green DAM, Duck Curve, Dark/Spark Spread)
- Lecture 54 - Carbon Credits and Carbon Credit Derivatives Market
- Lecture 55 - Carbon Credits (CDM, JI, RGGI, REC, ESCerts)
- Lecture 56 - Carbon Credits (REC, ESCerts, CORSIA) and Carbon Derivatives
- Lecture 57 - Freight Rates Derivatives
- Lecture 58 - Freight Rates Derivatives (Continued...)
- Lecture 59 - Water Derivatives
- Lecture 60 - Real Estate Derivatives and Derivatives Losses

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NPTEL : NOC:Service Management: Integrating Strategy, Operations, and Technology (Management)

Co-ordinators : Prof. Sanjib Chowdhury

Lecture 1 - The Role of Services in an Economy - 1

Lecture 2 - The Role of Services in an Economy - 2

Lecture 3 - The Nature of Services - 1

Lecture 4 - The Nature of Services - 2

Lecture 5 - The Nature of Services - 3

Lecture 6 - Strategic Service Vision, and Competitive Advantage

Lecture 7 - Generic Strategies for Competitive Advantage (Continued...)

Lecture 8 - Five-forces Model, and SWOT Analysis

Lecture 9 - Winning Customers, Sustainability, and Role of Information in Services

Lecture 10 - Virtual Value Chain, Limits in the Use of Information, and Service Firm Competitiveness

Lecture 11 - Sources of Growth and Innovations in Service Sector

Lecture 12 - Design and Development of New Service

Lecture 13 - Taxonomy and Generic Approaches to Service System Design

Lecture 14 - Role of Technology in Services and Service Encounter Triad

Lecture 15 - Service Encounter (Continued...)

Lecture 16 - Service Profit Chain

Lecture 17 - Servicescapes and Facility Design

Lecture 18 - Process Flows

Lecture 19 - Product Layout: Work Allocation Problem

Lecture 20 - Process Layout: Relative Location Problem

Lecture 21 - Process Layout: Relative Location Problem (Continued...)

Lecture 22 - Defining and Measuring Service Quality

Lecture 23 - Quality Service by Design

Lecture 24 - Unconditional Service Guarantee and Service Recovery

Lecture 25 - Statistical Process Control - I

Lecture 26 - Statistical Process Control - II

Lecture 27 - Statistical Process Control - III

Lecture 28 - Statistical Process Control - IV

Lecture 29 - Foundation of Continuous Improvement

Lecture 30 - Quality Improvement Programs - I

Lecture 31 - Quality Improvement Programs - II

- Lecture 32 - Domestic Growth and Expansion Strategies
- Lecture 33 - Generic International Strategies
- Lecture 34 - Transnational Operations and Global Service Strategies
- Lecture 35 - Strategic Location Considerations
- Lecture 36 - Facility Location Modelling
- Lecture 37 - Facility Location Techniques: Locational Cost-Profit-Volume analysis
- Lecture 38 - Facility Location Techniques: Cross-Median Approach
- Lecture 39 - Facility Location Techniques: Huff Retail Location Model - I
- Lecture 40 - Facility Location Techniques: Huff Retail Location Model - II
- Lecture 41 - Strategies for Managing Demand - I
- Lecture 42 - Strategies for Managing Demand - II
- Lecture 43 - Strategies for Managing Demand - III
- Lecture 44 - Strategies for Managing Capacity - I
- Lecture 45 - Strategies for Managing Capacity - II
- Lecture 46 - Yield Management - I
- Lecture 47 - Yield Management - II
- Lecture 48 - Strategies for Managing Customer Waiting
- Lecture 49 - Essential Features of Queuing Systems
- Lecture 50 - Relationship between negative Exponential and Poisson distribution
- Lecture 51 - Strategic Roles of Capacity Planning, and Queuing - Terminology
- Lecture 52 - Queuing Models - Operating System Characteristics
- Lecture 53 - Queuing System Cost Trade-off
- Lecture 54 - Basic Concepts and Approach to Managing Project
- Lecture 55 - Developing Project Plan using PERT/CPM
- Lecture 56 - Construction of Network and Network Computation Process
- Lecture 57 - Uncertain Activities, and Probability of Completion of Project on Time
- Lecture 58 - The Role of Inventory in Services, and Inventory Models
- Lecture 59 - Economic Order Quantity and Special Inventory Models
- Lecture 60 - Inventory Management under Uncertainty
- Lecture 61 - Inventory Control Systems and ABC Analysis

[Lecture 1](#)

[Lecture 2](#)

[Lecture 3](#)

[Lecture 4](#)

[Lecture 5](#)

[Lecture 6](#)

[Lecture 7](#)

[Lecture 8](#)

[Lecture 9](#)

[Lecture 10](#)

[Lecture 11](#)

[Lecture 12](#)

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[Lecture 38](#)

[Lecture 39](#)

[Lecture 40](#)

NPTEL : Infrastructure Finance (Management)

Co-ordinators : Dr. A. Thillai Rajan

Lecture 1 - Introduction

Lecture 2 - Overview on Infrastructure Financing Sources

Lecture 3 - Basics of Financial Management - Part-1

Lecture 4 - Basics of Financial Management - Part-2

Lecture 5 - Basics of Financial Management - Part-3

Lecture 6 - Basics of Financial Management - Part-4

Lecture 7 - Analysis of company Performance - Part-1

Lecture 8 - Analysis of company Performance - Part-2

Lecture 9 - Analysis of Project Viability Time value of money

Lecture 10 - Analysis of Project Viability Cost of Capital

Lecture 11 - Analysis of Project Viability Capital Budgeting Techniques - I

Lecture 12 - Analysis of Project Viability Capital Budgeting Guidelines - II

Lecture 13 - Analysis of Project Viability Capital Budgeting Guidelines - III

Lecture 14 - Analysis of Project Viability Capital Budgeting Guidelines - IV

Lecture 15 - Overview and introduction to project finance

Lecture 16 - Project Financing Attributes and Motivations - I

Lecture 17 - Project Financing Attributes and Motivations - II

Lecture 18 - Project Finance Markets - I

Lecture 19 - Project Finance Markets - II

Lecture 20 - Project Finance Markets - III

Lecture 21 - Project Finance Markets Mezzanine / Sub-ordinated Debt

Lecture 22 - Project Finance Markets - Type of Debt and Leasing

Lecture 23 - Project Finance Markets - Financial Intermediation

Lecture 24 - Project Finance Markets - Loan Refinancing

Lecture 25 - Project Finance Markets - Project Bonds - I

Lecture 26 - Project Finance Markets - Project Bonds - II

Lecture 27 - Public Private Partnerships

Lecture 28 - Risk Management - I

Lecture 29 - Risk Management - II

Lecture 30 - Risk Management - III

Lecture 31 - Risk Management - Market Risks

[Lecture 32 - Risk Management - Country / Political risks - I](#)

[Lecture 33 - Risk Management - Country / Political risks - II](#)

[Lecture 34 - Risk Management - Country / Political risks - III](#)

[Lecture 35 - Risk Management - Country / Political risks - IV](#)

[Lecture 36 - Context of infrastructure development - I](#)

[Lecture 37 - Context of infrastructure development - II](#)

[Lecture 38 - Context of infrastructure development - III](#)

[Lecture 39 - Context of infrastructure development - IV](#)

[Lecture 40 - Context of infrastructure development - V](#)

NPTEL : Manufacturing Systems Management (Management)

Co-ordinators : Prof. G. Srinivasan

- Lecture 1 - Introduction to Manufacturing Systems Management
- Lecture 2 - Different types of Manufacturing Systems
- Lecture 3 - Introduction to Cellular Manufacturing
- Lecture 4 - Cellular Manufacturing Applications, Production Flow Analysis
- Lecture 5 - Production Flow Analysis
- Lecture 6 - Cellular Manufacturing - Unidirectional flow, Capacity Planning, Layout
- Lecture 7 - Exercise on Production Flow Analysis
- Lecture 8 - Rank Order Clustering, Similarity Coefficient based algorithm
- Lecture 9 - Similarity Coefficient based clustering algorithm
- Lecture 10 - Hierarchical and Non hierarchical clustering algorithms
- Lecture 11 - Optimization based algorithms
- Lecture 12 - Optimization based algorithms, Assignment based algorithm
- Lecture 13 - Assignment model, Algorithm considering sequence of visit of machines
- Lecture 14 - Algorithm considering sequence of visit of machines
- Lecture 15 - Algorithm considering cell load data, alternate process plans
- Lecture 16 - Reducing Intercell moves
- Lecture 17 - Part subcontracting, Incremental cell formation
- Lecture 18 - Product based cells
- Lecture 19 - Branching algorithm for product based cells, Operator and task assignment
- Lecture 20 - Operator and task assignment
- Lecture 21 - Operator and task assignment continued
- Lecture 22 - Static and dynamic Operator allocation, Multiple products and incremental cells
- Lecture 23 - Cell scheduling and sequencing
- Lecture 24 - Cell scheduling and sequencing continued
- Lecture 25 - Single piece transportation
- Lecture 26 - Cell Layout, Introduction to Just-in-time manufacturing
- Lecture 27 - Cell control and JIT
- Lecture 28 - Basic elements of JIT, Kanban systems
- Lecture 29 - Role of basic elements, Critical success factors
- Lecture 30 - Models in JIT
- Lecture 31 - Models in JIT continued

- [Lecture 32 - CONWIP, Introduction to synchronous manufacturing](#)
- [Lecture 33 - Theory of constraints, Product mix problem](#)
- [Lecture 34 - Statistical Fluctuations, Random events, principles of SM](#)
- [Lecture 35 - Scheduling in SM](#)
- [Lecture 36 - Drum Buffer Rope system](#)
- [Lecture 37 - Flexible Manufacturing System, Part selection problem](#)
- [Lecture 38 - FMS Loading problem](#)
- [Lecture 39 - FMS Loading, multiple batches and changeover times](#)
- [Lecture 40 - FMS Loading and scheduling, Summary of the course contents](#)

NPTEL : Operations and Supply Chain Management (Management)

Co-ordinators : Prof. G. Srinivasan

- Lecture 1 - Introduction - (Challenges, Methodologies)
- Lecture 2 - Forecasting - Time series models - Simple Exponential smoothing
- Lecture 3 - Forecasting - Linear Models, Regression, Holt's , seasonality
- Lecture 4 - Forecasting - Winter's model, causal models, Goodness of forecast, Aggregate Planning, Tabular method
- Lecture 5 - Aggregate Planning, Tabular method, Linear Programming
- Lecture 6 - Aggregate Planning, Transportation model
- Lecture 7 - Aggregate Planning, Dynamic Programming, backordering
- Lecture 8 - Aggregate Planning, Quadratic model, Demand and capacity planning
- Lecture 9 - Inventory Models - Costs, EOQ model
- Lecture 10 - Inventory - EOQ model graphs, with backordering
- Lecture 11 - Inventory - Models for all quantity and marginal quantity Discount
- Lecture 12 - Multiple Quantity Discount, Multiple item inventory - Constraint on numbers of orders
- Lecture 13 - Multiple item inventory - Constraint on money value, space, equal number of orders
- Lecture 14 - Multiple item inventory - combining orders, production consumption model
- Lecture 15 - Inventory - Production consumption model with backordering, Economic lot scheduling problem
- Lecture 16 - Economic lot scheduling problem, Supply Chain inventory
- Lecture 17 - Lot sizing
- Lecture 18 - Lot sizing - heuristics
- Lecture 19 - Disaggregation
- Lecture 20 - Disaggregation - time varying demand, Safety stock - ROL for discrete demand distribution
- Lecture 21 - Safety stock - ROL for normal distribution of lead time demand
- Lecture 22 - Integrated model, ROL for normal distribution of LTD and given mean
- Lecture 23 - Safety stock reduction - delayed Product differentiation, substitution. MOM
- Lecture 24 - Sequencing and scheduling - Assumptions, objectives and shop settings
- Lecture 25 - Single machine sequencing. Two machine flow shop - Johnson's algorithm
- Lecture 26 - Flow shop scheduling - Three machines, Johnson's algorithm and Branch and bound algorithm
- Lecture 27 - Flow shop scheduling - heuristics - Palmer, Campbell Dudek Smith algorithm
- Lecture 28 - Job shop scheduling - Gantt chart, Different dispatching rules
- Lecture 29 - Job shop scheduling - Shifting bottleneck heuristic
- Lecture 30 - Job shop scheduling - Shifting bottleneck heuristic. Line Balancing
- Lecture 31 - Line Balancing

[Lecture 32 - Location problems - p median problem, Fixed charge problem](#)

[Lecture 33 - Location allocation problems in supply chain. Layout](#)

[Lecture 34 - Quantitative models for layout, Summary](#)

[Lecture 35 - Introduction to Supply Chain Management](#)

[Lecture 36 - Location Problems](#)

[Lecture 37 - Transportation and Distribution Models](#)

[Lecture 38 - Transportation and Distribution Models\(continued\)](#)

[Lecture 39 - Bin Packing and Travelling Salesman Problems](#)

[Lecture 40 - Vehicle Routeing Problems](#)

[Lecture 41 - Value of Information](#)

- Lecture 1 - Introduction to Business Analysis for Engineers
- Lecture 2 - Introduction to Accounting
- Lecture 3 - Accounting Principles - 1
- Lecture 4 - Balance Sheet Fundamentals
- Lecture 5 - Balance Sheet Fundamentals
- Lecture 6 - Accounting Principles - 2
- Lecture 7 - Introduction to Income Statement & Double Entry
- Lecture 8 - Double Entry Examples - 1
- Lecture 9 - Double Entry Examples - 2
- Lecture 10 - Preparation of Financial Statement
- Lecture 11 - Cash Flow Statement - 1
- Lecture 12 - Cash Flow Statement - 2
- Lecture 13 - Special Accounts Illustrations
- Lecture 14 - Final Illustrative Example
- Lecture 15 - Summary of Financial Accounting
- Lecture 16 - Introduction to Management Accounting & Behaviour of Cost
- Lecture 17 - Cost-Volume Relationship
- Lecture 18 - Cost-Objects & Variance
- Lecture 19 - Labour & Over Heads Variance Analysis
- Lecture 20 - Cash Conversion Cycle
- Lecture 21 - Inventory Management
- Lecture 22 - What is Strategy?
- Lecture 23 - Porter's Diamond Model
- Lecture 24 - Industry Analysis
- Lecture 25 - Industry Analysis & Sources of Strategy
- Lecture 26 - The Need for Value
- Lecture 27 - Value Chain Analysis
- Lecture 28 - Corporate Portfolio Analysis
- Lecture 29 - External & Internal Environ Analysis
- Lecture 30 - Models for Strategy,Ansoff matrix
- Lecture 31 - Porter's Generic Strategy

[Lecture 32 - Prahlad's Core Competency](#)

[Lecture 33 - Case study to understand strategy](#)

[Lecture 34 - Case study to understand strategy](#)

[Lecture 35 - Blue ocean and conclusion](#)

[Lecture 36 - Introduction to Economics](#)

[Lecture 37 - Introduction to GDP](#)

[Lecture 38 - Supply vs Demand](#)

[Lecture 39 - Price & Income Elasticity and Utility](#)

[Lecture 40 - Macroeconomic Variables](#)

[Lecture 41 - Fiscal & Monetary Policy](#)

[Lecture 42 - Union Budget & Conclusion](#)

Lecture 1 - Linear Programming Introduction and formulations - Product Mix problem and Notations

Lecture 2 - Linear Programming Introduction and formulations - Manpower and Production planning formulations

Lecture 3 - Linear Programming Introduction and formulations - Media selection problem and Bicycle problem

Lecture 4 - Linear Programming Introduction and formulations - Caterer problem

Lecture 5 - Linear Programming Introduction and formulations - Maximum flow and bin packing problems

Lecture 6 - Graphical and Algebraic methods - Graphical method (maximization)

Lecture 7 - Graphical and Algebraic methods - Graphical method (minimization)

Lecture 8 - Graphical and Algebraic methods - Algebraic method (maximization)

Lecture 9 - Graphical and Algebraic methods - Algebraic method (minimization)

Lecture 10 - Graphical and Algebraic methods - Comparing graphical and algebraic methods

Lecture 11 - Simplex Algorithm - Algebraic form of simplex algorithm

Lecture 12 - Simplex Algorithm - Tabular form of simplex (maximization)

Lecture 13 - Simplex Algorithm - Tabular form (minimization)

Lecture 14 - Simplex Algorithm - Unboundedness

Lecture 15 - Simplex Algorithm - Infeasibility

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Co-ordinators : Prof. C Bhaktavatsala Rao

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Co-ordinators : Prof. R. K. Amit, Prof. U. Chandrasekhar

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DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Technology Forecasting for Strategic Decision Making - An Introduction (Management)

Co-ordinators : Prof. Dmitry Kucharavy, Prof. Bala Ramadurai

Lecture 1 - Introduction to Tech Forecasting for Strategic Decision Making

Lecture 2 - Famous forecasts which missed the mark

Lecture 3 - Why do we need technology forecasts? - Innovation vs Invention Efficiency vs Effectiveness

Lecture 5 - Why do we need technology forecasts? - Limiting Resources

Lecture 6 - Why do we need technology forecasts? - Why is it difficult to forecast?

Lecture 7 - Why do we need technology forecasts? - General stages of forecasting?

Lecture 9 - Failure and Success Startup Stories

Lecture 10 - Strategic, Tactical and Operational Decision Making

Lecture 11 - Quiz about Strategic, Tactical and Operational decision making

Lecture 12 - Answer to the quiz on Strategic, Tactical and operational decision making

Lecture 13 - Introduction to Vacuum forming case study and FORMAT handbook

Lecture 14 - Quiz on systems and set

Lecture 15 - Quiz on functions

Lecture 16 - Technology Lifecycle - Example case study - Transportation

Lecture 17 - Technology Lifecycle - Seasons, Clockspeed - Part 1

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Lecture 22 - Aryabhata's experience in modeling and Live Solar Eclipse

Lecture 23 - Alternatives to forecasting in scope of technology management

Lecture 24 - Alternatives to forecasting in scope of technology management - Q&A

Lecture 25 - Element-Name-Value Model

Lecture 26 - System Operator

Lecture 27 - How to collect problems for mapping

Lecture 28 - How to formalize our knowledge about problems?

Lecture 29 - System function - What's function 1 Energy for cooking

Lecture 30 - System function - What's the function 2 Mosquito repellent

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Lecture 32 - Technological roadmaps

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- Lecture 27 - Vision, Strategy, Structure and Execution
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- Lecture 31 - Enablement as Development

- Lecture 32 - Instilling Development Passion
- Lecture 33 - CEO Succession
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- Lecture 37 - Operations Leadership
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- Lecture 39 - Finance Leadership
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- Lecture 56 - Dr A P J Abdul Kalam President without Precedent
- Lecture 57 - Dr C K Prahalad Timeless in Strategy, Tireless in Creativity
- Lecture 58 - Steve Jobs Technology Visionary Par Excellence
- Lecture 59 - Dr KallamAnjiReddy Game Changing Pharma Entrepreneur
- Lecture 60 - J R D Tata Conglomerate Leadership Beyond Compare
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- Lecture 4 - Generic competitive strategies
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- Lecture 10 - Balanced Scorecard
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- Lecture 16 - Competitive strategy overview
- Lecture 17 - Economic forces
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- Lecture 20 - Strategic groups
- Lecture 21 - Buyer power
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Lecture 33 - Comparators and responders

Lecture 34 - Strategic balance

Lecture 35 - Technology and collaboration

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- Lecture 17 - Industry and Market Analysis
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Lecture 4 - Factors affecting virtual teams

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Lecture 8 - Introduction to start-up teams

Lecture 9 - Factors affecting start-up teams

Lecture 10 - Introduction to IPO model in teams

Lecture 11 - Introduction to Human-AI teams

Lecture 12 - Inputs and Processes in Human-AI teams

Lecture 13 - States and Outcomes in Human-AI teams

Lecture 14 - Multiple Team Membership and Multi-team Systems

Lecture 15 - Introduction to Agile teams

Lecture 16 - Team Dynamics in Agile teams

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- Lecture 2 - Introduction to Corporate Finance
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- Lecture 5 - Interaction between Income Statement and Balance Sheet
- Lecture 6 - Preparation of Income Statement and Balance Sheet: Example - Part I
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- Lecture 9 - Preparation of Balance Sheet: Lone Pine Cafe A - Part I
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- Lecture 11 - Preparation of Income Statement: Lone Pine Cafe B
- Lecture 12 - Cash Flow Statement: Concept and Example (Direct Method) - Lone Pine Cafe
- Lecture 13 - Classification of Balance Sheet Items: Maynard Company A
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- Lecture 15 - Preparation of Cash Flow Statement: Lone Pine Cafe (Indirect Method)
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- Lecture 37 - Introduction to Budgeting: Preparation of Budgets - Part I
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- Lecture 41 - Foundations of Corporate Finance - Part I
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- Lecture 43 - Time Value of Money: Present Value and Future Value in Single and Multiperiod case
- Lecture 44 - Simplification of Cash Flows: Annuity, Growing Annuity, Perpetuity and Growing Perpetuity
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- Lecture 49 - Technique of Evaluating Capital Investment Decisions
- Lecture 50 - Numericals on Technique of Evaluating Capital Investment Decisions
- Lecture 51 - Risk and Return - Part I
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- Lecture 53 - Risk and Return: Individual Securities
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NPTEL : NOC:Strategic Sourcing (Management)

Co-ordinators : Prof. Arshinder Kaur

- Lecture 1 - Evolution of Sourcing and changing paradigms
- Lecture 2 - Changing Expectations leading to Supply Management and Strategic Sourcing
- Lecture 3 - Supply Chains and Supply Networks
- Lecture 4 - Return on Assets
- Lecture 5 - Strategic sourcing and Organisation's Strategy Importance of supply management
- Lecture 6 - Procure to Pay cycle
- Lecture 7 - Recognition of need
- Lecture 8 - Purchasing and supply process - 1
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- Lecture 10 - Need identification and types - 1
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- Lecture 12 - Indirect contributions of Supply
- Lecture 13 - Aligning supply objectives with organisation's strategy
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- Lecture 16 - Developing supply strategy - 1
- Lecture 17 - Developing Sourcing/Supply strategy - 1
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- Lecture 21 - Success stories about technologies in Sourcing
- Lecture 22 - Strategic cost management - 1
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Lecture 27 - Decision Making - Part V

Lecture 28 - Budgetary Control - Part I

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Lecture 5 - Registration - Part 1

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Lecture 2 - Research, Marketing Research and its Types

Lecture 3 - Introduction to Marketing Research Process

Lecture 4 - Step #1 Problem Definition Discussion with Decision Maker

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Lecture 7 - Journal (Part-II) - The first and original book of accounting

Lecture 8 - Ledger-The second book of accounts

Lecture 9 - Financial Statements

Lecture 10 - Financial Statements - Income Statement

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- Lecture 40 - Ratio Analysis - A case of Grasim Industries (Part-1)
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- Lecture 42 - Liquidity Ratios - Grasim Industries (Part-1)
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- Lecture 45 - Profitability Ratios- Grasim Industries (Part-1)
- Lecture 46 - Profitability Ratios- Grasim Industries (Part-2)
- Lecture 47 - Profitability Ratios- Grasim Industries (Part-3)
- Lecture 48 - DuPont Ratios (Part-1)
- Lecture 49 - DuPont Ratios (Part-2)
- Lecture 50 - Valuation or Capital Market Ratios (Part-1)
- Lecture 51 - Valuation or Capital Market Ratios (Part-2)
- Lecture 52 - Cash Flow Statement - Introduction (Part-1)
- Lecture 53 - Cash Flow Statement (Part-2)
- Lecture 54 - Preparation of Cash Flow Statement- Basic Cash Flow Statement
- Lecture 55 - Cash Flow Statement - Further Analysis (Part-1)
- Lecture 56 - Cash Flow Statement - Further Analysis (Part-2)
- Lecture 57 - Final Cash Flow Statement (Part-1)
- Lecture 58 - Final Cash Flow Statement (Part-2)
- Lecture 59 - Financial Reporting (Part-1)
- Lecture 60 - Financial Reporting (Part-2)

NPTEL : NOC:Supply Chain Analytics (Management)

Co-ordinators : Prof. Rajat Agrawal

- Lecture 1 - Introduction to Supply Chain Management
- Lecture 2 - Evolution of Supply Chain Management
- Lecture 3 - Analytics in Supply Chain Management
- Lecture 4 - Supply Chain Planning
- Lecture 5 - Different views of Supply Chain
- Lecture 6 - Supply Chain Strategy
- Lecture 7 - Supply Chain Drivers
- Lecture 8 - Developing Supply Chain Strategy
- Lecture 9 - Strategic Fit in Supply Chain
- Lecture 10 - Demand Forecasting in Supply Chain
- Lecture 11 - Bullwhip Effect and Time Series Analysis
- Lecture 12 - Exponential Smoothing Method of Forecasting
- Lecture 13 - Measures of Forecasting Errors
- Lecture 14 - Tracking Signal and Seasonality Models
- Lecture 15 - Forecasting using multiple characteristics in Demand Data and Inventory Management in Supply Chain
- Lecture 16 - Inventory Management in Supply Chain
- Lecture 17 - Multi echelon Inventory Management
- Lecture 18 - Multi echelon Inventory Management (Continued...)
- Lecture 19 - Multi echelon Inventory Management for four stations
- Lecture 20 - Multi echelon Inventory Management for four stations (Numerical Example)
- Lecture 21 - Multi echelon Inventory Management for four stations (Numerical Example) (Continued...)
- Lecture 22 - Network Design in Supply Chain
- Lecture 23 - Network Design of Global Supply Chain
- Lecture 24 - Alternative channels of Distribution
- Lecture 25 - Location Decisions in Supply Chain
- Lecture 26 - Network Optimization Models
- Lecture 27 - Using Excel Solver for Network Optimization
- Lecture 28 - Uncertainty in Network Design
- Lecture 29 - Network Design in Uncertain Environment and Flexibility
- Lecture 30 - Flexibility in Supply Chain
- Lecture 31 - Optimal Level of Product Availability in Supply chain

[Lecture 32 - Time Value of money in Supply Chain](#)

[Lecture 33 - Different types of Analytics in Supply Chain](#)

[Lecture 34 - Predictive Modelling in Forecasting in Supply Chain](#)

[Lecture 35 - Representation on Uncertainty in Supply Chain](#)

[Lecture 36 - Using Decision Tree for handling Uncertainty](#)

[Lecture 37 - Example of using Decision Tree incorporating Uncertainty in Single Factor](#)

[Lecture 38 - Example of using Decision Tree incorporating Uncertainty in two Key Factors](#)

[Lecture 39 - Modelling Flexibility in Supply Chain](#)

[Lecture 40 - Trends, Challenges and Future of Supply Chain](#)

Lecture 1 - Introduction to Marketing Research

Lecture 2 - Defining Research Problem

Lecture 3 - Developing Research Approach and Developing Research Design: Non- Conclusive

Lecture 4 - Research Design: Conclusive

Lecture 5 - Qualitative Research: Nature and Approaches

Lecture 6 - Qualitative Research: Depth Interview, Focus Group Discussion

Lecture 7 - Projective Technique, Case Study

Lecture 8 - Case Study, Descriptive Research Design and Research Errors

Lecture 9 - Primary and Secondary Data, Research Error

Lecture 10 - Measurement and Scaling: Comparative and Non-comparative Scaling

Lecture 11 - Scale Development Process

Lecture 12 - Questionnaire and Form Design

Lecture 13 - Causal Research and Types

Lecture 14 - Experimental Design and Sampling

Lecture 15 - Sampling Design and Procedure

Lecture 16 - Sampling and Sample Size Determination

Lecture 17 - Hypothesis Development: Null and Alternate, Type I and Type II Errors

Lecture 18 - Data Preparation

Lecture 19 - Hypothesis Testing: T-Test, Z-Test

Lecture 20 - T, Z and F Test

Lecture 21 - Hypothesis Testing: Anova and Manova

Lecture 22 - Cross Tabulation and Chi Square Test

Lecture 23 - Correlation and Regression

Lecture 24 - Regression

Lecture 25 - Factor Analysis

Lecture 26 - Factor Analysis

Lecture 27 - SEM and CFA - 1

Lecture 28 - SEM and CFA - 2

Lecture 29 - SEM and CFA - 3

Lecture 30 - Cluster Analysis - I

Lecture 31 - Cluster Analysis - II

[Lecture 32 - Discriminant Analysis](#)

[Lecture 33 - Discriminant Analysis - 1](#)

[Lecture 34 - Researching Rural Market](#)

[Lecture 35 - International Marketing Research](#)

[Lecture 36 - Ethics in Marketing Research](#)

[Lecture 37 - Ethics in Marketing Research - 1](#)

[Lecture 38 - Report Preparation and Presentation](#)

[Lecture 39 - Multi Dimensional Scaling](#)

[Lecture 40 - Conjoint Analysis](#)

Lecture 1 - Introduction of Project Management

Lecture 2 - Project Success

Lecture 3 - Types of Structure Organizations

Lecture 4 - Project Management Office

Lecture 5 - Stakeholders Management

Lecture 6 - Types of Projects and Project Life Cycle

Lecture 7 - Project Life Cycle Phases and Project Appraisal

Lecture 8 - Methods of Project Selection - I

Lecture 9 - Methods of Project Selection - II

Lecture 10 - Methods of Project Selection - MCDM-I

Lecture 11 - Methods of Project Selection - MCDM-II

Lecture 12 - Methods of Project Selection - MCDM-III

Lecture 13 - Market and Demand Analysis - I

Lecture 14 - Market and Demand Analysis - II

Lecture 15 - Financial Analysis

Lecture 16 - Capital Budgeting Techniques - I

Lecture 17 - Capital Budgeting Techniques - II

Lecture 18 - Financing of Projects

Lecture 19 - Risk Management - I

Lecture 20 - Risk Management - II

Lecture 21 - Risk Management (Control and Documentation)

Lecture 22 - Stand Alone Risk Analysis - I

Lecture 23 - Stand Alone Risk Analysis - II

Lecture 24 - Hillier Model

Lecture 25 - Simulation Analysis

Lecture 26 - Decision Tree Analysis - I

Lecture 27 - Decision Tree Analysis - II

Lecture 28 - Abandonment Analysis

Lecture 29 - Technical Analysis

Lecture 30 - Product Mix and Plant Capacity Analysis

Lecture 31 - Project Team Building, Conflict and Negotiation

- Lecture 32 - HRM Issues and time Management
- Lecture 33 - Project Time Management - Introduction
- Lecture 34 - Project Time Management - Project Scheduling
- Lecture 35 - Project time Management - Numbering of Nodes
- Lecture 36 - Project Time Management - PERT Networks
- Lecture 37 - Project Time Management - CPM
- Lecture 38 - Project Time Management - Laddering in PERT/CPM
- Lecture 39 - Probability Models in Networks - I
- Lecture 40 - Probability Models in Networks - II
- Lecture 41 - Probability Models in Networks - III
- Lecture 42 - Probability Models in Networks - IV
- Lecture 43 - Simulation of Networks - I
- Lecture 44 - Simulation of Networks - II
- Lecture 45 - Slacks and Floats - I
- Lecture 46 - Slacks and Floats - II
- Lecture 47 - Time and Cost Relationship
- Lecture 48 - Crashing of Networks - I
- Lecture 49 - Crashing of Networks - II
- Lecture 50 - Crashing of Networks - III (Free Float Method)
- Lecture 51 - Crashing of Networks - IV
- Lecture 52 - Introduction to Project Cost Management
- Lecture 53 - Cost Control (Tools and Techniques)
- Lecture 54 - Cost Estimation
- Lecture 55 - Introduction to Quality Management
- Lecture 56 - Cost of Quality
- Lecture 57 - Quality Management (Source of variability and Six Sigma)
- Lecture 58 - Quality Management (Six Sigma Tools)
- Lecture 59 - Procurement Management- I
- Lecture 60 - Procurement Management- II and Project Termination

Lecture 1 - Introduction

Lecture 2 - Data Mining Process

Lecture 3 - Introduction To R

Lecture 4 - Basic Statistics

Lecture 5 - Basic Statistics - Part 2

Lecture 6 - Partitioning Process

Lecture 7 - Visualization Techniques

Lecture 8 - Visualization Techniques - Part 2

Lecture 9 - Visualization Techniques - Part 3

Lecture 10 - Visualization Techniques - Part 4

Lecture 11 - Visualization Techniques - Part 5

Lecture 12 - Visualization Techniques - Part 6

Lecture 13 - Dimension Reduction Techniques

Lecture 14 - Dimension Reduction Techniques - Part 2

Lecture 15 - Dimension Reduction Techniques - Part 3

Lecture 16 - Performance Metrics

Lecture 17 - Performance Metrics - Part 2

Lecture 18 - Performance Metrics - Part 3

Lecture 19 - Performance Metrics - Part 4

Lecture 20 - Performance Metrics - Part 5

Lecture 21 - Prediction Performance

Lecture 22 - Multiple Linear Regression

Lecture 23 - Multiple Linear Regression - Part 2

Lecture 24 - Multiple Linear Regression - Part 3

Lecture 25 - Multiple Linear Regression - Part 4

Lecture 26 - Multiple Linear Regression - Part 5

Lecture 27 - Multiple Linear Regression - Part 6

Lecture 28 - Machine Learning Technique K-Nn

Lecture 29 - Machine Learning Technique K-Nn - Part 2

Lecture 30 - Machine Learning Technique K-Nn - Part 3

Lecture 31 - Naive Bayes

[Lecture 32 - Naive Bayes - Part 2](#)

[Lecture 33 - Naive Bayes - Part 3](#)

[Lecture 34 - Naive Bayes - Part 4](#)

[Lecture 35 - Naive Bayes - Part 5](#)

[Lecture 36 - Classification And Regression Trees](#)

[Lecture 37 - Classification And Regression Trees - Part 2](#)

[Lecture 38 - Classification And Regression Trees - Part 3](#)

[Lecture 39 - Classification And Regression Trees - Part 4](#)

[Lecture 40 - Classification And Regression Trees - Part 5](#)

[Lecture 41 - Classification And Regression Trees - Part 6](#)

[Lecture 42 - Pruning Process](#)

[Lecture 43 - Pruning Process - Part 2](#)

[Lecture 44 - Pruning Process - Part 3](#)

[Lecture 45 - Regression Trees](#)

[Lecture 46 - Logistic Regression](#)

[Lecture 47 - Logistic Regression - Part 2](#)

[Lecture 48 - Logistic Regression - Part 3](#)

[Lecture 49 - Logistic Regression - Part 4](#)

[Lecture 50 - Logistic Regression - Part 5](#)

[Lecture 51 - Logistic Regression - Part 6](#)

[Lecture 52 - Logistic Regression - Part 7](#)

[Lecture 53 - Artificial Neural Networks](#)

[Lecture 54 - Artificial Neural Network - Part 2](#)

[Lecture 55 - Artificial Neural Network - Part 3](#)

[Lecture 56 - Artificial Neural Network - Part 4](#)

[Lecture 57 - Artificial Neural Network - Part 5](#)

[Lecture 58 - Artificial Neural Network - Part 6](#)

[Lecture 59 - Discriminant Analysis](#)

[Lecture 60 - Discriminant Analysis - Part 2](#)

NPTEL : NOC:Working Capital Management (Management)

Co-ordinators : Prof. Anil K. Sharma

- Lecture 1 - Introduction - I
- Lecture 2 - Introduction - II
- Lecture 3 - Nature of the Working Capital Management
- Lecture 4 - Approaches of Working Capital Management - I
- Lecture 5 - Approaches of Working Capital Management - II
- Lecture 6 - Trade off between Profitability and Risk - I
- Lecture 7 - Trade off between Profitability and Risk - II
- Lecture 8 - Working Capital Management in Indian Business - I
- Lecture 9 - Working Capital Management in Indian Business - II
- Lecture 10 - Operating Cycle
- Lecture 11 - Weighted Operating Cycle
- Lecture 12 - Working Capital Requirement Assessment - I
- Lecture 13 - Working Capital Requirement Assessment - II
- Lecture 14 - Assessing Working Capital Requirements - Problem 2 and 5
- Lecture 15 - Working Capital Requirement- The Conclusion
- Lecture 16 - Working Capital Leverage
- Lecture 17 - Risk and Cost of Holding Inventory
- Lecture 18 - Inventory Costs
- Lecture 19 - Inventory Behaviour
- Lecture 20 - Inventory Management - Methods and Strategies
- Lecture 21 - EOQ Technique of Inventory Management
- Lecture 22 - Stockouts cause Walkouts
- Lecture 23 - Rationing of Working Capital - I
- Lecture 24 - Rationing of Working Capital - II
- Lecture 25 - Different Modes of Bank Finance
- Lecture 26 - Incremental Inventory - I
- Lecture 27 - Incremental Inventory - II
- Lecture 28 - Management of Accounts Receivables - I
- Lecture 29 - Management of Accounts Receivables - II
- Lecture 30 - Management of Accounts Receivables - III
- Lecture 31 - Motives of Credit Sale - I

- Lecture 32 - Motives of Credit Sale - II
- Lecture 33 - Limitations of Credit Time Period
- Lecture 34 - Written Credit Policy - I
- Lecture 35 - Written Credit Policy - II
- Lecture 36 - Goals and Functions of Accounts Receivables Management
- Lecture 37 - Valuation of Receivables at Cost or Sales Value
- Lecture 38 - Credit Policy Changes - I
- Lecture 39 - Credit Policy Changes - II
- Lecture 40 - Credit Policy Changes - III
- Lecture 41 - Optimum Credit Policy
- Lecture 42 - Credit Risk Analysis - I
- Lecture 43 - Credit Risk Analysis - II
- Lecture 44 - Credit Risk Analysis - III
- Lecture 45 - Credit Policy Variables
- Lecture 46 - Cash Management
- Lecture 47 - Cash Flow Presentation
- Lecture 48 - Models of Cash Management- Certainty Model by Baumol
- Lecture 49 - Certainty Model by Baumol Continued
- Lecture 50 - Uncertainty Model by Miller and Orr
- Lecture 51 - Miller and Orr (Continued...) and Cash Management Techniques
- Lecture 52 - Measures of Liquidity
- Lecture 53 - Window Dressing and Management of Current Liabilities
- Lecture 54 - Management of Accounts Payable
- Lecture 55 - Cost of Stretching Accounts Payable - I
- Lecture 56 - Cost of Stretching Accounts Payable - II
- Lecture 57 - Other Accruals and Overtrading
- Lecture 58 - Bank Finance - Introduction
- Lecture 59 - Recommendations of Tondon and Chore Committees
- Lecture 60 - Deciding a Suitable Mix

- Lecture 1 - Analyzing the Current Business Scenario
- Lecture 2 - Innovation and Creativity - An Introduction
- Lecture 3 - Innovation in Current Environment
- Lecture 4 - Types of Innovation
- Lecture 5 - School of Innovation
- Lecture 6 - Challenges of Innovation
- Lecture 7 - Steps of Innovation Management
- Lecture 8 - Idea Management System
- Lecture 9 - Divergent v/s Convergent Thinking
- Lecture 10 - Design Thinking and Entrepreneurship
- Lecture 11 - Experimentation in Innovation Management
- Lecture 12 - Idea Championship
- Lecture 13 - Participation for Innovation
- Lecture 14 - Co-creation for Innovation
- Lecture 15 - Prototyping to Incubation
- Lecture 16 - What is Business Model ?
- Lecture 17 - Who is an Entrepreneur ?
- Lecture 18 - Social Entrepreneurship ?
- Lecture 19 - Blue Ocean Strategy - I
- Lecture 20 - Blue Ocean Strategy - II
- Lecture 21 - Marketing of Innovation
- Lecture 22 - Technology Innovation Process
- Lecture 23 - Technological Innovation Management Planning
- Lecture 24 - Technological Innovation Management Strategies
- Lecture 25 - Technology Forecasting
- Lecture 26 - Sustainability Innovation and Entrepreneurship
- Lecture 27 - Innovation Sustainable Conditions
- Lecture 28 - Innovation: Context and Patterns
- Lecture 29 - SMEs' strategic involvement in sustainable development
- Lecture 30 - Insight and Entrepreneurship
- Lecture 31 - Management of Innovation, creation of IPR - I

[Lecture 32 - Management of Innovation, creation of IPR - II](#)

[Lecture 33 - Types of IPR](#)

[Lecture 34 - Patents and Copyrights](#)

[Lecture 35 - Patents in India](#)

[Lecture 36 - Business Models and value proposition](#)

[Lecture 37 - Business Model Failure: Reasons and Remedies](#)

[Lecture 38 - Incubators: Business Vs Technology](#)

[Lecture 39 - Managing Investors for Innovation](#)

[Lecture 40 - Future markets and Innovation needs for India](#)

[Lecture 1 - Association Rules - Part I](#)

[Lecture 2 - Association Rules - Part II](#)

[Lecture 3 - Association Rules - Part III](#)

[Lecture 4 - Association Rules - Part IV](#)

[Lecture 5 - Cluster Analysis - Part I](#)

[Lecture 6 - Cluster Analysis - Part II](#)

[Lecture 7 - Cluster Analysis - Part III](#)

[Lecture 8 - Cluster Analysis - Part IV](#)

[Lecture 9 - Cluster Analysis - Part V](#)

[Lecture 10 - Cluster Analysis - Part VI](#)

[Lecture 11 - Cluster Analysis - Part VII](#)

[Lecture 12 - Understanding Time Series - Part I](#)

[Lecture 13 - Understanding Time Series - Part II](#)

[Lecture 14 - Understanding Time Series - Part III](#)

[Lecture 15 - Understanding Time Series - Part IV](#)

[Lecture 16 - Regression Based Forecasting Methods - Part I](#)

[Lecture 17 - Regression Based Forecasting Methods - Part II](#)

[Lecture 18 - Regression Based Forecasting Methods - Part III](#)

[Lecture 19 - Time Series Forecasting - Smoothing Methods - Part I](#)

[Lecture 20 - Time Series Forecasting - Smoothing Methods - Part II](#)

Lecture 1 - Globalization - Part 1

Lecture 2 - Globalization - Part 2

Lecture 3 - Global Economic Environment - Part 1

Lecture 4 - Global Economic Environment - Part 2

Lecture 5 - Global Economic Environment - Part 3

Lecture 6 - Financial Environment - Part 1

Lecture 7 - Financial Environment - Part 2

Lecture 8 - Cultural Issues and Buying Behavior - Part 1

Lecture 9 - Cultural Issues and Buying Behavior - Part 2

Lecture 10 - Political/ Legal Environment - Part 1

Lecture 11 - Political/ Legal Environment - Part 2

Lecture 12 - Global Marketing Research - Part 1

Lecture 13 - Global Marketing Research - Part 2

Lecture 14 - Global Segmentation and Positioning - Part 1

Lecture 15 - Global Segmentation and Positioning - Part 2

Lecture 16 - Global Marketing Strategies - Part 1

Lecture 17 - Global Marketing Strategies - Part 2

Lecture 18 - Global Market Entry Modes - Part 1

Lecture 19 - Global Market Entry Modes - Part 2

Lecture 20 - Global Product Development - Part 1

Lecture 21 - Global Product Development - Part 2

Lecture 22 - Marketing Products and Services - Part 1

Lecture 23 - Marketing Products and Services - Part 2

Lecture 24 - Global Pricing - Part 1

Lecture 25 - Global Pricing - Part 2

Lecture 26 - Communicating with the World Consumer - Part 1

Lecture 27 - Communicating with the World Consumer - Part 2

Lecture 28 - Sales Management - Part 1

Lecture 29 - Sales Management - Part 2

Lecture 30 - Global Logistics and Distribution - Part 1

Lecture 31 - Global Logistics and Distribution - Part 2

[Lecture 32 - Export/Import Management - Part 1](#)

[Lecture 33 - Export/Import Management - Part 2](#)

[Lecture 34 - Export/Import Management - Part 3](#)

[Lecture 35 - Planning, Organization and Control of Global Marketing Operations - Part 1](#)

[Lecture 36 - Planning, Organization and Control of Global Marketing Operations - Part 2](#)

[Lecture 37 - Marketing in Emerging Markets - Part 1](#)

[Lecture 38 - Marketing in Emerging Markets - Part 2](#)

[Lecture 39 - Global Marketing and the Internet - Part 1](#)

[Lecture 40 - Global Marketing and the Internet - Part 2](#)

Lecture 1 - Introduction to Marketing Research - I

Lecture 2 - Introduction to Marketing Research - II

Lecture 3 - Marketing Research Process - I

Lecture 4 - Marketing Research Process - II

Lecture 5 - Marketing Research Process - III

Lecture 6 - Marketing Research Process - IV

Lecture 7 - Hypothesis and Research Question - I (with real life example)

Lecture 8 - Hypothesis and Research Question - II (with real life example)

Lecture 9 - Hypothesis Development - I (with a real life case)

Lecture 10 - Hypothesis Development - II (with a real life case)

Lecture 11 - Research Design - I

Lecture 12 - Research Design - II

Lecture 13 - Research Design - III

Lecture 14 - Research Design - IV

Lecture 15 - Research Design - V

Lecture 16 - Research Design - VI

Lecture 17 - Data Purification and handling - I

Lecture 18 - Data Purification and handling - II

Lecture 19 - Data Purification and handling - III

Lecture 20 - Data Purification and handling - IV

Lecture 21 - Power of a Test and Sample Size Calculation (Problem Solving)

Lecture 22 - Sample Size Calculation and Hypothesis Testing (Problem Solving)

Lecture 23 - Hypothesis Testing - I (Problem Solving)

Lecture 24 - Hypothesis Testing - II (Problem Solving)

Lecture 25 - Non-Parametric Test - I

Lecture 26 - Non-Parametric Test - II

Lecture 27 - Non-Parametric Test - III

Lecture 28 - Non-Parametric Test - IV

Lecture 29 - Non-Parametric Test - V

Lecture 30 - Non-Parametric Test - VI

Lecture 31 - Non-Parametric Test - VII

- Lecture 32 - Non-Parametric Test - VIII
- Lecture 33 - Introduction to ANOVA and ANCOVA
- Lecture 34 - Conducting one-way ANOVA
- Lecture 35 - Solving n-way ANOVA - I
- Lecture 36 - Solving n-way ANOVA - II
- Lecture 37 - N-way ANOVA and MANOVA in SPSS
- Lecture 38 - MANOVA and ANCOVA in SPSS
- Lecture 39 - ANCOVA in SPSS
- Lecture 40 - ANCOVA and MANCOVA in SPSS
- Lecture 41 - Covariance and Correlation
- Lecture 42 - Correlation in SPSS
- Lecture 43 - Partial and Multiple Correlation
- Lecture 44 - Simple Regression Analysis in SPSS
- Lecture 45 - Multiple Regression Analysis in SPSS - I
- Lecture 46 - Multiple Regression Analysis in SPSS - II
- Lecture 47 - Stepwise Regression and Hierarchical Regression
- Lecture 48 - Hierarchical Regression and Dummy Variable Regression
- Lecture 49 - Logistic Regression Analysis
- Lecture 50 - Discriminant Analysis in SPSS
- Lecture 51 - Factor Analysis in SPSS - I
- Lecture 52 - Factor Analysis in SPSS - II
- Lecture 53 - Exploratory Factor Analysis in SPSS
- Lecture 54 - Confirmatory Factor Analysis in SPSS - I
- Lecture 55 - Confirmatory Factor Analysis in SPSS - II
- Lecture 56 - Confirmatory Factor Analysis in SPSS - III
- Lecture 57 - Structural Equation Modelling in SPSS
- Lecture 58 - Mediation and Moderation Analysis in SPSS
- Lecture 59 - Cluster Analysis in Practice - I
- Lecture 60 - Cluster Analysis in Practice - II

Lecture 1 - Introduction to Statistics and Data

Lecture 2 - Types of Statistics, types of Data and sources of Data, Population vs Sample

Lecture 3 - Scales of Measurement

Lecture 4 - Data representation techniques - Part 1

Lecture 5 - Data representation techniques - Part 2 and measures of central tendency - Part 1

Lecture 6 - Measures of Central Tendency - Part 2

Lecture 7 - Examples of introduction to data and data representation techniques

Lecture 8 - Measures of Variation

Lecture 9 - Applications of Measures of Central Tendency and Measures of Variation

Lecture 10 - Chapter concepts- Measures of central tendency and measures of variation, Outliers, and shape of a distribution

Lecture 11 - Numerical Descriptive Measures

Lecture 12 - Covariance and Coefficient of Correlation, Introduction to Probability

Lecture 13 - Probability - Part 1

Lecture 14 - Probability - Part 2

Lecture 15 - Probability - Part 3

Lecture 16 - Probability Distributions - Part 1

Lecture 17 - Probability Distributions - Part 2

Lecture 18 - Probability Distributions - Part 3

Lecture 19 - Examples for Standardized Normal Distribution

Lecture 20 - Evaluating Normality, Exponential Probability Distribution

Lecture 21 - Chapter Concepts - Probability Distributions

Lecture 22 - Sampling and Sampling Techniques

Lecture 23 - Sampling Distribution - I

Lecture 24 - Sampling Distribution - II

Lecture 25 - Sampling Distribution - III

Lecture 26 - Method of Estimation

Lecture 27 - Interval Estimation

Lecture 28 - Confidence Interval - I

Lecture 29 - Confidence Interval - II

Lecture 30 - Types of Hypothesis Testing

Lecture 31 - Hypothesis Testing Process - I

- Lecture 32 - Hypothesis Testing Process - II
- Lecture 33 - Hypothesis Testing Examples
- Lecture 34 - Hypothesis Testing of Proportions - I
- Lecture 35 - Hypothesis Testing of Proportions - II
- Lecture 36 - Hypothesis Testing-One sample Test
- Lecture 37 - Hypothesis Testing using Minitab
- Lecture 38 - Hypothesis Testing of Proportions using Minitab
- Lecture 39 - Hypothesis Testing Two Sample Test - I
- Lecture 40 - Hypothesis Testing Two Sample Test - II
- Lecture 41 - Hypothesis Testing Two sample Test - III
- Lecture 42 - Paired Sample Test
- Lecture 43 - Hypothesis Testing of Proportion
- Lecture 44 - Example of Hypothesis Testing
- Lecture 45 - Design of Experiment
- Lecture 46 - Analysis of variance - I
- Lecture 47 - Analysis of variance - II
- Lecture 48 - Analysis of variance - III
- Lecture 49 - Tukey Kramer test
- Lecture 50 - Randomized Blocked Design
- Lecture 51 - A Factorial Design - I
- Lecture 52 - A Factorial Design - II
- Lecture 53 - Chi-square test goodness of fit - I
- Lecture 54 - Chi-square test goodness of fit - II
- Lecture 55 - Chi-square test of independence
- Lecture 56 - Simple linear regression - I
- Lecture 57 - Simple linear regression - II
- Lecture 58 - Assumption of Regression
- Lecture 59 - Multiple Regression
- Lecture 60 - Example of multiple Regression

Lecture 1 - Introduction to MCDM Techniques - Part I

Lecture 2 - Introduction to MCDM Techniques - Part II

Lecture 3 - Introduction to MCDM Techniques - Part III

Lecture 4 - Analytic Hierarchy Process (AHP) - Part I

Lecture 5 - Analytic Hierarchy Process (AHP) - Part II

Lecture 6 - Analytic Hierarchy Process (AHP) - Part III

Lecture 7 - Analytic Hierarchy Process (AHP) - Part IV

Lecture 8 - ELECTRE - Part I

Lecture 9 - ELECTRE - Part II

Lecture 10 - ELECTRE - Part III

Lecture 11 - ELECTRE - Part IV

Lecture 12 - ELECTRE - Part V

Lecture 13 - Introduction of TOPSIS - Part I

Lecture 14 - TOPSIS - Part II

Lecture 15 - VIKOR - Part I

Lecture 16 - VIKOR - Part II

Lecture 17 - Introduction of Fuzzy Sets

Lecture 18 - Fuzzy AHP - Part I

Lecture 19 - Fuzzy AHP - Part II

Lecture 20 - Sensitivity Analysis

NPTEL : NOC:Manufacturing Strategy (Management)

Co-ordinators : Prof. Rajat Agarwal

Lecture 1 - Output of Manufacturing

Lecture 2 - Operations Systems

Lecture 3 - Operations Strategy

Lecture 4 - Functional Strategy Within Context of a Firm

Lecture 5 - Functional Dominance within Corporate Strategy

Lecture 6 - World Class Manufacturing Organization

Lecture 7 - Ps of Manufacturing Strategy

Lecture 8 - Contribution of Skinner and Hayes and Wheelwright

Lecture 9 - Alternative Paradigm of Manufacturing Strategy

Lecture 10 - Some Generic Manufacturing Strategies - I

Lecture 11 - Developing Manufacturing Strategy

Lecture 12 - Understanding Markets

Lecture 13 - Concept of Order Winner and Qualifiers

Lecture 14 - Basic Characteristics and Specific Dimensions of Order Winners and Qualifiers

Lecture 15 - Some Specific Order Winners and Qualifiers - I

Lecture 16 - Some Specific Order Winners and Qualifiers - II

Lecture 17 - Some Specific Order Winners and Qualifiers - III

Lecture 18 - Some Specific Order Winners and Qualifiers (non operation related criteria)

Lecture 19 - Developing an Operations Strategy: Methodology

Lecture 20 - Developing an Operations Strategy

Lecture 21 - Developing an Operations Strategy: Roth and Miller Classification

Lecture 22 - Enlightened View of Manufacturing

Lecture 23 - Manufacturing Strategy Taxonomy: Some Evidences from China

Lecture 24 - Quality Management and Manufacturing Excellence

Lecture 25 - Total Quality Management and Manufacturing Excellence

Lecture 26 - Deming's Approach to Quality

Lecture 27 - Business Excellence Awards

Lecture 28 - Process Choice

Lecture 29 - Process Choice: 3 Dimensional View

Lecture 30 - Product Profiling

Lecture 31 - Critical Success Factor for World Class Manufacturing

[Lecture 32 - Value Added Engineering](#)

[Lecture 33 - Total Employee Involvement](#)

[Lecture 34 - HR Theories for Operation Strategy](#)

[Lecture 35 - Flexible Manufacturing System](#)

[Lecture 36 - Concept of Focus](#)

[Lecture 37 - Toyota Production System - I](#)

[Lecture 38 - Toyota Production System - II](#)

[Lecture 39 - World Class Manufacturing and India](#)

[Lecture 40 - Achieving World Class Status](#)

- Lecture 1 - Introduction to training - 1
- Lecture 2 - Introduction to training - 2
- Lecture 3 - Introduction to training - 3
- Lecture 4 - Introduction to training - 4
- Lecture 5 - Training Needs Assessment
- Lecture 6 - Methods of Training Needs Assessment - 1
- Lecture 7 - Methods of Training Needs Assessment - 2
- Lecture 8 - Methods of Training Needs Assessment - 3
- Lecture 9 - Trainings Design and Types of Training - 1
- Lecture 10 - Trainings Design and Types of Training - 2
- Lecture 11 - Trainings Design and Types of Training - 3
- Lecture 12 - Trainings Design and Types of Training - 4
- Lecture 13 - Design thinking in training
- Lecture 14 - Role of Technology - 1
- Lecture 15 - Role of Technology - 2
- Lecture 16 - Digital Pedagogy in training
- Lecture 17 - Introduction to Training Methods - 1
- Lecture 18 - Introduction to Training Methods - 2
- Lecture 19 - Choosing a Training Method
- Lecture 20 - Examples of Training
- Lecture 21 - Understanding training groups and its dynamics
- Lecture 22 - Training Methods - Case Study - 1
- Lecture 23 - Training Methods - Case Study - 2
- Lecture 24 - Training Methods - Case Study - 3
- Lecture 25 - Training Methods - Case Study - 4
- Lecture 26 - Training Methods - Business Game - 1
- Lecture 27 - Training Methods - Business Game - 2
- Lecture 28 - Training Methods - Business Game - 3
- Lecture 29 - Training Methods - Role Play - 1
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Co-ordinators : Prof. Rajat Agarwal

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Co-ordinators : Prof. Zillur Rahman

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- Lecture 52 - Brand Portfolio And Brand Hierarchies
- Lecture 53 - Brand Equity: Measuring Outcomes - 1
- Lecture 54 - Brand Equity: Measuring Outcomes - 2
- Lecture 55 - Brand Extension
- Lecture 56 - Brand Experience and Brand Loyalty
- Lecture 57 - Brand Continuum and Brand Reinforcement
- Lecture 58 - Brand Revitalization and Repositioning
- Lecture 59 - Rebranding, Brand Demise and Brand Lifecycle
- Lecture 60 - Product and Brand Management - Conclusion

Lecture 1 - Overview and Introduction, Debt and Equity

Lecture 2 - Hybrids, Derivatives

Lecture 3 - Financial Risk

Lecture 4 - Arbitrage

Lecture 5 - Arbitrage Free Pricing

Lecture 6 - Arbitrage Free Pricing of Bonds

Lecture 7 - Forward Rates, Bond Pricing with Forward Rates

Lecture 8 - Binomial Interest Rate Tree

Lecture 9 - Bond Pricing with Binomial Trees

Lecture 10 - Bond Pricing (Continued...)

Lecture 11 - Valuation of Bonds with Embedded Options

Lecture 12 - Features of Option Embedded Bonds

Lecture 13 - Yield to Maturity

Lecture 14 - Bond Yields and Yield Spreads

Lecture 15 - Z Spread and Option Adjusted Spread (OAS)

Lecture 16 - Yield Spreads

Lecture 17 - Interest Rate Risk

Lecture 18 - Duration and Immunization

Lecture 19 - Immunization and Bond Dynamics

Lecture 20 - Duration: Properties

Lecture 21 - Effective Duration

Lecture 22 - Key Rate Duration

Lecture 23 - One Sided Duration

Lecture 24 - Modeling of Fixed Income Returns

Lecture 25 - Immunizing a Single Liability

Lecture 26 - The Barbell Strategy - 1

Lecture 27 - The Barbell Strategy - 2

Lecture 28 - Yield Shifts and Immunization

Lecture 29 - Fixed Income Portfolio Strategies - 1

Lecture 30 - Fixed Income Portfolio Strategies - 2

Lecture 31 - Fixed Income Portfolio Strategies - 3

- Lecture 32 - Floaters, Caps and Floors
- Lecture 33 - Derivatives, A Recapitulation
- Lecture 34 - Forward Pricing - Investment Assets
- Lecture 35 - Forward Pricing - Consumption Assets
- Lecture 36 - Introduction to Options
- Lecture 37 - Put Call Parity and Arbitrage
- Lecture 38 - American Options - 1
- Lecture 39 - American Options - 2
- Lecture 40 - Option Trading Strategies - 1
- Lecture 41 - Option Trading Strategies - 2
- Lecture 42 - Option Trading Strategies - 3
- Lecture 43 - Option Pricing - Binomial Model - 1
- Lecture 44 - Option Pricing - Binomial Model - 2
- Lecture 45 - Option Pricing - American Options
- Lecture 46 - Random Walks
- Lecture 47 - Brownian Motion
- Lecture 48 - Stochastic Calculus
- Lecture 49 - Stock Price Modelling
- Lecture 50 - Black Scholes Model
- Lecture 51 - Futures - 1
- Lecture 52 - Futures - 2
- Lecture 53 - Forward vs Futures Prices
- Lecture 54 - Futures Hedging
- Lecture 55 - Issues in Futures Hedging
- Lecture 56 - Perfect Futures Hedge, Cross Hedge, Tailing the Hedge
- Lecture 57 - Stock Index Futures - 1
- Lecture 58 - Stock Index Futures - 2
- Lecture 59 - Interest Rate Futures - 1
- Lecture 60 - Interest Rate Futures - 2

- Lecture 1 - Breaking the Myths and Learning the Basics
- Lecture 2 - Evolution and Role of Sales Management
- Lecture 3 - Tactical Role of Sales Management
- Lecture 4 - Complexities in Sales Management and Characteristics of Modern Selling
- Lecture 5 - Difference Between Sales and Marketing
- Lecture 6 - Selling in a VUCA World
- Lecture 7 - Place of Selling in Overall Marketing Plan
- Lecture 8 - Use of Marketing Principles in Creating Strategic Sales Plan
- Lecture 9 - Sales Forecasting Methods for Informed Decision-Making
- Lecture 10 - Tools to Assess Market While Developing Strategic Sales Plan
- Lecture 11 - Models of Sales planning
- Lecture 12 - Types of sales man and what makes a good sales man
- Lecture 13 - Buying Centre and stages of sales call
- Lecture 14 - Transformative Factors And Evolved Selling Process And Theories
- Lecture 15 - Miller Heiman approach and virtual framework strategic selling
- Lecture 16 - Miller Heiman Approach And Virtual Framework Strategic Selling (Continued...)
- Lecture 17 - Buyer Persona and Consumer and B2B Decision Making process
- Lecture 18 - Consumer and B2B Decision Making process Selling and Consumer Behavior
- Lecture 19 - B2B Decision Making Process and Difference in B2B and B2C Selling
- Lecture 20 - Key Account Management and Customer Centric Selling
- Lecture 21 - Key Account Management, Customer Centric Selling and CRM Strategies (Continued...)
- Lecture 22 - Key Responsibilities of Salespeople
- Lecture 23 - Preparing for a Sales Role
- Lecture 24 - Preparing for a Sales Role (Continued...)
- Lecture 25 - Personal Selling Skills and Motivating Sales Team
- Lecture 26 - Personal Selling Skills and Motivating Sales Team (Continued...)
- Lecture 27 - Meaning and Role of Sales Intelligence
- Lecture 28 - Data for Sales intelligence
- Lecture 29 - Ideal Customer Profile
- Lecture 30 - Data-Driven Approaches to Selling
- Lecture 31 - Social Media for Lead Generation

[Lecture 32 - Understanding International Selling](#)

[Lecture 33 - Global Sales Dynamics and Sales Force Management](#)

[Lecture 34 - Do's and Don'ts of International Selling](#)

[Lecture 35 - Role of culture in International Selling](#)

[Lecture 36 - Challenges of Selling in International Markets](#)

[Lecture 37 - Role of technology management in selling](#)

[Lecture 38 - Use of Sales force Automation for Effective Selling](#)

[Lecture 39 - Role of AR/VR and AI in Selling](#)

[Lecture 40 - Managing a Diversified Sales-force](#)

[Lecture 41 - Ethical and Social issues in Selling](#)

NPTEL : NOC:Retail Marketing Strategy (Management)

Co-ordinators : Prof. Sourabh Arora

Lecture 1 - Understanding Retailing from a Strategic Standpoint

Lecture 2 - Why is Retailing so Important: Strategic Perspectives

Lecture 3 - Strategic Standpoint and Evolution of Retailing

Lecture 4 - Evolution of Retailing

Lecture 5 - Value Creation

Lecture 6 - Retailing Theories Role in Supply Chain

Lecture 7 - Retailing Theories and Retailers Role in Supply Chain

Lecture 8 - Retailers Role in Supply Chain and Retail Management Decision Process

Lecture 9 - Retail Management Decision Process (Continued...) and Kahn's Retailing Success Matrix

Lecture 10 - Retail Management Decision Process and Kahn's Retailing Success Matrix

Lecture 11 - Retail Management Decision Process, Kahn's Retailing Success Matrix and Success Factors

Lecture 12 - Kahn's Retailing Success Matrix and Success Factors for Retailing

Lecture 13 - Success Factors for Retailing and View of Consumer Decision Making Processes

Lecture 14 - Success Factors for Retailing and View of Consumer Decision Making Processes (Continued...)

Lecture 15 - Consumer Decision Making Processes (Continued...)

Lecture 16 - Consumer Decision Making Processes (Continued...)

Lecture 17 - Consumer Decision Making Processes (Continued...) and Consumer Motives

Lecture 18 - Tenets of Customer Centric Approach: A Retailers Perspective

Lecture 19 - Private Label Brands

Lecture 20 - Types of Private Label Brands and Introduction to Multi and Omni-Channel Retail

Lecture 21 - Introduction to Multi and Omni-Channel Retail

Lecture 22 - Introduction to Multi and Omni-Channel Retail (Continued...)

Lecture 23 - Introduction to Multi and Omni-Channel Retail (Continued...)

Lecture 24 - Formulating a Successful Retail Strategy

Lecture 25 - Formulating a Successful Retail Strategy

Lecture 26 - Formulating a Successful Retail Strategy (Continued...)

Lecture 27 - Formulating a Successful Retail Strategy (Continued...)

Lecture 28 - Formulating a Successful Retail Strategy (Continued...)

Lecture 29 - Formulating a Successful Retail Strategy (Continued...)

Lecture 30 - Formulating a Successful Retail Strategy (Continued...)

Lecture 31 - Location Decisions

[Lecture 32 - Location Decisions](#)

[Lecture 33 - Pricing Decisions](#)

[Lecture 34 - Merchandise Management and Planning](#)

[Lecture 35 - Merchandise Management and Planning \(Continued...\)](#)

[Lecture 36 - Role of HRM in Retailing](#)

[Lecture 37 - Role of HRM in Retailing \(Continued...\)](#)

[Lecture 38 - Motivating Employees](#)

[Lecture 39 - Showrooming and Webrooming](#)

[Lecture 40 - Showrooming and Webrooming](#)

[Lecture 41 - Virtual Reality, Augmented Reality and Artificial Intelligence in Retailing](#)

- Lecture 1 - Introduction to Business to Business Marketing
- Lecture 2 - Classification of Products and Customers in B2B
- Lecture 3 - B2B vs B2C Marketing - 1
- Lecture 4 - B2B vs B2C Marketing - 2
- Lecture 5 - Some Important Concepts and Case Study
- Lecture 6 - Value Chain Analysis, Core Competence and Outsourcing
- Lecture 7 - Introduction to Organisational Buying Behaviour
- Lecture 8 - Howard's Seth Model
- Lecture 9 - Seth's Model
- Lecture 10 - Webster and Wind Model, Buying Center and Buygrid Framework
- Lecture 11 - Purchasing function Goals and Kraljic's Model
- Lecture 12 - Purchasing Cycle and Procurement Development Process
- Lecture 13 - Strategic Sourcing and Case Study
- Lecture 14 - E-Procurement and Supplier Assessment
- Lecture 15 - B2B Marketing Strategy Formulation
- Lecture 16 - B2B Marketing Strategy Formulation and Balance Scorecard
- Lecture 17 - Balance Scorecard, Strategy Maps and Case Study
- Lecture 18 - Managing Products in B2B Markets: PLC Approach
- Lecture 19 - Managing Products in B2B Markets: TA Life Cycle Approach
- Lecture 20 - Managing Services in B2B Markets
- Lecture 21 - Introduction to STP
- Lecture 22 - Segmentation in B2B Markets
- Lecture 23 - Bonama and Shapiro's Nested Approach and Targeting in B2B
- Lecture 24 - Target Market Strategies
- Lecture 25 - Positioning in B2B Markets
- Lecture 26 - B2B Positioning Strategies
- Lecture 27 - Business Market Communication: Personal Selling
- Lecture 28 - Business Market Communication: Sales Force Management
- Lecture 29 - Business Market Communication: Advertising
- Lecture 30 - Business Market Communication: Social Media, Trade shows and more
- Lecture 31 - Business Market Communication: Promotional Budgeting

- Lecture 32 - Demand Forecasting in B2B Markets: Introduction
- Lecture 33 - Demand Forecasting in B2B Markets: Qualitative Methods
- Lecture 34 - Demand Forecasting in B2B Markets: Quantitative Methods - 1
- Lecture 35 - Demand Forecasting in B2B Markets: Quantitative Methods - 2
- Lecture 36 - B2B Product Management: New Product Development
- Lecture 37 - B2B Product Management: Identifying New Products
- Lecture 38 - B2B Product Management: Customer Value, Product Launch and more
- Lecture 39 - B2B Product Management: Branding
- Lecture 40 - B2B Pricing: Introduction
- Lecture 41 - B2B Pricing: Price Setting Process - 1
- Lecture 42 - B2B Pricing: Price Setting Process - 2
- Lecture 43 - B2B Pricing: Pricing Methods
- Lecture 44 - B2B Pricing: Geographical and Value Based Pricing
- Lecture 45 - B2B Pricing: Competitive Bidding
- Lecture 46 - Introduction to Relationship Management in B2B Markets
- Lecture 47 - Types of Relationships in B2B Markets and Customer Profitability
- Lecture 48 - Customer Relationship Management
- Lecture 49 - Customer Lifetime Value
- Lecture 50 - B2B Marketing Research: Introduction
- Lecture 51 - B2B Marketing Research: Research Methods
- Lecture 52 - Business Marketing Channels: Introduction and its Types
- Lecture 53 - Business Marketing Channels: Types of Participants
- Lecture 54 - Business Marketing Channels: E-Commerce
- Lecture 55 - Supply Chain Management and its Drivers
- Lecture 56 - Approaches to SCM and Logistics Management
- Lecture 57 - Strategic Business Units (SBU) and BCG Matrix
- Lecture 58 - GE Matrix and McKinsey 7S Framework
- Lecture 59 - Marketing Techniques Implementation and Control
- Lecture 60 - A Comprehensive Case Study

- Lecture 1 - Introduction to Organization Design
- Lecture 2 - Evolution of Organization Theory and Design
- Lecture 3 - Approaches to Design Based on Different Models
- Lecture 4 - Role of Strategy in Organization Design
- Lecture 5 - A Framework for Selecting Strategy and Design
- Lecture 6 - Assessing Organizational Effectiveness - 1
- Lecture 7 - Assessing Organizational Effectiveness - 2
- Lecture 8 - Understanding Organizational Structure
- Lecture 9 - Dimension of Organization Structure - 1
- Lecture 10 - Dimension of Organization Structure - 2
- Lecture 11 - Dimension of Organization Structure - 3
- Lecture 12 - Interorganizational Relationship - 1
- Lecture 13 - Interorganizational Relationship - 2
- Lecture 14 - The Impact of External Environment
- Lecture 15 - Framework for Response to Environmental Change
- Lecture 16 - Organization Resilience and Adaptability
- Lecture 17 - Introduction to Organization Decision-making
- Lecture 18 - Models of Organizational decision-making
- Lecture 19 - Contingency Decision-Making Framework
- Lecture 20 - Role of IT in decision making
- Lecture 21 - Strategic Role of Change
- Lecture 22 - Model of Change Management
- Lecture 23 - Managing Technology Change
- Lecture 24 - Leading in VUCA World
- Lecture 25 - Enhancing Organizational Readiness for Change
- Lecture 26 - Designing Organizations for Competitive Success
- Lecture 27 - Understanding and Developing Organization culture
- Lecture 28 - Managing Culture by Design
- Lecture 29 - Learning Organization
- Lecture 30 - Ethical values and Social Responsibility
- Lecture 31 - Organizational Design Challenges

- Lecture 32 - Interdepartmental Conflict in Organization
- Lecture 33 - Power and Organization
- Lecture 34 - Political Processes in an organization
- Lecture 35 - Communications Structure of Organization
- Lecture 36 - Leadership in Organization Design
- Lecture 37 - The strategic value of Information Technology
- Lecture 38 - E-business Organization Design
- Lecture 39 - Workplace Technology and Design - 1
- Lecture 40 - Workplace Technology and Design - 2
- Lecture 41 - Innovation Management and its Principles
- Lecture 42 - Models of Organizational Innovation
- Lecture 43 - Innovation for Impact
- Lecture 44 - Design Thinking for Innovation - 1
- Lecture 45 - Design Thinking for Innovation - 2
- Lecture 46 - Growth and Organization Life cycle
- Lecture 47 - Organization Size and Complexity of Organization
- Lecture 48 - Organization Bureaucracy and Control
- Lecture 49 - Organization Development and Tools - 1
- Lecture 50 - Organization Development and Tools - 2
- Lecture 51 - Understanding Global Organizational Design
- Lecture 52 - Designing Structure to Fit Global Strategy
- Lecture 53 - Building Global Capabilities
- Lecture 54 - Sustainable Organization Design
- Lecture 55 - Job Crafting
- Lecture 56 - Workplace Design for Well-being
- Lecture 57 - Organization Building in Context of Employee Engagement
- Lecture 58 - The Experience-Centric Organization
- Lecture 59 - The Wheel of Experience Centricity
- Lecture 60 - Designing Organization for Meaningful Experiences

- Lecture 1 - Introduction to Project Management - I
- Lecture 2 - Introduction to Project Management - II
- Lecture 3 - Agile Project Management
- Lecture 4 - Project Selection Models
- Lecture 5 - Examples of Project Selection Models
- Lecture 6 - Project Manager
- Lecture 7 - Attributes of Effective Project Manager
- Lecture 8 - Managing for Stakeholders
- Lecture 9 - Resolving Conflicts
- Lecture 10 - Negotiation
- Lecture 11 - Project in the Organization structure
- Lecture 12 - Human factors and the Project Team
- Lecture 13 - Traditional Project Activity Planning
- Lecture 14 - Agile Project Planning, Project Charter
- Lecture 15 - Coordination through Integration Management
- Lecture 16 - Project Feasibility Analysis
- Lecture 17 - Estimating Project Budgets
- Lecture 18 - Project Risk Management
- Lecture 19 - Quantitative Risk Assessment Methodologies
- Lecture 20 - Critical Path Method (CPM)
- Lecture 21 - Programme Evaluation And Review Technique PERT
- Lecture 22 - Risk Analysis with simulation for scheduling
- Lecture 23 - Gantt Chart and Scheduling with scrum
- Lecture 24 - Crashing a project
- Lecture 25 - Resource Loading
- Lecture 26 - Resource Levelling
- Lecture 27 - Goldratt's critical chain
- Lecture 28 - Planning monitoring controlling cycle
- Lecture 29 - Earned value analysis
- Lecture 30 - Agile tools for tracking project
- Lecture 31 - Three types of Project Controlling

[Lecture 32 - Control of change scope and scope creep](#)

[Lecture 33 - Project Audit](#)

[Lecture 34 - Essentials of an audit evaluation](#)

[Lecture 35 - When to close a project ?](#)

[Lecture 36 - Benefits realization, Case study on the success of Chandrayan 3](#)

[Lecture 37 - Software for Project Management](#)

[Lecture 38 - Demo on project management software](#)

[Lecture 39 - Simulations Software for Project Management](#)

[Lecture 40 - Course Summary](#)

NPTEL : NOC:AI in Marketing (Management)

Co-ordinators : Prof. Zillur Rahman

- Lecture 1 - Understanding the basics of AI in Marketing - I
- Lecture 2 - Understanding the basics of AI in Marketing - II
- Lecture 3 - Understanding the basics of AI in Marketing - III
- Lecture 4 - Introduction to AI Algorithms
- Lecture 5 - Designs of AI, Transition process and AI matrix
- Lecture 6 - Customer value and Role of AI in Value Delivery Process
- Lecture 7 - Transforming Marketing Strategy using AI - I
- Lecture 8 - Transforming Marketing Strategy using AI - II
- Lecture 9 - Transforming Marketing Strategy using AI - III
- Lecture 10 - Transforming Marketing Strategy using AI - IV
- Lecture 11 - Transforming Marketing Strategy using AI - V
- Lecture 12 - Using AI for STP
- Lecture 13 - Application of AI in Marketing Mix - I
- Lecture 14 - Application of AI in Marketing Mix - II
- Lecture 15 - Marketing Information Systems and its Components
- Lecture 16 - What is Marketing Research - I
- Lecture 17 - What is Marketing Research - II
- Lecture 18 - Individual Dynamics and its influence on Consumer Behaviour
- Lecture 19 - Consumer Buying Decision Process
- Lecture 20 - Understanding Customer Journey - I
- Lecture 21 - Understanding Customer Journey - II
- Lecture 22 - Customer Experience: Meaning and Characteristics
- Lecture 23 - Personalization: Going Beyond Segmentation - I
- Lecture 24 - Personalization: Going Beyond Segmentation - II
- Lecture 25 - Avatar marketing
- Lecture 26 - Standardization, Personalization and Relationalization of Brands using AI
- Lecture 27 - Understanding Networks and Brand Network Effect
- Lecture 28 - Understanding the Use of AI for Addressing Competition
- Lecture 29 - AI and Brand Equity
- Lecture 30 - AI and New Brand Realities - I
- Lecture 31 - AI and New Brand Realities - II

- Lecture 32 - AI for Value Creation and Product Development
- Lecture 33 - Personalization and hyper-personalization Using AI - I
- Lecture 34 - Personalization and hyper-personalization Using AI - II
- Lecture 35 - Personalization and hyper-personalization Using AI - III
- Lecture 36 - Personalization and hyper-personalization Using AI - IV
- Lecture 37 - Personalization and hyper-personalization Using AI - V
- Lecture 38 - Implementation of AI by Product Managers
- Lecture 39 - AI in Service
- Lecture 40 - Pricing Strategies Using AI - I
- Lecture 41 - Pricing Strategies Using AI - II
- Lecture 42 - Pricing Strategies Using AI - III
- Lecture 43 - Pricing Strategies Using AI - IV
- Lecture 44 - Role of AI in Advertising - I
- Lecture 45 - Role of AI in Advertising - II
- Lecture 46 - AI in Sales promotion and Direct Marketing
- Lecture 47 - AI in PR and Publicity and Social Media Marketing - I
- Lecture 48 - AI in PR and Publicity and Social Media Marketing - II
- Lecture 49 - Personal Selling using AI
- Lecture 50 - Sales management using AI
- Lecture 51 - AI and Marketing Channel Management
- Lecture 52 - Omnichannel Marketing and Retailing
- Lecture 53 - Changing face of Retailing in the age of AI
- Lecture 54 - AI in Logistics Management - I
- Lecture 55 - AI in Logistics Management - II
- Lecture 56 - Navigating Ethical Challenges in AI - I
- Lecture 57 - Navigating Ethical Challenges in AI - II
- Lecture 58 - Navigating Ethical Challenges in AI - III
- Lecture 59 - Navigating Ethical Challenges in AI - IV
- Lecture 60 - AI and Sustainability

Lecture 1 - Introduction

Lecture 2 - Innovation

Lecture 3 - Innovations in Marketing and Marketing of Innovations

Lecture 4 - Innovations in Marketing

Lecture 5 - Need for Innovations in Marketing - 1

Lecture 6 - Need for Innovations in Marketing - 2

Lecture 7 - Change in Consumer Behaviour - 1

Lecture 8 - Change in Consumer Behaviour - 2

Lecture 9 - Innovative Perspectives about 4Pâ€™s for Innovation

Lecture 10 - Innovator's Dilemma

Lecture 11 - Go-To-Market Strategy

Lecture 12 - Targeting - Evolutionary Perspective

Lecture 13 - Innovations in Targeting and Positioning

Lecture 14 - Changing Concepts in Marketing of Products and Services

Lecture 15 - Changing Concepts of Marketing and Innovations in Service Marketing

Lecture 16 - Countering Commoditization: An Innovative Perspective

Lecture 17 - Innovations and Branding

Lecture 18 - Innovation in Pricing and Factors Affecting Pricing Innovations

Lecture 19 - Innovation in Pricing

Lecture 20 - Innovation in Pricing Strategies - 1

Lecture 21 - Innovation in Pricing Strategies - 2

Lecture 22 - Innovation in Distribution Channels

Lecture 23 - Innovation in Channel Management

Lecture 24 - Innovation in Retailing - 1

Lecture 25 - Innovation in Retailing - 2

Lecture 26 - Influence of distribution innovation on Marketing Mix

Lecture 27 - Innovation in Marketing Communication - 1

Lecture 28 - Innovation in Marketing Communication - 2

Lecture 29 - Innovation in Marketing Communication - 3

Lecture 30 - Innovative Marketing Communications: Direct Marketing

Lecture 31 - Innovative Marketing Communications: Sales Promotion and Public Relations

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

[Lecture 32 - Innovative Marketing Communications: Advertising - Print, Radio and Television](#)

[Lecture 33 - Innovative Marketing Communications: Digital and Social Media Marketing](#)

[Lecture 34 - Influence of Innovation in Marketing Communications on the Marketing Mix](#)

[Lecture 35 - Co-Creation of Value and Value Co-Creation](#)

[Lecture 36 - Innovation and Value Chains - 1](#)

[Lecture 37 - Innovation and Value Chains - 2](#)

[Lecture 38 - Beyond Business](#)

[Lecture 39 - What is Marketing of Innovation? - Part 1](#)

[Lecture 40 - What is Marketing of Innovation? - Part 2](#)

[Lecture 41 - What is Marketing of Innovation? - Part 3](#)

[Lecture 42 - Marketing of Innovation - new products/new usage/ new services/ new perspective?](#)

[Lecture 43 - Marketing Research on Marketing of Innovation - Part 1](#)

[Lecture 44 - Marketing Research on Marketing of Innovation - Part 2](#)

[Lecture 45 - Marketing of Innovation - A fundamental change of thought process](#)

[Lecture 46 - Introduction to Innovation](#)

[Lecture 47 - Sources and Principles of Innovation](#)

[Lecture 48 - Strategy and Innovation](#)

[Lecture 49 - Connecting Innovation to Strategy](#)

[Lecture 50 - Understanding Consumers](#)

[Lecture 51 - Consumer Behavior and Innovations](#)

[Lecture 52 - Product Life Cycle in case of Innovations; Is it different?](#)

[Lecture 53 - Branding of Innovation](#)

[Lecture 54 - Marketing of Innovation in Service Industry - Part 1](#)

[Lecture 55 - Marketing of Innovation in Service Industry - Part 2](#)

[Lecture 56 - Positioning of Innovation](#)

[Lecture 57 - New Product Development](#)

[Lecture 58 - Monetizing and Delivering Innovation](#)

[Lecture 59 - What if it did not happen?](#)

[Lecture 60 - Conclusion](#)

- Lecture 1 - Services and their Unique Characteristics
- Lecture 2 - Services in Modern Economy
- Lecture 3 - Trends and Challenges in Services Marketing
- Lecture 4 - Service Marketing Mix and Value Creation
- Lecture 5 - Services Ecosystem and Stakeholder Analysis
- Lecture 6 - Customer Journey Mapping and Touchpoint Analysis
- Lecture 7 - Designing memorable customer experiences
- Lecture 8 - Personalization and Customization in Services
- Lecture 9 - Emotional and Sensory marketing in Services
- Lecture 10 - Technology-enabled customer experiences
- Lecture 11 - Service Design Thinking and Design-driven Innovation
- Lecture 12 - Open Innovation and Collaboration in Services
- Lecture 13 - Crowdsourcing and customer involvement in service development
- Lecture 14 - Managing Service Failures and Service Recovery Strategies
- Lecture 15 - Leveraging Customer Feedback for Continuous Improvement
- Lecture 16 - Digitalization of Services and Digital Service Platforms
- Lecture 17 - Online Customer Engagement and Social Media Marketing
- Lecture 18 - Mobile Marketing and Location-based Services
- Lecture 19 - Artificial Intelligence and Chatbot Integration in Services
- Lecture 20 - Blockchain and its application in service industries
- Lecture 21 - Data-driven Decision-making in Services Marketing
- Lecture 22 - Customer Analytics and Segmentation Strategies
- Lecture 23 - Predictive Analytics for Personalized Marketing
- Lecture 24 - Sentiment Analysis and Social Listening in Services
- Lecture 25 - Ethical Considerations in Handling Customer Data
- Lecture 26 - Building a Strong Service Brand Identity
- Lecture 27 - Brand Positioning and Differentiation Strategies
- Lecture 28 - Online Brand Management and Reputation Monitoring
- Lecture 29 - Managing Brand Extensions and Brand Partnerships
- Lecture 30 - Internal Branding and Aligning Employees with the Brand
- Lecture 31 - Measuring and Improving Service Quality

- Lecture 32 - SERVQUAL and Other Service Quality Measurement Tools
- Lecture 33 - Service Guarantees and Service-level Agreements
- Lecture 34 - Service Recovery Strategies and Complaint Handling
- Lecture 35 - Cultivating a Culture of Service Excellence
- Lecture 36 - Pricing Strategies for Services and Value-based Pricing
- Lecture 37 - Dynamic Pricing and Revenue Optimization Techniques
- Lecture 38 - Bundling and Packaging Strategies in Service Pricing
- Lecture 39 - Subscription Models and Revenue Diversification
- Lecture 40 - Pricing Strategies for Freemium and Subscription-based Services
- Lecture 41 - Cultural Nuances and Their Impact on Service Marketing
- Lecture 42 - Adapting Services for Different Cultural Contexts
- Lecture 43 - Global Branding and Localization Strategies
- Lecture 44 - Managing Diversity and Inclusivity in Service Delivery
- Lecture 45 - Cross-cultural Communication and Customer Relationship Management
- Lecture 46 - Sustainable practices and corporate social responsibility in services
- Lecture 47 - Environmental consciousness and green marketing
- Lecture 48 - Eco-friendly service design and operations
- Lecture 49 - Ethical sourcing and responsible supply chain management
- Lecture 50 - Consumer attitudes towards sustainable services
- Lecture 51 - Developing service leadership skills
- Lecture 52 - Motivating and empowering service employees
- Lecture 53 - Service culture and service-oriented organizational behaviour
- Lecture 54 - Training and development for service excellence
- Lecture 55 - Managing service teams and fostering collaboration
- Lecture 56 - Innovations in Service Delivery and Technology
- Lecture 57 - Augmented Reality and Virtual Reality in Services
- Lecture 58 - Internet of Things (IoT) in Service Ecosystem
- Lecture 59 - Servitization and Product-Service Systems
- Lecture 60 - Future Prospects and Challenges in Services Marketing

Lecture 1 - Introduction to HR Analytics

Lecture 2 - HR Data Preparation and Development of HR metrics

Lecture 3 - Data science framework

Lecture 4 - Pitfalls of data science framework and Basics of data visualization

Lecture 5 - Developing HR analytics unit and culture

Lecture 6 - List of books

Lecture 7 - Introduction to data visualization

Lecture 8 - Data Visualization Power BI - 1

Lecture 9 - Data Visualization Power BI - 2

Lecture 10 - Data Visualization Power BI - 3

Lecture 11 - Data Visualization Excel - 1

Lecture 12 - Data Visualization Excel - 2

Lecture 13 - Steps of recruitment

Lecture 14 - Managerial challenges of recruitment - 1

Lecture 15 - Managerial challenges of recruitment - 2

Lecture 16 - Recruitment Analytics - 1

Lecture 17 - Recruitment Analytics - 2

Lecture 18 - Recruitment Analytics - 3

Lecture 19 - Recruitment Analytics - 4

Lecture 20 - Steps of employee selection process

Lecture 21 - Managerial challenges of employee selection - 1

Lecture 22 - Managerial challenges of employee selection - 2

Lecture 23 - Selection Analytics - 1

Lecture 24 - Selection Analytics - 2

Lecture 25 - Selection Analytics - 3

Lecture 26 - Selection Analytics - 4

Lecture 27 - Data Visualization of Recruitment and Selection

Lecture 28 - Steps of training

Lecture 29 - Managerial challenges of employee training - 1

Lecture 30 - Managerial challenges of employee training - 2

Lecture 31 - Training Analytics - 1

- Lecture 32 - Training Analytics - 2
- Lecture 33 - Training Analytics - 3
- Lecture 34 - Training Analytics - 4
- Lecture 35 - Steps of Employee Development
- Lecture 36 - Managerial Challenges of Employee Development - 1
- Lecture 37 - Managerial challenges of employee development - 2
- Lecture 38 - Employee Development Analytics - 1
- Lecture 39 - Employee Development Analytics - 2
- Lecture 40 - Employee Development Analytics - 3
- Lecture 41 - Employee Development Analytics - 4
- Lecture 42 - Data Visualization of Training and Development
- Lecture 43 - Steps of performance management
- Lecture 44 - Managerial challenges of performance management - 1
- Lecture 45 - Managerial challenges of performance management - 2
- Lecture 46 - Performance Analytics - 1
- Lecture 47 - Performance Analytics - 2
- Lecture 48 - Performance Analytics - 3
- Lecture 49 - Performance Analytics - 4
- Lecture 50 - Steps of compensation management
- Lecture 51 - Managerial challenges of compensation management - 1
- Lecture 52 - Managerial challenges of compensation management - 2
- Lecture 53 - Compensation Analytics - 1
- Lecture 54 - Compensation Analytics - 2
- Lecture 55 - Compensation Analytics - 3
- Lecture 56 - Compensation Analytics - 4
- Lecture 57 - Data Visualization of Performance and Compensation
- Lecture 58 - Data Visualization Tableau - 1
- Lecture 59 - Data Visualization Tableau - 2
- Lecture 60 - Data Visualization Tableau - 3
- Lecture 61 - Data Visualization Tableau - 4
- Lecture 62 - Data Visualization Tableau - 5

Lecture 1 - What is Strategic Management?

Lecture 2 - Concepts of Strategy - 1

Lecture 3 - Concepts of Strategy - 2

Lecture 4 - Concepts of Strategy - 3

Lecture 5 - Strategy, Strategic Plan and Tactics

Lecture 6 - Strategic Planning, Thinking and Business Policy

Lecture 7 - Importance of Strategic Management

Lecture 8 - Corporate Culture

Lecture 9 - Leadership - 1

Lecture 10 - Leadership - 2

Lecture 11 - Developing and Communicating a Strategic Vision

Lecture 12 - Communicating a Strategic Vision

Lecture 13 - Developing a Company's Mission Statement and Linking it with Company's Core Values

Lecture 14 - Strategic Management Process - 1

Lecture 15 - Strategic Management Process - 2

Lecture 16 - Concept of Organizational Life Cycle

Lecture 17 - Generic Competitive Strategies - 1

Lecture 18 - Generic Competitive Strategies - 2

Lecture 19 - Ethics as a Strategy - 1

Lecture 20 - Ethics as a Strategy - 2

Lecture 21 - Sustainability as a Strategic Approach - 1

Lecture 22 - Sustainability as a Strategic Approach - 2

Lecture 23 - Environment and Strategy - 1

Lecture 24 - Environment and Strategy - 2

Lecture 25 - Internal Environment

Lecture 26 - Environmental Analysis - Resource Based Model

Lecture 27 - I/O Model, Resources, Capabilities, Core Competencies and Value Chain

Lecture 28 - Industry Life Cycle

Lecture 29 - Competition as Basis for Strategy Formulation and Red Ocean Strategy

Lecture 30 - Blue Ocean Strategy - 1

Lecture 31 - Blue Ocean Strategy - 2

- Lecture 32 - Blue Ocean Strategy - 3
- Lecture 33 - Blue Ocean Strategy - 4
- Lecture 34 - Blue Ocean Strategy - 5
- Lecture 35 - Strategic Entrepreneurship
- Lecture 36 - Strategy for Value Creation
- Lecture 37 - Strategy from Different Perspectives: Fortune at the Bottom of the Pyramid
- Lecture 38 - Strategy from Different Perspectives: Capitalism at the Crossroads
- Lecture 39 - Strategy from Different Perspectives: Sustainable Value Framework
- Lecture 40 - Strategy from Different Perspectives: Development as Freedom
- Lecture 41 - Designing Business Level Strategies
- Lecture 42 - Designing and Strengthening Business Strategies
- Lecture 43 - Corporate Level Strategy - 1
- Lecture 44 - Corporate Level Strategy - 2
- Lecture 45 - Designing Corporate Level Strategy
- Lecture 46 - Designing and Strengthening Corporate Level Strategy
- Lecture 47 - Strengthening Company's Competitive Position - 1
- Lecture 48 - Strengthening Company's Competitive Position - 2
- Lecture 49 - Mergers and Acquisitions - 1
- Lecture 50 - Mergers and Acquisitions - 2
- Lecture 51 - Corporate Governance - 1
- Lecture 52 - Corporate Governance - 2
- Lecture 53 - Corporate Governance - 3
- Lecture 54 - Managing Internal Operations
- Lecture 55 - Strategy Implementation
- Lecture 56 - Strategy Evaluation
- Lecture 57 - The Black Swan
- Lecture 58 - ESG and SDG
- Lecture 59 - Stop Predicting
- Lecture 60 - Conclusion

NPTEL : Strategic Management (Management)

Co-ordinators : Prof. R. Srinivasan

Lecture 1 - Introduction to Strategic Management

Lecture 2 - Concept of Corporate Strategy

Lecture 3 - Strategic Management Process - 1

Lecture 4 - Strategic Management Process - 2

Lecture 5 - The 7-S Framework

Lecture 6 - Corporate Policy and Planning in India

Lecture 7 - Board of Directors - Role and Functions

Lecture 8 - Board of Directors - Role and Functions, Top Management - Role and Skills, Board Functioning - Indian Context

Lecture 9 - Board Functioning - Indian Context and Environmental Scanning

Lecture 10 - Environmental Scanning and Industry Analysis

Lecture 11 - The synthesis of External Factors and External Factors Analysis Summary (EFAS)

Lecture 12 - Internal Corporate Analysis and Impact Matrix

Lecture 13 - Value Chain Analysis

Lecture 14 - Synthesis of Internal Factors - 1

Lecture 15 - Synthesis of Internal Factors - 2

Lecture 16 - Internal Factors Analysis Summary (IFAS) and Case Study - 1

Lecture 17 - Case Analysis

Lecture 18 - Key Financial Ratios

Lecture 19 - Case Analysis - 2 and SFAS Matrix

Lecture 20 - Business Strategy

Lecture 21 - Corporate Strategy - 1

Lecture 22 - Corporate Strategy - 2

Lecture 23 - Corporate Strategy - 3 and Functional Strategy

Lecture 24 - Functional Strategy - 1

Lecture 25 - Functional Strategy - 2

Lecture 26 - Functional Strategy - 3 and Strategic Choice

Lecture 27 - Strategy Implementation - 1

Lecture 28 - Strategy Implementation - 2

Lecture 29 - Evaluation and Control

Lecture 30 - Strategic Information Systems - 1

Lecture 31 - Strategic Information Systems - 2

[Lecture 32 - Other Strategic Issues - 1](#)

[Lecture 33 - Other Strategic Issues - 2](#)

[Lecture 34 - Small and Medium Enterprises](#)

[Lecture 35 - Non- Profit Organizations](#)

[Lecture 36 - Summary - 1](#)

[Lecture 37 - Summary - 2](#)

NPTEL : Global Supply Chain Management (Management)

Co-ordinators : Prof. N. Viswanadham

Lecture 1 - Introduction to Global Supply Chain Networks Part - 1

Lecture 2 - Introduction to Global Supply Chain Networks Part - 2

Lecture 3 - Zara - fast fashion

Lecture 4 - The Supply Chain Eco-System Framework

Lecture 5 - Supply Chain Eco-System Framework: Supply Chains & Resources

Lecture 6 - Supply Chain Eco-System Framework: Delivery services & Institutions

Lecture 7 - Metro Cash and Carry

Lecture 8 - Performance Analysis

Lecture 9 - Supply Chain Risk - Part-1

Lecture 10 - Supply Chain Risk - Part-2

Lecture 11 - Supply Chain Risk - Part-3

Lecture 12 - Mattel Toy Recalls and Supply Chain Management

Lecture 13 - Innovation in Emerging markets

Lecture 14 - Innovations in Supply Chain Ecosystem

Lecture 15 - Indian Telecom and Bharti Airtel

Lecture 16 - CEMEX - Part-1

Lecture 17 - CEMEX - Part-2

Lecture 18 - Governance

Lecture 19 - Governance of networked organizations

Lecture 20 - The Orchestration Governance Model

Lecture 21 - Orchestration-Examples

Lecture 22 - Li & Fung - Part-1

Lecture 23 - Li & Fung - Part-2

Lecture 24 - Supply Chain Design - Part-1

Lecture 25 - Supply Chain Design - Part-2

Lecture 26 - Green supply chain design - Part-1

Lecture 27 - Green supply chain design - Part-2

Lecture 28 - Green Supply Chain Ecosystem Analysis

Lecture 29 - GRIP Framework

Lecture 30 - Location Selection

Lecture 31 - Ecosystem Aware Location Analysis

[Lecture 32 - Food supply chain in India](#)

[Lecture 33 - Food supply chain ecosystem - Grip frame work](#)

[Lecture 34 - Food Security in India](#)

[Lecture 35 - Smart Villages and Cities - Part-1](#)

[Lecture 36 - Smart Villages and Cities - Part-2](#)

[Lecture 37 - Overview of the Course](#)

[Lecture 38 - How to use the Video lectures](#)

- Lecture 1 - Evolution of Marketing
- Lecture 2 - Marketing Management
- Lecture 3 - Marketing in India
- Lecture 4 - Role of Marketing
- Lecture 5 - Case Analysis
- Lecture 6 - Case Analysis
- Lecture 7 - Case of Suryodaya
- Lecture 8 - Marketing System
- Lecture 9 - Input-Output Map
- Lecture 10 - Competition
- Lecture 11 - Consumer Behaviour Model
- Lecture 12 - BCG Matrix, Strategic Marketing
- Lecture 13 - Marketing Strategy
- Lecture 14 - Market Segmentation, VALS Model
- Lecture 15 - Sales Function and Marketing Mix
- Lecture 16 - B-B Markets, Macro Environment
- Lecture 17 - Analytical Marketing System
- Lecture 18 - Decision Models
- Lecture 19 - E-Business
- Lecture 20 - Market Demand, Concept Testing
- Lecture 21 - Product, Product Mix, PLC
- Lecture 22 - PLC (Continued...)
- Lecture 23 - Pricing Strategies
- Lecture 24 - Brands, Channels
- Lecture 25 - Channel Management, Marketing Communication
- Lecture 26 - Advertising, Marketing Organisation
- Lecture 27 - Role of Product Manager, Industrial Buying
- Lecture 28 - Sales Forecasting, Marketing Control
- Lecture 29 - Marketing Expense Analysis
- Lecture 30 - Toyota Strategy
- Lecture 31 - Cafe Coffee Day(CCD)

[Lecture 32 - CCD \(Continued...\)](#)

[Lecture 33 - I flex \(OFSS\)](#)

[Lecture 34 - OFSS](#)

[Lecture 35 - Oilseeds Growers Cooperative Society \(OGCS\)](#)

[Lecture 36 - OGCS](#)

- Lecture 1 - Long Range/Strategic Planning
- Lecture 2 - Purpose, Mission, Goals
- Lecture 3 - Different types of Strategies
- Lecture 4 - Different types of Strategies
- Lecture 5 - Strategic Management Process (SMP)
- Lecture 6 - Modes of Strategic decisions
- Lecture 7 - 7-S Frame work
- Lecture 8 - Director, powers
- Lecture 9 - Functions of BoD
- Lecture 10 - Responsibilities of Business
- Lecture 11 - Taxonomy of Company Environment
- Lecture 12 - Competitive Landscape
- Lecture 13 - Global Uncertainty Internal Corporate Analysis
- Lecture 14 - Industry structure, Competitor Analysis
- Lecture 15 - Firm's value chain
- Lecture 16 - Key factors of Success, Porter's Industry Competition Model
- Lecture 17 - S and W Profile Analysis
- Lecture 18 - Competitive Advantage(CA), IFAS,SFAS
- Lecture 19 - Case Analysis
- Lecture 20 - Case Analysis (Continued...)
- Lecture 21 - Case Study - 1
- Lecture 22 - Case Study - 2
- Lecture 23 - Business Strategy
- Lecture 24 - BEA, Doom Loops, Corporate Strategy, Portfolio Analysis
- Lecture 25 - Corporate Strategy, Display Matrices
- Lecture 26 - Display Matrices
- Lecture 27 - Display Matrices
- Lecture 28 - National Diamond
- Lecture 29 - Functional Strategy
- Lecture 30 - Strategic Choice
- Lecture 31 - Stage I, II, III, IV organizations

[Lecture 32 - Risk, Corporate Diversification](#)

[Lecture 33 - Mergers and Acquisitions](#)

[Lecture 34 - Model for Evaluation](#)

[Lecture 35 - Rewards](#)

[Lecture 36 - Technology Road Map](#)

[Lecture 37 - IT and Strategy, R&D Strategy](#)

[Lecture 38 - Summary](#)

Lecture 1 - Introduction

Lecture 2 - Polynomial Approximation

Lecture 3 - Interpolating Polynomials

Lecture 4 - Properties of Divided Difference

Lecture 5 - Error in the Interpolating polynomial

Lecture 6 - Cubic Hermite Interpolation

Lecture 7 - Piecewise Polynomial Approximation

Lecture 8 - Cubic Spline Interpolation

Lecture 9 - Tutorial 1

Lecture 10 - Numerical Integration: Basic Rules

Lecture 11 - Composite Numerical Integration

Lecture 12 - Gauss 2-point Rule: Construction

Lecture 13 - Gauss 2-point Rule: Error

Lecture 14 - Convergence of Gaussian Integration

Lecture 15 - Tutorial 2

Lecture 16 - Numerical Differentiation

Lecture 17 - Gauss Elimination

Lecture 18 - L U decomposition

Lecture 19 - Cholesky decomposition

Lecture 20 - Gauss Elimination with partial pivoting

Lecture 21 - Vector and Matrix Norms

Lecture 22 - Perturbed Linear Systems

Lecture 23 - Ill-conditioned Linear System

Lecture 24 - Tutorial 3

Lecture 25 - Effect of Small Pivots

Lecture 26 - Solution of Non-linear Equations

Lecture 27 - Quadratic Convergence of Newton's Method

Lecture 28 - Jacobi Method

Lecture 29 - Gauss-Seidel Method

Lecture 30 - Tutorial 4

Lecture 31 - Initial Value Problem

[Lecture 32 - Multi-step Methods](#)

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[Lecture 34 - Boundary Value Problems](#)

[Lecture 35 - Eigenvalues and Eigenvectors](#)

[Lecture 36 - Spectral Theorem](#)

[Lecture 37 - Power Method](#)

[Lecture 38 - Inverse Power Method](#)

[Lecture 39 - Q R Decomposition](#)

[Lecture 40 - Q R Method](#)

NPTEL : Measure and Integration (Mathematics)

Co-ordinators : Prof. Inder K Rana

Lecture 1 - Introduction, Extended Real numbers

Lecture 2 - Algebra and Sigma Algebra of a subset of a set

Lecture 3 - Sigma Algebra generated by a class

Lecture 4 - Monotone Class

Lecture 5 - Set function

Lecture 6 - The Length function and its properties

Lecture 7 - Countably additive set functions on intervals

Lecture 8 - Uniqueness Problem for Measure

Lecture 9 - Extension of measure

Lecture 10 - Outer measure and its properties

Lecture 11 - Measurable sets

Lecture 12 - Lebesgue measure and its properties

Lecture 13 - Characterization of Lebesgue measurable sets

Lecture 14 - Measurable functions

Lecture 15 - Properties of measurable functions

Lecture 16 - Measurable functions on measure spaces

Lecture 17 - Integral of non negative simple measurable functions

Lecture 18 - Properties of non negative simple measurable functions

Lecture 19 - Monotone convergence theorem & Fatou's Lemma

Lecture 20 - Properties of Integral functions & Dominated Convergence Theorem

Lecture 21 - Dominated Convergence Theorem and applications

Lecture 22 - Lebesgue Integral and its properties

Lecture 23 - Denseness of continuous function

Lecture 24 - Product measures, an Introduction

Lecture 25 - Construction of Product Measure

Lecture 26 - Computation of Product Measure - I

Lecture 27 - Computation of Product Measure - II

Lecture 28 - Integration on Product spaces

Lecture 29 - Fubini's Theorems

Lecture 30 - Lebesgue Measure and integral on \mathbb{R}^2

Lecture 31 - Properties of Lebesgue Measure and integral on \mathbb{R}^n

[Lecture 32 - Lebesgue integral on \$\mathbb{R}^2\$](#)

[Lecture 33 - Integrating complex-valued functions](#)

[Lecture 34 - \$L_p\$ - spaces](#)

[Lecture 35 - \$L^2\(X, S, \mu\)\$](#)

[Lecture 36 - Fundamental Theorem of calculus for Lebesgue Integral - I](#)

[Lecture 37 - Fundamental Theorem of calculus for Lebesgue Integral - II](#)

[Lecture 38 - Absolutely continuous measures](#)

[Lecture 39 - Modes of convergence](#)

[Lecture 40 - Convergence in Measure](#)

Lecture 1 - Indian Mathematics: An Overview

Lecture 2 - Vedas and Sulbasutras - Part 1

Lecture 3 - Vedas and Sulbasutras - Part 2

Lecture 4 - Panini's Astadhyayi

Lecture 5 - Pingala's Chandahsastra

Lecture 6 - Decimal place value system

Lecture 7 - Aryabhatiya of Aryabhata - Part 1

Lecture 8 - Aryabhatiya of Aryabhata - Part 2

Lecture 9 - Aryabhatiya of Aryabhata - Part 3

Lecture 10 - Aryabhatiya of Aryabhata - Part 4 and Introduction to Jaina Mathematics

Lecture 11 - Brahmasphutasiddhanta of Brahmagupta - Part 1

Lecture 12 - Brahmasphutasiddhanta of Brahmagupta - Part 2

Lecture 13 - Brahmasphutasiddhanta of Brahmagupta - Part 3

Lecture 14 - Brahmasphutasiddhanta of Brahmagupta - Part 4 and The Bakhshali Manuscript

Lecture 15 - Mahaviras Ganitasarasangraha - Part 1

Lecture 16 - Mahaviras Ganitasarasangraha - Part 2

Lecture 17 - Mahaviras Ganitasarasangraha - Part 3

Lecture 18 - Development of Combinatorics - Part 1

Lecture 19 - Development of Combinatorics - Part 2

Lecture 20 - Lilavati of Bhaskaracarya - Part 1

Lecture 21 - Lilavati of Bhaskaracarya - Part 2

Lecture 22 - Lilavati of Bhaskaracarya - Part 3

Lecture 23 - Bijaganita of Bhaskaracarya - Part 1

Lecture 24 - Bijaganita of Bhaskaracarya - Part 2

Lecture 25 - Ganitakaumudi of Narayana Pandita - Part 1

Lecture 26 - Ganitakaumudi of Narayana Pandita - Part 2

Lecture 27 - Ganitakaumudi of Narayana Pandita - Part 3

Lecture 28 - Magic Squares - Part 1

Lecture 29 - Magic Squares - Part 2

Lecture 30 - Development of Calculus in India - Part 1

Lecture 31 - Development of Calculus in India - Part 2

[Lecture 32 - Jyanayanam: Computation of Rsines](#)

[Lecture 33 - Trigonometry and Spherical Trigonometry - Part 1](#)

[Lecture 34 - Trigonometry and Spherical Trigonometry - Part 2](#)

[Lecture 35 - Trigonometry and Spherical Trigonometry - Part 3](#)

[Lecture 36 - Proofs in Indian Mathematics - Part 1](#)

[Lecture 37 - Proofs in Indian Mathematics - Part 2](#)

[Lecture 38 - Proofs in Indian Mathematics - Part 3](#)

[Lecture 39 - Mathematics in Modern India - Part 1](#)

[Lecture 40 - Mathematics in Modern India - Part 2](#)

Lecture 1 - (1A) Introduction, Extended Real Numbers

Lecture 2 - (1B) Introduction, Extended Real Numbers

Lecture 3 - (2A) Algebra and Sigma Algebra of Subsets of a Set

Lecture 4 - (2B) Algebra and Sigma Algebra of Subsets of a Set

Lecture 5 - (3A) Sigma Algebra generated by a Class

Lecture 6 - (3B) Sigma Algebra generated by a Class

Lecture 7 - (4A) Monotone Class

Lecture 8 - (4B) Monotone Class

Lecture 9 - (5A) Set Functions

Lecture 10 - (5B) Set Functions

Lecture 11 - (6A) The Length Function and its Properties

Lecture 12 - (6B) The Length Function and its Properties

Lecture 13 - (7A) Countably Additive Set Functions on Intervals

Lecture 14 - (7B) Countably Additive Set Functions on Intervals

Lecture 15 - (8A) Uniqueness Problem for Measure

Lecture 16 - (8B) Uniqueness Problem for Measure

Lecture 17 - (9A) Extension of Measure

Lecture 18 - (9B) Extension of Measure

Lecture 19 - (10A) Outer Measure and its Properties

Lecture 20 - (10B) Outer Measure and its Properties

Lecture 21 - (11A) Measurable Sets

Lecture 22 - (11B) Measurable Sets

Lecture 23 - (12A) Lebesgue Measure and its Properties

Lecture 24 - (12B) Lebesgue Measure and its Properties

Lecture 25 - (13A) Characterization of Lebesgue Measurable Sets

Lecture 26 - (13B) Characterization of Lebesgue Measurable Sets

Lecture 27 - (14A) Measurable Functions

Lecture 28 - (14B) Measurable Functions

Lecture 29 - (15A) Properties of Measurable Functions

Lecture 30 - (15B) Properties of Measurable Functions

Lecture 31 - (16A) Measurable Functions on Measure Spaces

- Lecture 32 - (16B) Measurable Functions on Measure Spaces
- Lecture 33 - (17A) Integral of Nonnegative Simple Measurable Functions
- Lecture 34 - (17B) Integral of Nonnegative Simple Measurable Functions
- Lecture 35 - (18A) Properties of Nonnegative Simple Measurable Functions
- Lecture 36 - (18B) Properties of Nonnegative Simple Measurable Functions
- Lecture 37 - (19A) Monotone Convergence Theorem and Fatou's Lemma
- Lecture 38 - (19B) Monotone Convergence Theorem and Fatou's Lemma
- Lecture 39 - (20A) Properties of Integrable Functions and Dominated Convergence Theorem
- Lecture 40 - (20B) Properties of Integrable Functions and Dominated Convergence Theorem
- Lecture 41 - (21A) Dominated Convergence Theorem and Applications
- Lecture 42 - (21B) Dominated Convergence Theorem and Applications
- Lecture 43 - (22A) Lebesgue Integral and its Properties
- Lecture 44 - (22B) Lebesgue Integral and its Properties
- Lecture 45 - (23A) Product Measure, an Introduction
- Lecture 46 - (23B) Product Measure, an Introduction
- Lecture 47 - (24A) Construction of Product Measures
- Lecture 48 - (24B) Construction of Product Measures
- Lecture 49 - (25A) Computation of Product Measure - I
- Lecture 50 - (25B) Computation of Product Measure - I
- Lecture 51 - (26A) Computation of Product Measure - II
- Lecture 52 - (26B) Computation of Product Measure - II
- Lecture 53 - (27A) Integration on Product Spaces
- Lecture 54 - (27B) Integration on Product Spaces
- Lecture 55 - (28A) Fubini's Theorems
- Lecture 56 - (28B) Fubini's Theorems
- Lecture 57 - (29A) Lebesgue Measure and Integral on \mathbb{R}^2
- Lecture 58 - (29B) Lebesgue Measure and Integral on \mathbb{R}^2
- Lecture 59 - (30A) Properties of Lebesgue Measure on \mathbb{R}^2
- Lecture 60 - (30B) Properties of Lebesgue Measure on \mathbb{R}^2
- Lecture 61 - (31A) Lebesgue Integral on \mathbb{R}^2
- Lecture 62 - (31B) Lebesgue Integral on \mathbb{R}^2

Lecture 1 - Introduction to the Course

Lecture 2 - Concept of a Set, Ways of Representing Sets

Lecture 3 - Venn Diagrams, Operations on Sets

Lecture 4 - Operations on Sets, Cardinal Number, Real Numbers

Lecture 5 - Real Numbers, Sequences

Lecture 6 - Sequences, Convergent Sequences, Bounded Sequences

Lecture 7 - Limit Theorems, Sandwich Theorem, Monotone Sequences, Completeness of Real Numbers

Lecture 8 - Relations and Functions

Lecture 9 - Functions, Graph of a Functions, Function Formulas

Lecture 10 - Function Formulas, Linear Models

Lecture 11 - Linear Models, Elasticity, Linear Functions, Nonlinear Models, Quadratic Functions

Lecture 12 - Quadratic Functions, Quadratic Models, Power Function, Exponential Function

Lecture 13 - Exponential Function, Exponential Models, Logarithmic Function

Lecture 14 - Limit of a Function at a Point, Continuous Functions

Lecture 15 - Limit of a Function at a Point

Lecture 16 - Limit of a Function at a Point, Left and Right Limits

Lecture 17 - Computing Limits, Continuous Functions

Lecture 18 - Applications of Continuous Functions

Lecture 19 - Applications of Continuous Functions, Marginal of a Function

Lecture 20 - Rate of Change, Differentiation

Lecture 21 - Rules of Differentiation

Lecture 22 - Derivatives of Some Functions, Marginal, Elasticity

Lecture 23 - Elasticity, Increasing and Decreasing Functions, Optimization, Mean Value Theorem

Lecture 24 - Mean Value Theorem, Marginal Analysis, Local Maxima and Minima

Lecture 25 - Local Maxima and Minima

Lecture 26 - Local Maxima and Minima, Continuity Test, First Derivative Test, Successive Differentiation

Lecture 27 - Successive Differentiation, Second Derivative Test

Lecture 28 - Average and Marginal Product, Marginal of Revenue and Cost, Absolute Maximum and Minimum

Lecture 29 - Absolute Maximum and Minimum

Lecture 30 - Monopoly Market, Revenue and Elasticity

Lecture 31 - Property of Marginals, Monopoly Market, Publisher v/s Author Problem

[Lecture 32 - Convex and Concave Functions](#)

[Lecture 33 - Derivative Tests for Convexity, Concavity and Points of Inflection, Higher Order Derivative Conditions](#)

[Lecture 34 - Convex and Concave Functions, Asymptotes](#)

[Lecture 35 - Asymptotes, Curve Sketching](#)

[Lecture 36 - Functions of Two Variables, Visualizing Graph, Level Curves, Contour Lines](#)

[Lecture 37 - Partial Derivatives and Application to Marginal Analysis](#)

[Lecture 38 - Marginals in Cobb-Douglas model, partial derivatives and elasticity, chain rules](#)

[Lecture 39 - Chain Rules, Higher Order Partial Derivatives, Local Maxima and Minima, Critical Points](#)

[Lecture 40 - Saddle Points, Derivative Tests, Absolute Maxima and Minima](#)

[Lecture 41 - Some Examples, Constrained Maxima and Minima](#)

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Lecture 2 - Introduction - II

Lecture 3 - Introduction - III

Lecture 4 - Systems of Linear Equations - I

Lecture 5 - Systems of Linear Equations - II

Lecture 6 - Systems of Linear Equations - III

Lecture 7 - Reduced Row Echelon Form and Rank - I

Lecture 8 - Reduced Row Echelon Form and Rank - II

Lecture 9 - Reduced Row Echelon Form and Rank - III

Lecture 10 - Solvability of a Linear System, Linear Span, Basis - I

Lecture 11 - Solvability of a Linear System, Linear Span, Basis - II

Lecture 12 - Solvability of a Linear System, Linear Span, Basis - III

Lecture 13 - Linear Span, Linear Independence and Basis - I

Lecture 14 - Linear Span, Linear Independence and Basis - II

Lecture 15 - Linear Span, Linear Independence and Basis - III

Lecture 16 - Row Space, Column Space, Rank-Nullity Theorem - I

Lecture 17 - Row Space, Column Space, Rank-Nullity Theorem - II

Lecture 18 - Row Space, Column Space, Rank-Nullity Theorem - III

Lecture 19 - Determinants and their Properties - I

Lecture 20 - Determinants and their Properties - II

Lecture 21 - Determinants and their Properties - III

Lecture 22 - Linear Transformations - I

Lecture 23 - Linear Transformations - II

Lecture 24 - Linear Transformations - III

Lecture 25 - Orthonormal Basis, Geometry in \mathbb{R}^2 - I

Lecture 26 - Orthonormal Basis, Geometry in \mathbb{R}^2 - II

Lecture 27 - Orthonormal Basis, Geometry in \mathbb{R}^2 - III

Lecture 28 - Isometries, Eigenvalues and Eigenvectors - I

Lecture 29 - Isometries, Eigenvalues and Eigenvectors - II

Lecture 30 - Isometries, Eigenvalues and Eigenvectors - III

Lecture 31 - Diagonalization and Real Symmetric Matrices - I

[Lecture 32 - Diagonalization and Real Symmetric Matrices - II](#)

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[Lecture 34 - Diagonalization and its Applications - I](#)

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[Lecture 36 - Diagonalization and its Applications - III](#)

[Lecture 37 - Abstract Vector Spaces - I](#)

[Lecture 38 - Abstract Vector Spaces - II](#)

[Lecture 39 - Abstract Vector Spaces - III](#)

[Lecture 40 - Inner Product Spaces - I](#)

[Lecture 41 - Inner Product Spaces - II](#)

Lecture 1 - Zariski Topology and K-Spectrum

Lecture 2 - Algebraic Varieties and Classical Nullstellensatz

Lecture 3 - Motivation for Krull's Dimension

Lecture 4 - Chevalley's dimension

Lecture 5 - Associated Prime Ideals of a Module

Lecture 6 - Support of a Module

Lecture 7 - Primary Decomposition

Lecture 8 - Primary Decomposition (Continued...)

Lecture 9 - Uniqueness of Primary Decomposition

Lecture 10 - Modules of Finite Length

Lecture 11 - Modules of Finite Length (Continued...)

Lecture 12 - Introduction to Krull's Dimension

Lecture 13 - Noether Normalization Lemma (Classical Version)

Lecture 14 - Consequences of Noether Normalization Lemma

Lecture 15 - Nil Radical and Jacobson Radical of Finite type Algebras over a Field and digression of Integral Extension

Lecture 16 - Nagata's version of NNL

Lecture 17 - Dimensions of Polynomial ring over Noetherian rings

Lecture 18 - Dimension of Polynomial Algebra over arbitrary Rings

Lecture 19 - Dimension Inequalities

Lecture 20 - Hilbert's Nullstellensatz

Lecture 21 - Computational rules for Poincaré Series

Lecture 22 - Graded Rings, Modules and Poincaré Series

Lecture 23 - Hilbert-Samuel Polynomials

Lecture 24 - Hilbert-Samuel Polynomials (Continued...)

Lecture 25 - Numerical Function of polynomial type

Lecture 26 - Hilbert-Samuel Polynomial of a Local ring

Lecture 27 - Filtration on a Module

Lecture 28 - Artin-Rees Lemma

Lecture 29 - Dimension Theorem

Lecture 30 - Dimension Theorem (Continued...)

Lecture 31 - Consequences of Dimension Theorem

- Lecture 32 - Generalized Krull's Principal Ideal Theorem
- Lecture 33 - Second proof of Krull's Principal Ideal Theorem
- Lecture 34 - The Spec Functor
- Lecture 35 - Prime ideals in Polynomial rings
- Lecture 36 - Characterization of Equidimensional Affine Algebra
- Lecture 37 - Connection between Regular local rings and associated graded rings
- Lecture 38 - Statement of the Jacobian Criterion for Regularity
- Lecture 39 - Hilbert function for Affine Algebra
- Lecture 40 - Hilbert Serre Theorem
- Lecture 41 - Jacobian Matrix and its Rank
- Lecture 42 - Jacobian Matrix and its Rank (Continued...)
- Lecture 43 - Proof of Jacobian Criterion
- Lecture 44 - Proof of Jacobian Criterion (Continued...)
- Lecture 45 - Preparation for Homological Dimension
- Lecture 46 - Complexes of Modules and Homology
- Lecture 47 - Projective Modules
- Lecture 48 - Homological Dimension and Projective module
- Lecture 49 - Global Dimension
- Lecture 50 - Homological characterization of Regular Local Rings (RLR)
- Lecture 51 - Homological characterization of Regular Local Rings (Continued...)
- Lecture 52 - Homological Characterization of Regular Local Rings (Continued...)
- Lecture 53 - Regular Local Rings are UFD
- Lecture 54 - RLR-Prime ideals of height 1
- Lecture 55 - Discrete Valuation Ring
- Lecture 56 - Discrete Valuation Ring (Continued...)
- Lecture 57 - Dedekind Domains
- Lecture 58 - Fractionary Ideals and Dedekind Domains
- Lecture 59 - Characterization of Dedekind Domain
- Lecture 60 - Dedekind Domains and prime factorization of ideals

Lecture 1 - Historical Perspectives

Lecture 2 - Examples of Fields

Lecture 3 - Polynomials and Basic properties

Lecture 4 - Polynomial Rings

Lecture 5 - Unit and Unit Groups

Lecture 6 - Division with remainder and prime factorization

Lecture 7 - Zeroes of Polynomials

Lecture 8 - Polynomial functions

Lecture 9 - Algebraically closed Fields and statement of FTA

Lecture 10 - Gauss's Theorem (Uniqueness of factorization)

Lecture 11 - Digression on Rings homomorphism, Algebras

Lecture 12 - Kernel of homomorphisms and ideals in $K[X], \mathbb{Z}$

Lecture 13 - Algebraic elements

Lecture 14 - Examples

Lecture 15 - Minimal Polynomials

Lecture 16 - Characterization of Algebraic elements

Lecture 17 - Theorem of Kronecker

Lecture 18 - Examples

Lecture 19 - Digression on Groups

Lecture 20 - Some examples and Characteristic of a Ring

Lecture 21 - Finite subGroups of the Unit Group of a Field

Lecture 22 - Construction of Finite Fields

Lecture 23 - Digression on Group action - I

Lecture 24 - Automorphism Groups of a Field Extension

Lecture 25 - Dedekind-Artin Theorem

Lecture 26 - Galois Extension

Lecture 27 - Examples of Galois extension

Lecture 28 - Examples of Automorphism Groups

Lecture 29 - Digression on Linear Algebra

Lecture 30 - Minimal and Characteristic Polynomials, Norms, Trace of elements

Lecture 31 - Primitive Element Theorem for Galois Extension

- Lecture 32 - Fundamental Theorem of Galois Theory
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Co-ordinators : Prof. Ronnie Sebastian

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Co-ordinators : Dr. S. Dharmaraja

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Co-ordinators : Prof. Nilladri Chaterjee

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Co-ordinators : Prof. Siddhartha Pratim Chakrabarty

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[Lecture 36 - Portfolio optimization with constraints, Value-at-Risk: Estimation and backtesting](#)

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Lecture 4 - Stochastic Processes

Lecture 5 - Definition of Markov Chain and Transition Probabilities

Lecture 6 - Markov Property and Chapman-Kolmogorov Equations

Lecture 7 - Chapman-Kolmogorov Equations: Examples

Lecture 8 - Accessibility and Communication of States

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Lecture 12 - Strong Markov Property

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- Lecture 2 - Characteristics of Queueing Systems, Kendall's Notation
- Lecture 3 - Little's Law, General Relationships
- Lecture 4 - Laplace and Laplace-Stieltjes Transforms, Probability Generating Functions
- Lecture 5 - An Overview of Stochastic Processes
- Lecture 6 - Markov Chains: Definition, Transition Probabilities
- Lecture 7 - Classification Properties of Markov Chains
- Lecture 8 - Long-Term Behaviour of Markov Chains
- Lecture 9 - Exponential Distribution and its Properties, Poisson Process
- Lecture 10 - Poisson Process and its Properties, Generalizations
- Lecture 11 - Continuous-Time Markov Chains, Generator Matrix, Kolmogorov Equations
- Lecture 12 - Stationary and Limiting Distributions of CTMC, Balance Equations, Birth-Death Processes
- Lecture 13 - Birth-Death Queues: General Theory, M/M/1 Queues and their Steady State Solution
- Lecture 14 - M/M/1 Queues: Performance Measures, PASTA Property, Waiting Time Distributions
- Lecture 15 - M/M/c Queues, Erlang Delay Formula
- Lecture 16 - M/M/c/K Queues
- Lecture 17 - Erlang's Loss System, Erlang Loss Formula, Infinite-Server Queues
- Lecture 18 - Finite-Source Queues, Engset Loss System, State-Dependent Queues, Queues with Impatience
- Lecture 19 - Transient Solutions: M/M/1/1, Infinite-Server and M/M/1 Queues, Busy Period Analysis
- Lecture 20 - Queues with Bulk Arrivals
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- Lecture 22 - Erlang and Phase-Type Distributions
- Lecture 23 - Erlangian Queues: Erlangian Arrivals, Erlangian Service Times
- Lecture 24 - Nonpreemptive Priority Queues
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- Lecture 27 - Discrete-Time Queues: Geo/Geo/1 (EAS), Geo/Geo/1 (LAS)
- Lecture 28 - Introduction to Queueing Networks, Two-Node Network
- Lecture 29 - Burke's Theorem, General Setup, Tandem Networks
- Lecture 30 - Queueing Networks with Blocking, Open Jackson Networks

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Lecture 13 - Wishart distribution and its properties - II

Lecture 14 - Hotelling's T^2 distribution and its applications

Lecture 15 - Hotelling's T^2 distribution and various confidence intervals and regions

Lecture 16 - Hotelling's T^2 distribution and Profile analysis

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Lecture 21 - MANOVA - III

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NPTEL : Calculus of Variations and Integral Equations (Mathematics)

Co-ordinators : Dr. Malay Banerjee, Prof. D. Bahuguna

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NPTEL : Linear programming and Extensions (Mathematics)

Co-ordinators : Prof. Prabha Sharma

Lecture 1 - Introduction to Linear Programming Problems

Lecture 2 - Vector space, Linear independence and dependence, basis

Lecture 3 - Moving from one basic feasible solution to another, optimality criteria

Lecture 4 - Basic feasible solutions, existence & derivation

Lecture 5 - Convex sets, dimension of a polyhedron, Faces, Example of a polytope

Lecture 6 - Direction of a polyhedron, correspondence between bfs and extreme points

Lecture 7 - Representation theorem, LPP solution is a bfs, Assignment 1

Lecture 8 - Development of the Simplex Algorithm, Unboundedness, Simplex Tableau

Lecture 9 - Simplex Tableau & algorithm ,Cycling, Bland's anti-cycling rules, Phase I & Phase II

Lecture 10 - Big-M method, Graphical solutions, adjacent extreme pts and adjacent bfs

Lecture 11 - Assignment 2, progress of Simplex algorithm on a polytope, bounded variable LPP

Lecture 12 - LPP Bounded variable, Revised Simplex algorithm, Duality theory, weak duality theorem

Lecture 13 - Weak duality theorem, economic interpretation of dual variables, Fundamental theorem of duality

Lecture 14 - Examples of writing the dual, complementary slackness theorem

Lecture 15 - Complementary slackness conditions, Dual Simplex algorithm, Assignment 3

Lecture 16 - Primal-dual algorithm

Lecture 17 - Problem in lecture 16, starting dual feasible solution, Shortest Path Problem

Lecture 18 - Shortest Path Problem, Primal-dual method, example

Lecture 19 - Shortest Path Problem-complexity, interpretation of dual variables, post-optimality analysis-changes in the cost vector

Lecture 20 - Assignment 4, postoptimality analysis, changes in b, adding a new constraint, changes in $\{a_{ij}\}$, Parametric analysis

Lecture 21 - Parametric LPP-Right hand side vector

Lecture 22 - Parametric cost vector LPP

Lecture 23 - Parametric cost vector LPP, Introduction to Min-cost flow problem

Lecture 24 - Mini-cost flow problem-Transportation problem

Lecture 25 - Transportation problem degeneracy, cycling

Lecture 26 - Sensitivity analysis

Lecture 27 - Sensitivity analysis

Lecture 28 - Bounded variable transportation problem, min-cost flow problem

Lecture 29 - Min-cost flow problem

Lecture 30 - Starting feasible solution, Lexicographic method for preventing cycling ,strongly feasible solution

Lecture 31 - Assignment 6, Shortest path problem, Shortest Path between any two nodes, Detection of negative cycles

[Lecture 32 - Min-cost-flow Sensitivity analysis Shortest path problem sensitivity analysis](#)

[Lecture 33 - Min-cost flow changes in arc capacities , Max-flow problem, assignment 7](#)

[Lecture 34 - Problem 3 \(assignment 7\), Min-cut Max-flow theorem, Labelling algorithm](#)

[Lecture 35 - Max-flow - Critical capacity of an arc, starting solution for min-cost flow problem](#)

[Lecture 36 - Improved Max-flow algorithm](#)

[Lecture 37 - Critical Path Method \(CPM\)](#)

[Lecture 38 - Programme Evaluation and Review Technique \(PERT\)](#)

[Lecture 39 - Simplex Algorithm is not polynomial time- An example](#)

[Lecture 40 - Interior Point Methods](#)

NPTEL : Convex Optimization (Mathematics)

Co-ordinators : Dr. Joydeep Dutta

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NPTEL : Foundations of Optimization (Mathematics)

Co-ordinators : Dr. Joydeep Dutta

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Lecture 1 - Basic principles of counting

Lecture 2 - Sample space, events, axioms of probability

Lecture 3 - Conditional probability, Independence of events

Lecture 4 - Random variables, cumulative density function, expected value

Lecture 5 - Discrete random variables and their distributions

Lecture 6 - Discrete random variables and their distributions

Lecture 7 - Discrete random variables and their distributions

Lecture 8 - Continuous random variables and their distributions

Lecture 9 - Continuous random variables and their distributions

Lecture 10 - Continuous random variables and their distributions

Lecture 11 - Function of random variables, Moment generating function

Lecture 12 - Jointly distributed random variables, Independent r. v. and their sums

Lecture 13 - Independent r. v. and their sums

Lecture 14 - Chi χ^2 square r. v., sums of independent normal r. v., Conditional distr

Lecture 15 - Conditional distri, Joint distr. of functions of r. v., Order statistics

Lecture 16 - Order statistics, Covariance and correlation

Lecture 17 - Covariance, Correlation, Cauchy- Schwarz inequalities, Conditional expectation

Lecture 18 - Conditional expectation, Best linear predictor

Lecture 19 - Inequalities and bounds

Lecture 20 - Convergence and limit theorems

Lecture 21 - Central limit theorem

Lecture 22 - Applications of central limit theorem

Lecture 23 - Strong law of large numbers, Joint mgf

Lecture 24 - Convolutions

Lecture 25 - Stochastic processes: Markov process

Lecture 26 - Transition and state probabilities

Lecture 27 - State prob., First passage and First return prob

Lecture 28 - First passage and First return prob. Classification of states

Lecture 29 - Random walk, periodic and null states

Lecture 30 - Reducible Markov chains

Lecture 31 - Time reversible Markov chains

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[Lecture 23 - Unconstrained Minimization Of Funtions Of Two Variables](#)

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[Lecture 28 - Multiple Integrals-1](#)

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Lecture 1 - Basic Probability

Lecture 2 - Interesting Problems In Probability

Lecture 3 - Random variables, distribution function and independence

Lecture 4 - Chebyshev inequality, Borel-Cantelli Lemmas and related issues

Lecture 5 - Law of Large Number and Central Limit Theorem

Lecture 6 - Conditional Expectation - I

Lecture 7 - Conditional Expectation - II

Lecture 8 - Martingales

Lecture 9 - Brownian Motion - I

Lecture 10 - Brownian Motion - II

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Lecture 12 - Ito Integral - I

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Lecture 14 - Ito Calculus - I

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Lecture 16 - Ito Integral In Higher Dimension

Lecture 17 - Application to Ito Integral - I

Lecture 18 - Application to Ito Integral - II

Lecture 19 - Black Scholes Formula - I

Lecture 20 - Black Scholes Formula - II

- Lecture 1 - Introduction to Several Variables and Notion Of distance in R^n
- Lecture 2 - Countinuity And Compactness
- Lecture 3 - Countinuity And Connectdness
- Lecture 4 - Derivatives: Possible Definition
- Lecture 5 - Matrix Of Linear Transformation
- Lecture 6 - Examples for Differentiable function
- Lecture 7 - Sufficient condition of differentiability
- Lecture 8 - Chain Rule
- Lecture 9 - Mean Value Theorem
- Lecture 10 - Higher Order Derivatives
- Lecture 11 - Taylor's Formula
- Lecture 12 - Maximum And Minimum
- Lecture 13 - Second derivative test for maximum, minimum and saddle point
- Lecture 14 - We formalise the second derivative test discussed in Lecture 2 and do examples
- Lecture 15 - Specialisation to functions of two variables
- Lecture 16 - Implicit Function Theorem
- Lecture 17 - Implicit Function Theorem -a
- Lecture 18 - Application of IFT: Lagrange's Multipliers Method
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- Lecture 20 - Application of IFT: Lagrange's Multipliers Method - c
- Lecture 21 - Application of IFT: Inverse Function Theorem - c

- Lecture 1 - Level curves and locus, definition of parametric curves, tangent, arc length, arc length parametrisation
- Lecture 2 - How much a curve is 'curved', signed unit normal and signed curvature, rigid motions, constant curvature
- Lecture 3 - Curves in \mathbb{R}^3 , principal normal and binormal, torsion
- Lecture 4 - Frenet-Serret formula
- Lecture 5 - Simple closed curve and isoperimetric inequality
- Lecture 6 - Surfaces and parametric surfaces, examples, regular surface and non-example of regular surface, transition maps.
- Lecture 7 - Transition maps of smooth surfaces, smooth function between surfaces, diffeomorphism
- Lecture 8 - Reparameterization
- Lecture 9 - Tangent, Normal
- Lecture 10 - Orientable surfaces
- Lecture 11 - Examples of Surfaces
- Lecture 12 - First Fundamental Form
- Lecture 13 - Conformal Mapping
- Lecture 14 - Curvature of Surfaces
- Lecture 15 - Euler's Theorem
- Lecture 16 - Regular Surfaces locally as Quadratic Surfaces
- Lecture 17 - Geodesics
- Lecture 18 - Existence of Geodesics, Geodesics on Surfaces of revolution
- Lecture 19 - Geodesics on surfaces of revolution; Clairaut's Theorem
- Lecture 20 - Pseudosphere
- Lecture 21 - Classification of Quadratic Surface
- Lecture 22 - Surface Area and Equiareal Map

Lecture 1 - Basic Fundamental Concepts Of Modelling

Lecture 2 - Regression Model - A Statistical Tool

Lecture 3 - Simple Linear Regression Analysis

Lecture 4 - Estimation Of Parameters In Simple Linear Regression Model

Lecture 5 - Estimation Of Parameters In Simple Linear Regression Model (Continued...) : Some Nice Properties

Lecture 6 - Estimation Of Parameters In Simple Linear Regression Model (Continued...)

Lecture 7 - Maximum Likelihood Estimation of Parameters in Simple Linear Regression Model

Lecture 8 - Testing of Hypothesis and Confidence Interval Estimation in Simple Linear Regression Model

Lecture 9 - Testing of Hypothesis and Confidence Interval Estimation in Simple Linear Regression Model (Continued...)

Lecture 10 - Software Implementation in Simple Linear Regression Model using MINITAB

Lecture 11 - Multiple Linear Regression Model

Lecture 12 - Estimation of Model Parameters in Multiple Linear Regression Model

Lecture 13 - Estimation of Model Parameters in Multiple Linear Regression Model (Continued...)

Lecture 14 - Standardized Regression Coefficients and Testing of Hypothesis

Lecture 15 - Testing of Hypothesis (Continued...) and Goodness of Fit of the Model

Lecture 16 - Diagnostics in Multiple Linear Regression Model

Lecture 17 - Diagnostics in Multiple Linear Regression Model (Continued...)

Lecture 18 - Diagnostics in Multiple Linear Regression Model (Continued...)

Lecture 19 - Software Implementation of Multiple Linear Regression Model using MINITAB

Lecture 20 - Software Implementation of Multiple Linear Regression Model using MINITAB (Continued...)

Lecture 21 - Forecasting in Multiple Linear Regression Model

Lecture 22 - Within Sample Forecasting

Lecture 23 - Outside Sample Forecasting

Lecture 24 - Software Implementation of Forecasting using MINITAB

Lecture 1 - How to Learn and Follow the Course

Lecture 2 - Why R and Installation Procedure

Lecture 3 - Introduction _Help_ Demo examples_ packages_ libraries

Lecture 4 - Introduction _Command line_ Data editor _ Rstudio

Lecture 5 - Basics in Calculations

Lecture 6 - Basics of Calculations _ Calculator _Built in Functions Assignments

Lecture 7 - Basics of Calculations _Functions _Matrices

Lecture 8 - Basics Calculations: Matrix Operations

Lecture 9 - Basics Calculations: Matrix operations

Lecture 10 - Basics Calculations: Missing data and logical operators

Lecture 11 - Basics Calculations: Logical operators

Lecture 12 - Basics Calculations: Truth table and conditional executions

Lecture 13 - Basics Calculations: Conditional executions and loops

Lecture 14 - Basics Calculations: Loops

Lecture 15 - Data management - Sequences

Lecture 16 - Data management - sequences

Lecture 17 - Data management - Repeats

Lecture 18 - Data management - Sorting and Ordering

Lecture 19 - Data management - Lists

Lecture 20 - Data management - Lists (Continued...)

Lecture 21 - Data management - Vector indexing

Lecture 22 - Data management - Vector Indexing (Continued...)

Lecture 23 - Data management - Factors

Lecture 24 - Data management - factors (Continued...)

Lecture 25 - Strings - Display and Formatting, Print and Format Functions

Lecture 26 - Strings - Display and Formatting, Print and Format with Concatenate

Lecture 27 - Strings - Display and Formatting, Paste Function

Lecture 28 - Strings - Display and Formatting, Splitting

Lecture 29 - Strings - Display and Formatting, Replacement_ Manipulations _Alphabets

Lecture 30 - Strings - Display and Formatting, Replacement and Evaluation of Strings

Lecture 31 - Data frames

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[Lecture 41 - Statistical Functions - Correlation and Examples of Programming](#)

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Lecture 1 - Introduction to R Software

Lecture 2 - Basics and R as a Calculator

Lecture 3 - Calculations with Data Vectors

Lecture 4 - Built-in Commands and Missing Data Handling

Lecture 5 - Operations with Matrices

Lecture 6 - Objectives, Steps and Basic Definitions

Lecture 7 - Variables and Types of Data

Lecture 8 - Absolute Frequency, Relative Frequency and Frequency Distribution

Lecture 9 - Frequency Distribution and Cumulative Distribution Function

Lecture 10 - Bar Diagrams

Lecture 11 - Subdivided Bar Plots and Pie Diagrams

Lecture 12 - 3D Pie Diagram and Histogram

Lecture 13 - Kernel Density and Stem - Leaf Plots

Lecture 14 - Arithmetic Mean

Lecture 15 - Median

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Lecture 16 - Partial Orders

Lecture 17 - Lattices

Lecture 18 - Equivalents of the Axiom of Choice (AC): Zorn's Lemma (ZL) and Well-ordering theorem (WOT)

Lecture 19 - Tutorial - Week 5

Lecture 20 - Boolean Algebras

Lecture 21 - Stone's Representation Theorems for Boolean Algebras

Lecture 22 - Some Exercises on Boolean Algebras

Lecture 23 - Ultrafilters in Boolean Algebras

Lecture 24 - Introduction to Mathematical Logic

Lecture 25 - Propositional Logic: Language, Formulas and Valuations

Lecture 26 - Propositional Logic: Logical Equivalence and Lindenbaum-Tarski Algebra

Lecture 27 - Tutorial - Week 7

Lecture 28 - Propositional Logic: Normal Forms of Formulas and Adequacy of Connectives

Lecture 29 - Propositional Logic: Semantic Consequence Relation

Lecture 30 - Propositional Logic: Syntactic Consequence Relation

Lecture 31 - Deduction Theorem (Continued...)

[Lecture 32 - Tutorial - Week 8](#)

[Lecture 33 - Propositional Logic: Consistency and Soundness Theorem](#)

[Lecture 34 - Propositional Logic: Completeness Theorem - Part I](#)

[Lecture 35 - Propositional Logic: Completeness Theorem - Part II](#)

[Lecture 36 - Compactness Theorem and Konig's Lemma](#)

[Lecture 37 - Tutorial - Week 9](#)

[Lecture 38 - Introduction to First-Order Predicate Logic](#)

[Lecture 39 - Predicate Logic: Terms and Formulas](#)

[Lecture 40 - Predicate Logic: Validity of Formulas](#)

[Lecture 41 - Tutorial - Week 10](#)

[Lecture 42 - Predicate Logic Substructures, Semantic Consequence Relation, and Models of Theories](#)

[Lecture 43 - Predicate Logic: Standard Logical Equivalences, Normal Forms, and Definable Sets](#)

[Lecture 44 - Tutorial - Week 11](#)

[Lecture 45 - Hyperreal Numbers](#)

[Lecture 46 - Predicate Logic: Ultraproduct of Structures and Los's Theorem](#)

[Lecture 47 - Predicate Logic: Compactness Theorem](#)

[Lecture 48 - Tutorial - Week 12](#)

[Lecture 49 - Predicate Logic: Lowenheim-Skolem Theorems](#)

[Lecture 50 - Predicate Logic: Reduced Products, Categoricity](#)

[Lecture 51 - Predicate Logic: Categoricity \(Continued...\) and Quantifier Elimination](#)

[Lecture 52 - Godel's Incompleteness Theorems](#)

Lecture 1 - Origin of Fourier series

Lecture 2 - Convergence of a series and Riemann integration

Lecture 3 - Riemann integration and periodic functions

Lecture 4 - Fourier coefficients and series

Lecture 5 - Complex Fourier series

Lecture 6 - Riemann Lebesgue lemma and Dirichlet kernel

Lecture 7 - Convolution of two Riemann integrable functions

Lecture 8 - Properties of convolution

Lecture 9 - Cesaro summability and summation by parts

Lecture 10 - Fejer kernel

Lecture 11 - Fejer theorem and applications

Lecture 12 - Good kernels and Poisson kernel

Lecture 13 - Abel summability

Lecture 14 - Dirichlet problem

Lecture 15 - Convergence at jump discontinuity

Lecture 16 - Orthonormal families

Lecture 17 - Pythagoras theorem and Parseval identity

Lecture 18 - Pointwise convergence

Lecture 19 - Parseval identity applications

Lecture 20 - Divergent Fourier series

Lecture 21 - Pointwise convergence of $S_N(f)$

Lecture 22 - Isoperimetric problem

Lecture 23 - Weyl's equidistribution theorem

Lecture 24 - on Equidistributed sequences

Lecture 25 - Proof of Weyl's criterion

Lecture 26 - Fourier analysis on finite groups

Lecture 27 - Fourier transform on $Z(N)$

Lecture 28 - Inversion theorem and Parseval identity

Lecture 29 - Results on Fourier coefficients of two functions

Lecture 30 - Fast Fourier transform

Lecture 31 - Fourier analysis on finite abelian group

- Lecture 32 - Fourier analysis on finite abelian groups
- Lecture 33 - Simultaneously diagonalizable operators and characters
- Lecture 34 - Results of Fourier series on finite abelian group
- Lecture 35 - Applications in Number theory
- Lecture 36 - Fourier transform on \mathbb{R}
- Lecture 37 - Properties of Fourier transform
- Lecture 38 - Inversion formula and convolution
- Lecture 39 - Fejer kernel on \mathbb{R}
- Lecture 40 - Schwartz space
- Lecture 41 - Convolution and Good kernel in Schwartz space
- Lecture 42 - Multiplication formula and Fourier inversion theorem
- Lecture 43 - Plancherel formula and Poisson summation formula
- Lecture 44 - Application of Poisson summation formula
- Lecture 45 - Weierstrass theorem and Heisenberg uncertainty principle
- Lecture 46 - Hermite operator
- Lecture 47 - Solution of ODE by using Fourier transform
- Lecture 48 - Laplacian equation
- Lecture 49 - Poisson kernel and mean value theorem for harmonic functions
- Lecture 50 - Wave equation
- Lecture 51 - Eigenvalues of Fourier transform
- Lecture 52 - Fourier transform on \mathbb{R}^n
- Lecture 53 - Properties of Fourier transform on \mathbb{R}^n
- Lecture 54 - Inversion theorem and Plancherel theorem
- Lecture 55 - Wave equation, heat equation and Poisson kernel
- Lecture 56 - Fourier series in higher dimension
- Lecture 57 - Poisson summation formula
- Lecture 58 - Application of Poisson summation formula
- Lecture 59 - Radon transform
- Lecture 60 - Reconstruction formula

Lecture 1 - Vector Spaces

Lecture 2 - Linear Transformation

Lecture 3 - Matrices

Lecture 4 - Calculus in Several Variable

Lecture 5 - Lipchitz Continuity

Lecture 6 - Cauchy-Schwartz and Gronwall Inequality

Lecture 7 - Ordinary Differential Equations: Introduction

Lecture 8 - Differential Inequalities

Lecture 9 - 2nd Order Constant coefficient linear equations

Lecture 10 - Picard Existence and Uniqueness Theorem

Lecture 11 - Linear System

Lecture 12 - Well-Posedness of a ODE

Lecture 13 - Linear System - 1

Lecture 14 - Linear System - 2

Lecture 15 - Fundamental Matrix

Lecture 16 - Exponential of a Linear Operator

Lecture 17 - Fundamental theorem of linear Systems

Lecture 18 - Higher Dimensional Matrix Exponential - 1

Lecture 19 - Higher Dimensional Matrix Exponential - 2

Lecture 20 - Method of Eigenvalue

Lecture 21 - Method of Eigenvalue (Continued...)

Lecture 22 - Maximal Interval of Existence

Lecture 23 - Maximal Interval of Existence: Worked out examples

Lecture 24 - Periodic Linear System

Lecture 25 - Asymptotic behavior of solution to linear system - I

Lecture 26 - Asymptotic behavior of solution to linear system - II

Lecture 27 - Asymptotic Behavior of Linear Systems - III

Lecture 28 - Exact and Adjoint equations

Lecture 29 - Sturm Comparison Theory

Lecture 30 - Oscillation Theory - 2

Lecture 31 - Linear Boundary Value Problem

[Lecture 32 - Maximum Principle](#)

[Lecture 33 - Sturm Liouville Theory - 1](#)

[Lecture 34 - Sturm Liouville Theory - 2](#)

[Lecture 35 - Periodic Sturm Liouville Problem](#)

[Lecture 36 - Eigenfunction Expansion](#)

[Lecture 37 - Stability in the sense of Lyapunov - I](#)

[Lecture 38 - Stability in the sense of Lyapunov - II](#)

[Lecture 39 - Lyapunov Direct method](#)

[Lecture 40 - Linear two-dimensional phase space dynamics \(Continued...\)](#)

[Lecture 41 - Phase Portrait for Planar Systems](#)

Lecture 1 - Introduction to Category Theory

Lecture 2 - Examples of Categories

Lecture 3 - Functors

Lecture 4 - Natural Transformations and Equivalences of Categories

Lecture 5 - Equivalence of Categories and some properties of morphisms

Lecture 6 - The Yoneda lemma and Representable functors

Lecture 7 - Limits and colimits - Part 1

Lecture 8 - Limits and colimits - Part 2

Lecture 9 - Limits and colimits - Part 3 - Interaction with functors - Adjunctions - I Definitions

Lecture 10 - Adjunctions - II Examples

Lecture 11 - Adjunctions - III Triangular identities

Lecture 12 - Adjunctions - IV General adjoint functor theorem

Lecture 13 - Adjunctions - V Special adjoint functor theorem Filtered colimits-I Basics

Lecture 14 - Filtered colimits - II Locally finitely presentable (LFP) categories

Lecture 15 - Monads - I Eilenberg-Moore and Kleisli categories

Lecture 16 - Monads - II Monadicity theorem

Lecture 17 - Monoidal categories and enriched categories

Lecture 18 - Abelian categories

Lecture 19 - Grothendieck categories and localization

Lecture 20 - Freyd-Mitchell embedding theorem Homological algebra I Diagram chasing

Lecture 21 - Homological algebra II Chain homotopy, projective resolutions and the derived category

Lecture 22 - Model categories

Lecture 23 - Topos Theory - I Elementary toposes

Lecture 24 - Topos Theory - II Grothendieck toposes

Lecture 1 - Review Groups, Fields and Matrices

Lecture 2 - Vector Spaces, Subspaces, Linearly Dependent/Independent of Vectors

Lecture 3 - Basis, Dimension, Rank and Matrix Inverse

Lecture 4 - Linear Transformation, Isomorphism and Matrix Representation

Lecture 5 - System of Linear Equations, Eigenvalues and Eigenvectors

Lecture 6 - Method to Find Eigenvalues and Eigenvectors, Diagonalization of Matrices

Lecture 7 - Jordan Canonical Form, Cayley Hamilton Theorem

Lecture 8 - Inner Product Spaces, Cauchy-Schwarz Inequality

Lecture 9 - Orthogonality, Gram-Schmidt Orthogonalization Process

Lecture 10 - Spectrum of special matrices, positive/negative definite matrices

Lecture 11 - Concept of Domain, Limit, Continuity and Differentiability

Lecture 12 - Analytic Functions, C-R Equations

Lecture 13 - Harmonic Functions

Lecture 14 - Line Integral in the Complex

Lecture 15 - Cauchy Integral Theorem

Lecture 16 - Cauchy Integral Theorem (Continued.)

Lecture 17 - Cauchy Integral Formula

Lecture 18 - Power and Taylor's Series of Complex Numbers

Lecture 19 - Power and Taylor's Series of Complex Numbers (Continued.)

Lecture 20 - Taylor's, Laurent Series of $f(z)$ and Singularities

Lecture 21 - Classification of Singularities, Residue and Residue Theorem

Lecture 22 - Laplace Transform and its Existence

Lecture 23 - Properties of Laplace Transform

Lecture 24 - Evaluation of Laplace and Inverse Laplace Transform

Lecture 25 - Applications of Laplace Transform to Integral Equations and ODEs

Lecture 26 - Applications of Laplace Transform to PDEs

Lecture 27 - Fourier Series

Lecture 28 - Fourier Series (Continued.)

Lecture 29 - Fourier Integral Representation of a Function

Lecture 30 - Introduction to Fourier Transform

Lecture 31 - Applications of Fourier Transform to PDEs

[Lecture 32 - Laws of Probability - I](#)

[Lecture 33 - Laws of Probability - II](#)

[Lecture 34 - Problems in Probability](#)

[Lecture 35 - Random Variables](#)

[Lecture 36 - Special Discrete Distributions](#)

[Lecture 37 - Special Continuous Distributions](#)

[Lecture 38 - Joint Distributions and Sampling Distributions](#)

[Lecture 39 - Point Estimation](#)

[Lecture 40 - Interval Estimation](#)

[Lecture 41 - Basic Concepts of Testing of Hypothesis](#)

[Lecture 42 - Tests for Normal Populations](#)

NPTEL : Functional Analysis (Mathematics)

Co-ordinators : Prof. P.D. Srivastava

- Lecture 1 - Metric Spaces with Examples
- Lecture 2 - Holder Inequality and Minkowski Inequality
- Lecture 3 - Various Concepts in a Metric Space
- Lecture 4 - Separable Metrics Spaces with Examples
- Lecture 5 - Convergence, Cauchy Sequence, Completeness
- Lecture 6 - Examples of Complete and Incomplete Metric Spaces
- Lecture 7 - Completion of Metric Spaces + Tutorial
- Lecture 8 - Vector Spaces with Examples
- Lecture 9 - Normed Spaces with Examples
- Lecture 10 - Banach Spaces and Schauder Basis
- Lecture 11 - Finite Dimensional Normed Spaces and Subspaces
- Lecture 12 - Compactness of Metric/Normed Spaces
- Lecture 13 - Linear Operators-definition and Examples
- Lecture 14 - Bounded Linear Operators in a Normed Space
- Lecture 15 - Bounded Linear Functionals in a Normed Space
- Lecture 16 - Concept of Algebraic Dual and Reflexive Space
- Lecture 17 - Dual Basis & Algebraic Reflexive Space
- Lecture 18 - Dual Spaces with Examples
- Lecture 19 - Tutorial - I
- Lecture 20 - Tutorial - II
- Lecture 21 - Inner Product & Hilbert Space
- Lecture 22 - Further Properties of Inner Product Spaces
- Lecture 23 - Projection Theorem, Orthonormal Sets and Sequences
- Lecture 24 - Representation of Functionals on a Hilbert Spaces
- Lecture 25 - Hilbert Adjoint Operator
- Lecture 26 - Self Adjoint, Unitary & Normal Operators
- Lecture 27 - Tutorial - III
- Lecture 28 - Annihilator in an IPS
- Lecture 29 - Total Orthonormal Sets And Sequences
- Lecture 30 - Partially Ordered Set and Zorns Lemma
- Lecture 31 - Hahn Banach Theorem for Real Vector Spaces

[Lecture 32 - Hahn Banach Theorem for Complex V.S. & Normed Spaces](#)

[Lecture 33 - Baires Category & Uniform Boundedness Theorems](#)

[Lecture 34 - Open Mapping Theorem](#)

[Lecture 35 - Closed Graph Theorem](#)

[Lecture 36 - Adjoint Operator](#)

[Lecture 37 - Strong and Weak Convergence](#)

[Lecture 38 - Convergence of Sequence of Operators and Functionals](#)

[Lecture 39 - LP - Space](#)

[Lecture 40 - LP - Space \(Continued.\)](#)

- Lecture 1 - Motivation with few Examples
- Lecture 2 - Single - Step Methods for IVPs
- Lecture 3 - Analysis of Single Step Methods
- Lecture 4 - Runge - Kutta Methods for IVPs
- Lecture 5 - Higher Order Methods/Equations
- Lecture 6 - Error - Stability - Convergence of Single Step Methods
- Lecture 7 - Tutorial - I
- Lecture 8 - Tutorial - II
- Lecture 9 - Multi-Step Methods (Explicit)
- Lecture 10 - Multi-Step Methods (Implicit)
- Lecture 11 - Convergence and Stability of multi step methods
- Lecture 12 - General methods for absolute stability
- Lecture 13 - Stability Analysis of Multi Step Methods
- Lecture 14 - Predictor - Corrector Methods
- Lecture 15 - Some Comments on Multi - Step Methods
- Lecture 16 - Finite Difference Methods - Linear BVPs
- Lecture 17 - Linear/Non - Linear Second Order BVPs
- Lecture 18 - BVPS - Derivative Boundary Conditions
- Lecture 19 - Higher Order BVPs
- Lecture 20 - Shooting Method BVPs
- Lecture 21 - Tutorial - III
- Lecture 22 - Introduction to First Order PDE
- Lecture 23 - Introduction to Second Order PDE
- Lecture 24 - Finite Difference Approximations to Parabolic PDEs
- Lecture 25 - Implicit Methods for Parabolic PDEs
- Lecture 26 - Consistency, Stability and Convergence
- Lecture 27 - Other Numerical Methods for Parabolic PDEs
- Lecture 28 - Tutorial - IV
- Lecture 29 - Matrix Stability Analysis of Finite Difference Scheme
- Lecture 30 - Fourier Series Stability Analysis of Finite Difference Scheme
- Lecture 31 - Finite Difference Approximations to Elliptic PDEs - I

- [Lecture 32 - Finite Difference Approximations to Elliptic PDEs - II](#)
- [Lecture 33 - Finite Difference Approximations to Elliptic PDEs - III](#)
- [Lecture 34 - Finite Difference Approximations to Elliptic PDEs - IV](#)
- [Lecture 35 - Finite Difference Approximations to Hyperbolic PDEs - I](#)
- [Lecture 36 - Finite Difference Approximations to Hyperbolic PDEs - II](#)
- [Lecture 37 - Method of characteristics for Hyperbolic PDEs - I](#)
- [Lecture 38 - Method of characterisitcs for Hyperbolic PDEs - II](#)
- [Lecture 39 - Finite Difference Approximations to 1st order Hyperbolic PDEs](#)
- [Lecture 40 - Summary, Appendices, Remarks](#)

NPTEL : Optimization (Mathematics)

Co-ordinators : Prof. A. Goswami, Dr. Debjani Chakraborty

Lecture 1 - Optimization - Introduction

Lecture 2 - Formulation of LPP

Lecture 3 - Geometry of LPP and Graphical Solution of LPP

Lecture 4 - Solution of LPP : Simplex Method

Lecture 5 - Big - M Method

Lecture 6 - Two - Phase Method

Lecture 7 - Special Cases in Simple Applications

Lecture 8 - Introduction to Duality Theory

Lecture 9 - Dual Simplex Method

Lecture 10 - Post Optimality Analysis

Lecture 11 - Integer Programming - I

Lecture 12 - Integer Programming - II

Lecture 13 - Introduction to Transportation Problems

Lecture 14 - Solving Various types of Transportation Problems

Lecture 15 - Assignment Problems

Lecture 16 - Project Management

Lecture 17 - Critical Path Analysis

Lecture 18 - PERT

Lecture 19 - Shortest Path Algorithm

Lecture 20 - Travelling Salesman Problem

Lecture 21 - Classical optimization techniques : Single variable optimization

Lecture 22 - Unconstrained multivariable optimization

Lecture 23 - Nonlinear programming with equality constraint

Lecture 24 - Nonlinear programming KKT conditions

Lecture 25 - Numerical optimization : Region elimination techniques

Lecture 26 - Numerical optimization : Region elimination techniques (Continued.)

Lecture 27 - Fibonacci Method

Lecture 28 - Golden Section Methods

Lecture 29 - Interpolation Methods

Lecture 30 - Unconstrained optimization techniques : Direct search method

Lecture 31 - Unconstrained optimization techniques : Indirect search method

[Lecture 32 - Nonlinear programming : constrained optimization techniques](#)

[Lecture 33 - Interior and Exterior penalty Function Method](#)

[Lecture 34 - Separable Programming Problem](#)

[Lecture 35 - Introduction to Geometric Programming](#)

[Lecture 36 - Constrained Geometric Programming Problem](#)

[Lecture 37 - Dynamic Programming Problem](#)

[Lecture 38 - Dynamic Programming Problem \(Continued.\)](#)

[Lecture 39 - Multi Objective Decision Making](#)

[Lecture 40 - Multi attribute decision making](#)

NPTEL : Probability and Statistics (Mathematics)

Co-ordinators : Prof. Somesh Kumar

- Lecture 1 - Algebra of Sets - I
- Lecture 2 - Algebra of Sets - II
- Lecture 3 - Introduction to Probability
- Lecture 4 - Laws of Probability - I
- Lecture 5 - Laws of Probability - II
- Lecture 6 - Problems in Probability
- Lecture 7 - Random Variables
- Lecture 8 - Probability Distributions
- Lecture 9 - Characteristics of Distribution
- Lecture 10 - Special Distributions - I
- Lecture 11 - Special Distributions - II
- Lecture 12 - Special Distributions - III
- Lecture 13 - Special Distributions - IV
- Lecture 14 - Special Distributions - V
- Lecture 15 - Special Distributions - VI
- Lecture 16 - Special Distributions - VII
- Lecture 17 - Functions of a Random Variable
- Lecture 18 - Joint Distributions - I
- Lecture 19 - Joint Distributions - II
- Lecture 20 - Joint Distributions - III
- Lecture 21 - Joint Distributions - IV
- Lecture 22 - Transformations of Random Vectors
- Lecture 23 - Sampling Distributions - I
- Lecture 24 - Sampling Distributions - II
- Lecture 25 - Descriptive Statistics - I
- Lecture 26 - Descriptive Statistics - II
- Lecture 27 - Estimation - I
- Lecture 28 - Estimation - II
- Lecture 29 - Estimation - III
- Lecture 30 - Estimation - IV
- Lecture 31 - Estimation - V

[Lecture 32 - Estimation - VI](#)

[Lecture 33 - Testing of Hypothesis - I](#)

[Lecture 34 - Testing of Hypothesis - II](#)

[Lecture 35 - Testing of Hypothesis - III](#)

[Lecture 36 - Testing of Hypothesis - IV](#)

[Lecture 37 - Testing of Hypothesis - V](#)

[Lecture 38 - Testing of Hypothesis - VI](#)

[Lecture 39 - Testing of Hypothesis - VII](#)

[Lecture 40 - Testing of Hypothesis - VIII](#)

NPTEL : Regression Analysis (Mathematics)

Co-ordinators : Dr. Soumen Maity

Lecture 1 - Simple Linear Regression

Lecture 2 - Simple Linear Regression (Continued...1)

Lecture 3 - Simple Linear Regression (Continued...2)

Lecture 4 - Simple Linear Regression (Continued...3)

Lecture 5 - Simple Linear Regression (Continued...4)

Lecture 6 - Multiple Linear Regression

Lecture 7 - Multiple Linear Regression (Continued...1)

Lecture 8 - Multiple Linear Regression (Continued...2)

Lecture 9 - Multiple Linear Regression (Continued...3)

Lecture 10 - Selecting the BEST Regression model

Lecture 11 - Selecting the BEST Regression model (Continued...1)

Lecture 12 - Selecting the BEST Regression model (Continued...2)

Lecture 13 - Selecting the BEST Regression model (Continued...3)

Lecture 14 - Multicollinearity

Lecture 15 - Multicollinearity (Continued...1)

Lecture 16 - Multicollinearity (Continued...2)

Lecture 17 - Model Adequacy Checking

Lecture 18 - Model Adequacy Checking (Continued...1)

Lecture 19 - Model Adequacy Checking (Continued...2)

Lecture 20 - Test for Influential Observations

Lecture 21 - Transformations and Weighting to correct model inadequacies

Lecture 22 - Transformations and Weighting to correct model inadequacies (Continued...1)

Lecture 23 - Transformations and Weighting to correct model inadequacies (Continued...2)

Lecture 24 - Dummy Variables

Lecture 25 - Dummy Variables (Continued...1)

Lecture 26 - Dummy Variables (Continued...2)

Lecture 27 - Polynomial Regression Models

Lecture 28 - Polynomial Regression Models (Continued...1)

Lecture 29 - Polynomial Regression Models (Continued...2)

Lecture 30 - Generalized Linear Models

Lecture 31 - Generalized Linear Models (Continued.)

[Lecture 32 - Non-Linear Estimation](#)

[Lecture 33 - Regression Models with Autocorrelated Errors](#)

[Lecture 34 - Regression Models with Autocorrelated Errors \(Continued.\)](#)

[Lecture 35 - Measurement Errors & Calibration Problem](#)

[Lecture 36 - Tutorial - I](#)

[Lecture 37 - Tutorial - II](#)

[Lecture 38 - Tutorial - III](#)

[Lecture 39 - Tutorial - IV](#)

[Lecture 40 - Tutorial - V](#)

Lecture 1 - Introduction and Motivation

Lecture 2 - Basic Concepts of Point Estimations - I

Lecture 3 - Basic Concepts of Point Estimations - II

Lecture 4 - Finding Estimators - I

Lecture 5 - Finding Estimators - II

Lecture 6 - Finding Estimators - III

Lecture 7 - Properties of MLEs

Lecture 8 - Lower Bounds for Variance - I

Lecture 9 - Lower Bounds for Variance - II

Lecture 10 - Lower Bounds for Variance - III

Lecture 11 - Lower Bounds for Variance - IV

Lecture 12 - Sufficiency

Lecture 13 - Sufficiency and Information

Lecture 14 - Minimal Sufficiency, Completeness

Lecture 15 - UMVU Estimation, Ancillarity

Lecture 16 - Invariance - I

Lecture 17 - Invariance - II

Lecture 18 - Bayes and Minimax Estimation - I

Lecture 19 - Bayes and Minimax Estimation - II

Lecture 20 - Bayes and Minimax Estimation - III

Lecture 21 - Testing of Hypotheses : Basic Concepts

Lecture 22 - Neyman Pearson Fundamental Lemma

Lecture 23 - Applications of NP lemma

Lecture 24 - UMP Tests

Lecture 25 - UMP Tests (Continued.)

Lecture 26 - UMP Unbiased Tests

Lecture 27 - UMP Unbiased Tests (Continued.)

Lecture 28 - UMP Unbiased Tests : Applications

Lecture 29 - Unbiased Tests for Normal Populations

Lecture 30 - Unbiased Tests for Normal Populations (Continued.)

Lecture 31 - Likelihood Ratio Tests - I

[Lecture 32 - Likelihood Ratio Tests - II](#)

[Lecture 33 - Likelihood Ratio Tests - III](#)

[Lecture 34 - Likelihood Ratio Tests - IV](#)

[Lecture 35 - Invariant Tests](#)

[Lecture 36 - Test for Goodness of Fit](#)

[Lecture 37 - Sequential Procedure](#)

[Lecture 38 - Sequential Procedure \(Continued.\)](#)

[Lecture 39 - Confidence Intervals](#)

[Lecture 40 - Confidence Intervals \(Continued.\)](#)

Lecture 1 - Rational Numbers and Rational Cuts

Lecture 2 - Irrational numbers, Dedekind's Theorem

Lecture 3 - Continuum and Exercises

Lecture 4 - Continuum and Exercises (Continued.)

Lecture 5 - Cantor's Theory of Irrational Numbers

Lecture 6 - Cantor's Theory of Irrational Numbers (Continued.)

Lecture 7 - Equivalence of Dedekind and Cantor's Theory

Lecture 8 - Finite, Infinite, Countable and Uncountable Sets of Real Numbers

Lecture 9 - Types of Sets with Examples, Metric Space

Lecture 10 - Various properties of open set, closure of a set

Lecture 11 - Ordered set, Least upper bound, greatest lower bound of a set

Lecture 12 - Compact Sets and its properties

Lecture 13 - Weiersstrass Theorem, Heine Borel Theorem, Connected set

Lecture 14 - Tutorial - II

Lecture 15 - Concept of limit of a sequence

Lecture 16 - Some Important limits, Ratio tests for sequences of Real Numbers

Lecture 17 - Cauchy theorems on limit of sequences with examples

Lecture 18 - Fundamental theorems on limits, Bolzano-Weiersstrass Theorem

Lecture 19 - Theorems on Convergent and divergent sequences

Lecture 20 - Cauchy sequence and its properties

Lecture 21 - Infinite series of real numbers

Lecture 22 - Comparison tests for series, Absolutely convergent and Conditional convergent series

Lecture 23 - Tests for absolutely convergent series

Lecture 24 - Raabe's test, limit of functions, Cluster point

Lecture 25 - Some results on limit of functions

Lecture 26 - Limit Theorems for functions

Lecture 27 - Extension of limit concept (one sided limits)

Lecture 28 - Continuity of Functions

Lecture 29 - Properties of Continuous Functions

Lecture 30 - Boundedness Theorem, Max-Min Theorem and Bolzano's theorem

Lecture 31 - Uniform Continuity and Absolute Continuity

- Lecture 32 - Types of Discontinuities, Continuity and Compactness
- Lecture 33 - Continuity and Compactness (Continued.), Connectedness
- Lecture 34 - Differentiability of real valued function, Mean Value Theorem
- Lecture 35 - Mean Value Theorem (Continued.)
- Lecture 36 - Application of MVT , Darboux Theorem, L Hospital Rule
- Lecture 37 - L'Hospital Rule and Taylor's Theorem
- Lecture 38 - Tutorial - III
- Lecture 39 - Riemann/Riemann Stieltjes Integral
- Lecture 40 - Existence of Reimann Stieltjes Integral
- Lecture 41 - Properties of Reimann Stieltjes Integral
- Lecture 42 - Properties of Reimann Stieltjes Integral (Continued.)
- Lecture 43 - Definite and Indefinite Integral
- Lecture 44 - Fundamental Theorems of Integral Calculus
- Lecture 45 - Improper Integrals
- Lecture 46 - Convergence Test for Improper Integrals

[Lecture 1 - Foundations of Probability](#)

[Lecture 2 - Laws of Probability](#)

[Lecture 3 - Random Variables](#)

[Lecture 4 - Moments and Special Distributions](#)

[Lecture 5 - Moments and Special Distributions \(Continued...\)](#)

[Lecture 6 - Special Distributions \(Continued...\)](#)

[Lecture 7 - Special Distributions \(Continued...\)](#)

[Lecture 8 - Sampling Distributions](#)

[Lecture 9 - Parametric Methods - I](#)

[Lecture 10 - Parametric Methods - II](#)

[Lecture 11 - Parametric Methods - III](#)

[Lecture 12 - Parametric Methods - IV](#)

[Lecture 13 - Parametric Methods - V](#)

[Lecture 14 - Parametric Methods - VI](#)

[Lecture 15 - Parametric Methods - VII](#)

[Lecture 16 - Multivariate Analysis - I](#)

[Lecture 17 - Multivariate Analysis - II](#)

[Lecture 18 - Multivariate Analysis - III](#)

[Lecture 19 - Multivariate Analysis - IV](#)

[Lecture 20 - Multivariate Analysis - V](#)

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[Lecture 22 - Multivariate Analysis - VII](#)

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[Lecture 24 - Multivariate Analysis - IX](#)

[Lecture 25 - Multivariate Analysis - X](#)

[Lecture 26 - Multivariate Analysis - XI](#)

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[Lecture 28 - Non parametric Methods - I](#)

[Lecture 29 - Non parametric Methods - II](#)

[Lecture 30 - Non parametric Methods - III](#)

[Lecture 31 - Non parametric Methods - IV](#)

[Lecture 32 - Nonparametric Methods - V](#)

[Lecture 33 - Nonparametric Methods - VI](#)

[Lecture 34 - Nonparametric Methods - VII](#)

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[Lecture 37 - Nonparametric Methods - X](#)

[Lecture 38 - Nonparametric Methods - XI](#)

[Lecture 39 - Nonparametric Methods - XII](#)

[Lecture 40 - Nonparametric Methods - XIII](#)

Lecture 1 - Sets, Classes, Collection

Lecture 2 - Sequence of Sets

Lecture 3 - Ring, Field (Algebra)

Lecture 4 - Sigma-Ring, Sigma-Field, Monotone Class

Lecture 5 - Random Experiment, Events

Lecture 6 - Definitions of Probability

Lecture 7 - Properties of Probability Function - I

Lecture 8 - Properties of Probability Function - II

Lecture 9 - Conditional Probability

Lecture 10 - Independence of Events

Lecture 11 - Problems in Probability - I

Lecture 12 - Problems in Probability - II

Lecture 13 - Random Variables

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NPTEL : Mathematical Logic (Mathematics)

Co-ordinators : Prof. Arindama Singh

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NPTEL : Advanced Complex Analysis - Part 2 (Mathematics)

Co-ordinators : Dr. T.E. Venkata Balaji

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Lecture 2 - Continuous Random Variables - Part 2

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Lecture 6 - Tutorial 1 : Cayley-Hamilton Theorem, Nakayama's Lemma

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Lecture 23 - Regular Functions on Quasi-Projective Varieties

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Lecture 2 - Sample Space and Events

Lecture 3 - Special Events and Various Approaches to Defining Probability

Lecture 4 - Important Theorems

Lecture 5 - Numerical Examples and Introduction to Conditional Probability

Lecture 6 - Definition of Conditional Probability and Independence

Lecture 7 - Bayes' Theorem

Lecture 8 - Random Variable

Lecture 9 - Events Defined by a Random Variable

Lecture 10 - Cumulative Distribution Function

Lecture 11 - Properties of the Cumulative Distribution Function and Discrete Random Variable

Lecture 12 - Probability Mass Function

Lecture 13 - Continuous Random Variable and Probability Density Function

Lecture 14 - Numerical Examples

Lecture 15 - Moments

Lecture 16 - Higher Order Moments and Variance of a Random Variable

Lecture 17 - Numerical Examples of Moments and Bernoulli Distribution

Lecture 18 - Binomial Distribution

Lecture 19 - Applications of Binomial Distribution

Lecture 20 - Poisson Distribution

Lecture 21 - Applications of Poisson Distribution

Lecture 22 - Numerical Examples of Poisson Distribution and Uniform Distribution

Lecture 23 - Application of Uniform Distribution and Exponential Distribution

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Lecture 25 - Memoryless Property and Gamma Distribution

Lecture 26 - Example of Gamma Distribution and Normal Distribution

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Lecture 29 - Applications of Normal Distributions and Conditional Distribution Function

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[Lecture 35 - Joint Probability Mass Function, Marginal Probability Mass Function, Examples](#)

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Lecture 2 - Set operation and laws of set operation

Lecture 3 - The principle of inclusion and exclusion

Lecture 4 - Application of the principle of inclusion and exclusion

Lecture 5 - Fundamentals of logic

Lecture 6 - Logical Inferences

Lecture 7 - Methods of proof of an implication

Lecture 8 - First order logic (1)

Lecture 9 - First order logic (2)

Lecture 10 - Rules of inference for quantified propositions

Lecture 11 - Mathematical Induction (1)

Lecture 12 - Mathematical Induction (2)

Lecture 13 - Sample space, events

Lecture 14 - Probability, conditional probability

Lecture 15 - Independent events, Bayes theorem

Lecture 16 - Information and mutual information

Lecture 17 - Basic definition

Lecture 18 - Isomorphism and sub graphs

Lecture 19 - Walks, paths and circuits operations on graphs

Lecture 20 - Euler graphs, Hamiltonian circuits

Lecture 21 - Shortest path problem

Lecture 22 - Planar graphs

Lecture 23 - Basic definition

Lecture 24 - Properties of relations

Lecture 25 - Graph of relations

Lecture 26 - Matrix of relation

Lecture 27 - Closure of relation (1)

Lecture 28 - Closure of relation (2)

Lecture 29 - Warshall's algorithm

Lecture 30 - Partially ordered relation

Lecture 31 - Partially ordered sets

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[Lecture 33 - Boolean algebra](#)

[Lecture 34 - Boolean function \(1\)](#)

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[Lecture 36 - Discrete numeric function](#)

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[Lecture 38 - Introduction to recurrence relations](#)

[Lecture 39 - Second order recurrence relation with constant coefficients \(1\)](#)

[Lecture 40 - Second order recurrence relation with constant coefficients \(2\)](#)

[Lecture 41 - Application of recurrence relation](#)

Lecture 1 - Introduction to linear differential equations

Lecture 2 - Linear dependence, independence and Wronskian of functions

Lecture 3 - Solution of second-order homogenous linear differential equations with constant coefficients - I

Lecture 4 - Solution of second-order homogenous linear differential equations with constant coefficients - II

Lecture 5 - Method of undetermined coefficients

Lecture 6 - Methods for finding Particular Integral for second-order linear differential equations with constant coefficients - I

Lecture 7 - Methods for finding Particular Integral for second-order linear differential equations with constant coefficients - II

Lecture 8 - Methods for finding Particular Integral for second-order linear differential equations with constant coefficients - III

Lecture 9 - Euler-Cauchy equations

Lecture 10 - Method of reduction for second-order linear differential equations

Lecture 11 - Method of variation of parameters

Lecture 12 - Solution of second order differential equations by changing dependent variable

Lecture 13 - Solution of second order differential equations by changing independent variable

Lecture 14 - Solution of higher-order homogenous linear differential equations with constant coefficients

Lecture 15 - Methods for finding Particular Integral for higher-order linear differential equations

Lecture 16 - Formulation of Partial differential equations

Lecture 17 - Solution of Lagrange's equation - I

Lecture 18 - Solution of Lagrange's equation - II

Lecture 19 - Solution of first order nonlinear equations - I

Lecture 20 - Solution of first order nonlinear equations - II

Lecture 21 - Solution of first order nonlinear equations - III

Lecture 22 - Solution of first order nonlinear equations - IV

Lecture 23 - Introduction to Laplace transforms

Lecture 24 - Laplace transforms of some standard functions

Lecture 25 - Existence theorem for Laplace transforms

Lecture 26 - Properties of Laplace transforms - I

Lecture 27 - Properties of Laplace transforms - II

Lecture 28 - Properties of Laplace transforms - III

Lecture 29 - Properties of Laplace transforms - IV

Lecture 30 - Convolution theorem for Laplace transforms - I

Lecture 31 - Convolution theorem for Laplace transforms - II

- Lecture 32 - Initial and final value theorems for Laplace transforms
- Lecture 33 - Laplace transforms of periodic functions
- Lecture 34 - Laplace transforms of Heaviside unit step function
- Lecture 35 - Laplace transforms of Dirac delta function
- Lecture 36 - Applications of Laplace transforms - I
- Lecture 37 - Applications of Laplace transforms - II
- Lecture 38 - Applications of Laplace transforms - III
- Lecture 39 - Z-transform and inverse Z-transform of elementary functions
- Lecture 40 - Properties of Z-transforms - I
- Lecture 41 - Properties of Z-transforms - II
- Lecture 42 - Initial and final value theorem for Z-transforms
- Lecture 43 - Convolution theorem for Z-transforms
- Lecture 44 - Applications of Z-transforms - I
- Lecture 45 - Applications of Z-transforms - II
- Lecture 46 - Applications of Z-transforms - III
- Lecture 47 - Fourier series and its convergence - I
- Lecture 48 - Fourier series and its convergence - II
- Lecture 49 - Fourier series of even and odd functions
- Lecture 50 - Fourier half-range series
- Lecture 51 - Parseval's Identity
- Lecture 52 - Complex form of Fourier series
- Lecture 53 - Fourier integrals
- Lecture 54 - Fourier sine and cosine integrals
- Lecture 55 - Fourier transforms
- Lecture 56 - Fourier sine and cosine transforms
- Lecture 57 - Convolution theorem for Fourier transforms
- Lecture 58 - Applications of Fourier transforms to BVP - I
- Lecture 59 - Applications of Fourier transforms to BVP - II
- Lecture 60 - Applications of Fourier transforms to BVP - III

Lecture 1 - Definition and classification of linear integral equations

Lecture 2 - Conversion of IVP into integral equations

Lecture 3 - Conversion of BVP into an integral equations

Lecture 4 - Conversion of integral equations into differential equations

Lecture 5 - Integro-differential equations

Lecture 6 - Fredholm integral equation with separable kernel: Theory

Lecture 7 - Fredholm integral equation with separable kernel: Examples

Lecture 8 - Solution of integral equations by successive substitutions

Lecture 9 - Solution of integral equations by successive approximations

Lecture 10 - Solution of integral equations by successive approximations: Resolvent kernel

Lecture 11 - Fredholm integral equations with symmetric kernels: Properties of eigenvalues and eigenfunctions

Lecture 12 - Fredholm integral equations with symmetric kernels: Hilbert Schmidt theory

Lecture 13 - Fredholm integral equations with symmetric kernels: Examples

Lecture 14 - Construction of Green function - I

Lecture 15 - Construction of Green function - II

Lecture 16 - Green function for self adjoint linear differential equations

Lecture 17 - Green function for non-homogeneous boundary value problem

Lecture 18 - Fredholm alternative theorem - I

Lecture 19 - Fredholm alternative theorem - II

Lecture 20 - Fredholm method of solutions

Lecture 21 - Classical Fredholm theory: Fredholm first theorem - I

Lecture 22 - Classical Fredholm theory: Fredholm first theorem - II

Lecture 23 - Classical Fredholm theory: Fredholm second theorem and third theorem

Lecture 24 - Method of successive approximations

Lecture 25 - Neumann series and resolvent kernels - I

Lecture 26 - Neumann series and resolvent kernels - II

Lecture 27 - Equations with convolution type kernels - I

Lecture 28 - Equations with convolution type kernels - II

Lecture 29 - Singular integral equations - I

Lecture 30 - Singular integral equations - II

Lecture 31 - Cauchy type integral equations - I

- Lecture 32 - Cauchy type integral equations - II
- Lecture 33 - Cauchy type integral equations - III
- Lecture 34 - Cauchy type integral equations - IV
- Lecture 35 - Cauchy type integral equations - V
- Lecture 36 - Solution of integral equations using Fourier transform
- Lecture 37 - Solution of integral equations using Hilbert transform - I
- Lecture 38 - Solution of integral equations using Hilbert transform - II
- Lecture 39 - Calculus of variations: Introduction
- Lecture 40 - Calculus of variations: Basic concepts - I
- Lecture 41 - Calculus of variations: Basic concepts - II
- Lecture 42 - Calculus of variations: Basic concepts and Euler equation
- Lecture 43 - Euler equation: Some particular cases
- Lecture 44 - Euler equation : A particular case and Geodesics
- Lecture 45 - Brachistochrone problem and Euler equation - I
- Lecture 46 - Euler's equation - II
- Lecture 47 - Functions of several independent variables
- Lecture 48 - Variational problems in parametric form
- Lecture 49 - Variational problems of general type
- Lecture 50 - Variational derivative and invariance of Euler's equation
- Lecture 51 - Invariance of Euler's equation and isoperimetric problem - I
- Lecture 52 - Isoperimetric problem - II
- Lecture 53 - Variational problem involving a conditional extremum - I
- Lecture 54 - Variational problem involving a conditional extremum - II
- Lecture 55 - Variational problems with moving boundaries - I
- Lecture 56 - Variational problems with moving boundaries - II
- Lecture 57 - Variational problems with moving boundaries - III
- Lecture 58 - Variational problems with moving boundaries; One sided variation
- Lecture 59 - Variational problem with a movable boundary for a functional dependent on two functions
- Lecture 60 - Hamilton's principle: Variational principle of least action

NPTEL : NOC:Nonlinear Programming (Mathematics)

Co-ordinators : S. K. Gupta

Lecture 1 - Convex Sets and Functions

Lecture 2 - Properties of Convex Functions - I

Lecture 3 - Properties of Convex Functions - II

Lecture 4 - Properties of Convex Functions- III

Lecture 5 - Convex Programming Problems

Lecture 6 - KKT optimality conditions

Lecture 7 - Quadratic Programming Problems - I

Lecture 8 - Quadratic Programming Problems - II

Lecture 9 - Separable Programming - I

Lecture 10 - Separable Programming - II

Lecture 11 - Geometric Programming - I

Lecture 12 - Geometric Programming - II

Lecture 13 - Geometric Programming - III

Lecture 14 - Dynamic Programming - I

Lecture 15 - Dynamic Programming - II

Lecture 16 - Dynamic programming approach to find shortest path in any network

Lecture 17 - Dynamic Programming - IV

Lecture 18 - Search Techniques - I

Lecture 19 - Search Techniques - II

Lecture 20 - Search Techniques - III

Lecture 1 - Introduction to error analysis and linear systems

Lecture 2 - Gaussian elimination with Partial pivoting

Lecture 3 - LU decomposition

Lecture 4 - Jacobi and Gauss Seidel methods

Lecture 5 - Iterative methods-II

Lecture 6 - Introduction to Non-linear equations and Bisection method

Lecture 7 - Regula Falsi and Secant methods

Lecture 8 - Newton-Raphson method

Lecture 9 - Fixed point iteration method

Lecture 10 - System of Nonlinear equations

Lecture 11 - Introduction to Eigenvalues and Eigenvectors

Lecture 12 - Similarity Transformations and Gershgorin Theorem

Lecture 13 - Jacobi's Method for Computing Eigenvalues

Lecture 14 - Power Method

Lecture 15 - Inverse Power Method

Lecture 16 - Interpolation - Part I (Introduction to Interpolation)

Lecture 17 - Interpolation - Part II (Some basic operators and their properties)

Lecture 18 - Interpolation - Part III (Newton's Forward/ Backward difference and derivation of general error)

Lecture 19 - Interpolation - Part IV (Error in approximating a function by a polynomial using Newton's Forward and Backward difference formula)

Lecture 20 - Interpolation - Part V (Solving problems using Newton's Forward and Backward difference formula)

Lecture 21 - Interpolation - Part VI (Central difference formula)

Lecture 22 - Interpolation - Part VII (Lagrange interpolation formula with examples)

Lecture 23 - Interpolation - Part VIII (Divided difference interpolation with examples)

Lecture 24 - Interpolation - Part IX (Hermite's interpolation with examples)

Lecture 25 - Numerical differentiation - Part I (Introduction to numerical differentiation by interpolation formula)

Lecture 26 - Numerical differentiation - Part II (Numerical differentiation based on Lagrange's interpolation with examples)

Lecture 27 - Numerical differentiation - Part III (Numerical differentiation based on Divided difference formula with examples)

Lecture 28 - Numerical differentiation - Part IV (Maxima and minima of a tabulated function and differentiation errors)

Lecture 29 - Numerical differentiation - Part V (Differentiation based on finite difference operators)

Lecture 30 - Numerical differentiation - Part VI (Method of undetermined coefficients and Derivatives with unequal intervals)

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Lecture 31 - Numerical Integration - Part I (Methodology of Numerical Integration and Rectangular rule)

Lecture 32 - Numerical Integration - Part II (Quadrature formula and Trapezoidal rule with associated errors)merical Integration Part-I (Methodology of Numerical Integration and Rectangular rule)

Lecture 33 - Numerical Integration - Part III (Simpsons 1/3rd rule with associated errors)

Lecture 34 - Numerical Integration - Part IV (Composite Simpsons 1/3rd rule and Simpsons 3/8th rule with examples)

Lecture 35 - Numerical Integration - Part V (Gauss Legendre 2-point and 3-point formula with examples)

Lecture 36 - Introduction to Ordinary Differential equations

Lecture 37 - Numerical methods for ODE-1

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NPTEL : Cryogenic Engineering (Mechanical Engineering)

Co-ordinators : Prof. M.D. Atrey

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DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : Robotics (Mechanical Engineering)

Co-ordinators : Prof. P. Seshu, Prof. P.S. Gandhi, Prof. K. Kurien Issac, Prof. B. Seth, Prof. C. Amarnath

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NPTEL : Project and Production Management (Mechanical Engineering)

Co-ordinators : Prof. Arun Kanda

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- Lecture 1 - Introduction to polymers
- Lecture 2 - Polymer structure
- Lecture 3 - Polymer classification
- Lecture 4 - Polymer length, packing and tacticity
- Lecture 5 - Glass transition temperature
- Lecture 6 - Temperature effects, glassy regime
- Lecture 7 - Viscoelastic, rubbery, viscous, decomposition
- Lecture 8 - Relaxation and creep tests
- Lecture 9 - Failure of polymers
- Lecture 10 - Heaviside, Dirac delta, Laplace
- Lecture 11 - Introduction to linear viscoelasticity
- Lecture 12 - Phenomenological models for linear viscoelasticity
- Lecture 13 - Maxwell model
- Lecture 14 - Kelvin model
- Lecture 15 - Three and four parameter models
- Lecture 16 - Generalized Maxwell and Kelvin models
- Lecture 17 - Boltzman superposition principle
- Lecture 18 - Alfrey's correspondence principle
- Lecture 19 - Analysis of viscoelastic bars
- Lecture 20 - Analysis of viscoelastic beams
- Lecture 21 - Dynamic mechanical analysis (DMA)
- Lecture 22 - Dynamic mechanical thermal analysis (DMTA)
- Lecture 23 - Time temperature superposition principle (TTSP)
- Lecture 24 - Plastic design consideration and practices
- Lecture 25 - What are composites?
- Lecture 26 - Composite materials and types
- Lecture 27 - Composite advantages and applications
- Lecture 28 - Fabrication and other aspects of composites
- Lecture 29 - 3D stress and strain components
- Lecture 30 - Symmetry in stress, strain and stiffness matrix
- Lecture 31 - Monoclinic, orthotropic and isotropic materials

- Lecture 32 - 3D stress strain relation for orthotropic material
- Lecture 33 - Plane stress: Specially orthotropic material
- Lecture 34 - Plane stress: Generally orthotropic material
- Lecture 35 - Lamina engineering constants
- Lecture 36 - Lamina hygrothermal effects
- Lecture 37 - Lamina fundamental strengths
- Lecture 38 - Lamina failure criteria
- Lecture 39 - Tsai-Hill and Hoffman failure criteria
- Lecture 40 - Micromechanics: Assumptions, RVE
- Lecture 41 - Micromechanics: Stiffness prediction
- Lecture 42 - Micromechanics: Stiffness and strength
- Lecture 43 - Macromechanics of laminate
- Lecture 44 - Classical laminate theory
- Lecture 45 - Classical laminate theory - II
- Lecture 46 - Symmetric laminates, orthotropic laminates
- Lecture 47 - Angle-ply, cross-ply and quasi-isotropic laminates
- Lecture 48 - Hygrothermal stresses in laminates
- Lecture 49 - Laminate failure
- Lecture 50 - Design practices with laminates
- Lecture 51 - Sandwich structures
- Lecture 52 - Composites testing
- Lecture 53 - Joining of composites

- Lecture 1 - Introduction to Tribology
- Lecture 2 - Tribological Interfaces
- Lecture 3 - Fundamentals of Friction and Wear
- Lecture 4 - Adhesion, Abrasion, and Surface Fatigue Mechanisms
- Lecture 5 - Wear Measurement Techniques
- Lecture 6 - Principles of Lubrication, types of Lubricants and their properties
- Lecture 7 - Lubrication regimes and film thickness calculations
- Lecture 8 - Mixed Lubrication
- Lecture 9 - Hydrodynamic Lubrication Theory
- Lecture 10 - Design Considerations for Hydrodynamic Lubrication Systems
- Lecture 11 - Elastohydrodynamic Lubrication
- Lecture 12 - Solid Lubrication
- Lecture 13 - Surface modification techniques for tribological applications
- Lecture 14 - Thin film coatings and their tribological properties
- Lecture 15 - Nanotribology
- Lecture 16 - Tribocorrosion
- Lecture 17 - Wear testing techniques and standards
- Lecture 18 - Measurement and analysis of wear debris
- Lecture 19 - Experimental Design and Statistical Analysis
- Lecture 20 - Introduction to Data-Enabled Engineering
- Lecture 21 - Data Collection and Preprocessing
- Lecture 22 - Feature Extraction and Selection
- Lecture 23 - Introduction to Machine Learning Algorithms
- Lecture 24 - Regression and Classification Algorithms for Tribological Modeling
- Lecture 25 - Deep Learning for Tribological Engineering
- Lecture 26 - Data-Driven Models for Friction Prediction
- Lecture 27 - Data-Driven Models for Wear Prediction
- Lecture 28 - Data-Driven Models for Lubricant Optimization
- Lecture 29 - Data-Driven Models for Tribofilm Formation
- Lecture 30 - Data-Driven Models for Tribocorrosion Prediction
- Lecture 31 - Prediction of Coating and Surface Treatment Performance

[Lecture 32 - Optimization of Surface Engineering Processes using Machine Learning](#)

[Lecture 33 - Uncertainty Quantification and Sensitivity Analysis](#)

[Lecture 34 - Data Management and Ethics in Data-Enabled Engineering](#)

[Lecture 35 - Case Studies in Data-Enabled Tribological Engineering](#)

[Lecture 36 - Future Directions in Data-Enabled Tribological Engineering](#)

NPTEL : Nonlinear Vibration (Mechanical Engineering)

Co-ordinators : Prof. S.K. Dwivedy

Lecture 1 - Introduction of Nonlinear systems

Lecture 2 - Review of Linear vibrating systems

Lecture 3 - Phenomena associated with Nonlinear systems

Lecture 4 - Commonly observed Phenomena in Nonlinear systems

Lecture 5 - Force and Moment based Approach

Lecture 6 - Energy based approach Extended Hamilton's principle and Lagrange Principle

Lecture 7 - Derivation of Equation of motion of nonlinear discrete system (More examples)

Lecture 8 - Derivation of Equation of motion of nonlinear continuous system - 1

Lecture 9 - Derivation of Equation of motion of nonlinear continuous system - 2

Lecture 10 - Ordering of nonlinear Equation of motion

Lecture 11 - Qualitative Analysis Straight forward expansion

Lecture 12 - Numerical method Straight forward expansion

Lecture 13 - Lindstedt Poincaré technique

Lecture 14 - Method of multiple scales

Lecture 15 - Method of Harmonic balance

Lecture 16 - Method of averaging

Lecture 17 - Generalized Method of averaging

Lecture 18 - Krylov-Bogoliubov-Mitropolski technique

Lecture 19 - Incremental harmonic balance method and Intrinsic multiple scale harmonic balance method

Lecture 20 - Modified Lindstedt Poincaré technique

Lecture 21 - Stability and Bifurcation of Fixed-point response - 1

Lecture 22 - Stability and Bifurcation of Fixed-point response - 2

Lecture 23 - Stability and Bifurcation of Fixed-point response - 3

Lecture 24 - Stability and Bifurcation of Fixed-point response - 4

Lecture 25 - Stability Analysis of Periodic response

Lecture 26 - Bifurcation of Periodic response And Introduction to quasi-periodic and Chaotic response

Lecture 27 - Quasi-Periodic and Chaotic response

Lecture 28 - Numerical methods to obtain roots of characteristic equation and time response

Lecture 29 - Numerical methods to obtain time response

Lecture 30 - Numerical methods to obtain frequency response

Lecture 31 - Free Vibration of Single degree of freedom Nonlinear systems with Cubic and quadratic nonlinearities

[Lecture 32 - Free Vibration of Single degree of freedom Nonlinear systems with Cubic and quadratic nonlinearities: effect of damping](#)

[Lecture 33 - Free Vibration of multi- degree of freedom Nonlinear systems with Cubic and quadratic nonlinearities](#)

[Lecture 34 - Forced nonlinear Vibration Single degree of freedom Nonlinear systems with Cubic nonlinearities:](#)

[Lecture 35 - Forced nonlinear Vibration Single and multi- degree of freedom Nonlinear systems](#)

[Lecture 36 - Nonlinear Forced-Vibration of Single and Multi Degree-of-Freedom System](#)

[Lecture 37 - Analysis of Multi- degree of freedom system](#)

[Lecture 38 - Nonlinear Vibration of Parametrically excited system: Axially loaded sandwich beam](#)

[Lecture 39 - Nonlinear Vibration of Parametrically excited system: Elastic and Magneto-elastic beam](#)

[Lecture 40 - Nonlinear Vibration of Parametrically excited system with internal resonance](#)

Lecture 1 - Introduction

Lecture 2 - A Brief History of Rotor Dynamics

Lecture 3 - The State of the Art of Rotor Dynamics

Lecture 4 - Simple Rotor Models with Rigid Bearings

Lecture 5 - Jeffcott Rotor Model

Lecture 6 - Variant of Jeffcott Rotor Model

Lecture 7 - Rigid Rotor Mounted on Simple Anisotropic Springs as Bearings

Lecture 8 - Rigid Rotor Mounted on Complex Anisotropic Bearings

Lecture 9 - Flexible Shaft with a Rigid Disc Mounted on Anisotropic Supports

Lecture 10 - Gyroscopic Effects : Synchronous whirl of a Rotor Systems with a thin Disc

Lecture 11 - Gyroscopic Effects : Synchronous and Asynchronous pure wobbling motions

Lecture 12 - Gyroscopic Effects : Asynchronous whirl of a Rotor system with a thin Disc

Lecture 13 - Gyroscopic Effects : Asynchronous whirl analysis with Dynamic Approach

Lecture 14 - Torsional Vibrations: Simple Rotor Systems

Lecture 15 - Three Disc Rotor System

Lecture 16 - Transfer Matrix Approach - Part I

Lecture 17 - Transfer Matrix Approach - Part II

Lecture 18 - Transfer Matrix Approach - Part III

Lecture 19 - Geared and Branched Systems

Lecture 20 - Continuous System and Finite Element Method

Lecture 21 - Finite Element Method

Lecture 22 - Finite Element Analysis

Lecture 23 - Finite Element Analysis - Part III

Lecture 24 - Influence Coefficient Method

Lecture 25 - Transfer Matrix Method - Part I

Lecture 26 - Transfer Matrix Method - Part II

Lecture 27 - Transfer Matrix Method - Part III

Lecture 28 - Continuous System Approach

Lecture 29 - Finite Element Method - Part I

Lecture 30 - Finite Element Method - Part II

Lecture 31 - Finite Element Method - Part III

[Lecture 32 - Instability in Rotor Systems: Bearings](#)

[Lecture 33 - Fluid-Film Bearings](#)

[Lecture 34 - Internal Damping & Asymmetrical Shaft](#)

[Lecture 35 - Steam Whirl and Seals](#)

[Lecture 36 - Subcritical Speed Whirl](#)

[Lecture 37 - Introduction to Rigid Rotor Balancing](#)

[Lecture 38 - Dynamic Balancing of Rotors: Rigid Rotor Balancing](#)

[Lecture 39 - Dynamic Balancing of Rotors:Flexible Rotor Model Balancing](#)

[Lecture 40 - Dynamic Balancing of Rotors:Influence Coefficient Method for Flexible Rotor](#)

[Lecture 41 - Common Faults & Vibration signatures](#)

[Lecture 42 - Condition Based Monitoring](#)

Lecture 1 - Fundamentals Of Engineering Mechanics

Lecture 2 - Equations of Equilibrium

Lecture 3 - Truss Analysis - Part 1

Lecture 4 - Truss Analysis - Part 2

Lecture 5 - Analysis of Frames Machines

Lecture 6 - Internal Forces

Lecture 7 - Internal Forces in Beams

Lecture 8 - Cables

Lecture 9 - Friction

Lecture 10 - Application of Friction - Part 1

Lecture 11 - Application of Friction - Part 2

Lecture 12 - Application of Friction - Part 3

Lecture 13 - Centroids Center of Mass

Lecture 14 - Centroids Area of Moments

Lecture 15 - Product of Inertia, Rotation of Axis and Principle Moments of Inertia

Lecture 16 - Principle Mass Moments of Inertia

Lecture 17 - Second Moment of Mass

Lecture 18 - Virtual Work of Ideal System

Lecture 19 - Principle of Virtual Work

Lecture 20 - Systems with Friction

Lecture 21 - Potential Energy

Lecture 22 - Stability of Equilibrium

Lecture 23 - Kinematics of a Particles

Lecture 24 - Kinematics of a Particle Moving on a Curve

Lecture 25 - Relative Motion

Lecture 26 - Plane Kinematics of Rigid Bodies

Lecture 27 - Kinematics of a Particle

Lecture 28 - Work and Energy

Lecture 29 - Impulse and Momentum

Lecture 30 - Direct and Oblique Impulse

Lecture 31 - Plane Kinetics of Rigid Bodies

[Lecture 32 - Kinetics of a Body](#)

[Lecture 33 - Method of Momentum and Analysis of Robot Manipulator](#)

[Lecture 34 - Kinematics in 3D](#)

[Lecture 35 - Kinetics in 3D](#)

[Lecture 36 - Free Vibration](#)

[Lecture 37 - Forced Vibration Damped Undamped](#)

[Lecture 38 - Vibration of Rigid Bodies - Part 1](#)

[Lecture 39 - Vibration of Rigid Bodies - Part 2](#)

[Lecture 40 - Some Problems of Vibration](#)

NPTEL : Mechanical Vibrations (Mechanical Engineering)

Co-ordinators : Prof. S.K. Dwivedy, Prof. Rajiv Tiwari

- Lecture 1 - Overview of the Course, Practical and Research Trends
- Lecture 2 - Harmonic and Periodic Motions, Vibration Terminology
- Lecture 3 - Vibration Model, Equation of Motion-Natural Frequency
- Lecture 4 - Energy Method, Principle of Virtual Work
- Lecture 5 - Viscously Damped Free Vibration Special Cases: Oscillatory
- Lecture 6 - Logarithmic Decrement Experimental Determination of Damping Coefficient Hysteresis Loop
- Lecture 7 - Coulomb Damping other Damping Models
- Lecture 8 - Forced Harmonic Vibration, Magnification Factor
- Lecture 9 - Laplace Transform, Superposition Theorem
- Lecture 10 - Rotor Unbalance and Whirling of Shaft, Transmissibility
- Lecture 11 - Support Motion, Vibration Isolation
- Lecture 12 - Sharpness of Resonance, Vibration Measuring Instruments
- Lecture 13 - Generalized and Principle Coordinates, Derivation of Equation of Motion
- Lecture 14 - Lagranges's Equation
- Lecture 15 - Coordinate Coupling
- Lecture 16 - Forced Harmonic Vibration
- Lecture 17 - Tuned Absorber, Determination of Mass Ratio
- Lecture 18 - Tuned and Damped Absorber, Untuned Viscous Damper
- Lecture 19 - Derivation of Equations of Motion, Influence Coefficient Method
- Lecture 20 - Properties of Vibrating Systems: Flexibility & Stiffness Matrices, Reciprocity Theorem
- Lecture 21 - Modal Analysis: Undamped
- Lecture 22 - Modal Analysis: Damped
- Lecture 23 - Simple Systems With One Two or Three Discs Geared System
- Lecture 24 - Multi-Degree of Freedom Systems-Transfer Matrix Method Branched Systems
- Lecture 25 - Derivation of Equations of Motion Part 1 - Newton
- Lecture 26 - Derivation of Equations of Motion Part 2 - Newton
- Lecture 27 - Vibration of Strings
- Lecture 28 - Longitudinal and Torsional Vibration of Rods
- Lecture 29 - Transverse Vibration of Beams, Equations of Motion and Boundary Conditions
- Lecture 30 - Transverse Vibration of Beams: Natural Frequencies and Mode Shapes
- Lecture 31 - Rayleigh's Energy Method

[Lecture 32 - Matrix Iteration Method](#)

[Lecture 33 - Durckerley, Rayleigh-Ritz and Galerkin Method](#)

[Lecture 34 - Finite Element Formulation for Rods, Gear Train and Branched System](#)

[Lecture 35 - Finite Element Formulation for Beams: Galerkin](#)

[Lecture 36 - Global Finite Element Assembly and Imposition of Boundary Conditions](#)

[Lecture 37 - Vibration Testing Equipments: Signal Measurements](#)

[Lecture 38 - Vibration Testing Equipments: Signal Analysis](#)

[Lecture 39 - Field Balancing of Rotors](#)

[Lecture 40 - Condition Monitoring](#)

Lecture 1 - Introduction to advanced machining processes

Lecture 2 - Ultrasonic machining - Part I

Lecture 3 - Ultrasonic machining - Part II

Lecture 4 - Abrasive jet machining

Lecture 5 - Water jet cutting and Abrasive water jet machining

Lecture 6 - Magnetic abrasive finishing

Lecture 7 - Abrasive Flow Finishing

Lecture 8 - Magnetorheological Finishing

Lecture 9 - Magnetorheological Abrasive Flow Finishing - Part I

Lecture 10 - Magnetorheological Abrasive Flow Finishing - Part II

Lecture 11 - Magnetorheological Abrasive Flow Finishing - Part III

Lecture 12 - Electric discharge machining (EDM)

Lecture 13 - Electric Discharge Grinding, Electric Discharge Diamond Grinding and Wire Electric Discharge Machining

Lecture 14 - Electrochemical Machining (ECM)

Lecture 15 - Electrochemical Grinding, Electrostream Drilling, Shaped Tube Electrolytic Machining

Lecture 16 - Plasma Arc Machining (PAM)

Lecture 17 - Electron Beam Machining (EBM) Edit Lesson

Lecture 18 - Laser Beam Machining (LBM)

Lecture 19 - Chemical Machining (ChM)

- Lecture 1 - Introduction of nuclear energy
- Lecture 2 - Binding energy and mass defect
- Lecture 3 - Radioactivity and radioactive decay
- Lecture 4 - Different types of nuclear transmutation
- Lecture 5 - Artificial radioactivity and neutron-nucleus interactions
- Lecture 6 - Energy and momentum conservation
- Lecture 7 - Fission and role of neutron energy
- Lecture 8 - Theory of elastic scattering
- Lecture 9 - Neutron multiplication factor
- Lecture 10 - Neutron diffusion theory
- Lecture 11 - Solution of one-group diffusion equation
- Lecture 12 - Simple reactor theory
- Lecture 13 - Nuclear fuel and simple energy consideration
- Lecture 14 - Axial temperature distribution and heat transfer coefficient
- Lecture 15 - Prompt and delayed neutrons
- Lecture 16 - Delayed neutron kinetics
- Lecture 17 - Different control mechanisms and various effects
- Lecture 18 - Classical reactor designs
- Lecture 19 - Evolution of reactors from Gen-I to Gen-IV
- Lecture 20 - The concept of breeding
- Lecture 21 - Fuel cycles and FBR
- Lecture 22 - Gen-IV FBR designs
- Lecture 23 - Hydrogen fusion reactions
- Lecture 24 - Coulomb barrier and other critical factors
- Lecture 25 - Radiation dose and gross biological effects
- Lecture 26 - Stochastic and deterministic effects of human cells
- Lecture 27 - Lessons from TMI and Chernobyl
- Lecture 28 - Defence-in-depth Philosophy
- Lecture 29 - Waste classification and Disposal of Mill Tailings
- Lecture 30 - Disposal methodologies for HLW and IMW

- Lecture 1 - Fundamentals of Welding and Joining - Part I
- Lecture 2 - Fundamentals of Welding and Joining - Part II
- Lecture 3 - Fundamentals of Welding and Joining - Part III
- Lecture 4 - Fundamentals of Welding and Joining - Part IV
- Lecture 5 - Fundamentals of Welding and Joining - Part V
- Lecture 6 - Laser and Electron Beam Welding - Part I
- Lecture 7 - Laser and Electron Beam Welding - Part II
- Lecture 8 - Solid State Welding Processes - Part I
- Lecture 9 - Solid State Welding Processes - Part II
- Lecture 10 - Solid State Welding Processes - Part III
- Lecture 11 - Computational Welding Mechanics - Part I
- Lecture 12 - Computational Welding Mechanics - Part II
- Lecture 13 - Computational Welding Mechanics - Part III
- Lecture 14 - Micro and Nano Joining Processes - Part I
- Lecture 15 - Micro and Nano Joining Processes - Part II
- Lecture 16 - Micro and Nano Joining Processes - Part III
- Lecture 17 - Welding Metallurgy - Part I
- Lecture 18 - Welding Metallurgy - Part II
- Lecture 19 - Welding Metallurgy - Part III
- Lecture 20 - Welding Metallurgy - Part IV
- Lecture 21 - Welding and Joining of Non-Metals - Part I
- Lecture 22 - Welding and Joining of Non-Metals - Part II
- Lecture 23 - Metal Transfer in Welding and Metal Printing

Lecture 1 - Introduction

Lecture 2 - Introduction and Importance of Machining

Lecture 3 - Principles of Machining or Metal Cutting

Lecture 4 - Cutting Tools

Lecture 5 - Forces in Machining

Lecture 6 - Tribology in Machining

Lecture 7 - Lubrication surface roughness in Machining

Lecture 8 - Machinability and Thermal Aspects

Lecture 9 - Tool Wear and Tool life - Part 1

Lecture 10 - Tool Wear and Tool life - Part 2

Lecture 11 - Tool Wear and Tool life - Part 3

Lecture 12 - Tool Materials and Coatings

Lecture 13 - Machining Fluids / Cutting Fluids and its Additives - Part 1

Lecture 14 - Machining Fluids / Cutting Fluids and its Additives - Part 2

Lecture 15 - Machining Fluids / Cutting Fluids and its Emissions

Lecture 16 - Eco Friendly Cutting Fluids - Part 1

Lecture 17 - Eco Friendly Cutting Fluids - Part 2

Lecture 18 - Rheology and Thermal Characterization of Machining / Cutting Fluids

Lecture 19 - Bio-degradation Studies of Machining / Cutting Fluids

Lecture 20 - Cutting Fluid Application in Machining Region

Lecture 21 - Practical Machining Processes - 1

Lecture 22 - Practical Machining Processes - 2

Lecture 23 - Introduction to Abrasive Processes - Grinding

Lecture 24 - Cutting fluids in Grinding Process

Lecture 25 - Unbonded Conventional Abrasive Processes

Lecture 26 - Advances in Metal Cutting_Machining Processes

Lecture 27 - Advances in Metal Cutting_Machining Processes - 2

Lecture 1 - Deformation of Metals

Lecture 2 - Mechanism of Plastic Deformation

Lecture 3 - Machining Processes: Single Edge Tool, Types of Chips

Lecture 4 - Tool Geometry: Single Point Cutting Tool Specifications

Lecture 5 - Tool Specifications, Conversion Of Tool Angles, Multi-Point Cutting Tools

Lecture 6 - Mechanics of Orthogonal Cutting, Force Relationships

Lecture 7 - Determination of Stress, Strain, and Strain Rate

Lecture 8 - Measurement of Shear Angle

Lecture 9 - Other Analysis for Force Relationships

Lecture 10 - Mechanics of Oblique Cutting

Lecture 11 - Measurement of Cutting Forces

Lecture 12 - Thermal Aspects Of Machining: Temperatures in Orthogonal Cutting

Lecture 13 - Tool Wear and Tool Life and Tool Life Equations

Lecture 14 - Economics in Machining

Lecture 15 - Practical Machining Operations: Turning And Shaping and Planning Operation

Lecture 16 - Practical Machining Operations: Milling And Drilling

Lecture 17 - Grinding of Metals and Mechanics of Grinding Process

Lecture 18 - Abrasive Machining and Finishing Operations

Lecture 19 - CNC Machines and CNC Programming

Lecture 20 - Introduction to Advanced Machining Processes

Lecture 1 - Introduction to hydraulic machines: classifications and operational principles

Lecture 2 - Euler equation for turbomachines: net head developed by the pump/turbines

Lecture 3 - Velocity triangles of pumps, effect of inlet swirl on pump operation

Lecture 4 - Velocity triangles of pumps, effect of inlet swirl on pump operation

Lecture 5 - Pump casings, Efficiencies and Problems - I

Lecture 6 - Pump casings, Efficiencies and Problems - II

Lecture 7 - Pump casings, Efficiencies and Problems - III

Lecture 8 - Axial flow pump, HQ curve, System Resistance Curve - I

Lecture 9 - Axial flow pump, HQ curve, System Resistance Curve - II

Lecture 10 - HQ Curve, System Resistance Curve - I

Lecture 11 - HQ Curve, System Resistance Curve - II

Lecture 12 - Introduction to Cavitation

Lecture 13 - Condition for Cavitation and NPSH

Lecture 14 - Net Positive Suction Head (NPSH)

Lecture 15 - Suction number and Introduction to off design condition

Lecture 16 - Cavitation: The effect of off-design Conditions

Lecture 17 - Cavitation: Preventive Measures

Lecture 18 - Cavitation: Preventive Measures, Effect on Pump Characteristic

Lecture 19 - Problems on Cavitation

Lecture 20 - Introduction to Slip : Stodola Slip Model

Lecture 21 - Departure from Euler theory

Lecture 22 - Slip Velocity - I

Lecture 23 - Slip Velocity - II

Lecture 24 - Problem on slip

Lecture 25 - Degree of reaction of pump

Lecture 26 - Degree of reaction and axial pump design

Lecture 27 - Testing of radial flow pump - I

Lecture 28 - Testing of radial flow pump - II

Lecture 29 - Problem on radial flow pump testing

Lecture 30 - Radial equilibrium of axial flow pump - I

Lecture 31 - Radial equilibrium of axial flow pump - II

- Lecture 32 - Pump operation: series and parallel connection
- Lecture 33 - Series and parallel operation of dissimilar pumps
- Lecture 34 - Pumping system design
- Lecture 35 - Design of parallel pumping system
- Lecture 36 - Numerical problem on pumps - I
- Lecture 37 - Numerical problem on pumps - II
- Lecture 38 - Numerical problem on pumps - III
- Lecture 39 - Working principle and Indicator diagram of PD pump
- Lecture 40 - Working principle and Indicator diagram of PD pump (Continued...)
- Lecture 41 - Modified indicator diagram and Head-Discharge curve
- Lecture 42 - Analysis and Head-Discharge curve of PD pump
- Lecture 43 - Analysis and efficiencies of PD pump
- Lecture 44 - Requirement of air chamber in PD pump
- Lecture 45 - Numerical problem on PD pump with air chamber
- Lecture 46 - Similarity and dimensional analysis of hydraulic machines
- Lecture 47 - Dimensional analysis of hydraulic machines: Buckingham's theorem
- Lecture 48 - Buckingham's theorem: Specific speed of hydraulic machines
- Lecture 49 - Turbine Classification and Operational principle of Pelton wheel
- Lecture 50 - Velocity Triangles and analysis
- Lecture 51 - Operational Principle of Reaction turbine
- Lecture 52 - Degree of Reaction and Introduction to axial flow turbine
- Lecture 53 - Kaplan Turbine: Operational Principle, Turbine efficiencies
- Lecture 54 - Draft Tube for Reaction Turbine and Cavitation
- Lecture 55 - Energy Balance and NPSH
- Lecture 56 - Thoma Cavitation Factor
- Lecture 57 - Reaction Turbine: Design aspects and Characteristic Curves
- Lecture 58 - Problems on Impulse and Reaction Turbines

- Lecture 1 - Introduction to Abrasive Machining and Finishing Processes
- Lecture 2 - Grinding Process
- Lecture 3 - Grinding Fluids and Its Additives
- Lecture 4 - Grinding Fluids and its Emissions
- Lecture 5 - Sustainable Grinding Process: Biodegradation of Grinding Fluids
- Lecture 6 - Sustainable Grinding Process: MQL in Grinding Process
- Lecture 7 - Honing Process
- Lecture 8 - Lapping Process
- Lecture 9 - Super Finishing and Sand Blasting
- Lecture 10 - Vibratory Bowl Finishing, Rotary Barrel Finishing or Tumbling
- Lecture 11 - Drag Finishing, Ice-bonded Abrasive Finishing, Pitch Polishing, Pad Polishing
- Lecture 12 - Introduction to Surface Texture in abrasive Process
- Lecture 13 - Representation of Surface Roughness
- Lecture 14 - Abrasive Jet Machining (AJM)
- Lecture 15 - Abrasive Water Jet Machining (AWJM)
- Lecture 16 - Ultrasonic Machining (USM)
- Lecture 17 - EDM, Wire-EDM, EDG, EDDG, AW-EDG
- Lecture 18 - Elastic Emission Machining
- Lecture 19 - PMEDM and ECD and ELID, ECH
- Lecture 20 - Abrasive Flow Finishing: Part 1
- Lecture 21 - Abrasive Flow Finishing: Part 2
- Lecture 22 - Magnetic Field Assisted Abrasive Finishing: MAF, MADe, MFP
- Lecture 23 - Magneto Rheological Finishing and BE-MRF
- Lecture 24 - Magnetic Field Assisted Abrasive Finishing: CNP, CMMRF, MRAFF, R-MRAFF
- Lecture 25 - Summary of the Course

Lecture 1 - Basic of Solid Mechanics

Lecture 2 - Energy Principles

Lecture 3 - Classification of Plate Theories and Some Basics

Lecture 4 - Tutorial: Transformation of Tensors

Lecture 5 - Governing Equation for Plate - 1

Lecture 6 - Governing Equation for Plate - 2

Lecture 7 - Tutorial: Reduced Stiffness and Plate Stiffness

Lecture 8 - Navier Solution + Levy solution

Lecture 9 - Levy Solution

Lecture 10 - Tutorial: Load Matrices Calculation

Lecture 11 - EKM and buckling of plates

Lecture 12 - 3D Solutions

Lecture 13 - Matlab Coding + ABAQUS

Lecture 14 - Tutorial: Levy Solutions

Lecture 1 - Introduction to measurement

Lecture 2 - Generalized measurement system and static characteristics

Lecture 3 - Uncertainties in measurement

Lecture 4 - Statistical treatment of random errors

Lecture 5 - System response to periodic inputs

Lecture 6 - Zeroth and first order systems

Lecture 7 - First and second order systems

Lecture 8 - Basics of digitization and number systems

Lecture 9 - Binary logic gates and binary codes

Lecture 10 - Analog-to-digital conversion

Lecture 11 - Digital-to-analog conversion

Lecture 12 - Electromagnetic indicators

Lecture 13 - Electronic amplifiers and filters

Lecture 14 - Resistive devices

Lecture 15 - Inductive, capacitive and optical devices

Lecture 16 - Piezoelectric and nozzle-flapper transducers

Lecture 17 - Resistive strain gages and associated circuitry

Lecture 18 - Strain gage rosettes and gage orientation

Lecture 19 - Elastic and strain gage load cells

Lecture 20 - Various load cells and dynamometers

Lecture 21 - Principles of manometry

Lecture 22 - Piezometer and elastic pressure transducer

Lecture 23 - Electric pressure transducer and high and low pressure measurement

Lecture 24 - Bernoulli's equation in obstruction meters

Lecture 25 - Obstruction meters and volume flowmeters

Lecture 26 - Mass flowmeters and velocity probes

Lecture 27 - Expansion-based devices

Lecture 28 - RTD, Thermistor and Thermocouple

Lecture 29 - Introduction to pyrometers

Lecture 30 - Basic seismic transducer

Lecture 31 - Vibro-, velo- and accelerometer

[Lecture 32 - Introduction to acoustic measurement](#)

[Lecture 33 - Radioactivity and its biological effects](#)

Lecture 1 - External and Internal combustion engines, Engine components, SI and CI engines

Lecture 2 - Four-stroke and Two-stroke engines, Comparison between SI and CI engines, and Four-stroke and Two-stroke engines

Lecture 3 - Classification of IC engines

Lecture 4 - Engine operating characteristics

Lecture 5 - Otto, Diesel and Dual cycles

Lecture 6 - Otto, Diesel and Dual cycles (Continued...)

Lecture 7 - Otto, Diesel and Dual cycles (Continued...)

Lecture 8 - Otto, Diesel and Dual cycles (Continued...)

Lecture 9 - Comparison between the cycles, Actual cycles and their analysis

Lecture 10 - Carburetor, Mixture requirements

Lecture 11 - Carburetor, Mixture requirements (Continued...)

Lecture 12 - Idling, cruising and power ranges

Lecture 13 - Idling, cruising and power ranges (Continued...)

Lecture 14 - Classification, types of nozzles, Ignition system, Battery and Magneto ignition systems

Lecture 15 - Classification, types of nozzles, Ignition system, Battery and Magneto ignition systems (Continued...)

Lecture 16 - Classification, types of nozzles, Ignition system, Battery and Magneto ignition systems (Continued...)

Lecture 17 - Engine friction, Lubrication systems, forces on piston

Lecture 18 - Lubricating oils, Thermochemistry and Fuels, Self-ignition

Lecture 19 - Octane and Cetane Numbers, Alternative Fuels - Methanol, Ethanol, hydrogen, Natural Gas

Lecture 20 - Octane and Cetane Numbers, Alternative Fuels - Methanol, Ethanol, hydrogen, Natural Gas (Continued...)

Lecture 21 - Combustion in SI and CI Engines, Pressure Crank Angle Diagram

Lecture 22 - Combustion in SI and CI Engines, Pressure Crank Angle Diagram (Continued...)

Lecture 23 - Combustion in SI and CI Engines, Pressure Crank Angle Diagram (Continued...)

Lecture 24 - SI engine injection system, Energy distribution, Engine temperatures, Heat transfer in combustion chambers

Lecture 25 - SI engine injection system, Energy distribution, Engine temperatures, Heat transfer in combustion chambers (Continued...)

Lecture 26 - CI engine injection systems, Air-cooled and liquid-cooled engines, Modern trends

Lecture 27 - CI engine injection systems, Air-cooled and liquid-cooled engines, Modern trends (Continued...)

Lecture 28 - CI engine injection systems, Air-cooled and liquid-cooled engines, Modern trends (Continued...)

Lecture 29 - Problems on IC engine

Lecture 30 - Turbomachines, Gas Turbine theory

Lecture 31 - Open Cycle Gas Turbine Power Plant, Twin Shaft Arrangement

- Lecture 32 - Closed Cycle, Multi-Spool Arrangement, Steam Power Plant
- Lecture 33 - Basic Thermodynamics
- Lecture 34 - Brayton Cycle: Introduction and General Relationships
- Lecture 35 - Brayton Cycle: Efficiency, Work Ratio and Optimum Work Output Condition
- Lecture 36 - Brayton Cycle with Heat Exchanger/Reheater
- Lecture 37 - Brayton Cycle with Intercooler
- Lecture 38 - Real Brayton Cycle, Solved Example for Ideal Cycle
- Lecture 39 - Solved Examples for Real Brayton Cycle
- Lecture 40 - Introduction and Performance Parameters of Propulsion System
- Lecture 41 - Basics of Various Aircraft Engine
- Lecture 42 - Euler Turbomachinery Equation
- Lecture 43 - Introduction and Flow Analysis of Centrifugal Compressors
- Lecture 44 - Thermodynamics Analysis of Centrifugal Compressors
- Lecture 45 - Axial Compressor: Basics, Velocity triangles, T-S diagram and Work Interaction
- Lecture 46 - Axial Compressor: Different factors, Degree of Reaction and Free Vortex Condition
- Lecture 47 - Complete Analysis of Axial Flow Gas Turbine
- Lecture 48 - Solved Examples for Axial Compressors, Centrifugal Compressors and Turbine
- Lecture 49 - Radial Flow Turbine, Solved Example of Free vortex Condition
- Lecture 50 - Nozzles and Diffusers: Introduction, Intake efficiency, Nozzle efficiency

Lecture 1 - Introduction of welding

Lecture 2 - Classification of welding and joints

Lecture 3 - Parts of weld joint

Lecture 4 - Welding Symbol

Lecture 5 - welding power source - 1

Lecture 6 - Welding power source - 2

Lecture 7 - Welding Power sources characteristics - 1

Lecture 8 - Welding Power sources characteristics - 2

Lecture 9 - Physics of welding - 1

Lecture 10 - Physics of welding - 2

Lecture 11 - Physics of welding - 4 (Arc Stability and Arc Blow)

Lecture 12 - Physics of welding - 3

Lecture 13 - Physics of welding - 5 (Metal Transfer-1)

Lecture 14 - Physics of welding - 6 (Metal Transfer-2)

Lecture 15 - Physics of welding - 7 (Metal Transfer-3)

Lecture 16 - Physics of welding - 8 (Metal Transfer-4)

Lecture 17 - Physics of welding - 9 (Metal Transfer-5)

Lecture 18 - Physics of welding - 10 (Metalting Efficiency)

Lecture 19 - Oxy-Fuel Gas Welding

Lecture 20 - Shielded Metal Arc Welding

Lecture 21 - Gas Tungsten Arc Welding

Lecture 22 - Gas Metal Arc Welding

Lecture 23 - Submerged Arc Welding

Lecture 24 - Welding Defects and Inspection

Lecture 1 - Introduction to Polymer Assisted Abrasive Finishing Processes

Lecture 2 - Surface Integrity and Surface roughness representation - Part I

Lecture 3 - Surface Integrity and Surface roughness representation - Part II

Lecture 4 - Introduction to Grinding and Polymer assisted Grinding Wheels

Lecture 5 - Polymer medium for vibratory bowl finishing, Tumbling, Drag finishing

Lecture 6 - Polymer Pad and Chemo-mechanical Polishing

Lecture 7 - Elastic Emission Machining

Lecture 8 - Hydrodynamic Polishing, Elasto Abrasive Finishing

Lecture 9 - Abrasive Flow Machining and Finishing - Part I

Lecture 10 - Abrasive Flow Machining and Finishing - Part II

Lecture 11 - Advances in Abrasive Flow Finishing: DBGAFF, CFAAFM

Lecture 12 - Advances in Abrasive Flow Finishing: Spiral Polishing, R-AFF

Lecture 13 - AFF Processes: Magnetio AFF (MRAFF), UAA-AFF, EC-AFF

Lecture 14 - Finishing of Biomedical implants (Micro AFF: Micro holes, Micro slots, Bio Implants: Knee implants , Hip implants and Applications of one way, two way and orbital AFF)

Lecture 15 - Summary of the Course

- Lecture 1 - Materials and manufacturing Processes - 1
- Lecture 2 - Materials and manufacturing Processes - 2
- Lecture 3 - Physics based modeling approach at different scale
- Lecture 4 - Evaluation of properties and process modelling
- Lecture 5 - Thermofluid and electromagnetic analysis
- Lecture 6 - Solid-state deformation and residual stress - 1
- Lecture 7 - Solid-state deformation and residual stress - 2
- Lecture 8 - Melting, solidification and additive manufacturing
- Lecture 9 - Force and velocity diagram - 1
- Lecture 10 - Force and velocity diagram - 2
- Lecture 11 - Heat transfer analysis
- Lecture 12 - Principal and mechanism at different processes - 1
- Lecture 13 - Principal and mechanism at different processes - 2
- Lecture 14 - Mechanics of bulk metal forming
- Lecture 15 - Mechanics of sheet metal forming - 1
- Lecture 16 - Mechanics of sheet metal forming - 2
- Lecture 17 - Heat transfer and thermomechanical processing
- Lecture 18 - Fusion welding processes - 1
- Lecture 19 - Fusion welding processes - 2
- Lecture 20 - Physics of welding and metal transfer
- Lecture 21 - Heat source model in fusion welding
- Lecture 22 - Heat transfer and material flow
- Lecture 23 - Solidification in welding - 1
- Lecture 24 - Solidification in welding - 2
- Lecture 25 - Solid state welding - 1
- Lecture 26 - Solid state welding - 2
- Lecture 27 - Hybrid welding, residual stress and distortion
- Lecture 28 - Cooling and solidification at different casting processes
- Lecture 29 - Powder metallurgy
- Lecture 30 - Principle of surface and coating technologies
- Lecture 31 - Principle and development of additive manufacturing technologies - 1

[Lecture 32 - Principle and development of additive manufacturing technologies - 2](#)

[Lecture 33 - Fundamentals of heat treatment](#)

[Lecture 34 - Evaluation of microstructural properties and residual stress](#)

[Lecture 35 - Down-scaling of conventional manufacturing processes and Micro-to-nano manufacturing](#)

[Lecture 36 - Packaging, micro-finishing and micro-manufacturing processes](#)

[Lecture 37 - Processing and shaping of non-metals and bio-materials](#)

[Lecture 38 - Principle of glass and ceramics processing and their shaping](#)

[Lecture 1 - Introduction and Notation](#)

[Lecture 2 - Flow Regimes and Flow Regime Maps](#)

[Lecture 3 - The Homogeneous Model](#)

[Lecture 4 - The Separated Flow Model](#)

[Lecture 5 - The Separated Flow Model \(Continued...\)](#)

[Lecture 6 - The Drift Flux Model](#)

[Lecture 7 - Estimation of pressure drop in two phase flow](#)

[Lecture 8 - Two phase flow and pressure drop in miniature channels](#)

- Lecture 1 - Overview of thermodynamic system and state
- Lecture 2 - First and second laws of thermodynamics
- Lecture 3 - Concept of entropy and entropy generation
- Lecture 4 - Concept of exergy and exergy destruction
- Lecture 5 - Thermodynamic potentials and Maxwell relations
- Lecture 6 - Generalized relations for entropy and specific heats
- Lecture 7 - Joule-Thomson coefficient and Clapeyron equation
- Lecture 8 - Liquid-vapor phase-change process
- Lecture 9 - Use of property tables
- Lecture 10 - Equations-of-state and Compressibility factor
- Lecture 11 - Ideal cycles for reciprocating engines
- Lecture 12 - Otto, Diesel and Dual combustion cycles
- Lecture 13 - Stirling and Ericsson cycles
- Lecture 14 - Fuel-air cycle
- Lecture 15 - Numerical exercise on Fuel-air cycles
- Lecture 16 - Losses in actual cycle and valve-timing diagram
- Lecture 17 - Ideal Brayton cycle
- Lecture 18 - Intercooling and reheating in Brayton cycle
- Lecture 19 - Regeneration in Brayton cycle
- Lecture 20 - Ideal Rankine cycle
- Lecture 21 - Improvements and modifications in Rankine cycle
- Lecture 22 - Regenerative Rankine cycle
- Lecture 23 - Binary vapor power cycle
- Lecture 24 - Combined gas-steam power plant
- Lecture 25 - Different arrangements in combined cycles
- Lecture 26 - Vapor compression refrigeration cycle
- Lecture 27 - SSS cycles and refrigerants
- Lecture 28 - Modifications in VCR systems
- Lecture 29 - Vapor absorption refrigeration cycle
- Lecture 30 - P-v-T behavior of gas mixtures
- Lecture 31 - Numerical examples

[Lecture 32 - Properties of moist air](#)

[Lecture 33 - Psychrometric chart and various psychrometric processes](#)

[Lecture 34 - Sensible heat factor and bypass factor](#)

[Lecture 35 - Theoretical and actual combustion process](#)

[Lecture 36 - Thermodynamic analyses of reacting systems](#)

Lecture 1 - Relationship of Thermodynamics with Heat transfer

Lecture 2 - Modes of heat transfer

Lecture 3 - Fourier's law and thermal conductivity

Lecture 4 - Generalized heat diffusion equation

Lecture 5 - Heat diffusion equation in curvilinear coordinates

Lecture 6 - Concept of thermal resistance

Lecture 7 - Use of network of resistances in wall and cylinder

Lecture 8 - Critical thickness of insulation

Lecture 9 - Conduction with energy generation - I

Lecture 10 - Conduction with energy generation - II

Lecture 11 - General Heat Transfer Analysis

Lecture 12 - Fins with uniform cross-section area - I

Lecture 13 - Fins with uniform cross-section area - II

Lecture 14 - Fins with non-uniform cross-section area

Lecture 15 - Method of Separation of Variables

Lecture 16 - Graphical approach

Lecture 17 - Method of Superposition

Lecture 18 - Lumped capacitance approach - I

Lecture 19 - Lumped capacitance approach - II

Lecture 20 - Semi-infinite Solid

Lecture 21 - Steady Heat Conduction

Lecture 22 - Unsteady Heat Conduction

Lecture 23 - Problem solving using Energy Balance Method

Lecture 24 - Introduction to radiative heat fluxes

Lecture 25 - Spectral and directional definitions

Lecture 26 - Blackbody radiation

Lecture 27 - Emissivity

Lecture 28 - Irradiation of real surfaces

Lecture 29 - View factor

Lecture 30 - Blackbody radiation exchange

Lecture 31 - Radiation networks

[Lecture 32 - Gas radiation](#)

[Lecture 33 - Radiative Transfer Equation](#)

Lecture 1 - Review of thermodynamics

Lecture 2 - Rankine cycle

Lecture 3 - Performance estimation of steam power cycles

Lecture 4 - Carnot cycle examples

Lecture 5 - Rankine cycle with superheat

Lecture 6 - Rankine cycle with reheat theory and example

Lecture 7 - Examples of Rankine cycle

Lecture 8 - Examples of reheat Rankine cycle

Lecture 9 - Rankine cycle with regeneration

Lecture 10 - Feedwater heaters

Lecture 11 - Cogeneration of power and process heat

Lecture 12 - Examples of regeneration

Lecture 13 - Examples of regenerative Rankine cycle

Lecture 14 - Binary/multi-fluid cycles

Lecture 15 - Low temperature power cycles

Lecture 16 - Examples of binary cycles

Lecture 17 - Types of boilers

Lecture 18 - Boiler accessories

Lecture 19 - Practice examples

Lecture 20 - Stagnation conditions and Nozzle flow

Lecture 21 - Nozzle flow

Lecture 22 - Examples of Nozzle

Lecture 23 - Impulse Turbine - 1

Lecture 24 - Impulse Turbine - 2

Lecture 25 - Examples on Impulse Turbine

Lecture 26 - Reaction Turbine

Lecture 27 - Reheat Factor

Lecture 28 - Examples on Turbine - 1

Lecture 29 - Examples on Turbine - 2

Lecture 30 - Gas Mixture

Lecture 31 - Psychrometry - 1

[Lecture 32 - Psychrometry - 2](#)

[Lecture 33 - Condensers](#)

- Lecture 1 - Introduction to Dynamic Behaviour of Materials - I
- Lecture 2 - Introduction to Dynamic Behaviour of Materials - II
- Lecture 3 - Introduction to Waves
- Lecture 4 - Quasi-static vs Dynamic Deformation
- Lecture 5 - Elastic Wave and its Classification
- Lecture 6 - Propagation of Elastic Waves in Continuum
- Lecture 7 - Wave Reflection, Refraction and Interaction
- Lecture 8 - General Solution of Elastic Wave Equation
- Lecture 9 - Additional Considerations of Elastic Wave in Cylindrical Bar
- Lecture 10 - Introduction to Plastic Waves
- Lecture 11 - Plastic Waves of Uniaxial Stress
- Lecture 12 - Plastic Waves of Combined Stress
- Lecture 13 - Taylor's Experiment for Plastic Wave Propagation - 1
- Lecture 14 - Taylor's Experiment for Plastic Wave Propagation - 2
- Lecture 15 - Taylor's Experiment: Wilkins-Guinan Analysis
- Lecture 16 - Introduction to Shock Waves - I
- Lecture 17 - Introduction to Shock Waves - II
- Lecture 18 - Shock Wave: Rankine Hugoniot Treatment
- Lecture 19 - Rankine Hugoniot Treatment and Shock Wave under Impact
- Lecture 20 - Shock Wave under Impact
- Lecture 21 - Equations of States (Shock Waves) : Experimental Methods
- Lecture 22 - Equations of States (Shock Waves) : Theoretical Calculations
- Lecture 23 - Complex Problems of Shock Waves and Temperature Rise under Shock Wave
- Lecture 24 - Shock Wave Attenuation, Interaction and Reflection - I
- Lecture 25 - Shock Wave Attenuation, Interaction and Reflection - II
- Lecture 26 - Shock Wave Interaction and Reflection
- Lecture 27 - Fundamentals of Materials Science and Engineering
- Lecture 28 - Shock Wave Induced Phase Transformations - 1
- Lecture 29 - Shock Wave Induced Phase Transformations - 2
- Lecture 30 - Shock Wave Induced Phase Transformations - 3
- Lecture 31 - Shock Wave Induced Phase Transformations - 4

[Lecture 32 - Experimental Techniques for Dynamic Deformation - 1](#)

[Lecture 33 - Experimental Techniques for Dynamic Deformation - 2](#)

[Lecture 34 - Plastic Deformation at High Strain Rates - 1](#)

[Lecture 35 - Plastic Deformation at High Strain Rates - 2](#)

[Lecture 36 - Plastic Deformation at High Strain Rates - 3](#)

[Lecture 37 - Plastic Deformation at High Strain Rates - 4](#)

[Lecture 38 - Plastic Deformation at High Strain Rates - 5](#)

[Lecture 39 - Plastic Deformation Under Shock Waves - 1](#)

[Lecture 40 - Plastic Deformation Under Shock Waves - 2](#)

[Lecture 41 - Plastic Deformation Under Shock Waves - 3](#)

[Lecture 42 - Shear Band - 1](#)

[Lecture 43 - Shear Band - 2](#)

[Lecture 44 - Dynamic Fracture - 1](#)

[Lecture 45 - Dynamic Fracture - 2](#)

Lecture 1 - Introduction to Plastic Working of Metals

Lecture 2 - Uniaxial Tension Test Analysis

Lecture 3 - Temperature effects in metal forming

Lecture 4 - Friction and Lubrication

Lecture 5 - Friction and Lubrication (Continued...)

Lecture 6 - Deformation zone + worked examples

Lecture 7 - Stresses at point and Theory of Plasticity

Lecture 8 - Slab Analysis

Lecture 9 - Slip Line Field Theory - Part 1

Lecture 10 - Slip Line Field Theory - Part 2

Lecture 11 - Upper Bound Theorem

Lecture 12 - Plasticity equations

Lecture 13 - Forging

Lecture 14 - Analysis of Forging

Lecture 15 - Analysis of Forging (Continued...)

Lecture 16 - Forging Die Design consideration

Lecture 17 - Forging Load

Lecture 18 - Rolling of Metals

Lecture 19 - Analysis of Rolling

Lecture 20 - Analysis of Rolling (Continued...)

Lecture 21 - Strain rate in the deformation zone

Lecture 22 - Rolling mills

Lecture 23 - Prblem on rolling

Lecture 24 - Drawing of Rods, Wires and Tubes

Lecture 25 - Drawing of Rods, Wires and Tubes (Continued...)

Lecture 26 - Analysis of Wire Drawing

Lecture 27 - Wire Drawing: Tutorial Problems

Lecture 28 - Extrusion Process

Lecture 29 - Analysis of Extrusion

Lecture 30 - Introduction

Lecture 31 - Sheet deformation process

[Lecture 32 - Deformation of sheet in plane stress](#)

[Lecture 33 - Analysis of stamping](#)

[Lecture 34 - Instability in sheet metal forming](#)

[Lecture 35 - Deep drawing](#)

[Lecture 36 - Hydroforming](#)

Lecture 1 - Introduction to Artificial Intelligence

Lecture 2 - Problem Solving as State Space Search

Lecture 3 - Uninformed Search

Lecture 4 - Heuristic Search

Lecture 5 - Informed Search

Lecture 6 - Constraint Satisfaction Problems

Lecture 7 - Searching AND/OR Graphs

Lecture 8 - Game Playing

Lecture 9 - Minimax + Alpha-Beta

Lecture 10 - Introduction to Knowledge Representation

Lecture 11 - Propositional Logic

Lecture 12 - First Order Logic - I

Lecture 13 - First Order Logic - II

Lecture 14 - Inference in First Order Logic - I

Lecture 15 - Inference in First Order Logic - II

Lecture 16 - Answer Extraction

Lecture 17 - Procedural Control of Reasoning

Lecture 18 - Reasoning under Uncertainty

Lecture 19 - Bayesian Network

Lecture 20 - Decision Network

Lecture 21 - Introduction to Planning

Lecture 22 - Plan Space Planning

Lecture 23 - Planning Graph and GraphPlan

Lecture 24 - Practical Planning and Acting

Lecture 25 - Sequential Decision Problems

Lecture 26 - Making Complex Decisions

Lecture 27 - Introduction to Machine Learning

Lecture 28 - Learning Decision Trees

Lecture 29 - Linear Regression

Lecture 30 - Support Vector Machines

Lecture 31 - Unsupervised Learning

[Lecture 32 - Reinforcement Learning](#)

[Lecture 33 - Learning in Neural Networks](#)

[Lecture 34 - Deep Learning: A Brief Overview](#)

Lecture 1 - Overview of Basic Thermodynamics

Lecture 2 - Solved Examples for Flow process

Lecture 3 - Turbomachines: Introduction, Classification, Types

Lecture 4 - Components of Gas Turbine Power Plant, Gas Turbine Attachments

Lecture 5 - Introduction to Various Aircraft engines, Engine Performance parameters

Lecture 6 - Air Standard Ideal Brayton Cycle

Lecture 7 - Examples for Ideal Brayton Cycle

Lecture 8 - Non-Ideal Brayton Cycle

Lecture 9 - Examples for Non-Ideal Brayton Cycle

Lecture 10 - Brayton Cycle with Heat Exchanger / Re-heater

Lecture 11 - Brayton Cycle with Intercooler / All Attachments

Lecture 12 - Examples of Gas Turbine Attachment

Lecture 13 - Examples of Gas Turbine Attachment

Lecture 14 - Stagnation Conditions, Real Brayton Cycle with Stagnation Conditions

Lecture 15 - Polytropic Efficiency of Compressor and Turbine

Lecture 16 - Examples of Real Cycle

Lecture 17 - Nozzle Flow: Isentropic Relations, Area Velocity Relation, Choked Mass Flow Rate

Lecture 18 - Aircraft Engine Intake, Intake Efficiency

Lecture 19 - Propelling Nozzle, Nozzle Efficiency

Lecture 20 - Turbojet engine: Configuration and Examples

Lecture 21 - Turbofan engine: Configuration and Examples

Lecture 22 - Ramjet engine: Parameters and losses

Lecture 23 - Examples of Ramjet Engine

Lecture 24 - Thrust Augmentation and Engine performance parameters for Aircrafts

Lecture 25 - Introduction to Turbomachinery

Lecture 26 - Centrifugal Compressor: Velocity diagrams, Workdone

Lecture 27 - Centrifugal Compressor: Thermodynamic analysis, Stage efficiency and Degree of reaction

Lecture 28 - Examples of Centrifugal compressor

Lecture 29 - Axial Flow Compressor: Velocity diagrams, Workdone and Degree of Reaction

Lecture 30 - Axial Flow Compressor: Free vortex Condition

Lecture 31 - Examples of Axial Flow Compressor

[Lecture 32 - Examples of Axial Flow Compressor](#)

[Lecture 33 - Examples of Axial Flow Compressor](#)

[Lecture 34 - Axial Turbine: Velocity diagrams, Workdone, and Degree of Reaction](#)

[Lecture 35 - Radial Turbine: Velocity diagrams, h-s diagram, Stage efficiency and degree of reaction](#)

[Lecture 36 - Examples of Axial Turbine](#)

[Lecture 37 - Practice examples of Axial Turbine and centrifugal compressor](#)

[Lecture 38 - Cascade theory and Blade design](#)

[Lecture 39 - Cascade variables and Turbine Cascade](#)

[Lecture 40 - Velocity diagrams of Turbine Cascade, Compressor cascade](#)

[Lecture 41 - Turbine cooling methods](#)

[Lecture 42 - Practice examples of aircraft engine](#)

Lecture 1 - Applications of CFD

Lecture 2 - Basic equations of fluid dynamics and heat transfer

Lecture 3 - Initial and boundary conditions

Lecture 4 - Physical Classification, System of first-order PDEs

Lecture 5 - System of second-order PDEs

Lecture 6 - Finite difference by Taylor series expansion

Lecture 7 - Finite difference by general approximation and polynomials

Lecture 8 - Finite difference in non-uniform grid

Lecture 9 - Types of error and accuracy of FD solutions

Lecture 10 - Finite difference formulations of Elliptic Equations with boundary condition treatment

Lecture 11 - Iterative Methods

Lecture 12 - Applications

Lecture 13 - Linear Solvers

Lecture 14 - Finite difference formulations of Parabolic Equations

Lecture 15 - Finite difference formulations of Parabolic Equations: Implicit Methods

Lecture 16 - Finite difference formulations of Parabolic Equations: Unsteady Two-Dimensional Equation

Lecture 17 - Finite difference formulations of Parabolic Equations: Unsteady Three-Dimensional Equation

Lecture 18 - Finite difference formulations of the first order wave equation: Explicit Method

Lecture 19 - Finite difference formulations of the first order wave equation: Implicit Method

Lecture 20 - Von Neumann stability analysis of different schemes for Parabolic equations

Lecture 21 - Von Neumann stability analysis of different schemes for Parabolic equations

Lecture 22 - Von Neumann stability analysis of different schemes for Hyperbolic equations

Lecture 23 - Modified equation, Artificial viscosity, Numerical diffusion

Lecture 24 - Discretization vorticity-stream function equations using FDM

Lecture 25 - Boundary conditions for flow problems

Lecture 26 - Solutions of vorticity-stream function equations

Lecture 27 - Solution of Navier-Stokes Equation using FDM

Lecture 28 - Solution of Navier-Stokes Equation using FDM (Continued...)

Lecture 29 - Introduction to finite volume method

Lecture 30 - Finite volume discretization of steady diffusion equation

Lecture 31 - Finite volume discretization of unsteady diffusion equation

[Lecture 32 - Finite volume discretization of steady convection-diffusion equation](#)

[Lecture 33 - Finite volume discretization of unsteady convection-diffusion equation](#)

[Lecture 34 - Convection Schemes](#)

[Lecture 35 - Solution of Navier-Stokes Equations using FVM - I](#)

[Lecture 36 - Solution of Navier-Stokes Equations using FVM - II](#)

[Lecture 37 - Boundary Conditions](#)

Lecture 1 - Basic concepts, Calibration

Lecture 2 - Dimensions, Units, Standards, Systems of dimensions, System of units, Unit conversion table

Lecture 3 - Basic concept of dynamic measurements

Lecture 4 - Basic concept of dynamic measurements (Continued...)

Lecture 5 - Basic concept of dynamic measurements (Continued...)

Lecture 6 - System response and distortion, Impedence matching

Lecture 7 - Dimensional measurement Gauge blocks, The pneumatic displacement gauge

Lecture 8 - Dimensional measurement Gauge blocks, The pneumatic displacement gauge

Lecture 9 - Pressure Measurements: Definition of pressure and Dynamic response considerations

Lecture 10 - Mechanical pressure measurement devices, U-tube manometer, The inclined well type manometer

Lecture 11 - The aneroid barometer, Diaphragm and Bellows Gauges

Lecture 12 - The Mcleod gauge, The Pirani gauge, The Ionization gauge

Lecture 13 - The Mcleod gauge, The Pirani gauge, The Ionization gauge (Continued...)

Lecture 14 - The Mcleod gauge, The Pirani gauge, The Ionization gauge (Continued...)

Lecture 15 - Pressure measurement using 3 holes/probes

Lecture 16 - Pressure measurement using 3 holes/probes (Continued...)

Lecture 17 - Flow obstruction flow rate measurement(venturimeter/orificemeter), the Rotameter

Lecture 18 - Flow obstruction flow rate measurement(venturimeter/orificemeter), the Rotameter (Continued...)

Lecture 19 - Thermal Anemometry(hot wire/hot film), Hot wire anemometer

Lecture 20 - Thermal Anemometry(hot wire/hot film), Hot wire anemometer (Continued...)

Lecture 21 - Laser Doppler anemometry

Lecture 22 - Measurement of velocity components by 3 holes and 4 holes probes

Lecture 23 - Ideal gas thermometer, Temperature measurement by mechanical and electrical effects

Lecture 24 - Ideal gas thermometer, Temperature measurement by mechanical and electrical effects (Continued...)

Lecture 25 - Thermostatic temperature, Resistance Temperature Detectors (RTD), Thermistors, Thermocouples

Lecture 26 - Temperature measurement by Radiation, The optical pyrometer

Lecture 27 - Transient response of thermal system, Thermocouple compensation, high speed flow

Lecture 28 - Transient response of thermal system, Thermocouple compensation, high speed flow (Continued...)

Lecture 29 - Transient response of thermal system, Thermocouple compensation, high speed flow (Continued...)

Lecture 30 - Constant temperature hot-wire anemometer, LDA

Lecture 31 - Use of PIV

[Lecture 32 - Use of PIV \(Continued...\)](#)

[Lecture 33 - Use of PIV \(Continued...\)](#)

[Lecture 34 - Measurement of pitch angle](#)

[Lecture 35 - Measurement of torque by dynamometers, strain gauge, transducers](#)

[Lecture 36 - Measurement of microscale flow features - I](#)

[Lecture 37 - Measurement of microscale flow features - II](#)

[Lecture 38 - Transient and Frequency response consideration](#)

[Lecture 39 - Examples](#)

[Lecture 40 - Analysis of experimental data, causes and types of experimental errors](#)

[Lecture 41 - Rejection of data: Chauvenets Criterion with example](#)

[Lecture 42 - Error propagation: function of two variables, several variables](#)

[Lecture 43 - The Method of Least square with example](#)

Lecture 1 - Basic concepts

Lecture 2 - Mechatronics

Lecture 3 - Mechatronics based systems

Lecture 4 - Automated systems and equipment used in manufacturing - Part I

Lecture 5 - Automated systems and equipment used in manufacturing - Part II

Lecture 6 - Selection of electrical and electronics components for mechatronics based systems

Lecture 7 - Terms related to performance of electro-mechanical systems

Lecture 8 - Computer aided design of components

Lecture 9 - Fabrication Processes

Lecture 10 - Measurement system and potentiometer sensors

Lecture 11 - Displacement, position and proximity sensors - I

Lecture 12 - Displacement, position and proximity sensors - II

Lecture 13 - Fluid flow, pressure, and temperature measurement

Lecture 14 - Signal Conditioning: amplification, filtering

Lecture 15 - Pulse modulation, Protection devices, and Wheatstone bridge

Lecture 16 - Signal conversion

Lecture 17 - Microprocessor Technology

Lecture 18 - Introduction to Microprocessor Programming

Lecture 19 - Application of electric drives in automation

Lecture 20 - DC and AC motors

Lecture 21 - Stepper motor and servo motor

Lecture 22 - Types of industrial automation and mechanisms

Lecture 23 - Ball screw based linear motion drives

Lecture 24 - Application of cams in automation

Lecture 25 - Application of indexing mechanisms in automation

Lecture 26 - Application of tool magazines in automation

Lecture 27 - Material handling systems

Lecture 28 - Fundamental concepts

Lecture 29 - Hydraulic pumps

Lecture 30 - Direction control valves

Lecture 31 - Flow control and pressure relief valves

[Lecture 32 - Graphical representation of hydraulic system elements](#)

[Lecture 33 - Basic concepts and air compressors](#)

[Lecture 34 - Air treatment and pressure regulation](#)

[Lecture 35 - Graphical representation and pneumatic circuits](#)

[Lecture 36 - Computer aided manufacturing and process planning](#)

[Lecture 37 - CNC machines and interpolation](#)

[Lecture 38 - CNC Programming](#)

- Lecture 1 - Review Concepts of Fluid Mechanics and Thermodynamics - I
- Lecture 2 - Review Concepts of Fluid Mechanics and Thermodynamics - II
- Lecture 3 - Review Concepts of Fluid Mechanics and Thermodynamics - III
- Lecture 4 - Wave Propagation in Compressible Medium - I
- Lecture 5 - Wave Propagation in Compressible Medium - II
- Lecture 6 - Wave Propagation in Compressible Medium - III
- Lecture 7 - Quasi-One Dimensional Isentropic Flow - I
- Lecture 8 - Quasi-One Dimensional Isentropic Flow - II
- Lecture 9 - Quasi-One Dimensional Isentropic Flow - III
- Lecture 10 - Normal Shock Waves - I
- Lecture 11 - Normal Shock Waves - II
- Lecture 12 - Normal Shock Waves - III
- Lecture 13 - Normal Shock Waves - IV
- Lecture 14 - Expansion Waves and Oblique Shocks - I
- Lecture 15 - Expansion Waves and Oblique Shocks - II
- Lecture 16 - Expansion Waves and Oblique Shocks - III
- Lecture 17 - Expansion Waves and Oblique Shocks - IV
- Lecture 18 - Expansion Waves and Oblique Shocks - V
- Lecture 19 - Expansion Waves and Oblique Shocks - VI
- Lecture 20 - Supersonic Nozzles and Diffusers - I
- Lecture 21 - Supersonic Nozzles and Diffusers - II
- Lecture 22 - Supersonic Nozzles and Diffusers - III
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- Lecture 24 - Reaction Mechanisms - Part I
- Lecture 25 - Reaction Mechanisms - Part II
- Lecture 26 - Chemical and Thermal Analysis of Reacting Systems
- Lecture 27 - Simplified Conservation Equations for Reacting Flows
- Lecture 28 - Laminar Premixed Flame - Part I
- Lecture 29 - Laminar Premixed Flame - Part II
- Lecture 30 - Laminar Diffusion Flame
- Lecture 31 - Droplet Evaporation and Turbulent Flame

Lecture 32 - Engine Combustion and Pollution

- Lecture 1 - First law of Thermodynamics for control mass and control volume systems
- Lecture 2 - First law of Thermodynamics for control volume system (Flow system)
- Lecture 3 - Steady State Steady Flow Processes, combination of First and Second Laws
- Lecture 4 - Second Law of Thermodynamics: A Brief Review
- Lecture 5 - Combined First and Second Laws Applied to Processes
- Lecture 6 - Combined First and Second Laws: Flow and Non-Flow Processes
- Lecture 7 - Description of Steam Power Plant: Application of 1st and 2nd Laws to Different Processes
- Lecture 8 - Second Law Applied to Processes of Power Plant and Ideal Cycle of Power Plant
- Lecture 9 - Steam Power Plant: Thermodynamic aspects, Efficiency, Work ratio and Ideal Cycle
- Lecture 10 - Ideal Power Cycle and its Limitations, Introduction to Actual Power Cycle
- Lecture 11 - Limitations of Carnot Cycle, Simple Rankine Cycle and Analysis
- Lecture 12 - Analysis of Simple Rankine Cycle and its Design Modifications
- Lecture 13 - Reheat Cycle and Analysis
- Lecture 14 - Reheat Cycle and Analysis (Continued...)
- Lecture 15 - Regenerative Principle of Steam Power Cycles
- Lecture 16 - Analysis of Regenerative Steam Power Cycles
- Lecture 17 - Regenerative Steam Power Cycle with Closed Feed-Water Heater, Ideal Working Fluid
- Lecture 18 - Multi-fluid Cycle and Analysis
- Lecture 19 - Analysis of Multi-fluid Cycle; Second Law Analysis of Steam Power Cycle
- Lecture 20 - Problems of Steam Power Cycle
- Lecture 21 - Problems of Steam Power Cycle (Continued...)
- Lecture 22 - Types of Boiler, Different Cycles in Boiler Operation, Boiler attachment
- Lecture 23 - Cochran Boiler Operation, Boiler attachment
- Lecture 24 - Boiler Attachments
- Lecture 25 - Superheaters and their Arrangements, Steam Temperature Control
- Lecture 26 - Characteristics of Convective and Radiant Superheaters; Steam Temperature Control
- Lecture 27 - Problems on Boiler/Steam Generator
- Lecture 28 - Use of nozzles in steam power plant, flow analysis of steam in nozzle
- Lecture 29 - Flow analysis of steam in nozzle: Mass flow rate
- Lecture 30 - Mass flow rate of steam in nozzle, Critical Pressure Ratio
- Lecture 31 - Critical Pressure Ratio and its Physical Significance

- Lecture 32 - Nozzle efficiency and factors that affect the efficiency
- Lecture 33 - Factors that affect the efficiency, problem on flow nozzle
- Lecture 34 - Problem on flow nozzle
- Lecture 35 - Steam Turbines: types and analysis using velocity triangles
- Lecture 36 - Analysis of Impulse Steam Turbine
- Lecture 37 - Compounding of Steam Turbine
- Lecture 38 - Analysis of Reaction Steam Turbine
- Lecture 39 - Problems on Steam Turbine
- Lecture 40 - The Role of Condenser in Power Plant
- Lecture 41 - Cooling Tower: Types and Analysis
- Lecture 42 - Cooling Tower Performance
- Lecture 43 - IC Engines, Classification, Different Parts, SI and CI Engines
- Lecture 44 - Comparison of 2-stroke and 4-stroke Engines
- Lecture 45 - Comparison of SI and CI Engines, Compression Ratio
- Lecture 46 - Introduction to Carburettor and Regimes of Engine Operation
- Lecture 47 - Regimes of Engine Operation and Simple Float Type Carburettor
- Lecture 48 - Simple Float Type Carburettor and its Analysis
- Lecture 49 - Mass Flow Rate of Fuel and limitations of Simple Float Type Carburettor
- Lecture 50 - Limitations of Simple Float Type Carburettor, Problem on Carburettion
- Lecture 51 - Engine Operating Characteristics: MEP and Indicator diagram
- Lecture 52 - Performance Analysis parameters of IC Engine
- Lecture 53 - Fuel of IC Engines
- Lecture 54 - Alternative Fuels and Self Ignition Characteristics of Fuel: Octane Number, Cetane Number
- Lecture 55 - Thermodynamic Analysis of SI Engine
- Lecture 56 - Thermodynamic Analysis of CI Engine
- Lecture 57 - Numerical Problems on Engine Performance
- Lecture 58 - Pressure-Crank angle diagram, Engine Efficiencies
- Lecture 59 - Numerical Problems on SI and CI Engines
- Lecture 60 - Vapour Compression Refrigeration Cycle and its analysis
- Lecture 61 - Problems on Vapour Compression Refrigeration Cycle
- Lecture 62 - Gas Turbine Units and Thermodynamic Cycles
- Lecture 63 - Gas Compressor and Optimum Pressure Ratio
- Lecture 64 - Compressor Efficiency and Multistage Compression with Intercooling

[Lecture 65 - Gas Turbine Unit: Combined Cycle](#)

[Lecture 66 - Problems On Gas Turbine Cycle](#)

Lecture 1 - Introduction to sheet forming and tensile test of sheets

Lecture 2 - Tensile test, effect of properties, exercise problem

Lecture 3 - Sheet deformation processes

Lecture 4 - Sheet deformation processes (Continued...)

Lecture 5 - Sheet deformation processes (Continued...)

Lecture 6 - Sheet deformation in plane stress

Lecture 7 - Sheet deformation in plane stress (Continued...)

Lecture 8 - Stamping analyses

Lecture 9 - Load instability and tearing

Lecture 10 - Load instability and tearing

Lecture 11 - Formability testing of sheet metals

Lecture 12 - Sheet formability

Lecture 13 - Sheet formability (Continued...)

Lecture 14 - Bending of sheets

Lecture 15 - Bending of sheets (Continued...)

Lecture 16 - Cup deep drawing

Lecture 17 - Deep drawing, redrawing, ironing of cup

Lecture 18 - Stretching of sheet

Lecture 19 - Hydroforming

Lecture 20 - Yield functions with sheet anisotropy

Lecture 21 - Demonstration of sheet forming experiments

Lecture 1 - Thermodynamics Concepts - Part I

Lecture 2 - Thermodynamics Concepts - Part II

Lecture 3 - Thermodynamic Analysis of Vapor Power Cycle

Lecture 4 - Rankine Cycle

Lecture 5 - Modified Rankine Cycle

Lecture 6 - Exergy Analysis of Vapor Power Cycles

Lecture 7 - Rotodynamic Machines

Lecture 8 - Impulse Turbine

Lecture 9 - Reaction Turbine

Lecture 10 - Performance Analysis of Steam Turbines

Lecture 11 - Steam Nozzles - Part I

Lecture 12 - Steam Nozzles - Part II

Lecture 13 - Steam Generator

Lecture 14 - Water Tube Boiler - Part I

Lecture 15 - Water Tube Boiler - Part II

Lecture 16 - Fuels and Combustion - Part I

Lecture 17 - Fuels and Combustion - Part II

Lecture 18 - Steam Condenser

Lecture 19 - Feed Water Heaters

Lecture 20 - Cooling Towers

Lecture 21 - Fundamentals of Gas turbine systems

Lecture 22 - Modifications of Brayton cycle

Lecture 23 - Combined Power cycle

Lecture 24 - Gas Turbines for Aircraft Propulsion

Lecture 25 - Hydro-Power System - Part I

Lecture 26 - Hydro-Power System - Part II

Lecture 27 - Wind Energy - Part I

Lecture 28 - Wind Energy - Part II

Lecture 29 - Energy From Oceans - Part I

Lecture 30 - Energy From Oceans - Part II

Lecture 31 - Geothermal Energy

[Lecture 32 - Energy Storage - I](#)

[Lecture 33 - Energy Storage - II](#)

[Lecture 34 - Energy Storage - III](#)

- Lecture 1 - Introduction to phase diagrams
- Lecture 2 - Thermodynamic relations
- Lecture 3 - Single component system and binary solutions
- Lecture 4 - Regular solutions
- Lecture 5 - Real solutions
- Lecture 6 - Phase transformations
- Lecture 7 - Practice problems (Module 1)
- Lecture 8 - Introduction to homogenous nucleation process
- Lecture 9 - Fundamental to heterogeneous nucleation
- Lecture 10 - Growth of pure metal
- Lecture 11 - Alloy solidification
- Lecture 12 - Formation of different S/L interface
- Lecture 13 - Solidification structures and segregation
- Lecture 14 - Weld Metal Solidification and Microstructure - I
- Lecture 15 - Weld Metal Solidification and Microstructure - II
- Lecture 16 - Solidification of additive manufacturing - I
- Lecture 17 - Solidification of additive manufacturing - II
- Lecture 18 - Rate of solidification-sand casting
- Lecture 19 - Rate of solidification-die casting
- Lecture 20 - Riser design and solidification of pure metal
- Lecture 21 - Zone melting and rapid solidification
- Lecture 22 - Semisolid processing and other solidification techniques
- Lecture 23 - Demonstration of the solidification process and numerical problems

- Lecture 1 - Materials and microstructure evolutions - 1
- Lecture 2 - Materials and microstructure evolutions - 2
- Lecture 3 - Materials and microstructure evolutions - 3
- Lecture 4 - Basics of heat conduction - 1
- Lecture 5 - Basics of heat conduction - 2
- Lecture 6 - Basics of heat conduction - 3
- Lecture 7 - Basics of heat conduction - 4
- Lecture 8 - Basics of fluid flow - 1
- Lecture 9 - Basics of fluid flow - 2
- Lecture 10 - Solidification processing - 1
- Lecture 11 - Solidification processing - 2
- Lecture 12 - Casting and welding - 1
- Lecture 13 - Casting and welding - 2
- Lecture 14 - Casting and welding - 3
- Lecture 15 - Casting and welding - 4
- Lecture 16 - Material forming
- Lecture 17 - Material forming: Numerical problem
- Lecture 18 - Processing of metal: Casting Process - I
- Lecture 19 - Processing of metal: Casting Process - II
- Lecture 20 - Processing of polymer: Thermoplastic and thermosets
- Lecture 21 - Processing of polymer: Extrusion
- Lecture 22 - Processing of polymer: Injection molding
- Lecture 23 - Processing of polymer: Blow molding
- Lecture 24 - Processing of polymer: Thermosets
- Lecture 25 - Processing of ceramics - I
- Lecture 26 - Processing of ceramics - II
- Lecture 27 - Processing of glasses and fused deposition modeling
- Lecture 28 - Arc welding processes
- Lecture 29 - Welding of polymers
- Lecture 30 - Laser and electron beam welding processes
- Lecture 31 - Advanced welding processes

[Lecture 32 - Welding solidification](#)

[Lecture 33 - Metallic wire additive manufacturing](#)

[Lecture 34 - Mechanical responses of metals and polymers](#)

[Lecture 35 - Hot working and cold working](#)

[Lecture 36 - Types of metal forming processes - I](#)

[Lecture 37 - Types of metal forming processes - II](#)

[Lecture 38 - Types of metal forming processes - III and Hot rolling of steel](#)

[Lecture 39 - Solid state deformation - 1](#)

[Lecture 40 - Solid state deformation - 2](#)

[Lecture 41 - Powder processing - 1](#)

[Lecture 42 - Powder processing - 2](#)

[Lecture 43 - Powder processing - 3](#)

[Lecture 44 - Ceramic processing: Dry pressing and plastic forming methods](#)

[Lecture 45 - Ceramic processing: Colloidal processing, casting, and coating techniques](#)

[Lecture 46 - Introduction to steel making and single crystal production](#)

[Lecture 47 - Integrated Analysis of Steel Solidification, Fluid Flow, and Powder Processing Technologies](#)

[Lecture 48 - Processing of electronics Materials, A case Study: semiconductor measurements](#)

[Lecture 49 - Processing of magnetic materials and Processing of magnetic materials for advanced materials](#)

[Lecture 50 - Processing of optics materials and pertaining case study](#)

NPTEL : Acoustics (Mechanical Engineering)

Co-ordinators : Prof. Nachiketa Tiwari

Lecture 1 - Intro, sound wave versus vibration, different types of waves, octave, music scales, sense of SPL

Lecture 2 - Review: Linearity, complex numbers, and spring mass system

Lecture 3 - Review: Poles and zeroes, phase and magnitude plots, transfer functions, Bode plots

Lecture 4 - Review: Transfer functions, and Bode plots

Lecture 5 - 1-D wave equation, and its solution

Lecture 6 - Solution for 1-D wave equation

Lecture 7 - Waveguides, transmission line equations, and standing waves

Lecture 8 - Waveguides, transmission line equations, and standing waves

Lecture 9 - Examples of 1-D waves in tubes, short tubes, Kundt's tube

Lecture 10 - Thermodynamic processes during sound transmission

Lecture 11 - Numerical examples

Lecture 12 - Sound transmission through walls

Lecture 13 - Sound transmission through walls

Lecture 14 - Leakage in walls, STC Ratings, Octave bands

Lecture 15 - Instantaneous power flow

Lecture 16 - Radial propagation of sound, monopoles, and dipoles

Lecture 17 - Radial propagation of sound, monopoles, and dipoles

Lecture 18 - Radial propagation of sound, monopoles, and dipoles

Lecture 19 - Numerical examples

Lecture 20 - Numerical examples

Lecture 21 - Directivity

Lecture 22 - Directivity

Lecture 23 - Directivity

Lecture 24 - Directivity

Lecture 25 - Generalized elements

Lecture 26 - Examples of electromechanical systems

Lecture 27 - Transformers, radiation impedance, and Helmholtz resonator

Lecture 28 - Radiation impedance

Lecture 29 - Radiation impedance

Lecture 30 - Models of electro-mechanical-acoustic systems

Lecture 31 - Solution for a loudspeaker model

[Lecture 32 - Microphones](#)

[Lecture 33 - Vibro-meter, seismometer, accelerometer, shaker table](#)

[Lecture 34 - Sound propagation in rooms, 1-D rooms, 2D rooms](#)

[Lecture 35 - Sound in 3-D rooms](#)

[Lecture 36 - Absorption coefficient, and irregular rooms](#)

[Lecture 37 - Room constant, and Sabine's coefficient](#)

[Lecture 38 - Design of a muffler](#)

[Lecture 39 - Noise in machines, basics of noise management](#)

NPTEL : Advanced Machining Processes (Mechanical Engineering)

Co-ordinators : Prof. Vijay K. Jain

[Lecture 1 - Advanced Machining Processes](#)

[Lecture 2 - Advanced Machining Processes](#)

[Lecture 3 - Advanced Machining Processes](#)

[Lecture 4 - Advanced Machining Processes](#)

[Lecture 5 - Advanced Machining Processes](#)

[Lecture 6 - Advanced Machining Processes](#)

[Lecture 7 - Advanced Machining Processes](#)

[Lecture 8 - Advanced Machining Processes](#)

[Lecture 9 - Advanced Machining Processes](#)

[Lecture 10 - Advanced Machining Processes](#)

[Lecture 11 - Advanced Machining Processes](#)

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[Lecture 31 - Advanced Machining Processes](#)

[Lecture 32 - Advanced Machining Processes](#)

[Lecture 33 - Advanced Machining Processes](#)

[Lecture 34 - Advanced Machining Processes](#)

[Lecture 1](#)

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[Lecture 4](#)

[Lecture 5](#)

[Lecture 6](#)

[Lecture 7](#)

[Lecture 8](#)

[Lecture 9](#)

[Lecture 10 \(same as 9\)](#)

[Lecture 11](#)

[Lecture 12 \(Lecture Missing\)](#)

[Lecture 13](#)

[Lecture 14](#)

[Lecture 15](#)

[Lecture 16](#)

[Lecture 17](#)

[Lecture 18](#)

[Lecture 19](#)

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[Lecture 35](#)

[Lecture 36](#)

[Lecture 37](#)

[Lecture 38](#)

[Lecture 39](#)

[Lecture 40](#)

Lecture 1 - Introduction

Lecture 2 - Basic Ideas of Applied Linear Algebra

Lecture 3 - Systems of Linear Equations

Lecture 4 - Square Non-Singular Systems

Lecture 5 - Ill-Conditioned and Ill-Posed Systems

Lecture 6 - The Algebraic Eigenvalue Problem

Lecture 7 - Canonical Forms, Symmetric Matrices

Lecture 8 - Methods of Plane Rotations

Lecture 9 - Householder Method, Tridiagonal Matrices

Lecture 10 - QR Decomposition, General Matrices

Lecture 11 - Singular Value Decomposition

Lecture 12 - Vector Space: Concepts

Lecture 13 - Multivariate Calculus

Lecture 14 - Vector Calculus in Geometry

Lecture 15 - Vector Calculus in Physics

Lecture 16 - Solution of Equations

Lecture 17 - Introduction to Optimization

Lecture 18 - Multivariate Optimization

Lecture 19 - Constrained Optimization: Optimality Criteria

Lecture 20 - Constrained Optimization: Further Issues

Lecture 21 - Interpolation

Lecture 22 - Numerical Integration

Lecture 23 - Numerical Solution of ODE's as IVP

Lecture 24 - Boundary Value Problems, Question of Stability in IVP Solution

Lecture 25 - Stiff Differential Equations, Existence and Uniqueness Theory

Lecture 26 - Theory of First Order ODE's

Lecture 27 - Linear Second Order ODE's

Lecture 28 - Methods of Linear ODE's

Lecture 29 - ODE Systems

Lecture 30 - Stability of Dynamic Systems

Lecture 31 - Series Solutions and Special Functions

[Lecture 32 - Sturm-Liouville Theory](#)

[Lecture 33 - Approximation Theory and Fourier Series](#)

[Lecture 34 - Fourier Integral to Fourier Transform, Minimax Approximation](#)

[Lecture 35 - Separation of Variables in PDE's, Hyperbolic Equations](#)

[Lecture 36 - Parabolic and Elliptic Equations, Membrane Equation](#)

[Lecture 37 - Analytic Functions](#)

[Lecture 38 - Integration of Complex Functions](#)

[Lecture 39 - Singularities and Residues](#)

[Lecture 40 - Calculus of Variations](#)

NPTEL : Dynamics of Machines (Mechanical Engineering)

Co-ordinators : Prof. Amitabha Ghosh

Lecture 1 - Rigid Body Motion - Part 1

Lecture 2 - Rigid Body Motion - Part 2

Lecture 3 - Dynamic Force Analysis of Mechanisms

Lecture 4 - Space Motion of Rigid Bodies

Lecture 5 - Inertia Tensor Angular Momentum

Lecture 6 - Euler's Equation of Motion

Lecture 7 - Gyroscopic Action in Machines

Lecture 8 - Unbalance in Machines

Lecture 9 - Rotary Balancing

Lecture 10 - Balancing Machines

Lecture 11 - Field Balancing of Rotors

Lecture 12 - Single-Cylinder Engine Balancing

Lecture 13 - Balancing of Single Slider Machines

Lecture 14 - In-Line Engine Balancing

Lecture 15 - V and Radial Engine Balancing

Lecture 16 - Turning Moment Diagram

Lecture 17 - Flywheel Analysis

Lecture 18 - Dynamics of Machines

Lecture 19 - Dynamics of Machines

Lecture 20 - Dynamics of Machines

Lecture 21 - Dynamics of Machines

Lecture 22 - Dynamics of Machines

Lecture 23 - Dynamics of Machines

Lecture 24 - Dynamics of Machines

Lecture 25 - Dynamics of Machines

Lecture 26 - Dynamics of Machines

Lecture 27 - Dynamics of Machines

Lecture 28 - Dynamics of Machines

Lecture 29 - Rotating Vector Approach

Lecture 30 - Equivalent viscous damping

Lecture 31 - Dynamics of Machines

[Lecture 32 - Systems with two degree of freedom](#)

[Lecture 33 - Tuned Vibration Absorber](#)

[Lecture 34 - Design of Vibration Absorbers](#)

[Lecture 35 - Flexibility Matrix Influence Coeff](#)

[Lecture 36 - Forced Vibration of multiple](#)

[Lecture 37 - Forced Vibration of Multiple degrees](#)

[Lecture 38 - Vibration of Continuous Systems](#)

[Lecture 39 - Vibration of Continuous Systems](#)

[Lecture 40 - Vibration of Beams](#)

[Lecture 41 - Rayleigh's method](#)

[Lecture 42 - Rayleigh-Ritz Method](#)

[Lecture 43 - Vibration Measurement](#)

[Lecture 44 - Vibration Measurement Types of Pickups](#)

NPTEL : Finite Element Method (Mechanical Engineering)

Co-ordinators : Prof. C.S. Upadhyay

[Module 1 - Lecture 1](#)

[Module 1 - Lecture 2](#)

[Module 1 - Lecture 3](#)

[Module 2 - Lecture 1](#)

[Module 2 - Lecture 2](#)

[Module 2 - Lecture 3](#)

[Module 2 - Lecture 4](#)

[Module 3 - Lecture 1](#)

[Module 3 - Lecture 2](#)

[Module 3 - Lecture 3](#)

[Module 4 - Lecture 1](#)

[Module 4 - Lecture 2](#)

[Module 4 - Lecture 3](#)

[Module 5 - Lecture 1](#)

[Module 5 - Lecture 2](#)

[Module 5 - Lecture 3](#)

[Module 6 - Lecture 1](#)

[Module 6 - Lecture 2](#)

[Module 6 - Lecture 3](#)

[Module 7 - Lecture 1](#)

[Module 7 - Lecture 2](#)

[Module 7 - Lecture 3](#)

[Module 7 - Lecture 4](#)

[Module 8 - Lecture 1](#)

[Module 8 - Lecture 2](#)

[Module 8 - Lecture 3](#)

[Module 9 - Lecture 1](#)

[Module 9 - Lecture 2](#)

[Module 9 - Lecture 3](#)

[Module 10 - Lecture 1](#)

[Module 10 - Lecture 2](#)

[Module 11 - Lecture 1](#)

[Module 11 - Lecture 2](#)

[Module 12 - Lecture 1](#)

[Module 13 - Lecture 1](#)

[Module 13 - Lecture 2](#)

[Module 14 - Lecture 1](#)

[Module 14 - Lecture 2](#)

NPTEL : Kinematics of Machines (Mechanical Engineering)

Co-ordinators : Prof. Ashok K Mallik

[Module 1 - Lecture 1](#)

[Module 1 - Lecture 2](#)

[Module 1 - Lecture 3](#)

[Module 2 - Lecture 1](#)

[Module 2 - Lecture 2](#)

[Module 2 - Lecture 3](#)

[Module 3 - Lecture 1](#)

[Module 3 - Lecture 2](#)

[Module 3 - Lecture 3](#)

[Module 3 - Lecture 4](#)

[Module 4 - Lecture 1](#)

[Module 4 - Lecture 2](#)

[Module 5 - Lecture 1](#)

[Module 5 - Lecture 2](#)

[Module 5 - Lecture 3](#)

[Module 6 - Lecture 1](#)

[Module 6 - Lecture 2](#)

[Module 6 - Lecture 3](#)

[Module 7 - Lecture 1](#)

[Module 7 - Lecture 2](#)

[Module 7 - Lecture 3](#)

[Module 8 - Lecture 1](#)

[Module 8 - Lecture 2](#)

[Module 9 - Lecture 1](#)

[Module 9 - Lecture 2](#)

[Module 9 - Lecture 3](#)

[Module 9 - Lecture 4](#)

[Module 10 - Lecture 1](#)

[Module 10 - Lecture 2](#)

[Module 10 - Lecture 3](#)

[Module 11 - Lecture 1](#)

[Module 11 - Lecture 2](#)

[Module 11 - Lecture 3](#)

[Module 12 - Lecture 1](#)

[Module 12 - Lecture 2](#)

[Module 12 - Lecture 3](#)

[Module 13 - Lecture 1](#)

[Module 13 - Lecture 2](#)

[Module 13 - Lecture 3](#)

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[Lecture 25](#)

[Lecture 26](#)

[Lecture 27](#)

[Lecture 28](#)

[Lab session 1 - Advanced manufacturing process for micro sytem fabrication](#)

[Lab session 2 - EDM Micro Machening](#)

[Lab session 3 - EDM Micro Drilling](#)

[Lab session 4 - Laser Machening Process](#)

[Lab session 5 - Vaccume Assisted Forming](#)

[Lab session 6 - Vaccume Forming](#)

[Lab session 7 - Photolithiography](#)

[Lab session 8 - Replication part 1](#)

[Lab session 9 - Replication part 2](#)

[Lab session 10 - PCB Making](#)

[Lecture 1 - Technical Arts 101](#)

[Lecture 2 - Technical Arts 101](#)

[Lecture 3 - Technical Arts 101](#)

[Lecture 4 - Technical Arts 101](#)

[Lecture 5 - Technical Arts 101](#)

[Lecture 6 - Technical Arts 101](#)

[Lecture 7 - Technical Arts 101](#)

[Lecture 8 - Technical Arts 101](#)

[Lecture 9 - Technical Arts 101](#)

[Lecture 10 - Technical Arts 101](#)

[Lecture 11 - Technical Arts 101](#)

[Lecture 12 - Technical Arts 101](#)

[Lecture 13 - Technical Arts 101](#)

[Lecture 14 - Technical Arts 101](#)

[Lecture 15 - Technical Arts 101](#)

[Lecture 16 - Technical Arts 101](#)

[Lecture 17 - Technical Arts 101](#)

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[Lecture 22 - Technical Arts 101](#)

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[Lecture 24 - Technical Arts 101](#)

[Lecture 25 - Technical Arts 101](#)

[Lecture 26 - Technical Arts 101](#)

[Lecture 27 - Technical Arts 101](#)

[Lecture 28 - Technical Arts 101](#)

[Lab Session 1](#)

[Lab Session 2](#)

[Lab Session 3](#)

[Lab Session 4](#)

[Lab Session 5](#)

[Lab Session 6](#)

[Lab Session 7](#)

[Lab Session 8](#)

[Lab Session 9](#)

[Lab Session 10](#)

[Lab Session 11](#)

[Lab Session 12](#)

Lecture 1 - Lecture 1

Lecture 2 - Lecture 2

Lecture 3 - Lecture 3

Lecture 4 - Review Lecture 1,2,3

Lecture 5 - Lecture 4

Lecture 6 - Lecture 5

Lecture 7 - Lecture 6

Lecture 8 - Review Lecture 4,5,6

Lecture 9 - Lecture 7

Lecture 10 - Lecture 8

Lecture 11 - Lecture 9-10

Lecture 12 - Lecture-11

Lecture 13 - Lecture-12

Lecture 14 - Lecture-13

Lecture 15 - Lecture-14

Lecture 16 - Lecture-15

Lecture 17 - Lecture-16

Lecture 18 - Lecture-17

Lecture 19 - Lecture-18

Lecture 20 - Lecture-19

Lecture 21 - Review Lecture 7 to 10

Lecture 22 - Review Lecture 11 to 13

Lecture 23 - Review Lecture 14 to 16

Lecture 24 - Lecture-20

Lecture 25 - Lecture-21

Lecture 26 - Lecture-22

Lecture 27 - Lecture-23

Lecture 28 - Lecture-24

Lecture 29 - Lecture-25

Lecture 30 - Review Lecture 17,18,19

Lecture 31 - Review Lecture 20,21,22

[Lecture 32 - Lecture-26](#)

[Lecture 33 - Lecture-27](#)

[Lecture 34 - Lecture-28](#)

[Lecture 35 - Lecture-29](#)

[Lecture 36 - Lecture-30](#)

[Lecture 37 - Lecture-31](#)

[Lecture 38 - Lecture-32](#)

[Lecture 39 - Lecture-33](#)

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[Lecture 66 - Lesson 6 - Loudness](#)

[Lecture 67 - Lesson 1 - Octave Band Analysis - Part I](#)

[Lecture 68 - Lesson 2 - Octave Band Analysis - Part II](#)

[Lecture 69 - Lesson 3 - Octave Band Analysis - Part III](#)

[Lecture 70 - Lesson 4 - Reverberation Time](#)

[Lecture 71 - Lesson 5 - Calculation of Reverberation Time and Sound Transmission Class \(STC\)](#)

[Lecture 72 - Lesson 6 - Noise Reduction Coefficient \(NRC\)](#)

Lecture 1 - Recap - I

Lecture 2 - Recap - II

Lecture 3 - Recap - III

Lecture 4 - Determination of Phase Diagram (Experimentally) - I

Lecture 5 - Determination of Phase Diagram (Experimentally) - II

Lecture 6 - Determination of Phase Diagram (Thermodynamically)

Lecture 7 - Effect of pressure on phase transformation temperature and concept of equilibrium between condensed and vapor phase

Lecture 8 - Effect of different parameters on heat treatment and concept of saturation vapor pressure with examples

Lecture 9 - Title: Formation of ideal solid or liquid solution and (G-X) diagrams for ideal solutions (Part-I)

Lecture 10 - G-X diagrams (Part- II) and concept of chemical potential (Micro Sign) from G-X diagrams.

Lecture 11 - Concept of common tangent for equilibrium between two phases

Lecture 12 - Expressions for equilibrium of two phases - I

Lecture 13 - Expressions for equilibrium of two phases - II

Lecture 14 - Expressions for equilibrium of two phases - III

Lecture 15 - Determining nucleation of phases using G-X plot

Lecture 16 - $\hat{\Delta}G$ for nucleation and overall transformation, concepts of solid state transformation including precipitation and Quasi-Chemical Model (QCM)

Lecture 17 - Introduction to real solutions and expression of \hat{H}_{mix} based on the Quasi-Chemical Model (QCM)

Lecture 18 - Expression for \hat{H}_{mix} as a function of interaction energy and mole fraction, based on the QCM - Part I

Lecture 19 - Expression for \hat{H}_{mix} as a function of interaction energy and mole fraction, based on the QCM - Part II

Lecture 20 - Graphical representation of \hat{H}_{mix} , \hat{G}_{mix} , and $-T\hat{S}_{mix}$ for real solutions and evolution of eutectic phase diagram from the G-X plots

Lecture 21 - Effect of \hat{H}_{mix} on determination of phase diagrams (same crystal structure)

Lecture 22 - Effect of \hat{H}_{mix} on determination of phase diagrams (Continued...)

Lecture 23 - Importance of phase diagrams

Lecture 24 - Effect of heat treatment on microstructure evolution in steel - I

Lecture 25 - Effect of heat treatment on microstructure evolution in steel - II

Lecture 26 - Recap of homogeneous and heterogeneous nucleation for solid to solid transformation

Lecture 27 - Nucleation rate and its dependence on T (temp. of interest), \hat{I}^*T , \hat{I}^*G^* and \hat{I}^*G^* and, introduction to growth kinetics

Lecture 28 - Growth kinetics (Continued...)

Lecture 29 - Growth rate variation with undercooling and kinetics of overall phase transformation

Lecture 30 - Implication of Avrami's equation with example on excel spreadsheet

Lecture 31 - Experimental verification of Avrami Equation

Lecture 32 - Linear regression (least squares) method to find the value of n and k in Avrami equation

Lecture 33 - In this lecture, method to determine the goodness of fit has been explained. Procedure to estimate the values of n and k from experimental data have also been discussed.

Lecture 34 - Stereology and quantitative metallography - I

Lecture 35 - Stereology and quantitative metallography - II

Lecture 36 - Grain size measurements methods

Lecture 37 - Statistical tools for analysis and reporting of obtained data with examples

Lecture 38 - Evolution of TTT and CCT diagram from f vs. t plots

Lecture 39 - TTT, CCT continue and hardenability of steel

Lecture 40 - Importance of heat treatment practices in real life (with examples)

Lecture 1 - Brief Introduction

Lecture 2 - Define Phase, Equilibrium

Lecture 3 - Free Energy, Stability of Phases

Lecture 4 - Gibbs Free Energy of Binary Solution

Lecture 5 - Ideal Solution and Chemical Potential

Lecture 6 - Thermodynamics of solid solutions

Lecture 7 - G vs X curves

Lecture 8 - Solid solutions: Types

Lecture 9 - Heterogeneous phase equilibria

Lecture 10 - G vs X curves for eutectic system

Lecture 11 - G-X plot for peritectic system

Lecture 12 - Effect of temperature of solid solubility, Influence of interfaces on Equilibrium

Lecture 13 - Introduction of Diffusion

Lecture 14 - Mechanism of Diffusion, Fick's I law

Lecture 15 - Fick's II law

Lecture 16 - Fick's II law (Continued...), Diffusion and Temperature

Lecture 17 - Interfacial Free Energy, Solid/Vapor Interface

Lecture 18 - Boundaries in single phase solids

Lecture 19 - High angle grain boundaries, Equilibrium in poly-crystalline materials, Interphase interfaces in solids

Lecture 20 - Interphase interfaces in solids (Continued...)

Lecture 21 - CSL Boundaries

Lecture 22 - Types of Nucleations

Lecture 23 - Homogeneous Nucleation

Lecture 24 - Homogeneous Nucleation (Continued...)

Lecture 25 - Heterogeneous Nucleation

Lecture 26 - Heterogeneous nucleation (Continued...)

Lecture 27 - Growth

Lecture 28 - Atomic mechanism of growth

Lecture 29 - Dendritic Solidification

Lecture 30 - Growth rate for dendrite formation

Lecture 31 - Alloy solidification

- [Lecture 32 - Alloy solidification \(Continued...\)](#)
- [Lecture 33 - Eutectic: Solidification](#)
- [Lecture 34 - Eutectic: solidification \(Continued...\)](#)
- [Lecture 35 - Solidification of casting / ingot](#)
- [Lecture 36 - Precipitation hardenable alloy](#)
- [Lecture 37 - Precipitation age- hardening alloy \(Continued...\)](#)
- [Lecture 38 - Age hardening alloy](#)
- [Lecture 39 - Eutectoid transformation](#)
- [Lecture 40 - Eutectoid transformation \(Continued....\)](#)
- [Lecture 41 - Eutectoid transformation in steel \(Continued...\)](#)
- [Lecture 42 - Martensite](#)
- [Lecture 43 - Martensite \(Continued...\)](#)
- [Lecture 44 - Martensite \(Continued...\) and TTT curves](#)
- [Lecture 45 - TTT diagram](#)
- [Lecture 46 - Recovery, Recrystallization and Grain growth](#)
- [Lecture 47 - Recovery](#)
- [Lecture 48 - Recrystallization](#)
- [Lecture 49 - Recrystallization \(Continued...\)](#)
- [Lecture 50 - Introduction to spinodal decomposition](#)

Lecture 1 - Introduction to Composites

Lecture 2 - Matrices

Lecture 3 - Fiber reinforcements

Lecture 4 - Fiber reinforcements (Continued...)

Lecture 5 - Composites properties

Lecture 6 - Composites testing

Lecture 7 - Selection of material

Lecture 8 - Selection of material (Continued...)

Lecture 9 - Design for Manufacturing

Lecture 10 - Design for Manufacturing (Continued...)

Lecture 11 - Composite Manufacturing Processes

Lecture 12 - Filament winding Processes

Lecture 13 - Resin transfer moulding

Lecture 14 - Pultrusion

Lecture 15 - Compression Moulding Process

Lecture 16 - Vacuum Impregnation Methods

Lecture 17 - Stacking of Composites

Lecture 18 - Thermoplastic Composites Manufacturing Processes - Part 1

Lecture 19 - Thermoplastic Composites Manufacturing Processes - Part 2 (Continued...)

Lecture 20 - Non-destructive testing methods for composite materials

Lecture 21 - Metal Matrix Composites

Lecture 22 - Metal Matrix Composites applications (Continued...)

Lecture 23 - Processing of Metal Matrix Composites - Part 1

Lecture 24 - Processing of Metal Matrix Composites - Part 2

Lecture 25 - Ceramic Matrix Composites

Lecture 26 - Fabrication of Ceramic Matrix Composites (CMCs)

Lecture 27 - Carbon - Carbon Composites

Lecture 28 - Polymer Matrix and Nano Composites

Lecture 29 - Machining of Composites

Lecture 30 - Repair of Composites

Lecture 31 - Manufacturing Processes: Selection and Considerations

[Lecture 1](#)

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[Lecture 30 - Work Systems](#)

[Lecture 31 - Measures of Productivity](#)

[Lecture 32 - Productivity Measurement](#)

[Lecture 33 - Work Study](#)

[Lecture 34 - Motion and time study](#)

[Lecture 35 - Motion Study](#)

[Lecture 36 - Flow Diagram](#)

[Lecture 37 - Time Study](#)

[Lecture 38 - Manual Work System](#)

[Lecture 39 - Worker Machine Systems](#)

[Lecture 40 - Industrial accidents](#)

[Lecture 41 - Human Errors](#)

[Lecture 42 - Workers compensation laws](#)

[Lecture 43 - Organisation Ergonomics - Part 1](#)

[Lecture 44 - Organisation Ergonomics - Part 2](#)

[Lecture 45 - Job Satisfaction](#)

[Lecture 46 - Worker behavior](#)

[Lecture 47 - Job ranking Techniques](#)

[Lecture 48 - Waging System](#)

[Lecture 49 - Biomechanics - 1](#)

[Lecture 50 - Biomechanics - 2](#)

[Lecture 51 - Applications of Biomechanics](#)

[Lecture 52 - Problem solving - 1](#)

[Lecture 53 - Problem solving - 2](#)

[Lecture 54 - Problem solving - 3](#)

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Sustainability through Green Manufacturing Systems - An Applied Approach (Mechanical Engineering)

Co-ordinators : Dr. Deepu Philip, Dr. Amandeep Singh

[Lecture 1 - Basics of Production](#)

[Lecture 2 - Basics of Production \(Continued...\)](#)

[Lecture 3 - Sustainability and Manufacturing](#)

[Lecture 4 - Introduction to Simulation](#)

[Lecture 5 - Introduction to Simulation \(Continued...\)](#)

[Lecture 6 - Basic Statistical Concepts for Sustainable Manufacturing Analysis](#)

[Lecture 7 - Basic Statistical Concepts for Sustainable Manufacturing Analysis \(Continued...\)](#)

[Lecture 8 - Life Cycle Assessment](#)

[Lecture 9 - Life Cycle Assessment Elements](#)

[Lecture 10 - Life Cycle Assessment Procedure](#)

[Lecture 11 - Life Cycle Assessment \(Continued...\)](#)

[Lecture 12 - Sustainability Framework](#)

[Lecture 13 - Basic Modeling Concepts for Factory Simulation](#)

[Lecture 14 - Basic Modeling Concepts for Factory Simulation \(Continued...\)](#)

[Lecture 15 - Green Manufacturing Modelling: Metrics for Green Manufacturing](#)

[Lecture 16 - Green Manufacturing Modelling \(Continued...\) Indices for Green Manufacturing](#)

[Lecture 17 - Green Manufacturing Modelling \(Continued...\) Developing Green Manufacturing System](#)

[Lecture 18 - Productivity and Sustainability](#)

[Lecture 19 - Productivity and Sustainability \(Continued...\)](#)

[Lecture 20 - Green Manufacturing Techniques](#)

[Lecture 21 - Green Manufacturing Techniques \(Continued...\)](#)

[Lecture 22 - Renewable Sources of Energy](#)

[Lecture 23 - Renewable Sources of Energy \(Continued...\)](#)

[Lecture 24 - Renewable energy in India and Industrial Symbiosis](#)

[Lecture 25 - Demonstration of Various Instruments Used for Green Machining](#)

[Lecture 26 - Laboratory demonstration](#)

[Lecture 27 - Developing a Smart Factory](#)

[Lecture 28 - Demonstration on PLM Software](#)

[Lecture 29 - Developing a Smart Factory \(Continued...\)](#)

[Lecture 30 - Sustainability and Green Manufacturing System](#)

Lecture 1 - Course Overview

Lecture 2 - Introduction

Lecture 3 - Nature Of Sound

Lecture 4 - Beats

Lecture 5 - The Decibel Scale

Lecture 6 - Key Terms in Acoustics

Lecture 7 - Decibel Scale - Part 1

Lecture 8 - Decibel Scale - Part 2

Lecture 9 - Decibel Scale - Part 3

Lecture 10 - Complex Numbers

Lecture 11 - Complex Time Function

Lecture 12 - Linear Systems

Lecture 13 - Transfer Functions

Lecture 14 - Introduction to One Dimensional Wave Equation

Lecture 15 - The Momentum Equation

Lecture 16 - The Continuity Equation and The Gas Law

Lecture 17 - One Dimensional Wave Equation

Lecture 18 - Solution for One Dimensional Wave Equation

Lecture 19 - Transmission Line Equations

Lecture 20 - One Dimensional Example Problems

Lecture 21 - Impedance

Lecture 22 - Pressure Wave Travels in a Closed Tube

Lecture 23 - Standing Wave Formation in a Closed Tube With Rigid Termination

Lecture 24 - Pressure Wave Travels in an Open Tube

Lecture 25 - 1-D sound wave propagation: Kundt's tube - I

Lecture 26 - 1-D sound wave propagation: Kundt's tube - II

Lecture 27 - Radially propagating sound waves in spherical coordinate system - I

Lecture 28 - Radially propagating sound waves in spherical coordinate system - II

Lecture 29 - Complex impedance for radially propagating sound waves in spherical coordinate system

Lecture 30 - Volume velocity - I

Lecture 31 - Interference of 1-D spherically propagating sound waves - I

- Lecture 32 - Interference of 1-D spherically propagating sound waves - II
- Lecture 33 - Noise sources and introduction to microphones
- Lecture 34 - Classification of microphones - I
- Lecture 35 - Classification of microphones - II
- Lecture 36 - Classification of microphones - III
- Lecture 37 - Microphone Parameters
- Lecture 38 - Understanding microphone specifications
- Lecture 39 - Noise Source: Terminology
- Lecture 40 - Noise Source: Sound Attenuation
- Lecture 41 - Noise Source: Sound Pressure Level due to a noise source located outdoors
- Lecture 42 - Noise Source: Role of reflecting surfaces
- Lecture 43 - Noise Source: Sound Pressure Level due to a noise source located indoors - Part I
- Lecture 44 - Noise Source: Sound Pressure Level due to a noise source located indoors - Part II
- Lecture 45 - Measuring Sound Power Level - Understanding standard octave bands
- Lecture 46 - Measuring Sound Power Level - Fan noise - Part I
- Lecture 47 - Measuring Sound Power Level - Fan noise - Part II
- Lecture 48 - Measuring Sound Power Level - Fan noise - Part III
- Lecture 49 - Weighting
- Lecture 50 - Noise coming from Motors
- Lecture 51 - Noise coming from Motors and Pumps
- Lecture 52 - Noise coming from Pump and Motor Working Simultaneously
- Lecture 53 - Noise coming from Compressors
- Lecture 54 - Example problems regarding Noise coming from Compressor
- Lecture 55 - Noise Spread Mechanisms
- Lecture 56 - Reverberation time
- Lecture 57 - Reverberation time example problem
- Lecture 58 - Noise from Adjacent Room
- Lecture 59 - Acoustic Enclosures
- Lecture 60 - Acoustic Enclosures - Example Problems
- Lecture 61 - Large acoustical enclosures - I
- Lecture 62 - Large acoustical enclosures - II
- Lecture 63 - Acoustic barriers - I
- Lecture 64 - Acoustic barriers - II

[Lecture 65 - Acoustic barriers - III](#)

[Lecture 66 - Helmholtz resonator - I](#)

[Lecture 67 - Silencers](#)

[Lecture 68 - Side Branched Mufflers - I](#)

[Lecture 69 - Side Branched Mufflers - II](#)

[Lecture 70 - Side Branched Mufflers - III](#)

[Lecture 71 - Expansion Chamber Muffler](#)

[Lecture 72 - Single Expansion Chamber Muffler](#)

NPTEL : NOC:Design Practice (Mechanical Engineering)

Co-ordinators : Dr. Shantanu Bhattacharya

Lecture 1 - Brief introduction of Design systems

Lecture 2 - Product Development

Lecture 3 - Basic protocols of industrial design

Lecture 4 - Design thinking and innovation

Lecture 5 - Brain Storming

Lecture 6 - Design prototyping

Lecture 7 - Generic Phases of the Design

Lecture 8 - Configurational Design Aspects

Lecture 9 - Concurrent Engineering

Lecture 10 - Concurrent Engineering - 2

Lecture 11 - Concurrent Engineering Approaches

Lecture 12 - Concurrent Engineering Approaches - 2

Lecture 13 - Benefits of concurrent engineering

Lecture 14 - Concurrent engineering environment influencing dimensions

Lecture 15 - Concurrent engineering environment influencing dimensions - 2

Lecture 16 - Program and product Interface dimensions in Concurrent engineering

Lecture 17 - Product Development Methodology

Lecture 18 - Elements of concurrent engineering: Optimization in product development

Lecture 19 - Business relationships in concurrent engineering

Lecture 20 - Organizational elements in concurrent engineering

Lecture 21 - Techniques for the Implementation of concurrent engineering environment

Lecture 22 - Average quality loss

Lecture 23 - Robustness in Design

Lecture 24 - Robustness in Design - 2

Lecture 25 - Material selection in Engineering design

Lecture 26 - Material selection in Engineering Design.

Lecture 27 - Basic steps in Material Selection Process

Lecture 28 - Design of Work Systems

Lecture 29 - Motion Study

Lecture 30 - Axiomatic Design

Lecture 31 - Introduction to group technology

Lecture 32 - Failure Mode Effect Analysis

Lecture 1 - Definition of the composite materials

Lecture 2 - Composite materials and its applications

Lecture 3 - Classification of the composite materials

Lecture 4 - What Makes fiber so strong?

Lecture 5 - Advantages and limitations of composite materials

Lecture 6 - Properties of the composite materials.

Lecture 7 - Different Types of Fiber

Lecture 8 - Production process and different types of Glass Fiber

Lecture 9 - Graphite Fibers

Lecture 10 - Aramid and Boron Fibers

Lecture 11 - Ceramic Fibers

Lecture 12 - Matrix - Properties and classifications

Lecture 13 - Polymers as matrix material and its classification

Lecture 14 - Thermosets and thermoplastics

Lecture 15 - Properties of thermosets and thermoplastics

Lecture 16 - Thermoset materials and its production methods

Lecture 17 - Thermoplastics and metals as matrix materials

Lecture 18 - Ceramic and carbon matrices

Lecture 19 - What is a good fabrication process of a composite?

Lecture 20 - Fabrication of Thermoset Composites

Lecture 21 - Hand Lay-Up Process

Lecture 22 - Bag Molding Process

Lecture 23 - Resin Transfer Molding Process

Lecture 24 - Fabrication of Thermoplastic, Metal and Ceramic Matrix based Composites

Lecture 25 - Terminologies and basic concepts

Lecture 26 - Orthotropic material

Lecture 27 - Modeling of unidirectional composites

Lecture 28 - Composite density as a function of mass fraction and volume fraction

Lecture 29 - Calculation of longitudinal modulus for unidirectional composites

Lecture 30 - Failure modes of unidirectional composite

Lecture 31 - Failure of Unidirectional Lamina

- Lecture 32 - Minimum Volume Fraction and Critical Volume Fraction
- Lecture 33 - Example based on Failure of Composite Material
- Lecture 34 - Example based on Minimum and Critical Volume Fraction
- Lecture 35 - Transverse Modulus of Unidirectional Composite
- Lecture 36 - Halpin-Tsai Relation for Transverse Modulus
- Lecture 37 - Transverse modulus of unidirectional composites
- Lecture 38 - Transverse strength of unidirectional composites
- Lecture 39 - Poisson's ratio of unidirectional composites
- Lecture 40 - Failure modes of composite materials
- Lecture 41 - Failure modes of composite materials
- Lecture 42 - Other properties
- Lecture 43 - Concept of Tensor
- Lecture 44 - Stress Transformation (Two Dimensional)
- Lecture 45 - Analysis of Specially Orthotropic Lamina
- Lecture 46 - Analysis of Generally Orthotropic Lamina
- Lecture 47 - Transformation of Engineering Constants - Part I
- Lecture 48 - Transformation of Engineering Constants - Part II
- Lecture 49 - Variation of elastic constants with respect to fiber orientation for generally orthotropic lamina
- Lecture 50 - Generally orthotropic lamina
- Lecture 51 - Generalized Hooke's law for anisotropic materials
- Lecture 52 - Generalized Hooke's law for anisotropic materials
- Lecture 53 - Elastic constants for Specially orthotropic materials
- Lecture 54 - Elastic constants for Specially orthotropic materials in plane stress
- Lecture 55 - Relation Between Engineering Constants and Elements of Stiffness and Compliance Matrices - Part I
- Lecture 56 - Relation Between Engineering Constants and Elements of Stiffness and Compliance Matrices - Part II
- Lecture 57 - Stress Strain Relations for A Lamina With Arbitrary Orientation - Part I
- Lecture 58 - Stress- Strain Relation for A Lamina With Arbitrary Orientation - Part II
- Lecture 59 - Strength of An Orthotropic Lamina
- Lecture 60 - Importance of Sign of Shear Stress in context of Strength of A Unidirectional Lamina
- Lecture 61 - Strain displacement relations for a laminate
- Lecture 62 - Stress-strain relations for individual layers of a laminate
- Lecture 63 - Resultant forces and moments
- Lecture 64 - Relations between force and moment resultants and mid-plane strains and curvatures

[Lecture 65 - Physical significance of extensional stiffness matrix \[A\], coupling matrix \[B\] and bending stiffness matrix \[D\] matrices](#)

[Lecture 66 - Lamination sequence \(standard laminate code\)](#)

[Lecture 67 - Calculation of A, B and D Matrices.](#)

[Lecture 68 - Simplification of Stiffness Matrices - Part I](#)

[Lecture 69 - Simplification of Stiffness Matrices - Part II](#)

[Lecture 70 - Quasi-Isotropic Laminates - Part I](#)

[Lecture 71 - Quasi-Isotropic Laminates - Part II](#)

[Lecture 72 - Failure of Composite Laminates](#)

- Lecture 1 - Introduction to product design and Manufacturing
- Lecture 2 - Introduction to product design and Manufacturing (Continued...)
- Lecture 3 - Fundamentals of Manufacturing towards Product Development
- Lecture 4 - Fundamentals of Manufacturing towards Product Development (Continued...)
- Lecture 5 - Engineering Design Process
- Lecture 6 - Product design morphology
- Lecture 7 - Product characteristics
- Lecture 8 - Elements of Visual Design - Part 1
- Lecture 9 - Elements of Visual Design - Part 2
- Lecture 10 - Elements of Visual Design - Part 3
- Lecture 11 - Translating Customer Needs
- Lecture 12 - Translating Customer Needs
- Lecture 13 - Value Engineering, an introduction
- Lecture 14 - Value Engineering Methodology - Part 1
- Lecture 15 - Value Engineering Methodology - Part 2, FAST diagramming
- Lecture 16 - Value Engineering Methodology - Part 3
- Lecture 17 - Value Engineering, case study
- Lecture 18 - Materials Selection - Part 1
- Lecture 19 - Materials Selection - Part 2
- Lecture 20 - Manufacturing Process Selection - Part 1
- Lecture 21 - Manufacturing Process Selection - Part 2
- Lecture 22 - Product Costing
- Lecture 23 - Design for Manufacturing
- Lecture 24 - Design for Assembly
- Lecture 25 - Design for Maintenance
- Lecture 26 - Design for Environment - Part 1
- Lecture 27 - Design for Environment - Part 2
- Lecture 28 - Quality Control
- Lecture 29 - Quality Assurance
- Lecture 30 - Patent - Part 1
- Lecture 31 - Patent - Part 2

[Lecture 32 - Creativity techniques - Part 1](#)

[Lecture 33 - Creativity techniques - Part 2](#)

[Lecture 34 - Frugal Innovation](#)

[Lecture 35 - Rapid Prototyping, an introduction](#)

[Lecture 36 - Rapid Prototyping Modelling](#)

[Lecture 37 - Rapid Prototyping Processes - Part 1](#)

[Lecture 38 - Rapid Prototyping Processes - Part 2](#)

[Lecture 39 - Laboratory demonstration; 3D printing - Part 1](#)

[Lecture 40 - Laboratory demonstration; 3D printing - Part 2](#)

[Lecture 41 - Laboratory demonstration; 3D printing - Part 3](#)

[Lecture 42 - Plant Layout Planning - Part 1](#)

[Lecture 43 - Plant Layout Planning - Part 2](#)

[Lecture 44 - Laboratory demonstration; Plant Simulation - Part 1](#)

[Lecture 45 - Laboratory demonstration; Plant Simulation - Part 2](#)

[Lecture 46 - Laboratory demonstration; Plant Simulation - Part 3](#)

[Lecture 47 - Computer Integrated Manufacturing - Part 1](#)

[Lecture 48 - Computer Integrated Manufacturing - Part 2](#)

[Lecture 49 - Reverse Engineering](#)

[Lecture 50 - Managing Competitiveness](#)

Lecture 1 - Basic Thermodynamics: System, phase and components

Lecture 2 - Basic Thermodynamics: Gibbs Free Energy

Lecture 3 - Phase Stability in Materials

Lecture 4 - Effects of Temperature and Pressure on Single Components System

Lecture 5 - Clausius-Clapeyron Equation and Binary Solution

Lecture 6 - Calculation of Configurational Entropy

Lecture 7 - Chemical Potential

Lecture 8 - Phase Stability in Binary Solution

Lecture 9 - Activity and Thermodynamics of Regular Solution

Lecture 10 - Thermodynamic of Real Solution

Lecture 11 - Free Energy Curves and Various Systems

Lecture 12 - Solubility Limits 2-phase Co-existence

Lecture 13 - Phase Diagram Formation: Binary Solution

Lecture 14 - Phase Diagram Construction: Partial Soluble Phases

Lecture 15 - Phase Diagram Construction: Eutectic Phase

Lecture 16 - Intermetallics and Phase Diagrams

Lecture 17 - Phase Rule

Lecture 18 - Gibb's Phase Rule: Unary and Binary System

Lecture 19 - Gibb's Phase Rule: Eutectic Point and Lever Rule

Lecture 20 - Phase Fraction Calculation in a Phase Diagram

Lecture 21 - Microstructure evolution in Cu-Ni binary system

Lecture 22 - Microstructure evolution (Continued...)

Lecture 23 - Phase evolution in hypoeutectic region

Lecture 24 - Phase evolution at Eutectic point

Lecture 25 - Phase Diagrams of Cu-Ni and Al-Si

Lecture 26 - Phase Diagrams of Pb-Sn and Fe-C

Lecture 27 - Phase Diagram of Fe-C (Continued...)

Lecture 28 - Fe-C Phase Diagram (Continued...)

Lecture 29 - Fe-C Phase Diagram (Continued...)

Lecture 30 - Phase Diagrams for non-Ferrous Alloys

Lecture 31 - Method of measuring Phase diagram

[Lecture 32 - Methods of measuring phase diagram \(Continued...\)](#)

[Lecture 33 - Methods of measuring phase diagram: PbMg₂](#)

[Lecture 34 - Ternary Phase Diagram](#)

[Lecture 35 - Ternary Phase Diagram \(Continued...\)](#)

[Lecture 36 - Ternary system with two phases](#)

[Lecture 37 - Ternary system with three phases](#)

[Lecture 38 - Ternary phase diagram with 4 phases](#)

[Lecture 39 - Application of Phases diagrams](#)

[Lecture 40 - Summary of Course](#)

Lecture 1 - Basics of composite materials

Lecture 2 - Different type of Fibers

Lecture 3 - Properties of single layer continuous fiber composites

Lecture 4 - Properties of single layer continuous fiber composites

Lecture 5 - Strength of single layer continuous fiber composites

Lecture 6 - Strength of single layer continuous fiber composites

Lecture 7 - Concept of Tensor

Lecture 8 - General Anisotropic Material

Lecture 9 - Specially Orthotropic Material

Lecture 10 - Specially Orthotropic Material Under Plane Stress

Lecture 11 - Stress and Strain Transformation

Lecture 12 - Transformation of Stiffness and Compliance Matrices

Lecture 13 - Strain - Displacement relations

Lecture 14 - Relations for stress and strain along thickness of laminate

Lecture 15 - Stress - Strain variation along Laminate thickness

Lecture 16 - Force and Moment resultant - Part 1

Lecture 17 - Force and Moment resultant - Part 2

Lecture 18 - Important observation related to [A], [B] and [D] matrices

Lecture 19 - Quasi-Isotropic Laminates

Lecture 20 - Maximum Stress Theory

Lecture 21 - Maximum Strain Theory

Lecture 22 - Importance of Sign of Shear Stress.

Lecture 23 - Failure Initiation in Composite Laminate.

Lecture 24 - Progressive Failure of Laminae in A Laminate

Lecture 25 - Governing equations for composite plates

Lecture 26 - Force equilibrium in Z-direction

Lecture 27 - Moment equilibrium equations

Lecture 28 - Equilibrium equations for composite plates

Lecture 29 - Boundary conditions associated with different edges of composite plate - Part 1

Lecture 30 - Boundary conditions associated with different edges of composite plate - Part 2

Lecture 31 - Generalized Solution for Semi-Infinite Plate - Part I

- Lecture 32 - Generalized Solution for Semi-Infinite Plate - Part II
- Lecture 33 - Particular Solution for Semi-Infinite Plate: Case A
- Lecture 34 - Particular Solution for Semi-Infinite Plate: Case B
- Lecture 35 - Particular Solution for Semi-Infinite Plate: Case C
- Lecture 36 - Particular Solution for Semi-Infinite Plate: Case D
- Lecture 37 - Solution for governing equation related to semi-infinite composite plate
- Lecture 38 - Nature of displacement $u_0(x)$ and how it gets influence by important parameters of lamination sequence
- Lecture 39 - Semi-infinite plate loaded in the x-direction - Part 1
- Lecture 40 - Semi-infinite plate loaded in the x-direction - Part 2
- Lecture 41 - Thermal effects in composite laminates - Part 1
- Lecture 42 - Thermal effects in composite laminates - Part 2
- Lecture 43 - Thermal effects in composite laminates - Part 3
- Lecture 44 - Finite Rectangular Plate
- Lecture 45 - Different Boundary Conditions in Finite Rectangular Plate
- Lecture 46 - Example Based On a Finite Rectangular Plate: Part-I
- Lecture 47 - Example Based On a Finite Rectangular Plate: Part-II
- Lecture 48 - Example Based On a Finite Rectangular Plate: Part-III
- Lecture 49 - Anticlastic curvature
- Lecture 50 - Principle of virtual work
- Lecture 51 - Virtual work method: apply to beam problem
- Lecture 52 - Virtual work method: apply to simply supported plate
- Lecture 53 - Beam (two term solution)
- Lecture 54 - 3rd Interpretation of special Galerkin method
- Lecture 55 - Role of D16 and D26 Terms On Laminated Plate Response: Part-I
- Lecture 56 - Role of D16 and D26 Terms On Laminated Plate Response: Part-II
- Lecture 57 - Role of D16 and D26 Terms On Laminated Plate Response: Part-III
- Lecture 58 - Role of D16 and D26 Terms On Laminated Plate Response: Part-IV
- Lecture 59 - Free Vibration in Composite Plate: Part-I
- Lecture 60 - Free Vibration in Composite Plate: Part-II
- Lecture 61 - Buckling of composite plates
- Lecture 62 - Force equilibrium in z-direction for buckling of composite plates
- Lecture 63 - Moment equilibrium around x, y and z-directions for buckling of composite plates
- Lecture 64 - Buckling of an infinitely long composite plate

[Lecture 65 - Buckling of a simply supported finite plate](#)

[Lecture 66 - Composite plate under bidirectional compression](#)

[Lecture 67 - Shear Buckling in Rectangular Composite Plate: Part-I](#)

[Lecture 68 - Shear Buckling in Rectangular Composite Plate: Part-II](#)

[Lecture 69 - Introduction to Short-Fiber Composites](#)

[Lecture 70 - Theories of Stress Transfer: Part-I](#)

[Lecture 71 - Theories of Stress Transfer: Part-II](#)

[Lecture 72 - Modulus of Short-Fiber Composites and Closure](#)

Lecture 1 - Introduction to measurements and metrology

Lecture 2 - Instruments in measurement systems

Lecture 3 - Instruments in measurement systems

Lecture 4 - General concepts and definitions in metrology

Lecture 5 - Standards of measurement

Lecture 6 - Limits, Fits, and Tolerances - Part 1

Lecture 7 - Limits, Fits, and Tolerances - Part 2

Lecture 8 - Limits, Fits, and Tolerances - Part 3

Lecture 9 - Limits, Fits, and Tolerances - Part 4

Lecture 10 - Linear Measurements - Part 1

Lecture 11 - Linear Measurements - Part 2

Lecture 12 - Laboratory demonstration, Vernier Caliper

Lecture 13 - Laboratory demonstration, Dial gauge and vernier, micrometer, surface plate, feeler gauge

Lecture 14 - Angular Measurements - Part 1

Lecture 15 - Angular Measurements - Part 2

Lecture 16 - Laboratory demonstration, Vernier height gauge

Lecture 17 - Laboratory demonstration, Thread gauge, spirit level

Lecture 18 - Laboratory demonstration, Combination set, slip gauges, sine bar

Lecture 19 - Comparators - Part 1

Lecture 20 - Comparators - Part 2

Lecture 21 - Transducers - Part 1

Lecture 22 - Transducers - Part 2

Lecture 23 - Screw thread metrology

Lecture 24 - Gears metrology - Part 1

Lecture 25 - Gears metrology - Part 2

Lecture 26 - Laboratory demonstration, Gear Vernier

Lecture 27 - Surface metrology

Lecture 28 - Temperature measurements

Lecture 29 - Pressure measurements - Part 1

Lecture 30 - Pressure measurements - Part 2

Lecture 31 - Strain measurements - Part 1

- Lecture 32 - Strain measurements - Part 2
- Lecture 33 - Optical measurements and Nanometrology - Part 1
- Lecture 34 - Optical measurements and Nanometrology - Part 2
- Lecture 35 - Optical measurements and Nanometrology - Part 3
- Lecture 36 - Statistics in Metrology, an introduction - Part 1
- Lecture 37 - Statistics in Metrology, an introduction - Part 2
- Lecture 38 - Data and scales in measurements
- Lecture 39 - Discrete and continuous data
- Lecture 40 - Statistics for metrology, fundamental concepts - Part 1
- Lecture 41 - Statistics for metrology, fundamental concepts - Part 2
- Lecture 42 - Statistics for metrology, fundamental concepts - Part 3
- Lecture 43 - Probability distributions for estimating measurement
- Lecture 44 - Normal distribution
- Lecture 45 - Statistics for proportions
- Lecture 46 - Chi square distribution, and Data outlier detection
- Lecture 47 - Quality Control, introduction
- Lecture 48 - Quality Control, control charts for variables
- Lecture 49 - Quality Control, control charts for attributes
- Lecture 50 - Quality Control, critical aspects
- Lecture 51 - 3D measurements, Coordinate Measuring Machine (CMM)
- Lecture 52 - Laboratory demonstration, Coordinate Measuring Machine (CMM)

Lecture 1 - Introduction to Smart Materials

Lecture 2 - Piezoelectric Material

Lecture 3 - Magnetostrictive Material

Lecture 4 - Active Smart Polymer

Lecture 5 - Shape Memory Alloys

Lecture 6 - Introduction to composites

Lecture 7 - Classification of Composites

Lecture 8 - Micromechanics and Macromechanics of Composites

Lecture 9 - Classical Laminated Plate Theory

Lecture 10 - ABD Matrices

Lecture 11 - Modelling of piezoelectric material 1

Lecture 12 - Modelling of piezoelectric material 2

Lecture 13 - Modelling of Magnetostrictive material

Lecture 14 - Modelling of Shape memory Alloys

Lecture 15 - Smart Actuators

Lecture 16 - Smart Materials based MEMS

Lecture 17 - Smart MEMS Applications

Lecture 18 - Energy Harvesting

Lecture 19 - Concept of Self Healing

Lecture 1 - Design concepts

Lecture 2 - Computer Aided Design (CAD)

Lecture 3 - Geometrical transformation

Lecture 4 - Composition of geometrical transformation

Lecture 5 - Geometric modeling

Lecture 6 - Representation of curves

Lecture 7 - Parametric representation of synthetic curves

Lecture 8 - Curve fitting problem (Hermite case)

Lecture 9 - Problem solving (based on Bezier curve)

Lecture 10 - Representation of Surfaces

Lecture 11 - Introduction to Micro-Electro mechanical Systems (MEMS)

Lecture 12 - Lab-on-Chip

Lecture 13 - Introduction to Sensors

Lecture 14 - Introduction to Transducers

Lecture 15 - Introduction to device fabrications

Lecture 16 - Introduction to Silicon as a MEMS material

Lecture 17 - Etching processes

Lecture 18 - Types of Photolithography

Lecture 19 - Introduction to actuators

Lecture 20 - Designing of the Micro-Valve

Lecture 21 - Electrochemical valves

Lecture 22 - Micropumps

Lecture 23 - Designing of peristaltic pumps

Lecture 24 - Different types of pumps and sensors

Lecture 25 - Gas Sensors

Lecture 26 - Computer Numerical Control

Lecture 27 - Numerical Control Programming

Lecture 28 - NC Part Programming

Lecture 29 - Canned Cycles

Lecture 30 - Introduction to Rapid Prototyping

Lecture 31 - Different Types of Rapid Prototyping Technologies

[Lecture 32 - LAB Demonstration of FDM Process](#)

[Lecture 33 & 34](#)

[Lecture 35](#)

[Lecture 36](#)

[Lecture 37, 38 & 39](#)

[Lecture 40](#)

- Lecture 1 - Introduction to Rapid Manufacturing - Part 1
- Lecture 2 - Introduction to Rapid Manufacturing - Part 2
- Lecture 3 - Introduction to Rapid Manufacturing - Part 3
- Lecture 4 - Product Development Process - Part 1
- Lecture 5 - Product Development Process - Part 2
- Lecture 6 - Product Development Process - Part 3
- Lecture 7 - Design for Modularity (Manufacturing)
- Lecture 8 - Design for Modularity (Assembly; Part 1)
- Lecture 9 - Design for Modularity (Assembly; Part 2)
- Lecture 10 - Design for Modularity
- Lecture 11 - Subtractive versus Rapid Manufacturing
- Lecture 12 - Reverse Engineering - Part 1
- Lecture 13 - Reverse Engineering - Part 2
- Lecture 14 - Laboratory Demonstration, Co-ordinate Measuring Machine - Part 1
- Lecture 15 - Laboratory Demonstration, Co-ordinate Measuring Machine - Part 2
- Lecture 16 - Laboratory Demonstration, 3D scanners - Part 1
- Lecture 17 - Laboratory Demonstration, 3D scanners - Part 2
- Lecture 18 - Polymerization Processes - Part 1
- Lecture 19 - Polymerization Processes - Part 2
- Lecture 20 - Powder based processes - Part 1
- Lecture 21 - Powder based processes - Part 2
- Lecture 22 - Powder based processes - Part 3
- Lecture 23 - Extrusion based processes - Part 1
- Lecture 24 - Extrusion based processes - Part 2
- Lecture 25 - Sheet Stacking processes
- Lecture 26 - 3D printing processes
- Lecture 27 - Laboratory Demonstration, 3D printing - Part 1
- Lecture 28 - Laboratory Demonstration, 3D printing - Part 2
- Lecture 29 - Laboratory Demonstration, 3D printing - Part 3
- Lecture 30 - Beam Deposition processes
- Lecture 31 - Materials in Rapid Manufacturing - Part 1

[Lecture 32 - Materials in Rapid Manufacturing - Part 2](#)

[Lecture 33 - Post-processing concerns - Part 1](#)

[Lecture 34 - Post-processing concerns - Part 2](#)

[Lecture 35 - Product costing for Rapid Manufacturing - Part 1](#)

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[Lecture 37 - Rapid Product Development, CAD/CAM - Part 1](#)

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[Lecture 39 - Rapid Product Development, CAD/CAM - Part 3](#)

[Lecture 40 - Rapid Product Development, CAE and CIM](#)

[Lecture 41 - Rapid Product Development, Technomatix, Plant Simulation 10 - Part 1](#)

[Lecture 42 - Rapid Product Development, Technomatix, Plant Simulation 10 - Part 2](#)

[Lecture 43 - Rapid Product Development, Technomatix, Plant Simulation 10 - Part 3](#)

[Lecture 44 - Rapid Manufacturing, case studies](#)

Lecture 1 - Introduction to Combustion

Lecture 2 - Introduction to Combustion (Continued...)

Lecture 3 - Introduction to Combustion (Continued...)

Lecture 4 - Introduction to Combustion (Continued...) + Combustion and Thermochemistry

Lecture 5 - Combustion and Thermochemistry

Lecture 6 - Combustion and Thermochemistry (Continued...)

Lecture 7 - Combustion and Thermochemistry (Continued...) + Chemical Kinetics

Lecture 8 - Chemical Kinetics (Continued...)

Lecture 9 - Chemical Kinetics (Continued...)

Lecture 10 - Chemical Kinetics (Continued...) + Combustion Chemistry

Lecture 11 - Combustion Chemistry (Continued...)

Lecture 12 - Heat and Mass Transfer

Lecture 13 - Heat and Mass Transfer + Coupling of Chemical Kinetics and Thermodynamics

Lecture 14 - Coupling of Chemical Kinetics and Thermodynamics (Continued...)

Lecture 15 - Coupling of Chemical Kinetics and Thermodynamics + Laminar Premixed Flames

Lecture 16 - Laminar Premixed Flames (Continued...)

Lecture 17 - Laminar Premixed Flames (Continued...)

Lecture 18 - Laminar Premixed Flames (Continued...) + Laminar Non-Premixed Flames

Lecture 19 - Laminar Non-Premixed Flames (Continued...)

Lecture 20 - Laminar Non-Premixed Flames (Continued...)

Lecture 21 - Laminar Non-Premixed Flames

Lecture 22 - Laminar Non-Premixed Flames (Continued...)

Lecture 23 - Laminar Non-Premixed Flames (Continued...)

Lecture 24 - Laminar Non-Premixed Flames (Continued...)

Lecture 25 - Laminar Non-Premixed Flames (Continued...)

Lecture 26 - Laminar Non-Premixed Flames + Turbulence

Lecture 27 - Turbulence : Introduction

Lecture 28 - Turbulence : Introduction (Continued...)

Lecture 29 - Turbulence : Flow Stability analysis

Lecture 30 - Turbulence : Flow Stability analysis (Continued...)

Lecture 31 - Turbulence : Stability and Burger's Equation

- Lecture 32 - Turbulence : Energy cascade, length scales and Statistical description
- Lecture 33 - Turbulence : Statistical analysis and free shear flows
- Lecture 34 - Turbulence : Free shear and wall bounded shear flows
- Lecture 35 - Turbulence : Turbulent boundary layer
- Lecture 36 - Turbulence
- Lecture 37 - Turbulence : Temperature effects and Modelling
- Lecture 38 - Turbulence : Modelling and statistics
- Lecture 39 - Turbulence : Modelling (Continued...)
- Lecture 40 - Turbulence : Modelling (Continued...)
- Lecture 41 - Turbulence : Chemistry Interaction
- Lecture 42 - Turbulence : Chemistry Interaction (Continued...)
- Lecture 43 - Turbulence : Chemistry Interaction (Continued...)
- Lecture 44 - Turbulence : Chemistry Interaction (Continued...)
- Lecture 45 - Turbulence : Chemistry Interaction (Continued...)
- Lecture 46 - Turbulent Combustion : Stochastic method of solution
- Lecture 47 - Turbulent Combustion : Transported scalar PDF model
- Lecture 48 - Turbulent Combustion : Transported joint velocity - scalar PDF model
- Lecture 49 - Turbulent Combustion : Modelling Turbulent Premixed Combustion
- Lecture 50 - Turbulent Combustion : Modelling Turbulent Premixed Combustion (Continued...)
- Lecture 51 - Turbulent Combustion : Modelling Turbulent Premixed Combustion (Continued...)
- Lecture 52 - Turbulent Combustion : Modelling Turbulent Premixed Combustion (Continued...)
- Lecture 53 - Turbulent Combustion : Modelling Turbulent Non-Premixed Combustion
- Lecture 54 - Turbulent Combustion : Modelling Turbulent Non-Premixed Combustion (Continued...)
- Lecture 55 - Turbulent Combustion : Modelling Turbulent Non-Premixed Combustion (Continued...)
- Lecture 56 - Turbulent Combustion : Modelling Turbulent Non-Premixed Combustion
- Lecture 57 - Turbulent Combustion : Modelling Turbulent Non-Premixed Combustion (Continued...)
- Lecture 58 - Multiphase Combustion : Introduction + Droplet Evaporation
- Lecture 59 - Multiphase Combustion : Droplet Combustion
- Lecture 60 - Multiphase Combustion : Spray Combustion

Lecture 1 - Introduction to Manufacturing Automation

Lecture 2 - Various Aspects of Manufacturing Automation

Lecture 3 - Part Transfer Mechanisms

Lecture 4 - Automated Flow Lines

Lecture 5 - Analysis of Automated Flow Lines

Lecture 6 - Vibratory Bowl Feeder

Lecture 7 - Analysis of Vibratory Bowl Feeder

Lecture 8 - Reciprocating Tube Hopper Feeder

Lecture 9 - Centreboard Hopper Feeder and its analysis

Lecture 10 - Reciprocating fork and External Gate Hopper Feeders

Lecture 11 - Rotary Disc Feeder and Centrifugal Hopper Feeder

Lecture 12 - Bladed Wheel and Tumbling Barrel Hopper Feeders

Lecture 13 - Rotary Centreboard and Magnetic Feeders

Lecture 14 - Part Orienting Devices

Lecture 15 - Feed Tracks and their analysis

Lecture 16 - Powered Feed Track and Escapements

Lecture 17 - Various Escapements and Part Placing Mechanisms

Lecture 18 - Design for Automatic Assembly

Lecture 19 - Performance and Economics of Assembly Systems

Lecture 20 - Performance of Indexing and Free Transfer Machines

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Co-ordinators : Prof. J. Ramkumar, Prof. Amandeep Singh

Lecture 1 - Introduction to CIM - Part 1

Lecture 2 - Introduction to CIM - Part 2

Lecture 3 - Computers and Manufacturing Systems - Part 1

Lecture 4 - Computers and Manufacturing Systems - Part 2

Lecture 5 - Computers and Manufacturing Systems - Part 3

Lecture 6 - Computer Graphics - Part 1

Lecture 7 - Computer Graphics - Part 2

Lecture 8 - Computer Graphics - Part 3

Lecture 9 - Computer Graphics - Part 4

Lecture 10 - Geometric Modelling - Part 1

Lecture 11 - Geometric Modelling - Part 2

Lecture 12 - Computer Numerical Control - Part 1

Lecture 13 - Computer Numerical Control - Part 2

Lecture 14 - Computer Numerical Control - Part 3

Lecture 15 - Computer Numerical Control - Part 4

Lecture 16 - CNC Machining - Part 1

Lecture 17 - CNC Machining - Part 2

Lecture 18 - CNC Tooling

Lecture 19 - CNC Part Programming - Part 1

Lecture 20 - CNC Part Programming - Part 2

Lecture 21 - CNC Part Programming - Part 3

Lecture 22 - CNC Part Programming - Part 4

Lecture 23 - Laboratory Demonstration, Computer Aided Design - Part 1

Lecture 24 - Laboratory Demonstration, Computer Aided Design - Part 2

Lecture 25 - CAM softwares

Lecture 26 - Laboratory Demonstration, Computer Aided Manufacturing - Part 1

Lecture 27 - Laboratory Demonstration, Computer Aided Manufacturing - Part 2

Lecture 28 - Group Technology

Lecture 29 - Computer Aided Process Planning - Part 1

Lecture 30 - Computer Aided Process Planning - Part 2

Lecture 31 - Flexible Manufacturing System

- Lecture 32 - Robotics
- Lecture 33 - Programmable Logic Controller
- Lecture 34 - Automatic Identification and Data Capture
- Lecture 35 - Computer Aided Quality Control - Part 1
- Lecture 36 - Computer Aided Quality Control - Part 2
- Lecture 37 - Laboratory Demonstration, Coordinate Measuring Machine
- Lecture 38 - Rapid Manufacturing - Part 1
- Lecture 39 - Rapid Manufacturing - Part 2
- Lecture 40 - Laboratory demonstration, Rapid Manufacturing - Part 1
- Lecture 41 - Laboratory demonstration, Rapid Manufacturing - Part 2
- Lecture 42 - Laboratory Demonstration, CAD using Fusion 360, an introduction
- Lecture 43 - Laboratory Demonstration, CAD using Fusion 360, Rendering and 3D printing
- Lecture 44 - Material Handling
- Lecture 45 - Laboratory Demonstration, Plant Simulation software - Part 1
- Lecture 46 - Laboratory Demonstration, Plant Simulation software - Part 2
- Lecture 47 - Laboratory Demonstration, Plant Simulation software - Part 3
- Lecture 48 - Computers in Manufacturing Industry, current scenario - Part 1
- Lecture 49 - Computers in Manufacturing Industry, current scenario - Part 2
- Lecture 50 - Computers in Manufacturing Industry, current scenario - Part 3

Lecture 1 - Introduction to Machining

Lecture 2 - Mechanism of plastic deformation

Lecture 3 - Basic machining parameters, Cutting Tools and Types of Machining

Lecture 4 - Types of Chips, Tool nomenclature and tool angles

Lecture 5 - Tool Nomenclature in Normal Rake System and conversion of angles

Lecture 6 - Selection of Tool angles

Lecture 7 - Forces in machining, Merchant's Circle Diagram

Lecture 8 - Stress, Strain and Strain Rate and Shear Plane Angle

Lecture 9 - Numerical Examples; Lee and Shaffer's model

Lecture 10 - Friction in metal cutting: Zorev's Friction Model

Lecture 11 - Practical Machining Operations

Lecture 12 - Slab Milling; Measurement of Cutting Forces

Lecture 13 - Dynamometers; Tool Wear and Tool Life

Lecture 14 - Factors affecting tool life; Abrasive Machining Processes

Lecture 15 - Mechanics of Grinding Process

Lecture 16 - Chip length and specific energy in Grinding

Lecture 17 - Grinding wheel wear; Oblique Cutting

Lecture 18 - Rake angles in oblique cutting; Economics of Machining

Lecture 19 - Economics of Machining (Continued...); Thermal aspects of machining

Lecture 20 - Surface finish

Lecture 1 - Introduction to Cognitive Robotics (Private)

Lecture 2 - Smart Materials - I (Private)

Lecture 3 - Smart Materials - II (Private)

Lecture 4 - Smart Materials - III (Private)

Lecture 5 - Architecture of the Brain

Lecture 6 - Architecture of the Brain (Continued...)

Lecture 7 - Nerve Cells

Lecture 8 - Introduction to Synchronisation Models

Lecture 9 - Synchronisation models (Continued...)

Lecture 10 - Introduction to EEG

Lecture 11 - Theories of Intelligence - I

Lecture 12 - Theories of Intelligence - II

Lecture 13 - Kuramoto Model

Lecture 14 - Child Robot Interaction

Lecture 1 - Introduction to Robotics

Lecture 2 - Robot Joints and Work Volume

Lecture 3 - Spatial transformations

Lecture 4 - Homogenous Transformtions

Lecture 5 - Practice Problems with MATLAB in Rotation matrices

Lecture 6 - Kinematics: Derivation of Link Transformations

Lecture 7 - Problem Solving DH Parameters

Lecture 8 - Forward Kinematics

Lecture 9 - Inverse Kinematics

Lecture 10 - Problems in Kinematics

Lecture 11 - Inverse Kinematics of PUMA Robot

Lecture 12 - Jacobian and Singularity

Lecture 13 - Velocity and Static Forces

Lecture 14 - Dynamics - Lagrangian Euler

Lecture 15 - Newton Euler Dynamics

Lecture 16 - Trajectory Planning

Lecture 17 - Inverse Dynamics using MATLAB

Lecture 18 - Sensors

Lecture 19 - Actuators and Basic Control System

Lecture 20 - Block Diagram Reduction and Position Regulator

Lecture 21 - Control of a single joint

Lecture 22 - Non Linear Control of Manipulators

Lecture 23 - Force Control

Lecture 24 - Manipulator Mechanism Design

Lecture 25 - Industrial Robots and Applications

Lecture 26 - Specifications and Programming

Lecture 27 - VAL programming

Lecture 28 - Experiment With PUMA Robot Using VAL- II

Lecture 1 - Introduction to Acoustic Wave Propagation

Lecture 2 - D'Alembert's solution and 1-D Continuity equation

Lecture 3 - Muffler Acoustics-Application to Automotive Exhaust Noise Control

Lecture 4 - Linearization of governing equations, and Development of 1-D Acoustic wave and Helmholtz equation

Lecture 5 - Solution of 1-D Helmholtz equation: Propagation in 1-D ducts/pipes

Lecture 6 - 1-D Acoustic Wave Equation in Ducts Carrying Uniform Mean Flow: Derivation

Lecture 7 - 1-D Acoustic Wave Equation in Ducts Carrying Uniform Mean Flow: Solution

Lecture 8 - 3-D Acoustic Wave Equation in Rectangular and Circular Waveguides: Derivation, Modal Solution and Concept of Cut-on Frequency

Lecture 9 - Sound Pressure Level, Intensity Level and Sound Power Level

Lecture 10 - Acoustic Impedance and Reflection Coefficient

Lecture 11 - Lumped System Analysis: Inertance and Compliance

Lecture 12 - Lumped Analysis of a Uniform Pipe Closed/Open at an End, Concept of End Correction

Lecture 13 - Helmholtz Resonator, Electro-Acoustic Analogy and Layout of a typical engine exhaust system

Lecture 14 - Muffler Performance Measures: Insertion Loss

Lecture 15 - Muffler Performance Measures: Transmission Loss and Level Difference

Lecture 16 - Lumped Analysis of a Tube, Simple Area Discontinuity and Transfer Matrices

Lecture 17 - Sudden area Discontinuity (Continued...)

Lecture 18 - Simple Expansion Chamber Analysis Using Transfer Matrix Method

Lecture 19 - Transmission Loss (TL) Graph for a Simple Expansion Muffler (MATLAB)

Lecture 20 - Extended-Inlet and Extended-Outlet Muffler Analysis

Lecture 21 - Extended-Inlet and Extended-Outlet Muffler Analysis (Continued...)

Lecture 22 - TL Analysis of Extended-Inlet and Extended-Outlet Muffler (MATLAB)

Lecture 23 - TL Analysis of Side-Inlet and Side-Outlet Muffler Using Transfer Matrix Method

Lecture 24 - Wave Propagation in Gradually Varying Area Ducts: Webster's Horn Equation

Lecture 25 - Webster's Horn Equation (Continued...) and Exponential Ducts

Lecture 26 - Solution of Webster's Horn Equation for Conical Ducts

Lecture 27 - TL analysis for Conical Muffler Configurations (MATLAB)

Lecture 28 - Segmentation Approach for Analysing Gradually Varying Area Ducts (MATLAB)

Lecture 29 - Acoustic Intensity (Energy Flux) in a Pipe with Mean Flow, and Transmission Loss Expression

Lecture 30 - Aeroacoustic State Variables Transfer Matrix for a Tubular Element (Uniform Pipe)

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Lecture 31 - Transfer Matrix for Extended-Inlet and Outlet Element and Use of Perforated Elements in Commercial Mufflers

Lecture 32 - Two-interacting Duct Configurations: Development of Equations and Concentric Tube Resonators

Lecture 33 - Concentric Tube Resonator: Partially Perforated Pipe or Airway (MATLAB)

Lecture 34 - Review of Perforate Impedance Expressions

Lecture 35 - MATLAB Demonstration for Fully and Partially Perforated CTR

Lecture 36 - Cross-Flow elements: Setting-up the Equations

Lecture 37 - Cross-Flow elements: MATLAB Demonstration for Simple Configurations

Lecture 38 - Plug Mufflers, Three-pass Perforated Element Muffler (Commercial Configurations) - MATLAB

Lecture 39 - Multiply-Connected Mufflers: HQ Tubes

Lecture 40 - TL Analysis of HQ Tubes (MATLAB): Network Analysis and Analytical Formula

Lecture 41 - Transmission Loss in terms of Scattering and Impedance Matrix Parameters

Lecture 42 - Rectangular Chamber Muffler: Characterization and TL Analysis using 3-D Piston-driven Model

Lecture 43 - Circular Chambers: Characterization and TL Analysis Using 3-D Piston-driven Model

Lecture 44 - Analytical Mode-Matching for Extended-Inlet and Outlet Muffler: Setting-up of the Equations

Lecture 45 - MATLAB Demonstration for Transmission Loss Calculations

Lecture 46 - Dissipative Mufflers (Lined Circular duct) - A Brief Discussion

Lecture 47 - Summary of the Topics Covered in This Course, Topics to be Covered in a Future Course

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Lecture 1 - Casting: Introduction to Casting

Lecture 2 - Various aspects of Casting

Lecture 3 - Patterns and Moulds

Lecture 4 - Sand Mould and Gating System

Lecture 5 - Gating System Design

Lecture 6 - Aspiration Effects and Riser Design

Lecture 7 - Solidification of Metals and Alloys

Lecture 8 - Stress, Strain and Strain Rate and Shear Plane Angle

Lecture 9 - Steps in Sand Casting Processes

Lecture 10 - Expendable Mould Casting Processes

Lecture 11 - Permanent Mould Casting

Lecture 12 - Various Casting Processes and Cost Analysis

Lecture 13 - Cost analysis, Casting Defects and Product Design

Lecture 14 - Introduction to Joining Processes

Lecture 15 - Characteristic Features of Welding Processes

Lecture 16 - Various Welding Processes

Lecture 17 - Advanced Welding Processes

Lecture 18 - Characteristic Features of Arc Welding

Lecture 19 - Shielded metal arc welding, MIG and TIG Welding

Lecture 20 - Gas Welding, Brazing and Soldering, Welding Defects

Lecture 1 - Historical Perspectives and Introduction to the Course

Lecture 2 - Finite Difference Method - Basic Idea of Discretization

Lecture 3 - Explicit and Implicit Formulations, Stability Analysis - Part 1

Lecture 4 - Stability Analysis - Part 2

Lecture 5 - Important Aspects of Flow Modelling - Part 1

Lecture 6 - Important Aspects of Flow Modelling - Part 2

Lecture 7 - Important Aspects of Flow Modelling - Part 3

Lecture 8 - Applications of Our Knowledge to a Problem of Practical Interest and Setting up an Algorithm

Lecture 9 - Finite Volume Method - Part 1

Lecture 10 - Finite Volume Method - Part 2

Lecture 11 - Finite Volume Method - Part 3

Lecture 12 - Introduction to Finite Element Method (Preliminary Concepts)

Lecture 13 - Introduction to Finite Element Method (Galerkin Weighted Residual Method)

Lecture 14 - Introduction to Finite element Method (Elemental contributions and formation of Global Matrix)

Lecture 15 - Vorticity Stream Function Approach (Formulation and Algorithm)

Lecture 16 - Vorticity-Stream Function Approach For Solving Navier-Stokes Equations

Lecture 17 - Solving Navier-Stokes Equations For Incompressible Flows using SIMPLE Algorithm - Part 1

Lecture 18 - Solving Navier-Stokes Equations For Incompressible Flows using SIMPLE Algorithm - Part 2

Lecture 19 - Solving Navier-Stokes Equations For Incompressible Flows using MAC Algorithm - Part 2

Lecture 20 - MAC Algorithm (Pressure - Velocity Iteration and the Solution)

Lecture 21 - MAC Algorithm (Solution of Energy Equation)

Lecture 22 - A Finite Volume Method to solve NS Equations in 3D Complex Geometry - Part 1

Lecture 23 - A Finite Volume Method to solve NS Equations in 3D Complex Geometry - Part 2

Lecture 24 - A Finite Volume Method to solve NS Equations in 3D Complex Geometry - Part 3

Lecture 25 - Mathematical Approaches to Turbulent Flows (Preliminaries and Modeling Framework)

Lecture 26 - Mathematical Approaches to Turbulent Flows (Modeling on the basis of RANS)

- Lecture 1 - Engineering Materials and Their Properties - 1
- Lecture 2 - Engineering Materials and Their Properties - 2
- Lecture 3 - Engineering Materials and Their Properties - 3
- Lecture 4 - Metal Machining-1: Introduction to Machining
- Lecture 5 - Metal Machining-2: Mechanism of plastic deformation
- Lecture 6 - Metal Machining-3: Types of Chips, Tool nomenclature and tool angles
- Lecture 7 - Metal Machining-4: Selection of Tool angles, Forces in machining
- Lecture 8 - Metal Machining-5: Merchant's Circle Diagram
- Lecture 9 - Metal Machining-6: Friction in Metal Cutting
- Lecture 10 - Metal Machining-7: Practical Machining Operations; Force Measurement
- Lecture 11 - Metal Machining-8: Force Measurement
- Lecture 12 - Metal Machining-9: Tool Wear and Tool Life
- Lecture 13 - Metal Machining-10: Factors affecting Tool Life
- Lecture 14 - Metal Machining-11: Abrasive Machining Processes
- Lecture 15 - Metal Machining-12: Abrasive Machining Processes
- Lecture 16 - Metal Machining-13: Grinding; Economics of Machining
- Lecture 17 - Machining-14: Economics of Machining
- Lecture 18 - Non-Traditional Machining-1: Introduction; Classification
- Lecture 19 - Non-Traditional Machining-2: Various Non-Traditional Machining Processes
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NPTEL : Solar Energy Technology (Mechanical Engineering)

Co-ordinators : Prof. V.V. Satyamurty

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Lecture 2 - Sun - Earth Geometry

Lecture 3 - Terminology Extra - Terrestrial Radiation Terrestria Radiation

Lecture 4 - Measuring Instruments

Lecture 5 - Estimation of Solar Radiation or Details

Lecture 6 - Radiation Processing - Long Term

Lecture 7 - Evaluation of the Apparent Sunrise and Sunset Angles

Lecture 8 - Estimation of Daily/Monthly Average daily Tilt Factor Under Terrestrial Conditions

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Lecture 11 - Daily (Or Monthly Average Daily) Transmittance - Absorptance Product Analytical Evaluation

Lecture 12 - Theory of Flat Plate Collectors - Liquid Based (A)

Lecture 13 - Theory of Flat Plate Collectors - Liquid Based (B)

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Lecture 15 - Mean temperature and Heat Capacity Effects

Lecture 16 - Theory of Air Based Solar Flat Plate Collectors

Lecture 17 - Theory of Air Based Solar Flat Plate Collectors (Continued.)

Lecture 18 - Other Collector Geometries

Lecture 19 - Concentrating Collectors

Lecture 20 - Concentrating Collectors (Continued.)

Lecture 21 - Concentrating Collectors (Continued.)

Lecture 22 - Compound Parabolic Collectors

Lecture 23 - Exercise - I

Lecture 24 - Exercise - I (Continued.)

Lecture 25 - Device and System Performance

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Lecture 28 - Long Term Solar Energy System Performance Simplified Design Methods

Lecture 29 - Long Term Solar Energy System Performance Simplified Design Methods (Continued.)

Lecture 30 - Monthly Average Daily Utilizability

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Lecture 3 - Adhesion of Surface Coating

Lecture 4 - CVD System

Lecture 5 - CVD of TiC

Lecture 6 - Chemical Vapour Deposition of Nitride Coating

Lecture 7 - Chemical Vapour Deposition of Carbo-Nitride Coating

Lecture 8 - Chemical Vapour Deposition of Chromium

Lecture 9 - Chemical Vapour Deposition of Aluminium Oxide

Lecture 10 - Chemical Vapour Deposition of Diamond

Lecture 11 - Vacuum Evaporation Deposition

Lecture 12 - Reactive Evaporation Deposition

Lecture 13 - Cathodic Arc Evaporation Deposition

Lecture 14 - Sputtering

Lecture 15 - Magnetron Sputtering

Lecture 16 - Unbalanced Magnetron Sputtering

Lecture 17 - Radio frequency and pulsed DC sputtering

Lecture 18 - Sputter Deposition of Nitride Coating

Lecture 19 - Sputter Deposition of Molybdenum Di Sulphide Coating

Lecture 20 - Influence of Architecture of Sputter Deposited Molybdenum Di Sulphide Coating

Lecture 21 - Electro Plating, Anodizing and Electro-Less Plating

Lecture 22 - Coating of Monolayer Abrasive Grain by Electro Plating

Lecture 23 - Mechanism of Wetting

Lecture 24 - Coating on Ceramics by Wetting

Lecture 25 - Coating of Monolayer Abrasive Grain by Wetting

Lecture 26 - Coating on Abrasive Grain

Lecture 27 - Combustion Spray Process

Lecture 28 - Plasma Spray Process

Lecture 29 - Mechanical, Chemical and Ion-Assisted Method

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- Lecture 2 - Transverse Vibrations of Strings - II
- Lecture 3 - Axial and Torsional Vibrations of Bars
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- Lecture 6 - Modal Analysis - I
- Lecture 7 - Modal Analysis - II
- Lecture 8 - Properties of the Eigenvalue Problem
- Lecture 9 - Modal Analysis: Approximate Methods - I
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- Lecture 11 - The Initial Value Problem
- Lecture 12 - Forced Vibration Analysis - I
- Lecture 13 - Forced Vibration Analysis - II
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- Lecture 15 - Damping in Structures
- Lecture 16 - Axially Translating Strings
- Lecture 17 - d' Alembert's Solution - I
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- Lecture 21 - Applications of Wave Solution - I
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- Lecture 23 - Beam Models - I
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- Lecture 6 - Second Law and Its Corollaries - I
- Lecture 7 - Second Law and Its Corollaries - II
- Lecture 8 - Second Law and Its Corollaries - III
- Lecture 9 - Second Law and Its Corollaries - IV
- Lecture 10 - Second Law and Available Energy - I
- Lecture 11 - Second Law and Available Energy - II
- Lecture 12 - Second Law and Available Energy - III
- Lecture 13 - Thermodynamic Property Relations - I
- Lecture 14 - Thermodynamic Property Relations - II
- Lecture 15 - Joule-Kelvin Expansion: Properties of Pure Substances
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- Lecture 18 - Properties of Pure Substances: Ideal Gases
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- Lecture 21 - Vapor Power Cycle - II
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Lecture 2 - Design And Manufacturing

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Lecture 9 - Design for Strength

Lecture 10 - Design For Strength

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Lecture 19 - Design Of Power Screws

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Lecture 22 - Rivet Joints

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Lecture 25 - Design of Joints With Eccentric Loading

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NPTEL : Manufacturing Processes II (Mechanical Engineering)

Co-ordinators : Prof. S. Paul, Prof. A.B. Chattopadhyay, Prof. A.K. Chattopadhyay

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Lecture 4 - Interrelations Among The Tool Angles

Lecture 5 - Mechanism of Chip Formation

Lecture 6 - Orthogonal and Oblique Cutting

Lecture 7 - Use of Chip Breaker in Machining

Lecture 8 - Machining Forces

Lecture 9 - Analytical and Experimental

Lecture 10 - Dynamometers for Measuring Cutting Forces

Lecture 11 - CTCEAC

Lecture 12 - CCTCFA

Lecture 13 - Concept of Machinability and its Improvement

Lecture 14 - Tool Life

Lecture 15 - Conventional Cutting Tool Maths

Lecture 16 - Advanced Tool Materials

Lecture 17 - Kinematics System of Centre Lathe

Lecture 18 - General Purpose Machine Tool Drills

Lecture 19 - Kinematic Systems and Operations

Lecture 20 - Configuration and Kinematic System

Lecture 21 - Mounting of jobs and Cutting Tools in Machine

Lecture 22 - Mounting of jobs and Cutting Tools in Machine

Lecture 23 - Construction, Operation and Tool Layout

Lecture 24 - Use of Attachments In Machine Tools

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[Lecture 33 - Gear Manufacturing](#)

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NPTEL : Refrigeration and Air Conditioning (Mechanical Engineering)

Co-ordinators : Prof. M. Ramgopal, Prof. R.C. Arora

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Lecture 2 - Refrigerant Compressors & Development

Lecture 3 - Applications of RTAC

Lecture 4 - Review of Fundamentals Thermodynamics - I

Lecture 5 - Review of Fundamentals

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Lecture 7 - Fundamentals of Heat Transfer

Lecture 8 - Methods of Producing low Temperatures

Lecture 9 - Air Cycle Refrigeration Systems

Lecture 10 - Vapour Compression Refrigeration Systems

Lecture 11 - Vapour Compression Refrigeration Systems (Continued...)

Lecture 12 - Vapour Compression Refrigeration Systems (Continued...)

Lecture 13 - Vapour Compression Refrigeration Systems (Continued...)

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Lecture 16 - Vapour Absorption Refrigeration Systems (Continued...)

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Lecture 21 - Refrigeration System Components : Compressor (Continued...)

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Lecture 23 - Refrigeration System Components : Compressor (Continued...)

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- [Lecture 36 - Inside Design Condition Thermal Comfort](#)
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- [Lecture 44 - Transmission and Distribution of Air](#)
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NPTEL : Fluid Mechanics (Mechanical Engineering)

Co-ordinators : Prof. S.K. Som

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Lecture 2 - Introduction and Fundamental Concepts - Part II

Lecture 3 - Introduction and Fundamental Concepts - Part III

Lecture 4 - Fluid Statics - Part I

Lecture 5 - Fluid Statics - Part II

Lecture 6 - Fluid Statics - Part III

Lecture 7 - Fluid Statics - Part IV

Lecture 8 - Fluid Statics - Part V

Lecture 9 - Fluid Statics - Part VI

Lecture 10 - Kinematics of Fluid - Part I

Lecture 11 - Kinematics of Fluid - Part II

Lecture 12 - Kinematics of Fluid - Part III

Lecture 13 - Conservation Equations in Fluid Flow - Part I

Lecture 14 - Conservation Equations in Fluid Flow - Part II

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Lecture 18 - Conservation Equations in Fluid Flow - Part VI

Lecture 19 - Conservation Equations in Fluid Flow - Part VII

Lecture 20 - Conservation Equations in Fluid Flow - Part VIII

Lecture 21 - Conservation Equations in Fluid Flow - Part IX

Lecture 22 - Fluid Flow Applications - Part I

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Lecture 24 - Fluid Flow Applications - Part III

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- [Lecture 36 - Principles of Similarity - Part I](#)
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- [Lecture 41 - Flows with a Free Surface - Part I](#)
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- [Lecture 46 - Introduction to Laminar Boundary Layer - Part I](#)
- [Lecture 47 - Introduction to Laminar Boundary Layer - Part II](#)
- [Lecture 48 - Introduction to Turbulent Flow - Part I](#)
- [Lecture 49 - Introduction to Turbulent Flow - Part II](#)

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Lecture 2 - Energy Transfer in Fluid Machines Part - I

Lecture 3 - Energy Transfer in Fluid Machines Part - II

Lecture 4 - Energy Transfer - impulse and Reaction Machines, efficiencies of Fluid Machines

Lecture 5 - Principles of Similarity in Fluid Machines

Lecture 6 - Concept of specific speed and introduction to Impulse Hydraulic Turbine

Lecture 7 - Analysis of force on the Bucket of Pelton wheel and Power Generation

Lecture 8 - Specific speed, Governing and Limitation of a Pelton Turbine

Lecture 9 - Introduction to reaction Type of Hydraulic Turbine - A Francis Turbine

Lecture 10 - Analysis of Force on Francis Runner and Power Generation

Lecture 11 - Axial Flow Machine and Draft Tube

Lecture 12 - Governing of Reaction Turbine

Lecture 13 - Introduction to Rotodynamic Pumps

Lecture 14 - Flow and Energy Transfer in a Centrifugal Pump

Lecture 15 - Characteristics of a Centrifugal Pump

Lecture 16 - Matching of Pump and System Characteristics

Lecture 17 - Diffuser and Cavitation

Lecture 18 - Axial Flow Pump

Lecture 19 - Reciprocating Pump - Part I

Lecture 20 - Reciprocating Pump - Part II

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Lecture 25 - Axial Flow Compressor - Part II

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Lecture 28 - Thermodynamic Relations and Speed of Sound

Lecture 29 - Disturbance propagation, Stagnation and Sonic Properties

Lecture 30 - Effects of Area Variation on Properties in an Isentropic Flow

Lecture 31 - Choking in a Converging Nozzle

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[Lecture 9 - Fluid Statics \(Continued...\)](#)

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[Lecture 12 - Fluid Kinematics \(Continued...\)](#)

[Lecture 13 - Fluid Kinematics \(Continued...\)](#)

[Lecture 14 - Fluid Kinematics \(Continued...\)](#)

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[Lecture 18 - Dynamics of Inviscid Flows \(Continued...\)](#)

[Lecture 19 - Dynamics of Inviscid Flows \(Continued...\)](#)

[Lecture 20 - Dynamics of Inviscid Flows \(Continued...\)](#)

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[Lecture 23 - Integral Forms of Control Volume Conservation Equations \(Reynolds Transport Theorem\) \(Continued...\)](#)

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[Lecture 30 - Some Exact Solutions of Navier Stokes Equation](#)

[Lecture 31 - Some Exact Solutions of Navier Stokes Equation \(Continued...\)](#)

- [Lecture 32 - Some Exact Solutions of Navier Stokes Equation \(Continued...\)](#)
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- [Lecture 35 - Introduction to Turbulence \(Continued...\)](#)
- [Lecture 36 - Introduction to Turbulence \(Continued...\)](#)
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NPTEL : Micro fluidics (Mechanical Engineering)

Co-ordinators : Prof. S. Chakraborty

Lecture 1 - Introduction to Microfluidics

Lecture 2 - Microfluidics: Some Application Examples

Lecture 3 - Microfluidics: Some More Application Examples

Lecture 4 - Equations of Conservation

Lecture 5 - Navier Stokes Equation

Lecture 6 - Navier Stokes Equation (Continued...)

Lecture 7 - Energy Equation

Lecture 8 - Energy Equation (Continued...) and Species Conservation Equation

Lecture 9 - Pressure-driven Microflows

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Lecture 14 - Some Examples of Unsteady Flows

Lecture 15 - Some Examples of Unsteady Flows (Continued...)

Lecture 16 - Some Examples of Unsteady Flows (Continued...)

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Lecture 19 - Lubrication Theory (Continued...)

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Lecture 1 - Introduction and Fundamental Concepts - I

Lecture 2 - Introduction and Fundamental Concepts - II

Lecture 3 - Heat Conduction Equation

Lecture 4 - Heat Conduction Equation and Different Types of Boundary Conditions

Lecture 5 - 1D Steady State Heat Conduction In Plane Wall Without Generation of Thermal Energy

Lecture 6 - 1D Steady State Heat Conduction In Plane Wall With Generation of Thermal Energy

Lecture 7 - Problems on 1D Steady State Heat Conduction In Plane Wall

Lecture 8 - 1D Steady State Heat Conduction In Cylindrical Geometry

Lecture 9 - 1D Steady State Heat Conduction In Cylindrical Geometry (Continued...)

Lecture 10 - 1D Steady State Heat Conduction in Spherical Geometry

Lecture 11 - Heat Transfer from Extended Surfaces (Fins)

Lecture 12 - Heat Transfer from Extended Surfaces (Continued...)

Lecture 13 - Two-dimensional Steady State Heat Conduction

Lecture 14 - Unsteady State Heat Conduction

Lecture 15 - Unsteady State Heat Conduction (Continued...)

Lecture 16 - One Dimensional Unsteady State Heat Conduction - I

Lecture 17 - One Dimensional Unsteady State Heat Conduction - II

Lecture 18 - Introduction to Convection

Lecture 19 - Convection - I

Lecture 20 - Review of Fluid Mechanics - I

Lecture 21 - Review of Fluid Mechanics - II

Lecture 22 - Review of Fluid Mechanics - III

Lecture 23 - Review of Fluid Mechanics - IV

Lecture 24 - Review of Fluid Mechanics - V

Lecture 25 - Review of Fluid Mechanics - VI

Lecture 26 - Review of Fluid Mechanics - VIII

Lecture 27 - Energy Equation - I

Lecture 28 - Energy Equation - II and Thermal Boundary Layer - I

Lecture 29 - Thermal Boundary Layer - II

Lecture 30 - Integral Method for Thermal BL Analysis

Lecture 31 - Internal Forced Convection - I

[Lecture 32 - Internal Forced Convection - II](#)

[Lecture 33 - Internal Forced Convection - III](#)

[Lecture 34 - Internal Forced Convection - IV](#)

[Lecture 35 - Free Convection - I \(Natural Convection\)](#)

[Lecture 36 - Free Convection - II \(Natural Convection\)](#)

[Lecture 37 - Boiling and Condensation - I](#)

[Lecture 38 - Boiling and Condensation - II](#)

[Lecture 39 - Heat Exchanger - I](#)

[Lecture 40 - Heat Exchanger - II](#)

[Lecture 41 - Heat Exchanger - II \(Continued...\)](#)

- Lecture 1 - Transverse Vibrations of Strings - I
- Lecture 2 - Transverse Vibrations of Strings - II
- Lecture 3 - Axial and Torsional Vibrations of Bars
- Lecture 4 - Variational Formulation - I
- Lecture 5 - Variational Formulation - II
- Lecture 6 - Modal Analysis - I
- Lecture 7 - Modal Analysis - II
- Lecture 8 - Properties of the Eigenvalue Problem
- Lecture 9 - Modal Analysis: Approximate Methods - I
- Lecture 10 - Modal Analysis: Approximate Methods - II
- Lecture 11 - The Initial Value Problem
- Lecture 12 - Forced Vibration Analysis - I
- Lecture 13 - Forced Vibration Analysis - II
- Lecture 14 - Forced Vibration Analysis - III
- Lecture 15 - Damping in Structures - I
- Lecture 16 - Damping in Structures - II
- Lecture 17 - Beam Models - I
- Lecture 18 - Beam Models - II
- Lecture 19 - Modal Analysis of Beams
- Lecture 20 - Application of Modal Solution
- Lecture 21 - Approximate Methods
- Lecture 22 - Topics in Beam Vibrations - I
- Lecture 23 - Topics in Beam Vibrations - II
- Lecture 24 - Dynamics of Curved Beams
- Lecture 25 - Vibrations of Rings and Arches - I
- Lecture 26 - Vibrations of Rings and Arches - II
- Lecture 27 - Dynamics of Membranes
- Lecture 28 - Vibrations of Rectangular Membranes
- Lecture 29 - Vibrations of Circular Membranes - I
- Lecture 30 - Vibrations of Circular Membranes - II
- Lecture 31 - Dynamics of Plates

[Lecture 32 - Vibrations of Rectangular Plates](#)

[Lecture 33 - Vibrations of Circular Plates](#)

[Lecture 34 - Special Problems in Plate Vibrations - I](#)

[Lecture 35 - Special Problems in Plate Vibrations - II](#)

Lecture 1 - Definition of Fluid Machines and Energy Transfer in Fluid Machines - Part I

Lecture 2 - Energy Transfer in Fluid Machines - Part II

Lecture 3 - Impulse and Reaction Machines: Introductory Concepts

Lecture 4 - Principles of Similarity in Fluid Machine

Lecture 5 - Concept of Specific Speed

Lecture 6 - Basic Principles, Analysis of Force and Power Generation - Part I

Lecture 7 - Basic Principles, Analysis of Force and Power Generation - Part II

Lecture 8 - Specific Speed Governing and Limitations of Impulse Turbine

Lecture 9 - Tutorial - I

Lecture 10 - Tutorial - II

Lecture 11 - Introduction and Analysis of Force on Francis Turbine (Radial Flow) - Part I

Lecture 12 - Analysis of Force (Part-II) and Power Generation

Lecture 13 - Draft Tube

Lecture 14 - Tutorial - III

Lecture 15 - Tutorial - IV

Lecture 16 - Axial Flow Turbine

Lecture 17 - Governing of Reaction Turbine

Lecture 18 - Introduction to Rotodynamic Pumps

Lecture 19 - Flow and Energy Transfer to Centrifugal Pumps

Lecture 20 - Tutorial - V

Lecture 21 - Characteristics of a Centrifugal Pump

Lecture 22 - Matching of Pump and System Characteristics

Lecture 23 - Diffuser and Cavitation

Lecture 24 - Tutorial - VI

Lecture 25 - Tutorial - VIII

Lecture 26 - Axial Flow Pump

Lecture 27 - Reciprocating Pump - Part I

Lecture 28 - Reciprocating Pump - Part II

Lecture 29 - Tutorial - VIII

Lecture 30 - Basic Principles and Energy Transfer in Centrifugal Compressor - Part I

Lecture 31 - Basic Principles and Energy Transfer in Centrifugal Compressor - Part II

[Lecture 32 - Basic Principles and Energy Transfer in Centrifugal Compressor - Part III](#)

[Lecture 33 - Basic Principles and Energy Transfer in Centrifugal Compressor - Part IV and Losses in Centrifugal Compressors](#)

[Lecture 34 - Performance Characteristics of Centrifugal Compressors - Part I](#)

[Lecture 35 - Performance Characteristics of Centrifugal Compressors - Part II](#)

[Lecture 36 - Basic Principles and Energy Transfer in Axial Flow Compressor - Part I](#)

[Lecture 37 - Basic Principles and Energy Transfer in Axial Flow Compressor - Part II](#)

[Lecture 38 - Fans and Blowers - Part I](#)

[Lecture 39 - Fans and Blowers - Part II](#)

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Computer numerical control (CNC) of machine tools and processes (Mechanical Engineering)

Co-ordinators : Prof. Asimava Roy Choudhury

Lecture 1 - Introduction to computer control – role of computers in automation

Lecture 2 - Introduction (Continued...) - binary logic and logic gates

Lecture 3 - Classification of Computer numerical control (CNC) – Point to point and continuous control

Lecture 4 - Classification (Continued...) - Closed loop and open loop control

Lecture 5 - Tutorial involving simple calculations on different aspects of CNC controls

Lecture 6 - Questions, MCQ Discussions on Motors, Encoders, Decoders and Programming Practice

Lecture 7 - Stepper motors, Permanent magnet DC motors

Lecture 8 - Binary circuits and decoders

Lecture 9 - Tachogenerator, printed circuit motors, Encoders

Lecture 10 - Programming Practice - I

Lecture 11 - Programming Practice - II

Lecture 12 - Computer Aided Offline Programming

Lecture 13 - Interpolators - Linear

Lecture 14 - Interpolators - Curvilinear

Lecture 15 - Questions on Programming and Interpolation

Lecture 16 - 3-D Machining - Basic Concepts

Lecture 17 - Curved Surface Geometry

Lecture 18 - Cutter Path Generation for Curved Surfaces

Lecture 19 - Cutter Path Generation (Concluding Part) and Current Status - CNC Machining and Related Processes

Lecture 20 - Questions and Discussions on Curved Surface Machining

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Non Traditional Abrasive Machining Processes - Ultrasonic, Abrasive Jet and Abrasive Water Jet Machining (Mechanical Engineering)

Co-ordinators : Prof. Asimava Roy Choudhury

Lecture 1 - Non-traditional abrasive machining : Ultrasonic, Abrasive jet and abrasive water jet machining

Lecture 2 - Ultrasonic Machining

Lecture 3 - Ultrasonic Machining (Continued...)

Lecture 4 - Ultrasonic Machining - Free Impacts and Problem Solving

Lecture 5 - Ultrasonic Machining - Problems and MCQs

Lecture 6 - USM - Horn Design

Lecture 7 - USM - Horn Design (Continued...)

Lecture 8 - Ultrasonic Machining - Feed Mechanism, Head design and other aspects

Lecture 9 - Ultrasonic Machining - Effects of Various Inputs on the Output

Lecture 10 - Ultrasonic Machining - Numerical and MCQs

Lecture 11 - A JM (Abrasive jet machining)

Lecture 12

Lecture 13 - A JM - Numerical problems

Lecture 14 - A JM - Process Parameters and Response Characteristics take - home assignment discussing

Lecture 15 - A JM - MCQs

Lecture 16

Lecture 17 - AWJM - Equipment

Lecture 18 - AWJM - Numerical Problems

Lecture 19 - AWJM - Application Equipment Details

Lecture 20 - AWJM - MCQs

- Lecture 1 - Lagrangian and Eulerian Approach, Types of fluid flow
- Lecture 2 - Streamlines, Streakline and Pathline
- Lecture 3 - Acceleration of fluid flow
- Lecture 4 - Deformation and Conservation of mass of fluid a element
- Lecture 5 - Angular deformation of a fluid element, vorticity and streamfunction and velocity potential
- Lecture 6 - Euler's equation
- Lecture 7 - Bernoulli's Equation - Part I
- Lecture 8 - Bernoulli's Equation - Part II
- Lecture 9 - Reynolds Transport Theorem (RTT)
- Lecture 10 - Application of Conservation of Mass
- Lecture 11 - Application of RTT: Conservation of Linear Momentum
- Lecture 12 - Application of RTT in Accelerating Reference Frames
- Lecture 13 - Navier's Equation of Motion
- Lecture 14 - Derivation of Navier-Stokes Equation
- Lecture 15 - Derivation of Navier-Stokes Equation (Continued...)
- Lecture 16 - Derivation of Navier-Stokes Equation (Continued...)
- Lecture 17 - Fully developed flow between two parallel plates
- Lecture 18 - Force on a surface immersed in fluid - Part III, Stability of solid bodies in fluid - Part I
- Lecture 19 - Couette flow
- Lecture 20 - Flow with interfaces
- Lecture 21 - Thin film flow on an inclined plane and Hagen-Poiseuille flow
- Lecture 22 - Hagen-Poiseuille flow (Continued...)
- Lecture 23 - Flow between two rotating cylinders
- Lecture 24 - Stokes 1st problem
- Lecture 25 - Stokes 2nd problem
- Lecture 26 - Introduction to turbulence: basic concepts
- Lecture 27 - Eddies
- Lecture 28 - Eddies (Continued...) and Vortex shredding
- Lecture 29 - Statistical description of turbulent flows
- Lecture 30 - Reynolds stress
- Lecture 31 - Reynolds averaged Navier Stokes equation (RANS)

- Lecture 32 - Bernoulli's equation - Part I
- Lecture 33 - Bernoulli's equation - Part II
- Lecture 34 - Bernoulli's equation - Part III
- Lecture 35 - Euler's equation in streamline coordinates
- Lecture 36 - Flow over a flat plate: Blasius equation
- Lecture 37 - Momentum integral method for boundary layer analysis
- Lecture 38 - Approximate solution of the momentum integral equation
- Lecture 39 - Displacement and Momentum thickness
- Lecture 40 - Illustrative examples
- Lecture 41 - Boundary layer separation
- Lecture 42 - Resultant force on a body immersed in a fluid under motion
- Lecture 43 - Potential flow
- Lecture 44 - Examples of Potential flow
- Lecture 45 - Some more examples of Potential flows, Lift and Drag force
- Lecture 46 - Applications of lift and drag force
- Lecture 47 - Some examples of flow past immersed bodies
- Lecture 48 - Sports Ball aerodynamics
- Lecture 49 - Introduction to compressible flows
- Lecture 50 - Significance of Mach number
- Lecture 51 - Navier-Stokes equation - Part I
- Lecture 52 - Navier-Stokes equation - Part II
- Lecture 53 - Navier-Stokes equation - Part III
- Lecture 54 - Navier-Stokes equation - Part IV
- Lecture 55 - Pipe Flow - Part I
- Lecture 56 - Pipe Flow - Part II
- Lecture 57 - Pipe Flow - Part III
- Lecture 58 - Pipe Flow - Part IV
- Lecture 59 - Principle of Similarity and Dynamical Analysis - Part I
- Lecture 60 - Principle of Similarity and Dynamical Analysis - Part II

Lecture 1 - Introduction

Lecture 2 - Simple Gear Calculations

Lecture 3 - Gear Geometry

Lecture 4 - Helical Gear Problems

Lecture 5 - Numerical Problem MCQ

Lecture 6 - Numerical Problem Milling of Helical Gears

Lecture 7 - Simple and Compound Indexing

Lecture 8 - Differential Indexing

Lecture 9 - Helical Gear Cutting on Milling Machine

Lecture 10 - Numerical Problems on Gear Milling

Lecture 11 - Gear Shaping - I

Lecture 12 - Gear Shaping - II

Lecture 13 - Gear Shaping - III

Lecture 14 - Gear Shaping - IV

Lecture 15 - Gear Hobbing - I

Lecture 16 - Gear Hobbing - II

Lecture 17 - Gear Hobbing - III

Lecture 18 - Gear Hobbing - IV

Lecture 19 - Gear Hobbing - V

Lecture 20 - Gear Hobbing - VI

Lecture 1 - Introduction, Definition of System, Properties and State of a System

Lecture 2 - Properties of pure substances

Lecture 3 - Properties of pure substances (Continued...)

Lecture 4 - Heat and Work

Lecture 5 - Tutorial 1: Properties of pure substances, heat and work

Lecture 6 - Zeroth Law of Thermodynamics

Lecture 7 - First law of thermodynamics for closed systems - Part I

Lecture 8 - First law of thermodynamics for closed systems - Part II, some examples

Lecture 9 - Tutorial 2: First law of thermodynamics for closed systems

Lecture 10 - First law of thermodynamics for open systems

Lecture 11 - Tutorial 3: First law of thermodynamics for open systems

Lecture 12 - Second law and its corollaries - Part I

Lecture 13 - Second law and its corollaries - Part II

Lecture 14 - Second law and its corollaries - Part III

Lecture 15 - Definition of entropy and entropy change in closed systems

Lecture 16 - Entropy change in closed systems (Continued...)

Lecture 17 - Tutorial 4: Entropy

Lecture 18 - Entropy and its transport

Lecture 19 - Tutorial 5: Entropy and its transport

Lecture 20 - Introduction to Third Law

Lecture 21 - Review of learning concepts

Lecture 1 - Introduction to waste heat recovery

Lecture 2 - Introduction to waste heat recovery (Continued...)

Lecture 3 - Introduction to waste heat recovery (Continued...)

Lecture 4 - Introduction to waste heat recovery (Continued...)

Lecture 5 - Thermodynamic principles of waste heat recovery

Lecture 6 - Thermodynamic principles of waste heat recovery (Continued...)

Lecture 7 - Thermodynamic principles of waste heat recovery (Continued...)

Lecture 8 - Thermodynamic principles of waste heat recovery (Continued...)

Lecture 9 - Reversible Cycles

Lecture 10 - Reversible Cycles (Continued...)

Lecture 11 - Entropy

Lecture 12 - Entropy (Continued...)

Lecture 13 - Entropy (Continued...), Exergy

Lecture 14 - Exergy, Second Law efficiency

Lecture 15 - Second Law efficiency (Continued...)

Lecture 16 - Recapitulation of common power cycles

Lecture 17 - Recapitulation of common power cycles (Continued...)

Lecture 18 - Recapitulation of common power cycles (Continued...)

Lecture 19 - Recapitulation of common power cycles (Continued...)

Lecture 20 - Recapitulation of common power cycles (Continued...)

Lecture 21 - Recapitulation of common power cycles (Continued...)

Lecture 22 - Gas Turbine cycle

Lecture 23 - Combined cycle

Lecture 24 - Combined cycle (Continued...)

Lecture 25 - Combined Cycle (Continued...)

Lecture 26 - Heat recovery steam generator

Lecture 27 - Thermodynamic cycles for low temperature application

Lecture 28 - Thermodynamic cycles for low temperature application (Continued...), Cogeneration

Lecture 29 - Heat Exchanger

Lecture 30 - Heat Exchanger (Continued...)

Lecture 31 - Heat Exchanger (Continued...)

[Lecture 32](#)

[Lecture 33](#)

[Lecture 34](#)

[Lecture 35](#)

[Lecture 36](#)

[Lecture 37 - Heat Pipe - Part I](#)

[Lecture 38 - Heat Pipe - Part II](#)

[Lecture 39 - Heat Pipe - Part III](#)

[Lecture 40 - Direct Conversion - Introduction to TEG](#)

[Lecture 41 - Thermoelectric Generators - Functioning and Applications](#)

[Lecture 42 - TEG - performance analysis](#)

[Lecture 43 - TEG - performance optimization](#)

[Lecture 44 - Direct Conversion - Magneto Hydro dynamics \(MHD\)](#)

[Lecture 45 - Direct Conversion - Thermo-Ionic generation](#)

[Lecture 46 - Direct Conversion - Thermo Photo Voltaic generation \(TPV\)](#)

[Lecture 47 - Heat Pumps - I](#)

[Lecture 48 - Heat Pumps - II](#)

[Lecture 49 - Heat Pumps - III](#)

[Lecture 50 - Waste Heat Recovery from Incinerator Plants](#)

[Lecture 51 - Energy Storage Systems - I](#)

[Lecture 52 - Energy Storage Systems - II](#)

[Lecture 53 - Energy Storage Systems - III](#)

[Lecture 54 - Energy Storage Systems - IV](#)

[Lecture 55 - Energy Storage Systems - V](#)

[Lecture 56 - Energy Storage Systems - VI](#)

[Lecture 57](#)

[Lecture 58](#)

[Lecture 59](#)

[Lecture 60](#)

[Lecture 61](#)

[Lecture 62](#)

[Lecture 63](#)

[Lecture 64](#)

[Lecture 65](#)

[Lecture 66](#)

[Lecture 67](#)

[Lecture 68 - Corrigendum](#)

[Lecture 1 - Introduction](#)

[Lecture 2 - Introduction \(Continued...\)](#)

[Lecture 3 - Introduction \(Continued...\)](#)

[Lecture 4 - Introduction \(Continued...\)](#)

[Lecture 5 - Introduction \(Continued...\)](#)

[Lecture 6 - Introduction \(Continued...\)](#)

[Lecture 7 - Scaling Laws](#)

[Lecture 8 - Scaling laws \(Continued...\)](#)

[Lecture 9 - Scaling laws \(Continued...\)](#)

[Lecture 10 - Difference between macro and micro machining](#)

[Lecture 11 - Difference between macro and micro machining \(Continued...\)](#)

[Lecture 12 - Difference between micro and macro machining \(Continued...\)](#)

[Lecture 13 - Difference between micro and macro machining \(Continued...\)](#)

[Lecture 14 - Difference between macro and micro machining \(Continued...\)](#)

[Lecture 15 - Difference between macro and micro machining \(Continued...\)](#)

[Lecture 16 - Difference between macro and micro machining \(Continued...\)](#)

[Lecture 17 - Difference between macro and micro machining \(Continued...\)](#)

[Lecture 18 - Difference between macro and micro machining \(Continued...\)](#)

[Lecture 19 - Difference between macro and micro machining \(Continued...\)](#)

[Lecture 20 - Difference between macro and micro machining \(Continued...\)](#)

[Lecture 21 - Difference between macro and micro machining \(Continued...\)](#)

[Lecture 22 - Component of the machine tool](#)

[Lecture 23 - Components of the machine tool \(Continued...\)](#)

[Lecture 24 - Components of the machine tool \(Continued...\)](#)

[Lecture 25 - Components of the machine tool \(Continued...\)](#)

[Lecture 26 - Components of the machine tool \(Continued...\)](#)

[Lecture 27 - Errors in machine tool \(Continued...\)](#)

[Lecture 28 - Errors in machine tool \(Continued...\)](#)

[Lecture 29 - Errors in machine tool \(Continued...\)](#)

[Lecture 30 - Errors in machine tool \(Continued...\)](#)

[Lecture 31 - Components of machine tool](#)

[Lecture 32 - Components of machine tool \(Continued...\)](#)

[Lecture 33 - Components of machine tool \(Continued...\)](#)

[Lecture 34 - Components of machine tool \(Continued...\)](#)

[Lecture 35 - Components of machine tool \(Continued...\)](#)

[Lecture 36 - Components of machine tool \(Continued...\)](#)

[Lecture 37 - Components of machine tool \(Continued...\)](#)

[Lecture 38 - Components of machine tool \(Continued...\)](#)

[Lecture 39 - Components of machine tool \(Continued...\)](#)

[Lecture 40 - Components of machine tool \(Continued...\)](#)

[Lecture 41 - Components of machine tool \(Continued...\)](#)

[Lecture 42 - Components of machine tool \(Continued...\)](#)

[Lecture 43 - Components of machine tool \(Continued...\)](#)

[Lecture 44 - Components of machine tool \(Continued...\)](#)

[Lecture 45 - Components of machine tool \(Continued...\)](#)

[Lecture 46 - Components of machine tool \(Continued...\)](#)

[Lecture 47 - Components of machine tool \(Continued...\)](#)

[Lecture 48 - Components of machine tool \(Continued...\)](#)

[Lecture 49 - Micro tools](#)

[Lecture 50 - Micro tools \(Continued...\)](#)

[Lecture 51 - Micro tools \(Continued...\)](#)

[Lecture 52 - Fabrication of micro tool by EDM process](#)

[Lecture 53 - Micro tools \(Continued...\)](#)

[Lecture 54 - Micro machines](#)

[Lecture 55 - Micro machines \(Continued...\)](#)

[Lecture 56 - Diamond turning](#)

[Lecture 57 - Diamond turning \(Continued...\)](#)

[Lecture 58 - Diamond turning \(Continued...\)](#)

[Lecture 59 - Diamond turning \(Continued...\)](#)

[Lecture 60 - Sensors and metrology for micro machining](#)

[Lecture 61 - Sensors and metrology for micro machining \(Continued...\)](#)

[Lecture 62 - Sensors and metrology for micro machining \(Continued...\)](#)

[Lecture 63 - 3D surface measurement using interferometer](#)

Lecture 1 - Introduction

Lecture 2 - Maintenance Principles

Lecture 3 - FMECA

Lecture 4 - Fault Diagnostics and Prognostics

Lecture 5 - Machine Learning in CBM

Lecture 6 - Basics of Vibration

Lecture 7 - Free and Forced Response

Lecture 8 - Vibration and Shock Isolation

Lecture 9 - Rotordynamics

Lecture 10 - Practical Examples of Vibration

Lecture 11 - Time Domain Analysis

Lecture 12 - Frequency Domain Analysis

Lecture 13 - Non Stationary Signal Analysis

Lecture 14 - Modulation and Beats

Lecture 15 - Orbit and Order Analysis

Lecture 16 - Computer aided data acquisition

Lecture 17 - Orbit and Order Analysis

Lecture 18 - Data Recording

Lecture 19 - Cepstrum Analysis

Lecture 20 - Hilbert Transform in Condition Monitoring

Lecture 21 - Introduction to MATLAB

Lecture 22 - Signal Processing using MATLAB

Lecture 23 - Numericals in Signal Processing and Data Acquisition

Lecture 24 - Signal Hetrodyming

Lecture 25 - Practical Signals

Lecture 26 - Basics Of Instrumentation

Lecture 27 - Signal Conditioning And Filtering

Lecture 28 - Errors In Measurements

Lecture 29 - Dynamic Range And Frequency Response

Lecture 30 - Overview Of Transducers For Cbm

Lecture 31 - Accelerometers

- Lecture 32 - Vibration Monitoring
- Lecture 33 - Rotational Speed Measurements
- Lecture 34 - Basics of Noise
- Lecture 35 - Noise Monitoring
- Lecture 36 - Introduction to Faults in Rotating Machines
- Lecture 37 - Unbalance Detection
- Lecture 38 - Field Balancing
- Lecture 39 - Misalignment
- Lecture 40 - Crack and Looseness
- Lecture 41 - Journal and Anti-Friction Bearings
- Lecture 42 - Gears
- Lecture 43 - Pumps and Cavitation
- Lecture 44 - IC Engines
- Lecture 45 - Machinery Diagnostic Chart
- Lecture 46 - Principles of Motor Current Signature Analysis
- Lecture 47 - Faults in Electrical Machines
- Lecture 48 - Thermography
- Lecture 49 - Wear Debris Analysis
- Lecture 50 - Oil Analysis
- Lecture 51 - Ultrasonics
- Lecture 52 - Eddy Current and Acoustic Emission
- Lecture 53 - Radiography, Dye Penetrant Tests
- Lecture 54 - Tool Condition Monitoring
- Lecture 55 - Experimental Modal Analysis
- Lecture 56 - Introduction to Failure Analysis
- Lecture 57 - Railway Locomotive Noise and Vibration Monitoring
- Lecture 58 - Paper Mill Vibration Monitoring
- Lecture 59 - Overview of CBM facilities at IIT Kharagpur
- Lecture 60 - Future of Condition based Monitoring

Lecture 1 - Introduction

Lecture 2 - Geometry of single point turning tools - 1

Lecture 3 - Geometry of turning tools - 2

Lecture 4 - Geometry of single point turning tools - 3

Lecture 5 - Geometry of cutting tools and numerical problems

Lecture 6 - Different types of tools and mcq

Lecture 7 - Mechanism of chip formation

Lecture 8 - Mechanics of material removal

Lecture 9 - Measurement of Cutting Forces

Lecture 10 - Numerical problems and MCQ

Lecture 11 - Tool wear and Tool life

Lecture 12 - Wear and life of cutting tools - 2

Lecture 13 - The lathe

Lecture 14 - Calculations on mechanisms in machine tools

Lecture 15 - Numerical problems on lathe

Lecture 16 - Milling machines

Lecture 17 - Milling machine - indexing

Lecture 18 - Gear cutting CNC and non traditional machining

Lecture 19 - CNC and non-traditional machining methods

Lecture 20 - Numerical problems for week 4

Lecture 21 - Live Session

Lecture 1 - Introduction - Motivation and Theme of the Course

Lecture 2 - Laws of Gearing, Kinematics and Geometry - Part I

Lecture 3 - Laws of Gearing, Kinematics and Geometry - Part II

Lecture 4 - Involute Toothed Gear- Properties and Terminology

Lecture 5 - Tutorial

Lecture 6 - Involute Straight Tooth Spur Gear

Lecture 7 - Helical Tooth Spur Gear and Loads on Gear Shaft

Lecture 8 - Design of Bevel Gear

Lecture 9 - Crossed Helical Gear - I

Lecture 10 - Crossed Helical Gear - II and Worm Gear

Lecture 11 - Gear Unit Design - Selection of Stage Ratios, Pinion and Gear Teeth Numbers

Lecture 12 - Gear Unit Design - First Stage Pinion and Gear Design- I (Module on Beam Strength Basis)

Lecture 13 - Gear Unit Design - Failure of Gear Tooth (Probable Dynamic Load and Wear Load Capacity)

Lecture 14 - Gear Unit Design - 1st. Stage Pinion and Gear Design-II (Probable Dynamic Load and Wear Load Capacity and Finalizing 1st. Stage Pinion and Gear set)

Lecture 15 - Gear Unit Design - 1st. Layout (After Gear Design)

Lecture 16 - Bearing Arrangement - Gear Box Shafts

Lecture 17 - Bearing Load Calculation - Intermediate Shaft

Lecture 18 - Bearing Selection and Introduction to Shaft Design Verification

Lecture 19 - Design Verification of Gear Box Shafts

Lecture 20 - Development (Layout) of Intermediate Shaft

Lecture 21 - Development (Layout) of Input Shaft and Integral Pinion

Lecture 22 - Development (Layout) of Output Shaft and 2nd. Stage (Output) Gear

Lecture 23 - Development (Layout) of Output Shaft (Continued...), Loads on Shaft and Bearings

Lecture 24 - Output Shaft-Bearing Lives

Lecture 25 - Design Verification of Output Shaft

Lecture 26 - Design Verification of Input Shaft (including Bearing Life Estimation)

Lecture 27 - Finalizing Design including the Sizes of the Keys

Lecture 28 - Development of Plan and Elevation of Gear Reduction Unit - I

Lecture 29 - Development of Plan and Elevation of Gear Reduction Unit - II

Lecture 30 - Development of Plan and Elevation of Gear Reduction Unit - III

[Lecture 31](#)

[Lecture 32](#)

[Lecture 33 - Involute Spur Gear Tooth Correction : Part I](#)

[Lecture 34 - Involute Spur Gear Tooth Correction : Part II](#)

[Lecture 35 - Involute Spur Gear Tooth Correction : Part III](#)

[Lecture 36 - Involute Spur Gear Tooth Correction : Tutorial \(Workout Example\)](#)

[Lecture 37 - Involute Spur Gear Tooth Correction : Tutorial \(Workout Example-2\)](#)

[Lecture 38 - Tooth Tip Interference, Avoidance and Contact Ratio in Involute Internal Gearing](#)

[Lecture 39](#)

[Lecture 40](#)

[Lecture 41](#)

[Lecture 42](#)

[Lecture 43](#)

[Lecture 44](#)

[Lecture 45 - Live Session](#)

Lecture 1 - Principle of Optimization

Lecture 2 - Traditional Methods of Optimization

Lecture 3 - Traditional Methods of Optimization (Continued...)

Lecture 4 - Binary-Coded Genetic Algorithm (BCGA)

Lecture 5 - Binary-Coded Genetic Algorithm (BCGA) (Continued...)

Lecture 6 - Binary-Coded Genetic Algorithm (BCGA) (Continued...)

Lecture 7 - Binary-Coded Genetic Algorithm (BCGA) (Continued...)

Lecture 8 - Binary-Coded Genetic Algorithm (BCGA) (Continued...)

Lecture 9 - Schema Theorem of BCGA

Lecture 10 - Schema Theorem of BCGA (Continued...)

Lecture 11 - Constraint Handling

Lecture 12 - Real-Coded GA

Lecture 13 - Faster Genetic Algorithms

Lecture 14 - Faster Genetic Algorithms (Continued...)

Lecture 15 - Faster Genetic Algorithms (Continued...)

Lecture 16 - Faster Genetic Algorithms (Continued...)

Lecture 17 - Scheduling GA

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DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Elements of Metal Cutting, Machine tools, Gear Cutting and CNC Machining (Mechanical Engineering)

Co-ordinators : Prof. Asimava Roy Choudhury

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Lecture 18 - Gear cutting CNC and non traditional machining

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NPTEL : Rocket Propulsion (Mechanical Engineering)

Co-ordinators : Prof. K. Ramamurthi

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NPTEL : Principles of Mechanical Measurements (Mechanical Engineering)

Co-ordinators : Prof. R. Raman

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- Lecture 24 - Principles Of Mechanical Measurements
- Lecture 25 - Principles Of Mechanical Measurements
- Lecture 26 - Principles Of Mechanical Measurements

NPTEL : Spray Theory and Applications (Mechanical Engineering)

Co-ordinators : Prof. Mahesh Panchagnula, Dr. Paul E. Sojka

- Lecture 1 - Introduction to sprays and their applications
- Lecture 2 - Spatial versus Temporal Sampling
- Lecture 3 - Spatial Vs Temporal Sampling example problem
- Lecture 4 - Steady vs unsteady spray
- Lecture 5 - Statistical measures on spray
- Lecture 6 - Discussion on pdf and moments
- Lecture 7 - Size velocity correlation
- Lecture 8 - Discussion on Interfacial tension
- Lecture 9 - Introduction to Atomizers and their design - 1
- Lecture 10 - Introduction to Atomizers and their design - 2
- Lecture 11 - Simple measurement techniques
- Lecture 12 - Selection of atomizers
- Lecture 13 - Spray measurement characteristics
- Lecture 14 - Spray measurements techniques
- Lecture 15 - Non-intrusive spray measurements techniques
- Lecture 16 - Non-intrusive spray measurements techniques
- Lecture 17 - Linear stability analysis “ Introduction
- Lecture 18 - Linear stability analysis- Kelvin-Helmholtz instability - 1
- Lecture 19 - Linear stability analysis- Kelvin-Helmholtz instability - 2
- Lecture 20 - Linear stability analysis- Kelvin-Helmholtz instability - 3
- Lecture 21 - Linear stability analysis procedure
- Lecture 22 - Linear stability analysis - Cylindrical jet instability - 1
- Lecture 23 - Linear stability analysis - Cylindrical jet instability - 2
- Lecture 24 - Linear stability analysis - Planar Liquid Sheet instability - 1
- Lecture 25 - Linear stability analysis - Planar Liquid Sheet instability - 2
- Lecture 26 - Design of pressure swirl atomizer - 1
- Lecture 27 - Design of pressure swirl atomizer - 2
- Lecture 28 - Design of pressure swirl atomizer - 3
- Lecture 29 - Design of pressure swirl atomizer - 4
- Lecture 30 - Secondary atomization-Dimensionless parameters
- Lecture 31 - Secondary atomization-Modes of breakup - 1

[Lecture 32 - Secondary atomization-Modes of breakup - 2](#)

[Lecture 33 - Multiphase modelling](#)

[Lecture 34 - Multiphase modelling](#)

[Lecture 35 - Multiphase flow modelling basics](#)

[Lecture 36 - Multiphase modelling “ Selection of model - 1](#)

[Lecture 37 - Multiphase modelling “ Selection of model - 2](#)

[Lecture 38 - Multiphase modelling - Governing equations](#)

[Lecture 39 - Droplet evaporation](#)

[Lecture 40 - Droplet combustion](#)

[Lecture 41 - Spray combustion](#)

Lecture 1 - Importance of Thermal Radiation

Lecture 2 - Blackbody definition

Lecture 3 - Solid angle, spectral radiation intensity

Lecture 4 - Radiation pressure and radiation energy density

Lecture 5 - Relationship between ϵ and ρ and Candidate blackbody distribution functions

Lecture 6 - Candidate blackbody distribution functions (Continued...)

Lecture 7 - Planck's blackbody radiation distribution function

Lecture 8 - Planck's distribution and Wien's displacement law

Lecture 9 - Universal blackbody function

Lecture 10 - Emissivity

Lecture 11 - Emissivity (Continued...)

Lecture 12 - Emissivity (Continued...)

Lecture 13 - Kirchoff law, Absorptivity

Lecture 14 - Kirchoff law, Absorptivity (Continued...)

Lecture 15 - Problems on emissivity, absorptivity

Lecture 16 - Reflectivity

Lecture 17 - Transmissivity

Lecture 18 - Problems on reflectivity and transmissivity

Lecture 19 - Radiation heat transfer between surfaces

Lecture 20 - View factor

Lecture 21 - View factor (Continued...)

Lecture 22 - View factor (Continued...)

Lecture 23 - Enclosure analysis

Lecture 24 - Enclosure analysis (Continued...)

Lecture 25 - Enclosure analysis - Gray surface

Lecture 26 - Enclosure analysis - Non gray surfaces

Lecture 27 - Radiation in participating media

Lecture 28 - Solution to the RTE

Lecture 29 - Concept of mean beam length

Lecture 30 - Enclosure analysis in the presence of absorbing / emitting gas

Lecture 31 - Emissivities and absorptivities of Gas mixtures

[Lecture 32 - Conduction - Introduction](#)

[Lecture 33 - Conduction - Energy equation](#)

[Lecture 34 - Conduction - 1D, steady state](#)

[Lecture 35 - Conduction - 1D, heat generation](#)

[Lecture 36 - Fin heat transfer - I](#)

[Lecture 37 - Fin heat transfer - II](#)

[Lecture 38 - Conduction - Cylindrical and Spherical geometries](#)

[Lecture 39 - Transient conduction](#)

[Lecture 40 - Transient conduction \(Continued...\)](#)

[Lecture 41 - Two dimensional steady state conduction](#)

[Lecture 42 - Analytical solution for Laplace equation](#)

[Lecture 43 - Numerical methods in conduction](#)

[Lecture 44 - Numerical methods in conduction \(Continued...\)](#)

[Lecture 45 - Conduction with change of phase](#)

[Lecture 46 - Conduction with change of phase \(Continued...\)](#)

Lecture 1 - Introduction

Lecture 2 - Introduction / Fundamental Ideas

Lecture 3 - Fundamental Ideas

Lecture 4 - Fundamental Ideas

Lecture 5 - Fundamental Ideas / Normal Shock Waves

Lecture 6 - Normal Shock Waves

Lecture 7 - Normal Shock Waves / Rayleigh Flow

Lecture 8 - Rayleigh Flow

Lecture 9 - Rayleigh Flow

Lecture 10 - Rayleigh Flow / Fanno Flow

Lecture 11 - Fanno Flow

Lecture 12 - Fanno Flow

Lecture 13 - Fanno Flow / Quasi One Dimensional Flows

Lecture 14 - Quasi One Dimensional Flows

Lecture 15 - Quasi One Dimensional Flows

Lecture 16 - Quasi One Dimensional Flows

Lecture 17 - Quasi One Dimensional Flows

Lecture 18 - Quasi One Dimensional Flows

Lecture 19 - Quasi One Dimensional Flows

Lecture 20 - Oblique Shock Waves

Lecture 21 - Oblique Shock Waves

Lecture 22 - Oblique Shock Waves

Lecture 23 - Oblique Shock Waves / Prandtl Meyer Waves

Lecture 24 - Prandtl Meyer Waves

Lecture 25 - Prandtl Meyer Waves

Lecture 26 - Propulsion - an Introduction

Lecture 27 - Components of the Gas Turbine Engine

Lecture 28 - Components of the Gas Turbine Engine

Lecture 29 - Components of the Gas Turbine Engine

Lecture 30 - Components of the Gas Turbine Engine

Lecture 31 - Components of the Gas Turbine Engine / Thermodynamic Analysis of the Engine

[Lecture 32 - Thermodynamic Analysis of the Engine](#)

[Lecture 33 - Thermodynamic Analysis of the Engine](#)

[Lecture 34 - Calculations for Thrust and Fuel Consumption](#)

[Lecture 35 - Calculations for Thrust and Fuel Consumption](#)

[Lecture 36 - Calculations for Thrust and Fuel Consumption / Emerging Trends](#)

[Lecture 37 - Emerging Trends / Ramjets](#)

[Lecture 38 - Ramjets](#)

[Lecture 39 - Ramjets / Scramjets](#)

[Lecture 40 - Scramjets](#)

[Lecture 1 - Introduction and Scaling](#)

[Lecture 2 - Scaling](#)

[Lecture 3 - Micro-scale fluid mechanics](#)

[Lecture 4 - Micro-scale fluid mechanics \(Continued...\)](#)

[Lecture 5 - Micro-scale fluid mechanics \(Continued...\)](#)

[Lecture 6 - Micro-scale fluid mechanics \(Continued...\)](#)

[Lecture 7 - Micro-scale fluid mechanics \(Continued...\)](#)

[Lecture 8 - Micro-scale fluid mechanics \(Continued...\)](#)

[Lecture 9 - Micro-scale fluid mechanics \(Continued...\)](#)

[Lecture 10 - Micro-scale fluid mechanics \(Continued...\)](#)

[Lecture 11 - Capillary Flows](#)

[Lecture 12 - Capillary Flows \(Continued...\)](#)

[Lecture 13 - Capillary Flows and Electrokinetics](#)

[Lecture 14 - Electrokinetics](#)

[Lecture 15 - Electrokinetics \(Continued...\)](#)

[Lecture 16 - Electrokinetics \(Continued...\)](#)

[Lecture 17 - Electrokinetics \(Continued...\)](#)

[Lecture 18 - Electrokinetics \(Continued...\)](#)

[Lecture 19 - Electrokinetics \(Continued...\)](#)

[Lecture 20 - Electrokinetics and Magnetophoresis](#)

[Lecture 21 - Microfabrication Techniques](#)

[Lecture 22 - Microfabrication Techniques \(Continued...\)](#)

[Lecture 23 - Microfabrication Techniques \(Continued...\)](#)

[Lecture 24 - Microfabrication Techniques \(Continued...\)](#)

[Lecture 25 - Microfabrication Techniques \(Continued...\)](#)

[Lecture 26 - Microfabrication Techniques \(Continued...\)](#)

[Lecture 27 - Microfabrication Techniques \(Continued...\)](#)

[Lecture 28 - Microfabrication Techniques \(Continued...\)](#)

[Lecture 29 - Micropump](#)

[Lecture 30 - Micropump \(Continued...\)](#)

[Lecture 31 - Microvalve](#)

[Lecture 32 - Microvalve \(Continued...\)](#)

[Lecture 33 - Microvalve \(Continued...\)](#)

[Lecture 34 - Micro Flow Sensor and Micro mixers](#)

[Lecture 35 - Micro mixers](#)

[Lecture 36 - Micro mixers \(Continued...\)](#)

[Lecture 37 - Micro droplets](#)

[Lecture 38 - Micro reactors \(Continued...\)](#)

[Lecture 39 - Micro needles and Microparticle separation](#)

[Lecture 40 - Few applications of microfluidics](#)

[Lecture 41 - Lab Demo](#)

- Lecture 1 - Introduction to convective heat transfer - Part 1
- Lecture 2 - Introduction to convective heat transfer - Part 2
- Lecture 3 - Continuity Equation
- Lecture 4 - Momentum and Energy Equations
- Lecture 5 - Energy Equation
- Lecture 6 - Reynolds Transport Theorem
- Lecture 7 - Entropy Generation and streamfunction-vorticity formulation
- Lecture 8 - Couette flow - Part 1
- Lecture 9 - Couette flow - Part 2
- Lecture 10 - Couette flow - Part 3
- Lecture 11 - Boundary layer approximation
- Lecture 12 - Laminar External flow past flat plate (Blasius Similarity Solution)
- Lecture 13 - Numerical solution to the Blasius equation and similarity solution to heat transfer
- Lecture 14 - Pohlhausen similarity solution and flows including pressure gradient (Falkner-Skan)
- Lecture 15 - Falkner skan solutions for heat transfer
- Lecture 16 - Similarity solution for flow and heat transfer with transpiration at walls
- Lecture 17 - Thermal boundary layer in high speed flows
- Lecture 18 - Approximate(Integral) methods for laminar external flow and heat transfer
- Lecture 19 - Integral method for laminar external thermal boundary layer over isothermal surface
- Lecture 20 - Integral method for flows with pressure gradient (von Karman-Pohlhausen method)
- Lecture 21 - Integral method with pressure gradient: heat transfer
- Lecture 22 - Heat transfer across a circular cylinder: Walz approximation
- Lecture 23 - Duhamel's method for varying surface temperature
- Lecture 24 - Laminar External heat transfer with non uniform surface temperature
- Lecture 25 - Laminar internal forced convection - fundamentals
- Lecture 26 - Hydrodynamically and thermally fully developed internal laminar flows
- Lecture 27 - Fully developed laminar internal flow and heat transfer
- Lecture 28 - Shooting method for fully developed heat transfer and thermal entry length problem
- Lecture 29 - Thermal entry length problem with plug velocity profile: Graetz problem
- Lecture 30 - Extended Graetz problem for parabolic velocity profile
- Lecture 31 - Extended Graetz problem

[Lecture 32 - Extended Graetz problem with wall flux boundary condition](#)

[Lecture 33 - Approximate method for laminar internal flows](#)

[Lecture 34 - Integral method for thermal entry length problem](#)

[Lecture 35 - Introduction to Natural Convection Heat Transfer](#)

[Lecture 36 - Similarity Solution in Natural Convection for Vertical isothermal Plate - Part 1](#)

[Lecture 37 - Similarity Solution in Natural Convection for Vertical isothermal Plate - Part 2](#)

[Lecture 38 - Similarity Solution in Natural Convection for Vertical isoflux Plate](#)

[Lecture 39 - Approximate Method in Natural Convection Heat Transfer](#)

[Lecture 40 - Natural Convection in Other Configurations](#)

[Lecture 41 - Turbulent Convective Heat Transfer : RANS Equations - Part 1](#)

[Lecture 42 - Turbulent Convective Heat Transfer : RANS Equations - Part 2](#)

[Lecture 43 - Analogies in Turbulent Convective Heat Transfer - Part 1](#)

[Lecture 44 - Analogies in Turbulent Convective Heat Transfer - Part 2](#)

Lecture 1 - Loud Bang and Disruption

Lecture 2 - Blast Wave in an Explosion: Predictions from Dimensional Considerations

Lecture 3 - Typical Examples of Explosions and Classification

Lecture 4 - Shock Hugoniot and Rayleigh Line

Lecture 5 - Properties behind a Constant Velocity Shock

Lecture 6 - Blast waves: Concentration of Mass at the Front, Snow Plow Approximation, Energy conservation in a Blast wave

Lecture 7 - Blast waves: Decay of a strong Blast wave, Explosion Length, Sach's Scaling, Over pressure, Cranz Hopkinson Scaling law of Overpressure

Lecture 8 - Blast Waves: Overpressure and Impulse in the Near and Far Field, Examples, Introduction to Impulse

Lecture 9 - Blast Waves: Non-dimensional Impulse, Cranz -Hopkinson Scaling, Missiles, Fragments and Shrapnel, Craters, Examples

Lecture 10 - Blast Waves: Interaction with Objects, Reflection and Transmission of Blast Waves, Impedance

Lecture 11 - Blast Waves: Amplification of Reflected Blast Waves; Role of Impedance, Spalling, Damage to Organs containing Air, Mushroom Cloud in an Explosion, Examples

Lecture 12 - Blast Waves: Damage from Blast Waves, Examples, Multiple Spikes in an Impulse, Iso-damage Curve on an Overpressure-Impulse Diagram, Complex Structures

Lecture 13 - Energy Release in a Chemical Reaction: Moles, Internal Chemical Energy, Standard Heats of Formation

Lecture 14 - Energy Release: Stoichiometry, Equivalence Ratio and Heat Release in Fuel Rich and Oxidizer Rich Compounds

Lecture 15 - Energy Release: Examples of Energy Release Calculations, Higher and Lower Calorific Values, Internal Energy of Formation

Lecture 16 - Rate of Energy Release: Concentration, Activation Energy, Energy Release Profile

Lecture 17 - Thermal Theory of Explosion

Lecture 18 - Thermal Theory

Lecture 19 - Role of Chain Carriers in an Explosion

Lecture 20 - Combustion - I

Lecture 21 - Combustion - II

Lecture 22 - Case Histories of Explosions involving Volatile Liquids

Lecture 23 - Detonation

Lecture 24 - Structure of Detonations

Lecture 25 - Realizable States in a Detonation

Lecture 26 - One Dimensional Model of Detonation

Lecture 27 - Case Histories of Explosions involving Detonation or Quasi-Detonation

Lecture 28 - Explosions in Confined and Unconfined Geometries

Lecture 29 - Dust Explosions - I

[Lecture 30 - Dust Explosions - II](#)

[Lecture 31 - Physical Explosions](#)

[Lecture 32 - Rupture of Cryogenic Storage Vessels and Pressure Vessels](#)

[Lecture 33 - Condensed Phased Explosives Based on Hydrocarbons](#)

[Lecture 34 - Condensed Phase Explosives and their Properties](#)

[Lecture 35 - TNT Equivalence and Yield of an Explosion](#)

[Lecture 36 - Atmospheric Dispersion](#)

[Lecture 37 - Modeling Atmospheric Dispersion](#)

[Lecture 38 - Explosions Involving Atmospheric Dispersion](#)

[Lecture 39 - Quantification of Damages in an Explosion](#)

[Lecture 40 - Risk Analysis for an Explosion](#)

Lecture 1 - Introduction to Metrology

Lecture 2 - Metrology terminologies

Lecture 3 - Measurement errors

Lecture 4 - Linear measuring instruments \hat{A} - 1 (Angle plate, steel rule, spring calipers)

Lecture 5 - Linear measuring instruments \hat{A} - 2 (Combination set, Vernier calipers)

Lecture 6 - Linear measuring instruments \hat{A} - 3 (Height gauge, Micrometers \hat{A} - 1)

Lecture 7 - Linear measuring instruments \hat{A} - 4 (Micrometers \hat{A} - 2, Bore gauge)

Lecture 8 - Linear measuring instruments \hat{A} - 5 (Dial indicators, thickness gauges, depth gauges)

Lecture 9 - Manufacturing tolerances and fits

Lecture 10 - Terminologies of limits fits and tolerances

Lecture 11 - Numerical problems on fit and tolerances

Lecture 12 - Selection of fits, Geometrical tolerances

Lecture 13 - Positional tolerances

Lecture 14 - Limit gauging - 1

Lecture 15 - Limit gauging - 2

Lecture 16 - Design of limit gauges

Lecture 17 - Measurement of straightness, flatness and squareness

Lecture 18 - Perpendicularity measurement

Lecture 19 - Basics of surface roughness

Lecture 20 - Surface finish parameters

Lecture 21 - Stylus type surface finish measuring instruments

Lecture 22 - Non-contact type surface finish measuring instruments

Lecture 23 - Screw thread production and terminology

Lecture 24 - Measurement of screw thread elements

Lecture 25 - Introduction to gears

Lecture 26 - Measurement of gear elements

Lecture 27 - Angle measurement - 1

Lecture 28 - Angle measurement - 2

Lecture 29 - Radius measurement, Contact angle measurement

Lecture 30 - Basics of interferometry

Lecture 31 - Interferometers

[Lecture 32 - Introduction to comparators, Mechanical comparators](#)

[Lecture 33 - Electrical and electronic comparators, Optical comparators](#)

[Lecture 34 - Pneumatic comparators](#)

[Lecture 35 - Geometrical tests on lathe](#)

[Lecture 36 - Geometrical tests on pillar type drilling machine](#)

[Lecture 37 - Universal measuring machine \(UMM\) and Coordinate measuring machine \(CMM\)](#)

[Lecture 38 - CMM probes and CMM software](#)

[Lecture 39 - Feature measurement using CMM, Laser vision](#)

[Lecture 40 - In-process gauging and control](#)

[Lecture 41 - Stage position metrology](#)

[Lecture 42 - Micro and Nano stages, Nano technology instrumentation](#)

[Lecture 43 - Optical system design](#)

[Lecture 44 - Complex opto- mechanical assemblies, Metrology testing and certification services](#)

- Lecture 1 - Introduction to the course
- Lecture 2 - Newton's laws
- Lecture 3 - Equilibrium
- Lecture 4 - Example 1 - Statics
- Lecture 5 - Example 2 - Rigid Body Systems
- Lecture 6 - Example 3 - Rigid Body Systems
- Lecture 7 - Structural Systems with rigid bodies
- Lecture 8 - Types of 1-D Structural Elements
- Lecture 9 - Axial members
- Lecture 10 - Analysis of the truss system
- Lecture 11 - Stability of Structural systems
- Lecture 12 - Beams - Example 1
- Lecture 13 - Beams - BMD and SFD
- Lecture 14 - Beams - Loading, Shear and Bending Moment Relations
- Lecture 15 - Static Friction
- Lecture 16 - Friction - Solving Problems
- Lecture 17 - Particle Kinematics - 1
- Lecture 18 - Particle Kinematics - 2 (Example)
- Lecture 19 - Particle Kinematics - Curvilinear Coordinates
- Lecture 20 - Rigid Body Kinematics
- Lecture 21 - Rotational Motion (Example 1)
- Lecture 22 - Rotational Motion (Example 2)
- Lecture 23 - Dynamics (Introduction)
- Lecture 24 - Dynamics - Example 1
- Lecture 25 - Dynamics - Example 2
- Lecture 26 - Dynamics - Example 3
- Lecture 27 - Dynamics - Example 4
- Lecture 28 - Center of Percussion - Example
- Lecture 29 - Impulse / Momentum - Example 1
- Lecture 30 - Impulse / Momentum - Example 2
- Lecture 31 - Impulse / Momentum - Example 3

[Lecture 32 - Impulse / Momentum - Example 4](#)

[Lecture 33 - Work Energy Methods - Example 1](#)

[Lecture 34 - Work Energy Methods - Example 2](#)

[Lecture 35 - Work Energy Methods - Example 3](#)

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[Week 2 - Module-1](#)

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[Week 6 - Module-5](#)

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[Week 8 - Module-1](#)

[Week 8 - Module-2](#)

[Week 8 - Module-3](#)

[Week 8 - Module-4](#)

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[Week 8 - Module-6](#)

[Conclusion](#)

- Lecture 1 - Review of fundamentals of fluid mechanics - I
- Lecture 2 - Review of fundamentals of fluid mechanics - II
- Lecture 3 - Concept of a Boundary Layer (BL) - I
- Lecture 4 - Concept of a Boundary Layer (BL) - II
- Lecture 5 - Concepts of BL thickness (?)
- Lecture 6 - Concepts of BL displacement thickness (δ^*) and BL momentum thickness (θ)
- Lecture 7 - Control Volume approach to derive expressions for δ^* over a flat plate
- Lecture 8 - Control Volume approach to derive expressions for θ over a flat plate
- Lecture 9 - Concept of wall friction
- Lecture 10 - Concept of friction drag
- Lecture 11 - Skin Friction Coefficient - I
- Lecture 12 - Skin Friction Coefficient - II
- Lecture 13 - Derivation of Prandtl's Laminar BL Equations - I
- Lecture 14 - Derivation of Prandtl's Laminar BL Equations - II
- Lecture 15 - Derivation of Prandtl's Laminar BL Equations - III
- Lecture 16 - Derivation of Prandtl's Laminar BL Equations - IV
- Lecture 17 - Similarity Solutions to the BL Equations Applied to a Flat Plate - I
- Lecture 18 - Similarity Solutions to the BL Equations Applied to a Flat Plate - II
- Lecture 19 - Similarity Solutions to the BL Equations Applied to a Flat Plate - III
- Lecture 20 - Runge-Kutta Method to Numerically Solve the BL Equations Applied to a Flat Plate
- Lecture 21 - Description of the Numerical Code to Solve the BL Equations Applied to a Flat Plate
- Lecture 22 - Similarity Solutions to the BL Equations (other than flat plate) - I
- Lecture 23 - Similarity Solutions to the BL Equations (other than flat plate) - II
- Lecture 24 - Similarity Solutions to the BL Equations (other than flat plate) - III
- Lecture 25 - Similarity Solutions to the BL Equations (other than flat plate) - IV
- Lecture 26 - Description of the Numerical Code to Solve the BL Equations (other than flat plate)
- Lecture 27 - The Energy Equation - I
- Lecture 28 - The Energy Equation - II
- Lecture 29 - Similarity Solutions to Thermal BL - I
- Lecture 30 - Similarity Solutions to Thermal BL - II
- Lecture 31 - Similarity Solutions to Thermal BL - III

[Lecture 32 - BL Separation with Pressure-Gradient - I](#)

[Lecture 33 - BL Separation with Pressure Gradient - II](#)

[Lecture 34 - Effect of Prandtl Number in Thermal BL - I](#)

[Lecture 35 - Effect of Prandtl Number in Thermal BL - II](#)

[Lecture 36 - Effect of Prandtl Number in Thermal BL - III](#)

[Lecture 37 - Effect of Dissipation in Thermal BL - I](#)

[Lecture 38 - Effect of Dissipation in Thermal BL - II](#)

[Lecture 39 - Effect of Dissipation in Thermal BL - III](#)

[Lecture 40 - Similarity Solutions to Thermal BL - An Overview](#)

Lecture 1 - Introduction

Lecture 2 - Basics of Thermodynamics

Lecture 3 - Tutorial 1

Lecture 4 - Control Volume Approach

Lecture 5 - Conservation Equations

Lecture 6 - Tutorial 2

Lecture 7 - Energy Equation

Lecture 8 - Concept of stagnation

Lecture 9 - Discussion on stagnation

Lecture 10 - Velocity of sound

Lecture 11 - Discussion on velocity of sound and mach number

Lecture 12 - Wave propagation

Lecture 13 - Mach wave

Lecture 14 - Mach number relations

Lecture 15 - Variable Area Adiabatic flow

Lecture 16 - Variable Area Adiabatic flow (Continued...)

Lecture 17 - * reference quantities and their relations

Lecture 18 - Importance of stagnation temperature in relation to v

Lecture 19 - Discussion on variable area adiabatic flow and * reference quantities

Lecture 20 - Gas tables

Lecture 21 - Converging nozzle

Lecture 22 - Condition of choked flow and associated properties

Lecture 23 - Area ratio and pressure ratio in converging nozzles

Lecture 24 - Discussion on converging nozzles

Lecture 25 - Converging - Diverging (C-D) nozzles

Lecture 26 - More on C-D nozzles

Lecture 27 - Discussion on C-D nozzles - 1

Lecture 28 - Discussion on C-D nozzles - 2

Lecture 29 - Examples and applications of flow through C-D nozzles

Lecture 30 - Introduction to normal shocks

Lecture 31 - Normal shock relations - 1

[Lecture 32 - Normal shock relations - 2](#)

[Lecture 33 - Rankine-Hugoniot equation](#)

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[Lecture 40 - Oblique shocks](#)

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[Lecture 42 - Discussion on oblique shocks](#)

[Lecture 43 - Reflection of oblique shocks](#)

[Lecture 44 - Discussion on reflection of oblique shocks](#)

[Lecture 45 - Prandtl-Meyer flow](#)

[Lecture 46 - Prandtl-Meyer flow \(Continued...\)](#)

[Lecture 47 - Discussion on Prandtl-Meyer expansion](#)

[Lecture 48 - Shock Polar diagram and Prandtl-Meyer relation for Oblique shocks](#)

Lecture 1 - Introduction to Stress Analysis – Analytical and Numerical Approaches

Lecture 2 - Introduction to Stress Analysis - Experimental Approaches

Lecture 3 - Optical Methods Work as Optical Computers

Lecture 4 - Basic information provided by various experimental methods

Lecture 5 - Visual Appreciation of Field Information - Part 1

Lecture 6 - Visual Appreciation of Field Information - Part 2

Lecture 7 - Visual Appreciation of Field Information - Part 3

Lecture 8 - Visual Appreciation of Field Information - Part 4

Lecture 9 - Visual Appreciation of Field Information - Part 5

Lecture 10 - Completeness of a Numerical Solution

Lecture 11 - Principle of Strain Gauges

Lecture 12 - Overview of Strain Gauge Measurements

Lecture 13 - Elegance of Photoelasticity

Lecture 14 - Introduction to Photoelasticity

Lecture 15 - Different Polariscope

Lecture 16 - Principles of Moiré

Lecture 17 - Introduction to Moiré

Lecture 18 - Introduction to Brittle Coatings

Lecture 19 - Introduction to Holography

Lecture 20 - Introduction to Hologram Interferometry

Lecture 21 - Introduction to Double exposure hologram interferometry

Lecture 22 - Introduction to Speckle Methods

Lecture 23 - Introduction to Speckle Interferometry Techniques

Lecture 24 - Introduction to TSA and DIC

Lecture 25 - Introduction to Caustics

Lecture 26 - Introduction to Coherent Gradient Sensor

Lecture 27 - Naming of Experimental Methods

Lecture 28 - Fringe Patterns - Richness of Qualitative Information

Lecture 29 - Key technologies that have influenced Experimental Mechanics

Lecture 30 - Multiscale analysis and trends in experimental mechanics

Lecture 31 - Selection of an experimental technique - Part 1

Lecture 1 - Introduction to Fluid Flow

Lecture 2 - Flow field, Stresses on fluid element, Newtonian fluid

Lecture 3 - Non Newtonian fluid, Classification of flow, Analysis of flow

Lecture 4 - Tutorial

Lecture 5 - Lecture 1 - Integral analysis, Control volume, Generalised conservation equation

Lecture 6 - Lecture 2 - Mass and linear momentum conservation in CV

Lecture 7 - Lecture 3 - Angular momentum conservation, Non-inertial frame of reference

Lecture 8 - Lecture 4 - Tutorial

Lecture 9 - Lecture 1 - Differential Analysis

Lecture 10 - Lecture 2 - Navier-Stokes equation for 2D incompressible flow

Lecture 11 - Lecture 3 - Vorticity, Stream function, Bernoulli's equation

Lecture 12 - Lecture 4 - Tutorial

Lecture 13 - Lecture 1 - External flows, Laminar and Turbulent Boundary Layer

Lecture 14 - Lecture 2 - Differential analysis of boundary layer, Blassius equation

Lecture 15 - Lecture 3 - Boundary Layer flow with pressure gradient, Flow separation

Lecture 16 - Lecture 4 - Internal flow, Pipe friction

Lecture 17 - Lecture 1 - Basic Thermodynamics

Lecture 18 - Lecture 2 - Turbomachines: Definition and classification

Lecture 19 - Lecture 3 - Dimensional Analysis

Lecture 20 - Lecture 4 - Tutorial

Lecture 21 - Lecture 1 - Representation of Turbomachines and Definition of velocity

Lecture 22 - Lecture 2 - Euler's energy equation

Lecture 23 - Lecture 3 - Real fluid flow and efficiency of turbomachine

Lecture 24 - Lecture 4 - Tutorial

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Lecture 15 - Determination of Photoelastic Parameters at an Arbitrary Point

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DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Design for Quality, Manufacturing and Assembly (Mechanical Engineering)

Co-ordinators : Prof. Palaniappaan Ramu

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Lecture 9 - Design for Six Sigma - Stages, Design of Experiments

Lecture 10 - Introduction To Design Of Experiments

Lecture 11 - Need for DoE and basic DoE methods

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Lecture 14 - Setting up an Orthogonal Array

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Lecture 1 - Introduction to the course

Lecture 2 - Some applications of MD simulations

Lecture 3 - Introduction to Bravais lattices and constructing simple crystals with MATLAB

Lecture 4 - Introduction to symmetry - 1

Lecture 5 - Symmetry Elements - 1

Lecture 6 - Symmetry elements - 2

Lecture 7 - Plane groups and their Hermann-Mauguin (HM) symbols

Lecture 8 - Glide reflection; Examples of writing point group symbols; Wyckoff positions

Lecture 9 - Generating 2D crystal with MATLAB using Bilbao crystallography website

Lecture 10 - Symmetry of space groups

Lecture 11 - Hermann mauguin symbols of space groups

Lecture 12 - Translational symmetry operators

Lecture 13 - The Space groups

Lecture 14 - Generation of crystals

Lecture 15 - Generation of monoclinic lattice

Lecture 16 - Introduction to Statistical Mechanics - 1

Lecture 17 - Introduction to Statistical Mechanics - 2

Lecture 18 - Introduction to Statistical Mechanics - 3

Lecture 19 - Statistical mechanics - 1

Lecture 20 - Statistical mechanics - 2

Lecture 21 - Basic introduction to mechanics

Lecture 22 - Introduction to phase space

Lecture 23 - Introduction to phase average and time average

Lecture 24 - Canonical ensemble; Partition function

Lecture 25 - Basic introduction to MD

Lecture 26 - Input script for LAMMPS - 1

Lecture 27 - Input script for LAMMPS - 2

Lecture 28 - Input script for LAMMPS - 3

Lecture 29 - Input script for LAMMPS - 4

Lecture 30 - LAMMPS exercises - 1

Lecture 31 - LAMMPS exercises - 2

[Lecture 32 - LAMMPS exercises - 3](#)

[Lecture 33 - LAMMPS exercises - 4](#)

[Lecture 34 - LAMMPS exercises - 5](#)

Lecture 1 - Introduction

Lecture 2 - Combustion processes in ICE and Gas turbine engines

Lecture 3 - Combustion in solid and liquid rocket motors

Lecture 4 - Equilibrium

Lecture 5 - Chemical kinetics, Equilibrium vs rate controlled

Lecture 6 - Demonstration of NASA-CEA

Lecture 7 - Premixed and diffusion flames: principal features and differences - Part I

Lecture 8 - Premixed and diffusion flames: principal features and differences - Part II

Lecture 9 - Quenching, flammability and other limit phenomena

Lecture 10 - Conservation equations

Lecture 11 - Integral Analysis of flame

Lecture 12 - Solid propellant combustion

Lecture 13 - Erosive burning

Lecture 14 - Instability in solid rockets

Lecture 15 - Analysis of p-t traces - Part II

Lecture 16 - Statistical representation of composite propellants in HeQu1D - geometry and thermochemistry

Lecture 17 - HeQu1D model - Parameter estimation

Lecture 18 - Effects of Al - extended HeQu1D model

Lecture 19 - Instability in solid rockets - II

Lecture 20 - Tutorial

Lecture 21 - Liquid propellant rockets - Part I

Lecture 22 - Liquid propellant rockets - Part II

Lecture 23 - Combustion in liquid rockets

Lecture 24 - Instabilities in liquid rockets and gas turbine after burners

Lecture 25 - CFD modeling aspects - Fundamentals

Lecture 26 - CFD modeling aspects - Modeling approaches

Lecture 27 - Effect of turbulence on flames

Lecture 28 - Scramjets - Part I

Lecture 29 - Scramjets - Part II

Lecture 30 - Summary - Premixed flames

Lecture 31 - Summary - Non-premixed flames

[Lecture 32 - Summary - Solid rocket propulsion](#)

[Lecture 33 - Additional Insights](#)

Lecture 1 - Introduction

Lecture 2 - Material Property Landscape

Lecture 3 - Crystal Structure-1 (Platonic Solids)

Lecture 4 - Crystal Structure-2 (Unit Cell, Lattice, Crystal)

Lecture 5 - Crystal Structure-3 (Bravais lattice, Symmetry in Crystals)

Lecture 6 - Crystal Structure-4 (Miller Indices for Crystallographic Points and Directions)

Lecture 7 - Crystal Structure-5 (Miller-Bravais Indices, Linear and Planar Density)

Lecture 8 - Crystal Structure-6 (Planar density, Close-Packed Structures, Stacking Faults)

Lecture 9 - Crystal Structure-7 (Single Crystal and Polycrystalline Materials)

Lecture 10 - Crystal Structure-8 (X-Ray Diffraction and Determination of Structure)

Lecture 11 - Defects in Crystalline Materials-1 (Types of Crystalline Defects)

Lecture 12 - Defects in Crystalline Materials-1 (Point Defects)

Lecture 13 - Defects in Crystalline Materials-1 (Equilibrium Concentration of Vacancies)

Lecture 14 - Defects in Crystalline Materials-1 (Theoretical Shear Strength)

Lecture 15 - Defects in Crystalline Materials-2 (Effect of Point Defects)

Lecture 16 - Defects in Crystalline Materials-2 (Point Defects and Solid Solutions)

Lecture 17 - Defects in Crystalline Materials-3 (Line Defects, Types of Dislocations and their Characteristics)

Lecture 18 - Defects in Crystalline Materials-4 (Slip Systems, Burger's Vector and Dislocation Motion)

Lecture 19 - Defects in Crystalline Materials-4 (Slip in Single Crystals and Resolved Shear Stress)

Lecture 20 - Defects in Crystalline Materials-5 (Different Stages of Slip in Single Crystalline Materials)

Lecture 21 - Defects in Crystalline Materials-5 (Geometry and Slip, Stress Field Around a Dislocation and Deformation Twinning)

Lecture 22 - Defects in Crystalline Materials-6 (Twinning, Interfacial Defects and Volume Defects)

Lecture 23 - Defects in Crystalline Materials-6 (Strengthening Mechanisms)

Lecture 24 - Defects in Crystalline Materials-7 (Plastic deformation in polycrystalline materials, Softening Mechanisms)

Lecture 25 - Mechanical Properties of Materials (Concept of Stress Tensor)

Lecture 26 - Mechanical Properties (Tension Test-Elastic Deformation)

Lecture 27 - Mechanical Properties (Tension Test - Plastic Deformation)

Lecture 28 - Mechanical Properties (Tension Test - Plastic Deformation)

Lecture 29 - Mechanical Properties (Hardness Test)

Lecture 30 - Static Failure Theories (Introduction, Definition of Failure)

Lecture 31 - Static Failure Theories (General form of failure theory, Stress tensor, Principal stress)

Lecture 32 - Static Failure Theories (Distortion Energy Theory)

Lecture 33 - Static Failure Theories (Maximum Shear Stress Theory)

Lecture 34 - Static Failure Theories (Design Problems)

Lecture 35 - Static Failure Theories (Failure of Brittle Materials)

Lecture 36 - Static Failure Theories (Coulomb-Mohr and Modified Coulomb-Mohr)

Lecture 37 - Static Failure Theories (Notches and Stress Concentration)

Lecture 38 - Introduction to Fracture Mechanics, Griffith's Analysis of a Cracked Body

Lecture 39 - Fracture Mechanics (Energy Release Rate)

Lecture 40 - Fracture Mechanics (Crack Resistance, Stress Intensity Factor, Fracture Toughness)

Lecture 41 - Fatigue Failure of Materials (Introduction, Historical Events, S-N Diagram)

Lecture 42 - Fatigue Failure of Materials (S-N Diagram, Types of Time Varying Loads)

Lecture 43 - Fatigue Failure of Materials (High Cycle Fatigue, Low Cycle Fatigue, Stress Ratio, Amplitude Ratio)

Lecture 44 - Fatigue Failure of Materials (Rotating Beam Bending Test, Estimated S-N diagram)

Lecture 45 - Fatigue Failure Theories (Fatigue strength correction factors)

Lecture 46 - Problems on Fatigue Failure-1 (S-N diagram and Corrected endurance strength)

Lecture 47 - Fatigue Failure of Materials (Features of Fatigue Failure; Factor of Safety in Life and Stress)

Lecture 48 - Fatigue Failure of Materials (Effect of Mean Stress)

Lecture 49 - Fatigue Failure of Materials (Multiaxial Fatigue and Variable Amplitude Loading)

Lecture 50 - Fatigue Failure of Materials (Fatigue Stress Concentration Factor)

Lecture 51 - Fatigue Failure of Materials (Fatigue Crack Growth, Paris' law)

Lecture 52 - Problems on Fatigue Failure-2 (Effect of mean stress, Fatigue crack growth)

Lecture 53 - Problems on Fatigue Failure-3 (Effect of Notch, Multiaxial Loading)

Lecture 54 - Phase Diagrams (Introduction)

Lecture 55 - Phase Diagrams (Language of Phase Diagrams, Types of Binary Phase Alloys)

Lecture 56 - Phase Diagrams (Tie line, Lever Rule, Identification of compositions and weight fractions in two-phase regions)

Lecture 57 - Phase Diagrams (Type I: Isomorphous Alloys, Microstructure evolution in Equilibrium and Non equilibrium cooling)

Lecture 58 - Phase Diagrams (Congruent Melting Alloys, Type II Alloys, Eutectic Reaction)

Lecture 59 - Phase Diagrams (Type III Alloys with Partial Solubility in Solid State)

Lecture 60 - Phase Diagrams (Congruent melting alloys, Peritectic Reaction, Monotectic Reaction)

Lecture 61 - Phase Diagrams (Allotropy, Eutectoid and Peritectoid Reactions)

Lecture 62 - Phase Diagrams (Iron-Iron Carbide Phase Diagram)

Lecture 63 - Kinetics of Phase Transformations (Homogeneous Nucleation)

Lecture 64 - Kinetics of Phase Transformations (Heterogeneous Nucleation)

[Lecture 65 - Isothermal Transformation Diagram](#)

[Lecture 66 - Martensite Transformation, C-C-T Diagram](#)

[Lecture 67 - Heat Treatment of Steels \(Annealing and Normalizing\)](#)

Lecture 1 - Review of governing equations: Conservation of mass

Lecture 2 - Review of governing equations: Conservation of momentum

Lecture 3 - Review of governing equations: Conservation of energy

Lecture 4 - Review of governing equations: Navier-Stokes equations and energy equation

Lecture 5 - Review of governing equations: General scalar transport equation

Lecture 6 - Review of governing equations: classification of PDEs

Lecture 7 - Overview of Numerical Methods: Finite Difference Method

Lecture 8 - Overview of Numerical Methods: Finite Volume Method

Lecture 9 - Overview of Numerical Methods: Solution of linear algebraic equations

Lecture 10 - Finite Volume Method for Diffusion Equation: Discretization of 1D diffusion equation

Lecture 11 - Finite Volume Method for Diffusion Equation: Discretization of 2D diffusion equation

Lecture 12 - Finite Volume Method for Diffusion Equation: Boundary conditions for 2D diffusion equation

Lecture 13 - Finite Volume Method for Diffusion Equation: Discretization of 3D diffusion equation, mixed boundary conditions

Lecture 14 - Finite Volume Method for Diffusion Equation: Tri-Diagonal Matrix Algorithm

Lecture 15 - Finite Volume Method for Diffusion Equation: Linearization of source term, line-by-line TDMA

Lecture 16 - Finite Volume Method for Diffusion Equation: Problem solving using TDMA

Lecture 17 - Finite Volume Method for Diffusion Equation: Problem solving using line-by-line TDMA

Lecture 18 - Finite Volume Method for Diffusion Equation: Steady diffusion in polar and axisymmetric coordinates

Lecture 19 - Finite Volume Method for Diffusion Equation: Discretization of unsteady diffusion equation

Lecture 20 - Finite Volume Method for Diffusion Equation: Unsteady diffusion time-stepping schemes

Lecture 21 - Finite Volume Method for Diffusion Equation: Unsteady diffusion time-stepping schemes and Truncation errors of the FV schemes

Lecture 22 - Finite Volume Method for Diffusion Equation: Truncation errors and stability analysis

Lecture 23 - Finite Volume Method for Diffusion Equation: Stability analysis and steady diffusion in unstructured meshes.

Lecture 24 - Finite Volume Method for Diffusion Equation: Steady diffusion in unstructured meshes - Part 1

Lecture 25 - Finite Volume Method for Diffusion Equation: Steady diffusion in unstructured meshes - Part 2

Lecture 26 - Finite Volume Method for Diffusion Equation: Steady diffusion in unstructured meshes - Part 3

Lecture 27 - Finite Volume Method for Diffusion Equation: Steady diffusion in unstructured meshes - Part 4

Lecture 28 - Finite Volume Method for Diffusion Equation: Steady diffusion in unstructured meshes - Part 5

Lecture 29 - Finite Volume Method for Convection and Diffusion: Discretization of steady convection equation

Lecture 30 - Finite Volume Method for Convection and Diffusion: Discretization of steady convection equation

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[Lecture 31 - Finite Volume Method for Convection and Diffusion: Discretization of steady and unsteady convection equation](#)

[Lecture 32 - Finite Volume Method for Convection and Diffusion: Discretization of unsteady convection equation](#)

[Lecture 33 - Finite Volume Method for Convection and Diffusion: Discretization of convection-diffusion equation on unstructured mesh](#)

[Lecture 34 - Finite Volume Method for Convection-diffusion and fluid flow calculations](#)

[Lecture 35 - Finite Volume Method for Fluid Flow Calculations: The staggered grid approach](#)

[Lecture 36 - Finite Volume Method for Fluid Flow Calculations: SIMPLE algorithm - Part 1](#)

[Lecture 37 - Finite Volume Method for Fluid Flow Calculations: SIMPLE algorithm - Part 2](#)

[Lecture 38 - Finite Volume Method for Fluid Flow Calculations: SIMPLE algorithm - Part 3](#)

[Lecture 39 - Finite Volume Method for Fluid Flow Calculations: SIMPLE-Revised and SIMPLE-Corrected algorithm](#)

[Lecture 40 - Finite Volume Method for Fluid Flow Calculations: SIMPLE algorithm for Colocated mesh - Part 1](#)

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[Lecture 42 - Finite Volume Method for Fluid Flow Calculations: SIMPLE-Colocated algorithm for Unstructured mesh](#)

Lecture 1 - Introduction to Mobile Robots and Manipulators

Lecture 2 - Introduction to Locomotion and Types of Locomotion

Lecture 3 - Introduction to Mobile Robot Kinematics

Lecture 4 - Degree of Maneuverability and Types of Wheels

Lecture 5 - Kinematic Simulation of a Mobile Robot (Land-based)

Lecture 6 - Kinematic Simulation and Motion Animation of a Mobile Robot (Land-based)

Lecture 7 - A Generalized Wheel (Kinematic) Model

Lecture 8 - Examples related to the Generalized Wheel (Kinematic) Model

Lecture 9 - Holonomic and Non-holonomic Mobile Robots

Lecture 10 - Kinematic Simulation of Wheeled Mobile Robots - Part 1

Lecture 11 - Kinematic Simulation of Wheeled Mobile Robots - Part 2

Lecture 12 - Kinematic Simulation of Wheeled Mobile Robots - Part 3

Lecture 13 - Mobile Robot Dynamics - Part 1

Lecture 14 - Mobile Robot Dynamics - Part 2

Lecture 15 - Equation of Motion and Dynamic Simulation of a Mobile Robot

Lecture 16 - Dynamic Models of Wheeled Mobile Robots with Wheel Configurations

Lecture 17 - Kinematic and Dynamic Models of a Mobile base with Four-Independent Steerable Power Wheels

Lecture 18 - Sensing and Perception

Lecture 19 - Sensors and Sensing

Lecture 20 - Commonly used sensors - 1

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Lecture 22 - Commonly used sensors - 3

Lecture 23 - Sensor Errors and Error modelling

Lecture 24 - Mobile Robot Localisation

Lecture 25 - Map based Localisation

Lecture 26 - Markov Localisation

Lecture 27 - Kalman Filter Localisation

Lecture 28 - SLAM

Lecture 29 - Mobile Robot Navigation

Lecture 30 - Path Planning: Graph Construction

Lecture 31 - Graph Search Methods

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[Lecture 35 - Kinematic control of Land-based Mobile Robots](#)

[Lecture 36 - Simulation of Land-based Mobile Robots along with Kinematic Control - Part 1](#)

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[Lecture 38 - Simulation of Land-based Mobile Robots along with Kinematic Control - Part 3](#)

[Lecture 39 - Dynamic Control of Mobile Robots](#)

[Lecture 40 - Cascaded or Back-stepping Control of Mobile Robots](#)

[Lecture 41 - Modern Robotics and Challenges](#)

[Lecture 42 - Multiple Mobile Robotic Systems](#)

[Lecture 43 - Autonomous Mobile Robots and Mobile Manipulators](#)

[Lecture 44 - Legged and Hybrid Robots](#)

[Lecture 45 - Underwater and Aerial Robots](#)

[Lecture 46 - Healthcare Robots](#)

Lecture 1 - Fuel and their properties - Part 1

Lecture 2 - Fuel and their properties - Part 2 - Gaseous and Liquid fuels

Lecture 3 - Fuel and their properties - Part 3 - Liquid and Solid fuels

Lecture 4 - Review of basic thermodynamics of ideal gas mixtures - Part 1

Lecture 5 - Review of basic thermodynamics of ideal gas mixtures - Part 2

Lecture 6 - Stoichiometry - Part 1

Lecture 7 - Stoichiometry - Part 2 - Worked Examples

Lecture 8 - Stoichiometry - Part 3 - Worked Examples (Continued...)

Lecture 9 - First law and Second law of thermodynamics applied to combustion - Part 1 - Heat Calculation

Lecture 10 - First law and Second law of thermodynamics applied to combustion - Part 2 - Enthalpy Calculation

Lecture 11 - First law and Second law of thermodynamics applied to combustion - Part 3 - Calculation of flame temperature

Lecture 12 - First law and Second law of thermodynamics applied to combustion - Part 4 - Chemical equilibrium

Lecture 13 - First law and Second law of thermodynamics applied to combustion - Part 5 - Chemical equilibrium (Continued...)

Lecture 14 - First law and Second law of thermodynamics applied to combustion - Part 6 - Worked examples

Lecture 15 - First law and Second law of thermodynamics applied to combustion - Part 7 - Worked examples (Continued...)

Lecture 16 - Mass transfer basics - Part 1 - Fundamentals

Lecture 17 - Mass transfer basics - Part 2 - Calculation of diffusion velocity

Lecture 18 - Mass transfer basics - Part 3 - Steady evaporation (The Stefan Problem)

Lecture 19 - Mass transfer basics - Part 4 - Steady evaporation of liquid droplet and Worked examples

Lecture 20 - Fundamentals of combustion kinetics - Part 1 - Global and elementary reactions

Lecture 21 - Fundamentals of combustion kinetics - Part 2 - Reaction rates and equilibrium constant

Lecture 22 - Fundamentals of combustion kinetics - Part 3 - Steady state and partial equilibrium approximation

Lecture 23 - Fundamentals of combustion kinetics - Part 4 - Worked examples

Lecture 24 - Governing equations for reacting flow - Part 1 - Continuity, momentum and species conservation equations

Lecture 25 - Governing equations for reacting flow - Part 2 - The energy equation

Lecture 26 - Governing equations for reacting flow - Part 3 - Estimation of thermo-physical properties and control of combustion phenomena

Lecture 27 - Governing equations for reacting flow - Part 4 - Control of combustion phenomena and simplified chemically reacting system

Lecture 28 - Governing equations for reacting flow - Part 5 - Conserved scalars and mixture fraction approach

Lecture 29 - Characteristics of combustion flame and detonation - Part 1

Lecture 30 - Characteristics of combustion flame and detonation - Part 2

- Lecture 31 - Characteristics of combustion flame and detonation - Part 3 - Rankine-Hugoniot relation
- Lecture 32 - Characteristics of combustion flame and detonation - Part 4 - Estimation of detonation velocity and Worked examples
- Lecture 33 - Laminar Premixed Flames - Part 1 - Laminar flame propagation
- Lecture 34 - Laminar Premixed Flames - Part 2 - Laminar flame speed variation and Structure of premixed flames
- Lecture 35 - Laminar Premixed Flames - Part 3 - Flammability limits and Premixed flame theory
- Lecture 36 - Laminar Premixed Flames - Part 4 - Estimation of laminar flame speed
- Lecture 37 - Laminar Premixed Flames - Part 5 - Ignition of premixed mixture (Semenov's Analysis)
- Lecture 38 - Laminar Premixed Flames - Part 6 - Piloted ignition and Flame quenching
- Lecture 39 - Laminar Premixed Flames - Part 7 - Premixed flame stability
- Lecture 40 - Laminar Premixed Flames - Part 8 - Stability Maps and Worked examples
- Lecture 41 - Laminar Diffusion Flames - Part 1 - Theory of gas jets
- Lecture 42 - Laminar Diffusion Flames - Part 2 - Analysis of gas jets and jet diffusion flames
- Lecture 43 - Laminar Diffusion Flames - Part 3 - Diffusion flame characteristics and flame structure
- Lecture 44 - Laminar Diffusion Flames - Part 4 - Diffusion flame structure and Flame regimes
- Lecture 45 - Laminar Diffusion Flames - Part 5 - Diffusion flame regimes and Flame height correlations
- Lecture 46 - Laminar Diffusion Flames - Part 6 - Diffusion flame control
- Lecture 47 - Laminar Diffusion Flames - Part 7 - Diffusion flame configurations (coflow, crossflow and opposed flow flames)
- Lecture 48 - Laminar Diffusion Flames - Part 8 - Diffusion flame stability and Worked examples
- Lecture 49 - Turbulent Flames - Part 1 - Characteristics of turbulence
- Lecture 50 - Turbulent Flames - Part 2 - Turbulent length scales and turbulent stresses
- Lecture 51 - Turbulent Flames - Part 3 - Axisymmetric turbulent jet
- Lecture 52 - Turbulent Flames - Part 4 - Turbulent premixed flames and flame regimes
- Lecture 53 - Turbulent Flames - Part 5 - Turbulent diffusion flames
- Lecture 54 - Droplet evaporation and combustion - Part 1 - Steady evaporation of liquid droplet
- Lecture 55 - Droplet evaporation and combustion - Part 2 - Equilibrium under steady evaporation of liquid droplet and droplet combustion
- Lecture 56 - Droplet evaporation and combustion - Part 3 - Droplet combustion (simplified analysis)
- Lecture 57 - Droplet evaporation and combustion - Part 4 - Species and temperature profiles
- Lecture 58 - Droplet evaporation and combustion - Part 5 - Evaluation of mass burning rate and worked examples
- Lecture 59 - Combustion of carbon particle - Part 1 - Coal combustion
- Lecture 60 - Combustion of carbon particle - Part 2 - One film model
- Lecture 61 - Combustion of carbon particle - Part 3 - Two film model and worked examples

Lecture 1 - Introduction, Learning Objectives, Course Content and References

Lecture 2 - Merits and Demerits of Fluid Power, Power Transmission Method

Lecture 3 - Brief History, Application Areas, Major Divisions of Fluid Power System

Lecture 4 - Introduction to Oil Hydraulics and its Basic Components

Lecture 5 - Introduction to Pneumatic and its Basic Components, Applications-Stationary and Mobile

Lecture 6 - Typical Application of Fluid Power System, Status and Development

Lecture 7 - Pascal's law and its application-Hydraulic jack, Hydraulic brake and Numerical

Lecture 8 - Pressure Intensifier, Numericals, Air-to-Hydraulic Booster and Bernoulli equation

Lecture 9 - Applications of Bernoulli equation-Venturi, Torricelli's theorem, Siphon, Continuity equation and flow configuration, Concept of pressures and Gas laws

Lecture 10 - Introduction to Fluid Power Symbols, Hydraulic lines and Color Coding

Lecture 11 - Symbols for Functional Units, Hydraulic Pumps, Hydraulic Motors, Cylinders, Air Compressors, Pneumatic Motors and Orifices

Lecture 12 - Symbols for Filters, Check Valves, DCVs, Spool Actuation methods, PCV, Miscellaneous, Port Configurations

Lecture 13 - Introduction to Hydraulic Pumps, Facts and Figures, Classifications

Lecture 14 - Positive Displacement pump and pumping theory

Lecture 15 - Ideal pump, pump losses, efficiency curve, Constructional features and Operations of External Gear pump

Lecture 16 - Construction features and operations of Internal Gear Pump, Gerotor Pump and Screw Pump

Lecture 17 - Numericals on Gear Pump, Tree Structure of Vane Pump

Lecture 18 - Vane Pump, Pumping theory, Construction and Operation of Unbalanced Vane Pump, Vane loading and solutions, Different Vanes

Lecture 19 - Variable Displacement Pressure Compensated Vane Pump, Balance Vane Pump, Kinematic Inversion of Vane pump and Numerical

Lecture 20 - Piston pump, Pumping theory, Constructional features and Operations of Hand Pump-Single acting, Twin single acting, Double acting, Two-stage

Lecture 21 - Axial Piston Pump- Construction and Operating principles of Bent axis and Swash plate type pump

Lecture 22 - Radial Piston Pumps- Construction and Operation, Pump failure and Cavitations, Important parameters while selecting Pump, Numerical

Lecture 23 - Pneumatic Control System-Introduction, Air preparation-Primary and Secondary Air Treatment

Lecture 24 - Pneumatic Power Source- Compressor, Classification, Air Receiver and Control Methods

Lecture 25 - Reciprocating Type Air Compressor-Single and Multi-stage Piston Pump, PV Diagram and Work Done

Lecture 26 - Construction and Operation of Two-stage Reciprocating type Air Compressor, Diaphragm Type Air Compressor, Rotary Vane Compressor, Twin Lobe Air compressor, Screw Compressor, Liquid Ring Compressor and Selection Criteria

Lecture 27 - Energy Loss and Cost Break Down in Air Preparation Process, Pressure Drop and its Effect

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Lecture 28 - What causes Pressure Drop ?, Minimising Pressure Drop, Air Distribution System- Sizing of Pipes, Tubes, Materials and Fittings, Important Air Flow Parameters

Lecture 29 - Pressure drop Predictions using Various Empirical Formulae and Nomogram, Best Practices for Compressed Air Piping System and Installation Tips

Lecture 30 - Need for Air Dryer, Analysis of Moisture Removal from Air, Typical Air Drying Methods, Basic Types of Air Dryers

Lecture 31 - Construction and Operation of Refrigerated Air dryers, Absorption Dryer, Adsorption Dryer, Membrane Dryer, How to Choose the Right Air Dryer?

Lecture 32 - Directional Control Valves

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Lecture 37 - Pressure Control Valves

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Lecture 39 - Pressure Control Valves

Lecture 40 - Flow Control Valves

Lecture 41 - Flow Control Valves

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Lecture 43 - Estimation of leakage through spool and housing bore and Numericals on DCV, PCV and FCV

Lecture 44 - Estimation of leakage through spool and housing bore and Numericals on DCV, PCV and FCV

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Lecture 55 - Hydraulic Cylinders

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Lecture 57 - Numericals on Fluid Power Actuators

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Lecture 59 - Subsystems: Hydraulic Reservoir, Coolers and Filters

Lecture 60 - Subsystems: Hydraulic Reservoir, Coolers and Filters

Lecture 61 - Subsystems: Hydraulic Fluids, Conduits and Simple Numericals

Lecture 62 - Subsystems: Hydraulic Fluids, Conduits and Simple Numericals

Lecture 63 - Subsystems: Hydraulic Fluids, Conduits and Simple Numericals

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Lecture 66 - Subsystems: Hydraulic accumulators, Classifications, Applications, Accumulator physics, Maintenance, Numericals

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Lecture 23 - Brake: Braking Efficiency and Distance and Brake Factor

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NPTEL : NOC:Turbulence Modeling (Mechanical Engineering)

Co-ordinators : Prof. Vagesh D. Narasimhamurthy

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- Lecture 5 - Metal Casting basics, Gating and Riser design
- Lecture 6 - Evaporative Pattern Casting Process (EPC)
- Lecture 7 - Continuous, Permanent mold, Centrifugal and Pressure Die Casting
- Lecture 8 - Hybrid EPC Processes and Vacuum EPC Process
- Lecture 9 - Set-up of VEPC and Investment Casting Processes
- Lecture 10 - Ceramic Shell Investment Casting Process
- Lecture 11 - Shell Molding Process
- Lecture 12 - Abrasive Flow Machining
- Lecture 13 - Mechanism of Material Removal in AFM and Variant processes in AFM
- Lecture 14 - Abrasive Jet Machining (AJM)
- Lecture 15 - Water Jet and Abrasive Water Jet Machining
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- Lecture 17 - Mechanism, Processes Variants and applications of USM
- Lecture 18 - Micro USM and advances in USM
- Lecture 19 - Electric Discharge Machining (EDM) Process
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- Lecture 24 - Equipment and Process Parameters in LBM
- Lecture 25 - Electrochemical Machining (ECM)
- Lecture 26 - ECM Kinematics and Tool Design
- Lecture 27 - The Subsystems in ECM, advantages and applications
- Lecture 28 - Variant Processes in ECM: ECG, ECH, ECDe and STEM
- Lecture 29 - Electron Beam, Plasma Beam and Ion Beam Machining
- Lecture 30 - Submerged Arc Welding (SAW)
- Lecture 31 - Resistance Welding Process

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- Lecture 2 - CFD: Simulation Process and Course Outline
- Lecture 3 - Conservation Laws and Mathematical Preliminaries
- Lecture 4 - Mass Conservation: Continuity Equation
- Lecture 5 - Momentum Equation: Newton's 2nd Law
- Lecture 6 - Momentum Equation: Navier-Stokes Equations
- Lecture 7 - Navier-Stokes Equation and its Simplified Forms
- Lecture 8 - Energy and Scalar Transport Equations
- Lecture 9 - Scalar Transport, Mathematical Classification and Boundary Conditions
- Lecture 10 - Finite Difference Method: Methodology and Grid Notation
- Lecture 11 - Finite Difference Approximation of First Order Derivatives
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- Lecture 16 - Applications of FDM to Scalar Transport Problems - 1
- Lecture 17 - Applications of FDM to Scalar Transport Problems - 2
- Lecture 18 - Application of FDM to Advection-Diffusion and Computer Implementation Aspects
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- Lecture 23 - Direct and Basic Iterative Methods for Linear Systems
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NPTEL : Metal Casting (Mechanical Engineering)

Co-ordinators : Dr. D. B. Karunakar

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Lecture 4 - Overview of different casting processes - 3

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Lecture 8 - Moulding Sands Properties

Lecture 9 - Moulding Sand Properties Testing

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Lecture 11 - Patterns and Allowances

Lecture 12 - Steps Involved in Making a Sand Casting

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Lecture 18 - Design of Gating System - 1

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Lecture 23 - Treatment of Molten Metal

Lecture 24 - Fluidity of Molten Metal

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Lecture 26 - Cast Irons and Steels

Lecture 27 - Aluminum and Magnesium Cast Alloys

Lecture 28 - Copper, Zinc and Titanium Cast Alloys

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[Lecture 37 - Hole Making Techniques for Polymer Matrix Composites](#)

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NPTEL : Vibration control (Mechanical Engineering)

Co-ordinators : Dr. S. P. Harsha

Lecture 1 - Basics of Vibrations for Simple Mechanical Systems

Lecture 2 - Introduction to Damping in Free and Force Vibrations

Lecture 3 - Free and Forced Vibrations of Two Degree of Systems

Lecture 4 - Multi Degree of Freedom Systems

Lecture 5 - Reduction at source - 1

Lecture 6 - Reduction at source - 2

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Lecture 10 - Vibration Isolation - 1

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Lecture 13 - Source Classification

Lecture 14 - Self Excitation Vibration

Lecture 15 - Flow Induction Vibration

Lecture 16 - Field Balancing of Rigid / Flexible Rotors

Lecture 17 - Damping: Models and Measures - I

Lecture 18 - Damping: Models and Measures - II

Lecture 19 - Numerical Problems

Lecture 20 - Design Sensitivity - I

Lecture 21 - Design Specification

Lecture 22 - Design for Enhanced Material Damping

Lecture 23 - Basics of Passive Vibration Control

Lecture 24 - Design of Absorber

Lecture 25 - Shock Absorber

Lecture 26 - Isolators with Stiffness and Damping

Lecture 27 - Basics of Active Vibration Control

Lecture 28 - Piezoelectric Material - I

Lecture 29 - Piezoelectric Material - II: Applications

Lecture 30 - Piezoelectric Accelerometers

Lecture 31 - Electro-rheological (ER) Fluids

[Lecture 32 - Magneto-rheological \(MR\) Fluids](#)

[Lecture 33 - Magneto and Electrostrictive Materials](#)

[Lecture 34 - Shape Memory Alloy](#)

[Lecture 35 - Electro-Magnetics](#)

[Lecture 36 - Numerical Problems](#)

[Lecture 37 - Basics of Vibration Measurement System](#)

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[Lecture 39 - Fourier Transformation](#)

[Lecture 40 - Filters](#)

- Lecture 1 - Introduction to Welding Engineering
- Lecture 2 - Classification of Welding Processes - I
- Lecture 3 - Classification of Welding Processes - II
- Lecture 4 - Sources of Heat and Protection of Weld pool
- Lecture 5 - Protection of Weld Pool
- Lecture 6 - Introduction
- Lecture 7 - Fundamentals of Arc Initiation
- Lecture 8 - Arc Maintenance & Arc Characteristics
- Lecture 9 - Arc Forces
- Lecture 10 - Arc Efficiency
- Lecture 11 - Melting Rate in Different Welding Processes
- Lecture 12 - Types of power sources and their characteristics - I
- Lecture 13 - Types of power sources and their characteristics - II
- Lecture 14 - SMAW - I
- Lecture 15 - SMAW - II
- Lecture 16 - GTAW - I
- Lecture 17 - GTAW - II
- Lecture 18 - PAW & SAW
- Lecture 19 - SAW
- Lecture 20 - GMAW
- Lecture 21 - Brazing, Soldering & Braze Welding
- Lecture 22 - Braze welding and Electroslag welding
- Lecture 23 - Weld Thermal Cycle
- Lecture 24 - Effect of WTC and Cooling rate in welding
- Lecture 25 - Cooling rate
- Lecture 26 - Peak temperature & Solidification rate
- Lecture 27 - Residual stress - I
- Lecture 28 - Residual stress - II
- Lecture 29 - Introduction
- Lecture 30 - Type of joints and welds
- Lecture 31 - Edge preparation

[Lecture 32 - Design for static and fatigue loading](#)

[Lecture 33 - Fatigue fracture of weld joints - I](#)

[Lecture 34 - Fatigue fracture of weld joints - II](#)

[Lecture 35 - Introduction-](#)

[Lecture 36 - DT & NDT](#)

[Lecture 37 - Understanding Weldability](#)

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Lecture 1 - Production Planning and Control

Lecture 2 - Product Design and Development

Lecture 3 - Statistical Process Control - Part I

Lecture 4 - Statistical Process Control - Part II

Lecture 5 - Statistical Process Control - Part III

Lecture 6 - Productivity

Lecture 7 - Factors Affecting the Productivity

Lecture 8 - Improving the Productivity Introduction to Work Study

Lecture 9 - Work Study Human Component and Method Study

Lecture 10 - Recording Techniques for Method Study - Part I

Lecture 11 - Recording Techniques for Method Study - Part II

Lecture 12 - Recording Techniques Critical Examination

Lecture 13 - Principles of Motion Economy

Lecture 14 - Work Measurement Time Study - Part I

Lecture 15 - Work Measurement Time Study - Part II

Lecture 16 - Performance Rating Allowances

Lecture 17 - Work Measurement: Work Sampling

Lecture 18 - PMT System Standard Data Method

Lecture 19 - Ergonomics

Lecture 20 - Metabolism and Organization at Work

Lecture 21 - Working Conditions Lights Vibrations

Lecture 22 - Materials Management - Part I

Lecture 23 - Materials Management - Part II

Lecture 24 - Materials Requirement Planning

Lecture 25 - Sales Forecasting - Part I

Lecture 26 - Sales Forecasting - Part II

Lecture 27 - Capacity Planning - Part I

Lecture 28 - Capacity Planning - Part II

Lecture 29 - Network Analysis - Part I

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[Lecture 35 - Product Design Development](#)

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Lecture 1 - Powder Metallurgy - Part I

Lecture 2 - Powder Metallurgy - Part II

Lecture 3 - Powder Metallurgy - Part III

Lecture 4 - Metal Forming - Fundamentals

Lecture 5 - Forging

Lecture 6 - Swaging and Wire Drawing

Lecture 7 - Sheet Metal Operations - Part I

Lecture 8 - Sheet Metal Operations - Part II

Lecture 9 - Sheet Metal Operations - Part III

Lecture 10 - Sheet Metal Working - Presses

Lecture 11 - Sheet Metal Working - Equipment

Lecture 12 - High Energy Rate Forming Processes

Lecture 13 - Machining Fundamentals

Lecture 14 - Machining - Part I

Lecture 15 - Machining - Part II

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Lecture 17 - Metal casting - Part I

Lecture 18 - Metal casting - Part II

Lecture 19 - Metal Casting - Part III

Lecture 20 - Metal Casting - Part IV

Lecture 21 - Metal Casting - Part V

Lecture 22 - Metal Casting - Part VI

Lecture 23 - Metal Casting - Part VII

Lecture 24 - Metal Casting - Part VIII

Lecture 25 - Metal Casting - Part IX

Lecture 26 - Metal Casting - Part X

Lecture 27 - Introduction

Lecture 28 - Welding Process Classification

Lecture 29 - Brazing Soldering Braze Welding

Lecture 30 - Arc Welding Power Source - Part I

Lecture 31 - Arc Welding Power Source - Part II

[Lecture 32 - Shielded Metal Arc Welding - Part I](#)

[Lecture 33 - Shielded Metal Arc Welding - Part II](#)

[Lecture 34 - Submerged Arc Welding](#)

[Lecture 35 - Gas Metal Arc Welding - Part I](#)

[Lecture 36 - Gas Metal Arc Welding - Part II](#)

[Lecture 37 - Tungsten Inert Gas Welding - Part I](#)

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[Lecture 39 - Resistance Welding Process](#)

[Lecture 40 - Reaction in Weld Region Welding Defects](#)

NPTEL : Strength of Materials (Mechanical Engineering)

Co-ordinators : Dr. S.P. Harsha

Lecture 1 - Solid Mechanics

Lecture 2 - Strength of Materials

Lecture 3 - Strength of Materials

Lecture 4 - Solid Mechanics

Lecture 5 - Strength of Materials

Lecture 6 - Strength of Materials

Lecture 7 - Strength of Materials

Lecture 8 - Strength of Materials

Lecture 9 - Strength of Materials

Lecture 10 - Strength of Materials

Lecture 11 - Strength of Materials

Lecture 12 - Strength of Materials

Lecture 13 - Strength of Materials

Lecture 14 - Strength of Materials

Lecture 15 - Strength of Materials

Lecture 16 - Strength of Materials

Lecture 17 - Strength of Materials

Lecture 18 - Strength of Materials

Lecture 19 - Strength of Materials

Lecture 20 - Strength of Materials

Lecture 21 - Strength of Materials

Lecture 22 - Strength of Materials

Lecture 23 - Strength of Materials

Lecture 24 - Strength of Materials

Lecture 25 - Strength of Materials

Lecture 26 - Strength of Materials

Lecture 27 - Strength of Materials

Lecture 28 - Strength of Materials

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[Lecture 32 - Strength of Materials](#)

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[Lecture 36 - Strength of Materials](#)

[Lecture 37 - Strength of Materials](#)

[Lecture 38 - Strength of Materials](#)

[Lecture 39 - Strength of Materials](#)

[Lecture 40 - Strength of Materials](#)

Lecture 1 - Introduction

Lecture 2 - Flow Regimes

Lecture 3 - Homogeneous Model

Lecture 4 - Drift Flux Model

Lecture 5 - Separated Flow Model

Lecture 6 - Dispersed Flow

Lecture 7 - Slug Flow

Lecture 8 - Annular Flow

Lecture 9 - Droplet Annular and Stratified Flow

Lecture 10 - Measurement of Void Fraction

Lecture 11 - Signal Analysis

Lecture 12 - Two Fluid and Population Balance Model

Lecture 13 - Interface Tracking

Lecture 14 - Lattice Boltzmann Method

Lecture 15 - Smoothed Particle Hydrodynamics

Lecture 16 - Molecular Perspective of Two Phase Flow

Lecture 17 - Boiling Heat Transfer

Lecture 18 - Condensation

Lecture 19 - Solid-Liquid Flow

Lecture 20 - Gas-Solid Flow

Lecture 1 - Recapitulation of Thermodynamics

Lecture 2 - Introduction to Refrigeration

Lecture 3 - Air Refrigeration Cycle

Lecture 4 - Aircraft Refrigeration Cycles - 1

Lecture 5 - Aircraft Refrigeration Cycles - 2

Lecture 6 - Aircraft Refrigeration Cycles - 3

Lecture 7 - Vapour Compression Cycle - 1

Lecture 8 - Vapour Compression Cycle - 2

Lecture 9 - P-h Charts

Lecture 10 - Actual Vapour Compression Cycle - 1

Lecture 11 - Actual Vapour Compression Cycle - 2

Lecture 12 - Compound Compression with Intercooling - 1

Lecture 13 - Compound Compression with Intercooling - 2

Lecture 14 - Multiple Evaporator and Cascade System

Lecture 15 - Problem Solving - 1

Lecture 16 - Refrigerants - 1

Lecture 17 - Refrigerants - 2

Lecture 18 - Vpour Absorption Systems - 1

Lecture 19 - Vpour Absorption Systems - 2

Lecture 20 - Vpour Absorption Systems - 3

Lecture 21 - Introduction to Air-conditioning

Lecture 22 - Properties of Moist Air

Lecture 23 - Psychrometric Chart

Lecture 24 - Psychrometric Processes - 1

Lecture 25 - Psychrometric Processes - 2

Lecture 26 - Psychrometric Processes - 3

Lecture 27 - Infiltration

Lecture 28 - Design Conditions

Lecture 29 - Cooling Load - 1

Lecture 30 - Cooling Load - 2

Lecture 31 - Cooling Load - 3

[Lecture 32 - Air Distribution System - 1](#)

[Lecture 33 - Air Distribution System - 2](#)

[Lecture 34 - Problem Solving - 2](#)

[Lecture 35 - Air-Conditioning Systems](#)

[Lecture 36 - Human Physiology](#)

[Lecture 37 - Thermal Comfort](#)

[Lecture 38 - Indoor Environmental Health - 1](#)

[Lecture 39 - Indoor Environmental Health - 2](#)

[Lecture 40 - Problem Solving - 3](#)

- Lecture 1 - Introduction to Engineering Economy, Physical and Economic Environment, Phases in Engg. process
- Lecture 2 - Some economic concepts, Value and utility, Interest and Interest rate, Time value of money
- Lecture 3 - Interest formulas: Simple and compound interest, Cash flow diagrams
- Lecture 4 - Interest formulas for discrete compounding and discrete payments: Single payment (CAF and PWF)
- Lecture 5 - Interest formulas for discrete compounding and discrete payments: Equal payment series (CAF, CRF and PWF)
- Lecture 6 - Problem solving on discrete compounding, discrete payment
- Lecture 7 - Interest formulas for Uniform gradient series
- Lecture 8 - Interest formulas for geometric gradient series
- Lecture 9 - Compounding frequency of Interest: Nominal and Effective interest rates
- Lecture 10 - Problem solving on frequency compounding of interest and gradient series factors
- Lecture 11 - Economic equivalence: Meaning and principles of equivalence
- Lecture 12 - Equivalence calculations involving cash flows
- Lecture 13 - Methods of comparison of alternatives: Present worth, Annual equivalent, Future worth, Internal rate of return
- Lecture 14 - comparison of alternatives: Capitalized equivalent amount, Capital recovery with return
- Lecture 15 - Problem solving on equivalence and comparison of alternatives
- Lecture 16 - Replacement analysis: Reason, Concept of defender and challenger
- Lecture 17 - Proper treatment of sunk cost in replacement
- Lecture 18 - Replacement because of improved efficiency, inadequacy, demand etc.
- Lecture 19 - Problem solving on replacement analysis
- Lecture 20 - Economic life of the asset
- Lecture 21 - Depreciation: Definition, Reasons, Types of property, Value time function and book value
- Lecture 22 - Basic depreciation methods:S-L method, Declining balance method
- Lecture 23 - Depreciation: Declining balance switching to S-L, SOYD Method
- Lecture 24 - Modified accelerated cost recovery system (MACRS) method of depreciation, Depletion
- Lecture 25 - Depreciation: Units of production method, Depletion
- Lecture 26 - Problem solving based on Depreciation and Depletion
- Lecture 27 - Elements of cost: types of cost
- Lecture 28 - Breakeven analysis, Effect of fixed and variable cost on BEP.
- Lecture 29 - Economic order quantity
- Lecture 30 - Problem solving based on Breakeven analysis and EOQ
- Lecture 31 - Cost estimation: Methods of cost estimation, Adjustment of data, Learning

[Lecture 32 - cost estimating relationships](#)

[Lecture 33 - Introduction to decision under risk Criteria for decision under risk](#)

[Lecture 34 - Expected value decision making under risk](#)

[Lecture 35 - Expected variance decision making under risk](#)

[Lecture 36 - Problem solving based on decision under risk](#)

[Lecture 37 - Income taxes: Principles and calculation of effective income tax rates](#)

[Lecture 38 - Effect of method of depreciation on income taxes](#)

[Lecture 39 - After tax economic analysis](#)

[Lecture 40 - Problem solving based on Income tax analysis](#)

Lecture 1 - Introduction

Lecture 2 - Balance of Total Energy

Lecture 3 - Different Forms of Thermal Energy Equation

Lecture 4 - Thermal Boundary Layer

Lecture 5 - Forced Convection : Low Prandtl Number over a Flat Plate

Lecture 6 - Forced Convection : High Prandtl Number over a Flat Plate

Lecture 7 - Forced Convection over a Flat Plate : Uniform Heat Flux

Lecture 8 - Natural Convection : Uniform Wall Temperature

Lecture 9 - Natural Convection : Uniform Heat Flux

Lecture 10 - Tutorial : Convection over Flat Plate

Lecture 11 - Forced Convection in Ducts

Lecture 12 - Thermally Developed Slug Flow in a Duct

Lecture 13 - Thermally and Hydrodynamically Developed Flow : Uniform Heat Flux

Lecture 14 - Thermally and Hydrodynamically Developed Flow : Uniform Wall Temperature

Lecture 15 - Thermal Entrance Region : Uniform Wall Temperature

Lecture 16 - Thermal Entrance Region : Uniform Heat Flux

Lecture 17 - Rayleigh Benard Convection

Lecture 18 - Heat Transfer with Phase Change

Lecture 19 - Mass Transfer

Lecture 20 - Tutorial : Convection inside Duct and Mass Transfer

Lecture 1 - Lesson 1 - Introduction

Lecture 2 - Lesson 2 - Addition of two harmonic motions and beat phenomenon

Lecture 3 - Lesson 3 - Fourier series and harmonic analysis

Lecture 4 - Lesson 4 - Vibration analysis procedure

Lecture 5 - Lesson 5 - Numerical problems

Lecture 6 - Lesson 1 - Undamped free vibration

Lecture 7 - Lesson 2 - Energy method

Lecture 8 - Lesson 3 - Damped free vibration

Lecture 9 - Lesson 4 - Viscous damped systems and logarithmic decrement

Lecture 10 - Lesson 5 - Coulomb damping

Lecture 11 - Lesson 1 - Harmonic excitations

Lecture 12 - Lesson 2 - Magnification factor and frequency response curve

Lecture 13 - Lesson 3 - Rotating unbalance

Lecture 14 - Lesson 4 - Excitation of the support

Lecture 15 - Lesson 5 - Energy input and dissipation by viscous damping

Lecture 16 - Lesson 1 - Coulomb damping and equivalent viscous damping

Lecture 17 - Lesson 2 - Structural damping and equivalent viscous damping

Lecture 18 - Lesson 3 - Vibration isolation and force transmissibility

Lecture 19 - Lesson 4 - Motion transmissibility

Lecture 20 - Lesson 5 - Numerical problems

Lecture 21 - Lesson 1 - Transducers and vibration pickup

Lecture 22 - Lesson 2 - Vibrometer

Lecture 23 - Lesson 3 - Accelerometer

Lecture 24 - Lesson 4 - Velocity pickup or Velometer

Lecture 25 - Lesson 5 - Phase distortion and frequency measurement

Lecture 26 - Lesson 1 - Undamped free vibration

Lecture 27 - Lesson 2 - Principal modes of vibration

Lecture 28 - Lesson 3 - Combined rectilinear and angular modes

Lecture 29 - Lesson 4 - Damped free vibration

Lecture 30 - Lesson 5 - Undamped forced vibration with harmonic excitation

Lecture 31 - Lesson 1 - Undamped dynamic vibration absorber

[Lecture 32 - Lesson 2 - Tuned absorber](#)

[Lecture 33 - Lesson 3 - Numerical problems](#)

[Lecture 34 - Lesson 4 - Damped dynamic vibration absorber](#)

[Lecture 35 - Lesson 5 - Optimally tuned vibration absorber](#)

[Lecture 36 - Lesson 1 - Undamped free vibration](#)

[Lecture 37 - Lesson 2 - Eigen values and eigen vectors](#)

[Lecture 38 - Lesson 3 - Flexibility influence coefficients](#)

[Lecture 39 - Lesson 4 - Stiffness influence coefficients](#)

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- Lecture 1 - Introduction: Manufacturing and Joining
- Lecture 2 - Fundamental mechanisms of Joining
- Lecture 3 - Classification of Joining Processes
- Lecture 4 - Heat Generation in Welding
- Lecture 5 - Protection of Weld Metal
- Lecture 6 - Principle of Fusion Welding Processes: Gas Welding
- Lecture 7 - Fundamentals of Welding
- Lecture 8 - Physics of Welding Arc
- Lecture 9 - Shielded Metal Arc Welding
- Lecture 10 - Gas Tungsten Arc Welding
- Lecture 11 - Newer variants of Gas tungsten arc welding
- Lecture 12 - Gas metal arc welding
- Lecture 13 - Submerged arc welding
- Lecture 14 - Electro-slag and Electro-gas welding
- Lecture 15 - Laser beam welding
- Lecture 16 - Brazing
- Lecture 17 - Soldering and braze welding
- Lecture 18 - Fundamentals of resistance welding
- Lecture 19 - Resistance welding processes: spot and seam welding
- Lecture 20 - Flash butt welding
- Lecture 21 - Adhesive joining
- Lecture 22 - Weld bonding
- Lecture 23 - Solid state joining technologies: Fundamentals
- Lecture 24 - Ultrasonic welding
- Lecture 25 - Diffusion welding
- Lecture 26 - Explosive welding
- Lecture 27 - Magnetic pulse welding
- Lecture 28 - Weld thermal cycle
- Lecture 29 - Heat affected zone and weld thermal cycle - I
- Lecture 30 - Heat affected zone and weld thermal cycle - II
- Lecture 31 - Solidification of weld metal

- Lecture 32 - Metallurgical transformations in weld and heat affected zone of steels
- Lecture 33 - Residual Stresses in Weld Joints
- Lecture 34 - Solidification cracking and their control
- Lecture 35 - Cracking of Welded Joints II - Cold Cracks
- Lecture 36 - Understanding Weldability Introduction - I
- Lecture 37 - Understanding Weldability Introduction - II
- Lecture 38 - Metal Properties and Weldability - I
- Lecture 39 - Metal Properties and Weldability - II
- Lecture 40 - Weldability of Work Hardenable Metals
- Lecture 41 - Weldability of Work Hardenable and Precipitation Strengthened Metals
- Lecture 42 - Weldability of Precipitation Strengthened Metals
- Lecture 43 - Weldability of Metals Strengthened by Grain Refinement and Transformation Hardening
- Lecture 44 - Weldability of Transformation Hardening Metals
- Lecture 45 - Weldability of Metals - Combination of Strengthening Mechanisms
- Lecture 46 - Weldability Consideration
- Lecture 47 - Weldability of Carbon and Alloy Steel - I
- Lecture 48 - Weldability of Carbon and Alloy Steel - II
- Lecture 49 - Weldability of Carbon and Alloy Steel - III
- Lecture 50 - Weldability of Low Carbon Steel and Mild Steel
- Lecture 51 - Weldability of Medium Carbon Steel and High Carbon Steel
- Lecture 52 - Weldability of High Strength Low Alloy Steels
- Lecture 53 - Weldability of HTLA Steel - I
- Lecture 54 - Weldability of HTLA Steel - II
- Lecture 55 - Weldability of Cr-Mo Steel - I
- Lecture 56 - Weldability of Cr-Mo Steel - II
- Lecture 57 - Weldability of Pre-coated Steel - I
- Lecture 58 - Weldability of Pre-coated Steel - II
- Lecture 59 - Weldability of Stainless Steel - I
- Lecture 60 - Weldability of Stainless Steel - II

- Lecture 1 - Introduction to Modelling
- Lecture 2 - Examples of models
- Lecture 3 - Modeling of Dynamic Systems
- Lecture 4 - Introduction to Simulation
- Lecture 5 - MATLAB as a Simulation tool
- Lecture 6 - Bond graphs modelling
- Lecture 7 - Bond graph model and causality
- Lecture 8 - Generation of System Equations
- Lecture 9 - Methods of Drawing bond graph models - Mechanical Systems
- Lecture 10 - Methods of Drawing bond graph models - Electrical Systems
- Lecture 11 - Basic System Models - Mechanical Systems
- Lecture 12 - Basic System Models - Electrical Systems
- Lecture 13 - Basic System Models - Hydraulic Systems
- Lecture 14 - Basic System Models - Pneumatic Systems
- Lecture 15 - Basic System Models - Thermal Systems
- Lecture 16 - System Models : Linearity and Non Linearity in Systems
- Lecture 17 - System Model of Combined Rotary and Translatory Systems
- Lecture 18 - System Model of Electro Mechanical Systems
- Lecture 19 - System Model of Hydro Mechanical Systems
- Lecture 20 - System Models of Robots
- Lecture 21 - Dynamic response of the 1st order system
- Lecture 22 - Dynamic response of 2nd order system
- Lecture 23 - Performance measures for 2nd order system
- Lecture 24 - System Transfer functions
- Lecture 25 - Transfer Function of 1st and 2nd Order System
- Lecture 26 - Block Diagram Algebra
- Lecture 27 - Signal Flow Graphs
- Lecture 28 - State Variable Formulation
- Lecture 29 - Frequency Response
- Lecture 30 - Bode Plot
- Lecture 31 - Simulation using SIMULINK

[Lecture 32 - Simulation of simple and compound pendulums](#)

[Lecture 33 - Simulation of planar mechanisms](#)

[Lecture 34 - Simulation of wheeled mobile robots](#)

[Lecture 35 - Validation and Verification of Simulation Models](#)

[Lecture 36 - Parameter estimation methods](#)

[Lecture 37 - Parameter estimation examples](#)

[Lecture 38 - System identifications](#)

[Lecture 39 - Introduction to Optimization](#)

[Lecture 40 - Optimization with modeling of engineering problems](#)

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Lecture 2 - Mechanism of solidification

Lecture 3 - Solidification of Pure Metals and Alloys

Lecture 4 - Freeze Wave Mechanism and Solidification Time

Lecture 5 - Problem Solving on Solidification

Lecture 6 - Technology of pattern making

Lecture 7 - Allowances in pattern making

Lecture 8 - Moulding sands and its ingredients

Lecture 9 - Testing of molding sands

Lecture 10 - Sand preparation for casting

Lecture 11 - Technology of mould making

Lecture 12 - Technology of core making

Lecture 13 - Special sand moulding process

Lecture 14 - Organic binders

Lecture 15 - Special moulding process

Lecture 16 - Introduction of gating design

Lecture 17 - Types of gate

Lecture 18 - Pouring time calculation

Lecture 19 - Aspiration effects in gating system

Lecture 20 - Problem solving on gating design

Lecture 21 - Solidification analysis

Lecture 22 - Riser methods

Lecture 23 - Shape factor

Lecture 24 - Feeding and Chills effect

Lecture 25 - Problem related to riser design

Lecture 26 - Special casting process - 1

Lecture 27 - Special casting process - 2

Lecture 28 - Special casting process - 3

Lecture 29 - Technology of melting

Lecture 30 - Melting practices

Lecture 31 - Melting and Casting of cast metal

[Lecture 32 - Melting practice for gray iron](#)

[Lecture 33 - Melting practice for Malleable iron and S.G iron](#)

[Lecture 34 - Casting of steel and alloy steel](#)

[Lecture 35 - Casting practices for non-ferrous metals and alloys](#)

[Lecture 36 - Fettling of castings](#)

[Lecture 37 - Heat treatment of castings](#)

[Lecture 38 - Heat treatment practices for cast iron and non-ferrous metals and alloys](#)

[Lecture 39 - Casting defects](#)

[Lecture 40 - Diagnostics of casting defects](#)

Lecture 1 - Review of Thermodynamics

Lecture 2 - Rankine Cycle

Lecture 3 - Performance of Rankine Cycle

Lecture 4 - Binary vapour cycle and co-generation

Lecture 5 - Problem Solving (Rankine Cycle)

Lecture 6 - Steam Generators

Lecture 7 - Fire Tube Boilers

Lecture 8 - Water Tube Boilers

Lecture 9 - Boiler Mountings and Accessories

Lecture 10 - High Pressure Boilers (Part-1)

Lecture 11 - High Pressure Boilers (Part-2)

Lecture 12 - Draught

Lecture 13 - Performance of Boiler

Lecture 14 - Combustion of Fuel

Lecture 15 - Combustion of Fuel (Problem Solving)

Lecture 16 - Boiler Trial

Lecture 17 - Nozzles and Diffusers - Momentum and Continuity Equations

Lecture 18 - Nozzles and Diffusers - Efficiency and Critical Pressure

Lecture 19 - Nozzles and Diffusers - General Relationships and Supersaturated Flow

Lecture 20 - Problem Solving (Nozzles and diffusers)

Lecture 21 - Steam Turbine

Lecture 22 - Compounding of Steam Turbine

Lecture 23 - Impulse Steam Turbine

Lecture 24 - Impulse Steam Turbine Performance

Lecture 25 - Problem solving (Impulse Steam Turbine)

Lecture 26 - Impulse Reaction Steam Turbine

Lecture 27 - Impulse Reaction Steam Turbine Performance

Lecture 28 - Energy Losses in Steam Turbine

Lecture 29 - Condensers

Lecture 30 - Problem Solving (Steam Turbine)

Lecture 31 - Gas turbine cycle

[Lecture 32 - Gas Turbine cycle Performance Evaluations](#)

[Lecture 33 - Gas Turbine cycle - Modifications](#)

[Lecture 34 - Problem Solving \(Gas Turbine Cycle\)](#)

[Lecture 35 - Centrifugal Compressors](#)

[Lecture 36 - Centrifugal Compressors Characteristics](#)

[Lecture 37 - Axial Flow Compressor](#)

[Lecture 38 - Axial Flow Compressor Characteristics](#)

[Lecture 39 - Jet Propulsion](#)

[Lecture 40 - Problem Solving](#)

Lecture 1 - Introduction to product design and development

Lecture 2 - Product life-cycle

Lecture 3 - Product policy of an organization and selection of profitable products

Lecture 4 - Product design

Lecture 5 - Product design steps and product analysis

Lecture 6 - Value engineering concepts

Lecture 7 - Problem Identification and VEJP

Lecture 8 - Function analysis

Lecture 9 - Functional analysis system technique

Lecture 10 - Case study on value engineering

Lecture 11 - Quality function deployment

Lecture 12 - Computer aided design

Lecture 13 - Robust design

Lecture 14 - Design for X

Lecture 15 - Ergonomics in product design

Lecture 16 - DFMA guidelines

Lecture 17 - Product design for manual assembly

Lecture 18 - Design guidelines for different processes

Lecture 19 - Rapid prototyping: concept, advantages

Lecture 20 - Rapid prototyping processes

- Lecture 1 - Understanding Manufacturing
- Lecture 2 - Fundamental Approaches of Manufacturing
- Lecture 3 - Manufacturing Process Specific Advantages and Limitations
- Lecture 4 - Material and Manufacturing Processes
- Lecture 5 - Classification of Manufacturing Processes
- Lecture 6 - Selection of Manufacturing Processes
- Lecture 7 - Applications of Manufacturing Processes
- Lecture 8 - Effect of Manufacturing Processes on Mechanical Properties
- Lecture 9 - Break Even Analysis in Manufacturing Processes
- Lecture 10 - Casting: Introduction and Suitability
- Lecture 11 - Steps of Casting Processes
- Lecture 12 - Casting: Terminology
- Lecture 13 - The Pattern Allowances - I
- Lecture 14 - The Pattern Allowances - II
- Lecture 15 - Casting: Sand Moulding - I
- Lecture 16 - Sand Moulding - II
- Lecture 17 - Casting: Core and Core Prints
- Lecture 18 - Casting: Gating System
- Lecture 19 - Casting: Yield and Riser Design
- Lecture 20 - Casting: Riser Design
- Lecture 21 - Casting: Cleaning of Castings
- Lecture 22 - Casting: Casting Defects and their Preventions
- Lecture 23 - Casting: Shell Mould Casting
- Lecture 24 - Casting: Investment and Permanent Mould Casting
- Lecture 25 - Metal Working Processes: Hot and Cold Working
- Lecture 26 - Metal Working Processes: Rolling
- Lecture 27 - Metal Working Processes: Forging
- Lecture 28 - Metal Working Processes: Extrusion
- Lecture 29 - Metal Working Processes: Wire Drawing
- Lecture 30 - Metal Working Processes: Press
- Lecture 31 - Sheet Metal Operations: Shearing

- Lecture 32 - Metal Working Processes: Sheet Metal Operations - II
- Lecture 33 - Metal Working Processes: Sheet Metal Operations - III
- Lecture 34 - Metal Working Processes: Dies and Die sets
- Lecture 35 - Material Removal Processes: Machining
- Lecture 36 - Material Removal Processes: Mechanism of Metal Cutting
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Lecture 18 - Putting together the pseudo rigid-body model

Lecture 19 - Modeling a partially compliant mechanism

Lecture 20 - Kinematic coefficients of a four-bar linkage with and without springs

Lecture 21 - Solving equations of PRB modeling and comparing with finite element analysis

Lecture 22 - Loop-closure equations for PRB models of compliant mechanisms

Lecture 23 - Burmester theory for compliant mechanisms

Lecture 24 - PRB-based Synthesis Examples

Lecture 25 - Structural optimization approach

Lecture 26 - Early works on design for compliance

Lecture 27 - Design for deflection of trusses

Lecture 28 - Design for deflection of beams and frames

Lecture 29 - Design of elastic continua for desired deflection

Lecture 30 - Continuum element-based topology optimization of compliant mechanisms

Lecture 31 - YinSyn; synthesis of nonlinear responses with compliant mechanisms

[Lecture 32 - Five different formulations for compliant mechanism design and some benchmark problems](#)

[Lecture 33 - Distributed compliance](#)

[Lecture 34 - How to achieve distributed compliance](#)

[Lecture 35 - Shape optimization](#)

[Lecture 36 - Cam-flexure clamp-case-study](#)

[Lecture 37 - SL model for compliant mechanisms](#)

[Lecture 38 - Feasibility maps for compliant mechanisms](#)

[Lecture 39 - Selection of compliant mechanisms for given user-specifications](#)

[Lecture 40 - Two case-studies using feasibility maps technique](#)

[Lecture 41 - SML model for compliant mechanisms for dynamic response](#)

[Lecture 42 - Re-design of compliant mechanisms; Matlab and Java codes](#)

[Lecture 43 - Non-dimensional analysis of beams](#)

[Lecture 44 - Deformation index and slenderness ratio of compliant mechanisms](#)

[Lecture 45 - Kinetoelastostatic maps](#)

[Lecture 46 - Designing with kinetoelastic maps](#)

[Lecture 47 - Non-dimensinalization of stress, frequency, and other measures](#)

[Lecture 48 - Designing compliant suspensions using kinetoelastic maps](#)

[Lecture 49 - Instant centre method for designing compliant mechanisms](#)

[Lecture 50 - Stiffness and compliance ellipsoids](#)

[Lecture 51 - Building block method of designing compliant mechanisms](#)

[Lecture 52 - Comparative analysis of different methods for designing compliant mechanisms](#)

[Lecture 53 - Aspects of Mechanical advantage of compliant mechanisms](#)

[Lecture 54 - Mechanical advantage of rigid-body and compliant mechanisms](#)

[Lecture 55 - Bistability in elastic systems](#)

[Lecture 56 - Analysis of bistable arches](#)

[Lecture 57 - Compliant mechanisms with bistable arches](#)

[Lecture 58 - Static balancing and zero-free-length springs](#)

[Lecture 59 - Static balance of a compliant mechanism using a linkage](#)

[Lecture 60 - Static balancing method for compliant mechanisms](#)

[Lecture 61 - A catalogue of compliant mechanisms](#)

[Lecture 62 - Compliant suspension mechanism in microsystems \(MEMS\)](#)

[Lecture 63 - Micromechanical signal processors using compliant mechanisms](#)

[Lecture 64 - A few special concepts of compliant mechanisms](#)

[Lecture 65 - Materials and prototyping of compliant mechanisms](#)

[Lecture 66 - Summary of the course](#)

[Lecture 67 - Micromachined accelerometers with Displacement-amplifying Compliant Mechanisms \(DaCMs\)](#)

[Lecture 68 - Miniature compliant mechanisms as cell-manipulation tools](#)

[Lecture 69 - Micro-newton force sensor](#)

[Lecture 70 - Compliant tissue cutting mechanism](#)

[Lecture 71 - A compliant pipe-crawling robots](#)

[Lecture 72 - A compliant easy-chair for the elderly](#)

Lecture 1 - Introduction to Multiphase

Lecture 2 - Thermodynamics of Multiphase systems

Lecture 3 - Thermodynamics of Interface - I

Lecture 4 - Thermodynamics of Interface - II

Lecture 5 - Interfacial phenomena key concepts - I

Lecture 6 - Interfacial phenomena key concepts - II

Lecture 7 - Interfacial heat and mass transfer - I - Interfacial mass, momentum and energy balance, Surface tension, WettingL07

Lecture 8 - Interfacial heat and mass transfer - II - Interfacial dynamics, Instabilities of the interface

Lecture 9 - Interfacial heat and mass transfer - III - Evaporation from thin films

Lecture 10 - Governing equations and interfacial conditions

Lecture 11 - Governing equations : Averaging techniques - I

Lecture 12 - Governing equations : Averaging techniques - II

Lecture 13 - Governing equations : Averaging techniques - III

Lecture 14 - Interface shapes

Lecture 15 - Transport processes at interface with key concepts - I

Lecture 16 - Transport processes at interface with key concepts - II

Lecture 17 - Interfacial transport

Lecture 18 - Interfacial transport including dynamic behavior

Lecture 19 - Interface behavior

Lecture 20 - Heat transfer and evaporation in droplets

Lecture 21 - Droplet vaporization models - I

Lecture 22 - Droplet vaporization models - II

Lecture 23 - Droplet vaporization dynamics - I

Lecture 24 - Droplet vaporization dynamics - II

Lecture 25 - Droplet liquid phase transport

Lecture 26 - Comprehensive droplet vaporization model and correlations - I

Lecture 27 - Comprehensive droplet vaporization model and correlations - II

Lecture 28 - Comparison of droplet vaporization models

Lecture 29 - Species transport in droplet

Lecture 30 - Heat transfer and transport processes in sessile droplets

Lecture 31 - Introduction to atomization

[Lecture 32 - Atomization principles and governing parameters](#)

[Lecture 33 - Spray / droplet breakup models \$\hat{A}\$ - I \(TAB model\)](#)

[Lecture 34 - Spray / droplet breakup models \$\hat{A}\$ - II \(WAVE model\)](#)

[Lecture 35 - Droplet combustion - I](#)

[Lecture 36 - Droplet combustion - II](#)

[Lecture 37 - Regimes in spray combustion](#)

[Lecture 38 - Boiling - I](#)

[Lecture 39 - Boiling - II \(Bubble dynamics\)](#)

[Lecture 40 - Boiling - II \(Bubble dynamics and critical heat flux\)](#)

- Lecture 1 - Introduction to convective heat transfer
- Lecture 2 - Governing equations I - Momentum Conservation
- Lecture 3 - Governing equations II - Energy Conservation
- Lecture 4 - Introduction to external forced convection
- Lecture 5 - Scaling Analysis - Momentum
- Lecture 6 - Scaling Analysis - Energy I
- Lecture 7 - Scaling Analysis - Energy II
- Lecture 8 - Similarity solution - Momentum
- Lecture 9 - Similarity solution - Energy
- Lecture 10 - Integral solutions - Momentum
- Lecture 11 - Integral solutions - Energy
- Lecture 12 - Suction and Blowing
- Lecture 13 - Falkner-Skan solution
- Lecture 14 - Arbitrary Wall temperature
- Lecture 15 - Internal forced convection - Developing flow
- Lecture 16 - Hydrodynamic fully developed flow
- Lecture 17 - Mean temperature in fully developed flow
- Lecture 18 - Uniform heat flux
- Lecture 19 - Uniform wall temperature
- Lecture 20 - Tube surrounded by isothermal flow
- Lecture 21 - Heat transfer to fully developed flow - I
- Lecture 22 - Heat transfer to fully developed flow - II
- Lecture 23 - Laminar slug flow
- Lecture 24 - Power law fluids
- Lecture 25 - Forced convection - Tutorial I
- Lecture 26 - Forced convection - Tutorial II
- Lecture 27 - Forced convection - Tutorial III
- Lecture 28 - Introduction to external natural convection
- Lecture 29 - Scaling analysis - I
- Lecture 30 - Scaling analysis - II
- Lecture 31 - Integral solution

- Lecture 32 - Similarity solution
- Lecture 33 - Uniform wall heat flux
- Lecture 34 - Thermal stratification
- Lecture 35 - Mixed convection
- Lecture 36 - Internal natural convection - Scaling analysis
- Lecture 37 - Heat transfer regimes
- Lecture 38 - Regime III
- Lecture 39 - Regime IV - Shallow enclosure limit - I
- Lecture 40 - Regime IV - Shallow enclosure limit - II
- Lecture 41 - Partially divided enclosures
- Lecture 42 - Inclined enclosures
- Lecture 43 - Natural convection - Tutorial I
- Lecture 44 - Natural convection - Tutorial II
- Lecture 45 - Introduction to Turbulence
- Lecture 46 - Reynolds-Averaged Navier Stokes equation - I
- Lecture 47 - Reynolds-Averaged Navier Stokes equation - II
- Lecture 48 - Turbulent boundary layer - Viscous sub layer
- Lecture 49 - Turbulent boundary layer - Fully turbulent sub layer
- Lecture 50 - Heat transfer in turbulent boundary layer
- Lecture 51 - Turbulent internal flow - I
- Lecture 52 - Turbulent internal flow - II
- Lecture 53 - Turbulent internal flow - III
- Lecture 54 - $k - \epsilon$ model
- Lecture 55 - Turbulence - Tutorial
- Lecture 56 - Experimental techniques - Thermochromic liquid crystals
- Lecture 57 - Experimental techniques - IR thermography
- Lecture 58 - Droplet evaporation - Sessile I
- Lecture 59 - Droplet evaporation - Sessile II
- Lecture 60 - Droplet evaporation - Contact free

- Lecture 1 - Introduction to complex variables
- Lecture 2 - Cauchy Riemann Equations
- Lecture 3 - Analytic Functions
- Lecture 4 - Simple definitions
- Lecture 5 - Definition of sets, domains, theorem on antiderivative
- Lecture 6 - Cauchy Goursat Theorem
- Lecture 7 - Implications of Cauchy Goursat Theorem, Cauchy Integral Formula
- Lecture 8 - Implications of CIF, converse of CG theorem
- Lecture 9 - Examples in contour integrals, ratios of polynomials
- Lecture 10 - Contour integration of sinc function
- Lecture 11 - Method of path deformation
- Lecture 12 - Method of path deformation (Continued...)
- Lecture 13 - Infinite and finite branch cuts
- Lecture 14 - Finite Branch Cut
- Lecture 15 - Infinite branch cut example
- Lecture 16 - Contour integration: rectangular contour
- Lecture 17 - Finite square root branch cut
- Lecture 18 - Example on finite branch cut
- Lecture 19 - Pole on a branch cut
- Lecture 20 - L shaped branch cut
- Lecture 21 - L shaped branch cut continued
- Lecture 22 - Inverse Laplace Transform
- Lecture 23 - Inverse Laplace Transform (Continued...)
- Lecture 24 - Additional material or corrections to lectures
- Lecture 25 - Summary of the total course

Lecture 1 - Introduction

Lecture 2 - Deborah number

Lecture 3 - Response of Elastic solid

Lecture 4 - Response of Viscous fluid

Lecture 5 - Viscoelastic material

Lecture 6 - Creep and stress relaxation

Lecture 7 - Creep and stress relaxation functions

Lecture 8 - Linearity

Lecture 9 - Mechanical Analogues

Lecture 10 - Tutorial

Lecture 11 - Atoms and bonds

Lecture 12 - Interatomic bonds

Lecture 13 - Polymers

Lecture 14 - Polymers (Continued...)

Lecture 15 - Polymers (Continued...)

Lecture 16 - Freely jointed model

Lecture 17 - Constitutive equations

Lecture 18 - Constitutive equations (Continued...)

Lecture 19 - Constitutive equations (Continued...)

Lecture 20 - Viscoelastic effects

Lecture 21 - Lab Session

Lecture 22 - Polymer concentrations

Lecture 23 - Lagrangian and Eulerian perspectives

Lecture 24 - Maxwell model

Lecture 25 - Maxwell model (Continued...)

Lecture 26 - Kelvin-Meyer-Voigt model

Lecture 27 - Three parameter model

Lecture 28 - Three parameter model (Continued...)

Lecture 29 - Three parameter model (Continued...)

Lecture 30 - Jefferey's model

Lecture 31 - Two Maxwell model

[Lecture 32 - N-Maxwell model](#)

[Lecture 33 - N-Maxwell model \(Continued...\)](#)

[Lecture 34 - N-Kelvin Meyer Voigt model](#)

[Lecture 35 - Constitutive modelling](#)

[Lecture 36 - Objectivity](#)

[Lecture 37 - Objectivity](#)

[Lecture 38 - Sinusoidal oscillations](#)

[Lecture 39 - Sinusoidal oscillations \(Continued...\)](#)

[Lecture 40 - Sinusoidal oscillations \(Continued...\)](#)

[Lecture 41 - Summary](#)

[Lecture 42 - Tutorial](#)

[Lecture 43 - Tutorial \(Continued...\)](#)

Lecture 1 - Introduction, Types and Classification of Robots

Lecture 2 - Main Elements of a Robot

Lecture 3 - Modelling and Analysis of Robots

Lecture 4 - Mathematical Preliminaries, Homogeneous Transformations

Lecture 5 - Elements of robot - Joints, Elements of robots - Links

Lecture 6 - Examples of D-H parameters and Link transformation matrices

Lecture 7 - Introduction, Direct Kinematics of Serial Robots

Lecture 8 - Inverse Kinematics of Serial Robots

Lecture 9 - Inverse Kinematics of Serial Robots with $n < 6$, Inverse Kinematics of Serial Robots with $n > 6$

Lecture 10 - Elimination Theory and Solution of Non-linear Equations, Inverse Kinematics of a General 6R Robot

Lecture 11 - Introduction, Loop-closure Equations

Lecture 12 - Direct Kinematics of Parallel Manipulators

Lecture 13 - Mobility of Parallel Manipulators

Lecture 14 - Inverse Kinematics of Parallel Manipulators

Lecture 15 - Direct Kinematics of Stewart Platform Manipulators

Lecture 16 - Sun tracking using 3-DOF parallel manipulator

Lecture 17 - Stewart-Gough platform-based force-torque sensor

Lecture 18 - Vibration isolation using a Stewart-Gough platform

Lecture 19 - Introduction, Linear and Angular Velocity of Links

Lecture 20 - Serial Manipulator Jacobian Matrix

Lecture 21 - Parallel Manipulator Jacobian Matrix

Lecture 22 - Singularities in Serial and Parallel Manipulators

Lecture 23 - Statics of Serial and Parallel Manipulators

Lecture 24 - Hyper-redundant robots

Lecture 25 - Redundancy resolution in human arm

Lecture 26 - Flexible robots

Lecture 27 - Introduction, Lagrangian formulation

Lecture 28 - Examples of Equations of Motion

Lecture 29 - Inverse Dynamics and Simulation of Equations of Motion

Lecture 30 - Recursive Formulations of Dynamics of Manipulators

Lecture 31 - Motion planning

[Lecture 32 - Control of a single link](#)

[Lecture 33 - Control of a multi-link serial manipulator](#)

[Lecture 34 - Control of a multi-link manipulator](#)

[Lecture 35 - Control of constrained and parallel manipulator, Cartesian control of serial manipulators](#)

[Lecture 36 - Force control of manipulators, Hybrid position/force control of manipulators](#)

[Lecture 37 - Advanced topics in non-linear control of manipulators](#)

[Lecture 38 - Wheeled Mobile Robots \(WMR\) on Flat Terrain](#)

[Lecture 39 - Wheeled Mobile Robots \(WMR\) on Uneven Terrain](#)

[Lecture 40 - Kinematics and Dynamics of WMR on Uneven Terrain](#)

[Lecture 41 - Over-Constrained Mechanism and Deployable Structures](#)

[Lecture 42 - Kinematic and Static Analysis](#)

Lecture 1 - The longitudinal wave in vibrating spring

Lecture 2 - Harmonically excited systems

Lecture 3 - The concept of coincidence frequency

Lecture 4 - A classical problem in sound-structure interaction

Lecture 5 - Classical problem (Continued...)

Lecture 6 - Uncoupled solution to the classical problem

Lecture 7 - Uncoupled solution (Continued...).

Lecture 8 - Introduction to the coupled problem.

Lecture 9 - The coupled roots

Lecture 10 - Physical meaning of terms

Lecture 11 - Derivation of coupled roots using asymptotic method

Lecture 12 - Coupled roots derivation (Continued...)

Lecture 13 - Regions of heavy and light fluid loading

Lecture 14 - Light and heavy fluid loading (Continued...)

Lecture 15 - The coupled vibration field

Lecture 16 - The coupled acoustic field and stationary phase

Lecture 17 - The 2-D structural-acoustic waveguide

Lecture 18 - The coupled partial differential equations

Lecture 19 - Derivation of the coupled dispersion equation

Lecture 20 - A schematic of coupled waves

Lecture 21 - Derivation of coupled waves using asymptotic method

Lecture 22 - Asymptotic method (Continued...) and Maple demo

Lecture 23 - Physics of the coupled waves

Lecture 24 - Critical points

Lecture 25 - Heavy fluid loading

Lecture 26 - Summary of the rectangular waveguide

Lecture 27 - Impedance and mobility

Lecture 28 - Derivation of acoustic and vibration response

Lecture 29 - Derivation of vibro-acoustic response (Continued...)

Lecture 30 - Derivation of vibro-acoustic response (Continued...)

Lecture 31 - Numerical example

- Lecture 32 - Coupled resonance analysis using matrices
- Lecture 33 - Coupled resonance analysis (Continued...)
- Lecture 34 - Sound radiation from a baffled panel
- Lecture 35 - Derivation of pressure response.
- Lecture 36 - Radiation efficiency
- Lecture 37 - Physics of volume velocity cancellation
- Lecture 38 - Derivations in the frequency domain: 1-D
- Lecture 39 - Physics of the vibration spectrum in 2-D
- Lecture 40 - Modal character across the frequency range
- Lecture 41 - Simultaneous radiation from several modes
- Lecture 42 - Panel radiation model using monopoles
- Lecture 43 - Physics of panel radiation using monopole model
- Lecture 44 - Physics of panel radiation using monopole model (Cointinued...)
- Lecture 45 - Radiation resistance derivation from Maidanikâ€™s work (Continued...)
- Lecture 46 - Radiation resistance derivation from Maidanikâ€™s work (Continued...)
- Lecture 47 - Radiation resistance derivation from Maidanikâ€™s work (Continued...)
- Lecture 48 - Modal average radiation efficiency
- Lecture 49 - Modal average radiation efficiency (Cointinued...)
- Lecture 50 - Transmission of sound through a rigid panel with flexible mounts
- Lecture 51 - Frequency dependence of sound transmission
- Lecture 52 - Sound transmission through a flexible partition
- Lecture 53 - Transmission loss in different situations
- Lecture 54 - Cylindrical shell vibration
- Lecture 55 - Behavior of uncoupled shell waves
- Lecture 56 - Fluid waves in rigid-walled cylindrical shells
- Lecture 57 - Wave propagation characteristics in flexible cylindrical shells carrying fluid: Fullers paper
- Lecture 58 - Wave impedance of an infinite plate: fluid loading
- Lecture 59 - Fluid loading in a finite plate
- Lecture 60 - Summary of the entire course

- Lecture 1 - Introduction to differential geometry
- Lecture 2 - Properties of surfaces: First fundamental form
- Lecture 3 - Properties of surfaces: Second fundamental form
- Lecture 4 - Surfaces of revolution
- Lecture 5 - Gauss Codazzi relations
- Lecture 6 - Gauss Codazzi (Continued...)
- Lecture 7 - Differential element length in a thin shell
- Lecture 8 - Strain of a differential element
- Lecture 9 - Explicit strain expressions
- Lecture 10 - Love simplifications and inconsistencies Of the theory
- Lecture 11 - Euler Bernoulli Beam equation using the Hamilton's Law
- Lecture 12 - Euler Bernoulli Beam and Hamilton's Law (Continued...)
- Lecture 13 - Beta definition, force and moment resultants
- Lecture 14 - Hamilton's Law for a general shell
- Lecture 15 - The Hamilton's law (Continued...)
- Lecture 16 - Final Dynamical Equations and boundary conditions
- Lecture 17 - Physics of each term in the dynamic equations
- Lecture 18 - Physics of each term (Continued...)
- Lecture 19 - The sixth equation of motion
- Lecture 20 - The sixth equation of motion (Continued...)
- Lecture 21 - Equations of motion for a rectangular plate using Hamilton's law
- Lecture 22 - Equations of motion for a rectangular Plate (Continued...)
- Lecture 23 - Rectangular plate boundary conditions
- Lecture 24 - Rectangular plate equation using force balance
- Lecture 25 - Modeshapes and resonances of a vibrating beam
- Lecture 26 - Modeshapes and resonances of a vibrating Rectangular plate
- Lecture 27 - Modeshapes and resonances of a vibrating Circular plate
- Lecture 28 - Vibrating circular plate (Continued...)
- Lecture 29 - Modeshapes and resonances of a vibrating Circular ring
- Lecture 30 - Details of vibrating rings
- Lecture 31 - Insights into vibrations of ring

- Lecture 32 - Cylindrical shell equations of motion using Force balance
- Lecture 33 - Cylindrical shell: Transverse equation of motion
- Lecture 34 - Orthogonality of modeshapes
- Lecture 35 - Orthogonality of Modes (Continued...)
- Lecture 36 - The Rayleigh Quotient
- Lecture 37 - Rayleigh Quotient Example: Simply-supported beam
- Lecture 38 - The Rayleigh Ritz method
- Lecture 39 - The Rayleigh Ritz method applied to a Complicated system
- Lecture 40 - The Lagrange Multiplier method
- Lecture 41 - The penalty method
- Lecture 42 - Orthogonal polynomials of RB Bhat
- Lecture 43 - Rayleigh Ritz paper by RB Bhat
- Lecture 44 - Numerical examples of the Rayleigh Ritz method
- Lecture 45 - Numerical examples of Rayleigh Ritz method And animations
- Lecture 46 - Rayleigh Ritz applied to curved structures
- Lecture 47 - Forced response of plates and shells
- Lecture 48 - Forced response (Continued...)
- Lecture 49 - Simply-supported plate response to various forces
- Lecture 50 - Simply-supported plate response to various Forces (Continued...)
- Lecture 51 - Simply-supported cylindrical shell response to a Point harmonic force
- Lecture 52 - Cylindrical shell response (Continued...)
- Lecture 53 - Cylindrical shell response (Continued...)
- Lecture 54 - Cylindrical shell response to a traveling load using Only transverse modes
- Lecture 55 - The Receptance method
- Lecture 56 - The receptance method (Continued...)
- Lecture 57 - Stiffening a cylindrical shell using rings
- Lecture 58 - Stiffening of a cylindrical shell (Continued...)
- Lecture 59 - Damping in structures
- Lecture 60 - Loss factor and Complex Young modulus

Lecture 1 - Introduction to Course

Lecture 2 - Position and Orientation of a Rigid Body

Lecture 3 - Homogenous Transformation

Lecture 4 - Linear and angular velocity of rigid body

Lecture 5 - Motion of Rigid Body and Particles

Lecture 6 - Introduction to multi-body systems

Lecture 7 - Joints, Degrees of Freedom and Constraints

Lecture 8 - Position, Velocity and Acceleration in Multi-body Systems

Lecture 9 - Mass and Inertia of a Rigid Body

Lecture 10 - External forces and moments

Lecture 11 - Angular momentum, Spinning tops and Gyroscopes

Lecture 12 - Free-body diagram and Equations of motion

Lecture 13 - Newton-Euler Formulation for Serial Chains

Lecture 14 - Lagrangian Formulation

Lecture 15 - Examples of Equations of Motion

Lecture 16 - Equations of Motion Using Computer Tools

Lecture 17 - Introduction and Examples of equations of motion

Lecture 18 - Inverse dynamics and Simulations of equations Of motion

Lecture 19 - Simulation using Computer Tools

Lecture 20 - Introduction and Goal of control

Lecture 21 - State Space Formulation

Lecture 22 - Solution of State Equations

Lecture 23 - Stability of Dynamical Systems

Lecture 24 - Controllability and Observability of Linear Systems

Lecture 25 - Examples of Controllability and Observability

Lecture 26 - Introduction to Classical Control

Lecture 27 - Root Locus

Lecture 28 - Frequency Domain Approach

Lecture 29 - PID Control

Lecture 30 - Root Locus based Controller Design

Lecture 31 - State Space Design

Lecture 1 - Introduction

Lecture 2 - Mathematical Preliminaries - I

Lecture 3 - Tensors and Deformations

Lecture 4 - Lagrangian and Eulerian Perspectives

Lecture 5 - Mathematical Preliminaries - II

Lecture 6 - Image Processing Preliminaries

Lecture 7 - Image Processing Operations

Lecture 8 - Light Matter Interaction - I

Lecture 9 - Lab Demo I: Optical Microscope

Lecture 10 - Optical System: Lenses

Lecture 11 - Lab Demo II: Lenses and Camera

Lecture 12 - Light Matter Interaction - II (Lab Demonstration)

Lecture 13 - Light Matter Interaction - II (Lab Demonstration)

Lecture 14 - Tracer Particles for Flow Visualisation

Lecture 15 - Particle Tracking Velocimetry

Lecture 16 - Particle Image Velocimetry - I

Lecture 17 - Particle Image Velocimetry - II

Lecture 18 - Particle Image Velocimetry - III

Lecture 19 - Particle Image Velocimetry - IV

Lecture 20 - Particle Image Velocimetry - V

Lecture 21 - Particle Image Velocimetry - VI

Lecture 22 - Schlieren and Shadowgraphy

Lecture 23 - Lab Demo III: PIV and Schlieren

Lecture 24 - Introduction to optical methods for solids

Lecture 25 - Basics of Digital Image Correlation

Lecture 26 - Iterative implementation of DIC

Lecture 27 - Example implementations

Lecture 28 - How is a DIC experiment set up ?

Lecture 29 - DIY(C)!

Lecture 30 - Introduction to Photoelasticity

Lecture 31 - Why do we see fringes ?

[Lecture 32 - How does light interact with matter ?](#)

[Lecture 33 - Origin of Birefringence](#)

[Lecture 34 - Loaded sample in a polarizer](#)

[Lecture 35 - Stress-induced birefringence](#)

[Lecture 36 - Analyses of optical paths using matrix methods](#)

[Lecture 37 - Putting it all together](#)

[Lecture 38 - What is tomography ?](#)

[Lecture 39 - Signal processing and Fourier methods](#)

[Lecture 40 - Rays and the Radon transforms](#)

[Lecture 41 - Geometric interpretations](#)

[Lecture 42 - The inverse problem: From Radon transform to 2D cross-section](#)

[Lecture 43 - Cone beams, parallel beams and the Feldkamp algorithm](#)

Lecture 1 - Introduction to Statistical Thermodynamics

Lecture 2 - Basic Probability Theory and Statistics

Lecture 3 - Important Probability Distributions

Lecture 4 - Combinatorial Analysis for Statistical Thermodynamics

Lecture 5 - Basic Concepts

Lecture 6 - Macrostates and Microstates

Lecture 7 - Bose Einstein and Fermi Dirac Statistics

Lecture 8 - Entropy and the equilibrium particle distribution

Lecture 9 - Operator Theory - 1

Lecture 10 - Stirling Approximation and Lagrange Multipliers

Lecture 11 - Equilibrium particle distribution

Lecture 12 - The Dilute Limit and Concept of Molecular Partition Function

Lecture 13 - The Molecular Partition Function and its relationship with Classical Thermodynamics

Lecture 14 - Historical Survey of Quantum Mechanics

Lecture 15 - Operator Theory - 2

Lecture 16 - Operator Theory - 3

Lecture 17 - Bohr Model for the Spectrum of Atomic Hydrogen

Lecture 18 - Heuristic Introduction to the Schrodinger Equation

Lecture 19 - The postulates of Quantum Mechanics

Lecture 20 - The Steady State Schrodinger Equation: Single Particle Analysis

Lecture 21 - Coordinate System - 1

Lecture 22 - Coordinate System - 2

Lecture 23 - Coordinate System - 3

Lecture 24 - The Steady State Schrodinger Equation: Multiparticle analysis

Lecture 25 - The Particle in a Box

Lecture 26 - The Uncertainty Principle

Lecture 27 - The Pauli Exclusion and the Correspondence Principle

Lecture 28 - Problem Solving - 1

Lecture 29 - Problem Solving - 2

Lecture 30 - The Internal Motion for a two particle system

Lecture 31 - The rotational and vibrational energy mode for a diatomic molecule

- Lecture 32 - Hermite polynomials as vibrational energy mode solution
- Lecture 33 - Equivalent two body model of atomic hydrogen
- Lecture 34 - The Electronic Energy Mode for Atomic Hydrogen
- Lecture 35 - Problem Solving - 3
- Lecture 36 - The four quantum numbers and multielectron systems
- Lecture 37 - Spectroscopic term symbols for multielectron atoms
- Lecture 38 - Electron energies for multielectron systems
- Lecture 39 - Combined energy modes for atoms and diatomic molecules
- Lecture 40 - Perturbation analysis of the Schrodinger Wave equation
- Lecture 41 - Selection rules
- Lecture 42 - The Rotational and vibrational spectroscopy
- Lecture 43 - Ro-vibrational spectroscopy (Simplex model)
- Lecture 44 - Rotation vibration coupling (Complex model)
- Lecture 45 - Ro-vibrational spectroscopy (Complex model)
- Lecture 46 - Ro-vibronic spectroscopy
- Lecture 47 - Working with Spectroscopic Schemes, Notations and Term Symbols
- Lecture 48 - From Particles to assembly - I
- Lecture 49 - From Particles to assembly - II
- Lecture 50 - Connecting Quantum Mechanics to Classical Mechanics
- Lecture 51 - The Equipartition principle and ideal gas
- Lecture 52 - Thermodynamic properties of ideal monoatomic and diatomic gas
- Lecture 53 - The zero of energy (rotational and vibrational)
- Lecture 54 - Specific heats, Internal energy through Vibrational and Ro-vibrational energy modes
- Lecture 55 - The Ro-vibrational partition function and Introduction to intersction of Radiationand Matter
- Lecture 56 - Absorption and Emission of Radiation
- Lecture 57 - The Rabi frequency and Beer's Law
- Lecture 58 - Insights into radiative spectral transitions
- Lecture 59 - Theory of Absorption Spectroscopy

- Lecture 1 - The vibrating spring-mass-damper system
- Lecture 2 - Power calculations in a vibrating spring-mass-damper system
- Lecture 3 - Wave propagation on a string
- Lecture 4 - Examples of waves on strings: finite and semi-infinite cases
- Lecture 5 - General solution to 1-D wave equation: physical insights
- Lecture 6 - Wave solution: real notation vs complex notation
- Lecture 7 - The vibrating string with a general mechanical impedance
- Lecture 8 - The forced finite string with an end mass
- Lecture 9 - The one-D wave solution: physical insights
- Lecture 10 - Longitudinal wave propagation in a rod
- Lecture 11 - Forced semi-infinite and finite rods
- Lecture 12 - The derivation of the acoustic wave equation
- Lecture 13 - The derivation of the acoustic wave equation (Continued...)
- Lecture 14 - The derivation of the acoustic wave equation (Continued...)
- Lecture 15 - The derivation of the acoustic wave equation (Continued...)
- Lecture 16 - Sound propagation in piston driven semi-infinite and finite ducts
- Lecture 17 - Acoustics inside a piston driven finite duct with a general end impedance
- Lecture 18 - Time averaged power in a 1-D acoustic wave
- Lecture 19 - The Free Space Green Function in acoustics
- Lecture 20 - The Free Space Green Function (Continued...)
- Lecture 21 - Various Green Functions and their uses
- Lecture 22 - Derivation of the interior Kirchhoff Helmholtz Integral Equation
- Lecture 23 - Derivation of the exterior Kirchhoff Helmholtz Integral Equation
- Lecture 24 - Acoustic wave equation in spherical coordinates
- Lecture 25 - Legendre polynomials, spherical harmonics, orthogonality relations
- Lecture 26 - Spherical harmonics, Legendre polynomials and their orthogonality relations (Continued...)
- Lecture 27 - Interior Neumann Green function
- Lecture 28 - Exterior Neumann and Dirichlet Green functions
- Lecture 29 - Pulsating sphere using the exterior Neumann Green function
- Lecture 30 - Equivalence of Neumann Green function and separation of variables solution
- Lecture 31 - Sound from a pulsating sphere using boundary matching technique

- Lecture 32 - Sound from a pulsating sphere using boundary matching technique (Continued...)
- Lecture 33 - Sound radiation from a spherical cap on a rigid sphere using the Neumann Green function
- Lecture 34 - Scattering of a plane acoustic wave from a rigid sphere
- Lecture 35 - Example to show that the surface in the KHIE is notional (not actual)
- Lecture 36 - The Rayleigh Integral
- Lecture 37 - Sound field of an oscillating piston in a rigid baffle
- Lecture 38 - Sound field of an oscillating piston in a rigid baffle (Continued...)
- Lecture 39 - Physics of the sound field of an oscillating piston in a rigid baffle
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NPTEL : Electroceramics (Metallurgy and Material Science)

Co-ordinators : Dr. Ashish Garg

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NPTEL : Fuels Refractory and Furnaces (Metallurgy and Material Science)

Co-ordinators : Prof. Satish Ch. Koria

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Lecture 3 - Characterization of Fuels: Concepts

Lecture 4 - Production of Secondary Fuels : Carbonization

Lecture 5 - Materials Balance in Coke-making

Lecture 6 - Heat Balance and Clean Development Mechanism

Lecture 7 - Production of Secondary Fuels: Gasification

Lecture 8 - Materials and Heat Balance in Gasification

Lecture 9 - Principles of combustion: Concepts and illustrations

Lecture 10 - Principles of combustion: Concepts and illustrations

Lecture 11 - Materials balance in combustion

Lecture 12 - Principles of Combustion: Flame Temperature

Lecture 13 - Flame Temperature Calculations

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Lecture 15 - Refractory in Furnaces

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Lecture 17 - Heat Utilization in furnaces, energy flow diagrams

Lecture 18 - Heat Utilization in furnaces, energy flow diagrams

Lecture 19 - Heat Utilization in Furnaces: Heat Recovery Concepts and Illustrations

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NPTEL : Introduction to Biomaterials (Metallurgy and Material Science)

Co-ordinators : Dr. Kantesh Balani, Dr. Birkamjit Basu

Lecture 1 - Introduction to basic concepts of Biomaterials Science; Salient properties of important material classes; overview of body environment,

Lecture 2 - Manufacturing and properties of metals, ceramics, polymers and composites

Lecture 3 - Concept of biocompatibility, host response, structure-property of biological cell

Lecture 4 - Structure and properties of cells, protein and cellular adaptation process

Lecture 5 - Cell-I

Lecture 6 - Cell-II

Lecture 7 - Cell Migration and Cell Division and cell death

Lecture 8 - Cell Differentiation and Cell Death

Lecture 9 - Cell Apoptosis-I

Lecture 10 - Cell Apoptosis-II

Lecture 11 - Structure and properties of Protein; cell - material interaction

Lecture 12 - Assessment of biocompatibility of biomaterials

Lecture 13 - Biological testing (hemocompatibility, tribological testing)

Lecture 14 - Structure and properties of bone as well as in vivo testing and histocompatibility assessment

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Lecture 16 - Ti Alloy

Lecture 17 - Co-Cr-Mo alloys

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Lecture 20 - Ceramics, Bioceramics and Glasses

Lecture 21 - Sintering and mechanical properties of ceramics

Lecture 22 - Fracture and toughening of ceramic composites

Lecture 23 - Development of based bioceramic composites for hard tissue replacement

Lecture 24 - Alternative phosphate materials, based composites with bactericidal property and glass ceramics for dental restoration

Lecture 25 - Electrostatic Spraying of UHMWPE-HA-CNT composites

Lecture 26 - Thin Films and Coatings

Lecture 27 - Thermal Spray Coatings

Lecture 28 - Biocompatibility of plasma sprayed CNT reinforced Hydroxyapatite biocomposite coatings

Lecture 29 - Biocompatibility of Alumina and CNT reinforced Hydroxyapatite

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Lecture 7 - Exercise on Thermochemistry & Frequently Asked Questions

Lecture 8 - Errors in Measurements

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Lecture 10 - Introduction to Mineral Beneficiation

Lecture 11 - Materials Balance in Mineral Processing and Faq

Lecture 12 - Exercises in Mineral Processing

Lecture 13 - Calcination Concepts & Exercises

Lecture 14 - Pyromet Extraction Unit Processes

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Lecture 17 - Heat Balance in Roasting illustration

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Lecture 19 - Exercises on Roasting

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Lecture 21 - Exercise-I Matte Smelting

Lecture 22 - Exercise-II Matte Smelting

Lecture 23 - Reduction Smelting

Lecture 24 - Lead Smelting Material Balance

Lecture 25 - Imperial Smelting Process

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Lecture 27 - Coke Making

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NPTEL : Steel Making (Metallurgy and Material Science)

Co-ordinators : Prof. Satish Ch. Koria, Prof. Dipak Mazumdar

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- Lecture 5 - Third Law of Thermodynamics and Numerical Examples
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- Lecture 8 - Regular Solution Model: Application to Ternary System
- Lecture 9 - Gibbs Free Energy-Composition Curves, Phase Diagrams and Gibbs Phase rule
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- Lecture 13 - Fick's Law
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- Lecture 15 - Fick's Law for Multicomponent Diffusion
- Lecture 16 - Diffusion Equation and Solution to Steady State Diffusion
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Lecture 15 - Introduction to glass and amorphous solids

Lecture 16 - Understanding on conventional glass and amorphous solids

Lecture 17 - Glass-ceramics and specialty glasses

Lecture 18 - Mechanical properties of non-metallic materials, stress-strain response, elastic, and plastic deformation

Lecture 19 - Brittle and ductile materials, introduction to fracture mechanics, strength of brittle materials

Lecture 20 - Strengthening of materials, fatigue, and creep

Lecture 21 - Composite materials: Particle-reinforced composites, and fiber reinforced composites

Lecture 22 - Structural Composite

Lecture 23 - Dielectric and piezoelectric behavior

Lecture 24 - Ferroelectric Behaviour of Non-Metallic Materials and Ferroelectric thin film for Non-Volatile Memory Applications

Lecture 25 - Magnetic Properties : Origin of Magnetism, Para, Dia, Ferro, and Ferrimagnetism

Lecture 26 - Ceramic Magnets and their Applications

Lecture 27 - Thermal Properties : Specific Heat, Heat Conduction, Thermal Diffusivity, Thermal expansion

Lecture 28 - Thermoelectric Effect and Magnetocaloric Effect

Lecture 29 - Optical properties: Refractive index, absorption and transmission of electromagnetic radiation, LASERS

Lecture 30 - Introduction to electrochemistry, Galvanic cells, Cell potentials and Gibbs Energy, Concentration dependence

Lecture 31 - Electrochemical storage, rechargeable batteries

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Lecture 32 - Introduction to electrochemical methods; cyclic voltammetry and other related techniques

Lecture 33 - Fuel Cell and Energy harvesting

Lecture 34 - Preparation of ceramic powders: auto-combustion, sol-gel synthesis, microwave assisted hydrothermal synthesis

Lecture 35 - Introduction to sintering, sintering mechanism

Lecture 36 - Solid-state sintering and microstructure development

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Lecture 38 - Liquid phase sintering and microstructure development, speciality sintering, reactive sintering

Lecture 39 - Processing of glass and amorphous/non-crystalline solids

Lecture 40 - Fundamental of thin film growth, growth mechanism and kinetics

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Lecture 44 - Organic electronic materials: conducting polymers, semi-conducting organic materials, applications

Lecture 45 - Thermal analyses

Lecture 46 - Introduction of spectroscopic technique : UV-VIS spectroscopy

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Lecture 50 - Measurement of mechanical properties, fracture toughness, MOR, hardness

Lecture 51 - Ferroelectric thin film: synthesis and characterization

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Lecture 56 - Oxidation, corrosion of ceramic materials, degradation of polymers: swelling and dissolution, bond rupture, weathering

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Lecture 60 - Fly-ash based glazed wall tiles: A case study

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Lecture 21 - Signal Generation and Contrast Mechanism

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- Lecture 2 - Image formation, resolution, magnification, depth of field and depth of focus
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- Lecture 4 - Introduction, types and image formation in Optical microscopy
- Lecture 5 - Components of optical microscope
- Lecture 6 - Bright field and Dark field modes
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- Lecture 8 - Polarized light microscopy
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- Lecture 13 - Basic components of electron microscope (Continued...)
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Lecture 2 - Primary batteries and Secondary batteries

Lecture 3 - Supercapacitors

Lecture 4 - Concepts of thermodynamics pertinent to electrochemical cells

Lecture 5 - Kinetics of electrochemical cells and structural characteristics of electrodes

Lecture 6 - Introduction to EMF, redox potential, Faraday law and Nernst's law

Lecture 7 - Terminology related to secondary battery : half-cell, full-cell, redox couple, positive

Lecture 8 - Measurements: Cyclic voltammetry, nominal voltage, capacity, rate performance

Lecture 9 - Impedance spectroscopy measurement and analyses

Lecture 10 - Measurement of rechargeable cell: Case study

Lecture 11 - History and categories of lithium batteries

Lecture 12 - Operational mechanisms for lithium batteries: Intercalation materials, alloys

Lecture 13 - Differences of voltage profiles between intercalation materials, alloys, and conversion

Lecture 14 - Properties of electrode materials (Case study: alloy as anode)

Lecture 15 - Properties of electrode materials (conversion type oxide as case study)

Lecture 16 - Positive electrodes: Lithiated transition metal oxides, lithiated iron oxyphosphates etc

Lecture 17 - Negative electrodes: Carbonaceous materials, lithium titanium oxides etc

Lecture 18 - Electrolyte :Liquid Electrolyte, Polymer Electrolyte

Lecture 19 - Current Collector, Conductive Agents, Separator and Other Accessories

Lecture 20 - Novel materials for lithium ion rechargeable cells

Lecture 21 - Principle of Operation of Commercial Cells : viz. C - NMC, C - NCA etc

Lecture 22 - Principle of operation of commercial cells

Lecture 23 - Major characteristics of commercial Li ion cells: Cell performance, degradation phenomena

Lecture 24 - Fabrication of Li ion cell: Cylindrical configuration

Lecture 25 - Fabrication of Li ion cell: Pouch and prismatic cell

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Lecture 28 - Electrolytes: Roles and requirements, organic electrolyte, ionic liquid electrolyte

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Lecture 30 - Future perspective of Na ion cells

Lecture 31 - Introduction to battery module, BMS, thermal management and pack design

- Lecture 32 - Degradation and safety issues of Li ion rechargeable cells
- Lecture 33 - Introduction to battery management system: BMS topologies, hardware, concept of active
- Lecture 34 - Introduction to thermal management: Active thermal management system, passive thermal
- Lecture 35 - Packaging of battery pack and battery testing: Material selection, sealing of enclosure
- Lecture 36 - Classification of supercapacitors: EDLC and pseudocapacitive type
- Lecture 37 - Pseudocapacitor
- Lecture 38 - Asymmetric supercapacitor and BATCAP: Battery supercapacitor hybrid electrochemical
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- Lecture 40 - Current collectors, separators etc. and their effect on performance
- Lecture 41 - Operational principles of aqueous and Li - O₂ batteries
- Lecture 42 - Electrolytes for Li - O₂ batteries
- Lecture 43 - Limitations of Li - Air batteries
- Lecture 44 - State of the art Li - Air batteries : Carbonaceous materials
- Lecture 45 - State of the art Li - Air batteries: Case study
- Lecture 46 - The element sulfur, principle of operation
- Lecture 47 - Advantages and disadvantages of Li - S batteries, positive electrodes
- Lecture 48 - Electrolyte and negative electrode for Li - S battery
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- Lecture 50 - State of the art Li - S batteries : Case study - II
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- Lecture 53 - State of the art extraction techniques and known production reserves
- Lecture 54 - Recycling of lithium and other battery constituents from used battery
- Lecture 55 - Recycling of lithium and other battery constituents from used battery (Continued...)
- Lecture 56 - Lead Acid Batteries: Operational principles, main characteristics and applications
- Lecture 57 - Lead Acid Batteries: Operational principles, main characteristics and applications (Continued...)
- Lecture 58 - Ni-Cd and Ni-MeH Batteries: Operational principles, main characteristics and applications
- Lecture 59 - Redox flow battery vanadium redox battery, operational principle, and main characteristics
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Lecture 3 - Processing - Texture - Anisotropic Properties

Lecture 4 - Crystal Structure and Stereographic Projections

Lecture 5 - Utilization of Stereographic Projections

Lecture 6 - Diffraction and Bragg's Law

Lecture 7 - Structure Factor and Diffraction Extinction Criteria

Lecture 8 - Structure factor and diffraction extinction criteria (Continued...)

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Lecture 10 - Pole figures (Continued...)

Lecture 11 - Inverse Pole Figures

Lecture 12 - Three Dimensional Texture Analysis

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Lecture 15 - Euler Angles and ODFs (Continued...)

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Lecture 19 - Texture Fibre, Periodicity in Euler Space, Incomplete Pole Figures

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Lecture 23 - Penetration Depth of X-ray, Neutron, e-1 and Basics of X-ray Generation

Lecture 24 - Characteristic X-ray, Absorption and Filters

Lecture 25 - Principles of pole figure measurements by X-ray diffraction

Lecture 26 - Texture Goniometer Components

Lecture 27 - Limitations and Errors in X-ray Texture Measurement and Corrections

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Lecture 31 - Kikuchi Diffraction Pattern - II

- Lecture 32 - Quantitative Evaluation of Kikuchi Diffraction Pattern - I
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- Lecture 36 - Analysis using the AZtec Crystal software
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- Lecture 38 - Introduction to solidification texture
- Lecture 39 - Solidification texture in Alloys
- Lecture 40 - Solidification texture in FCC, BCC, and HCP structures
- Lecture 41 - Phase Transformation Texture and Bain Strain
- Lecture 42 - Orientation Relationships between FCC and BCC / BCT
- Lecture 43 - Various Orientation Relationships and Variants
- Lecture 44 - Basic Mechanics of Polycrystal Plasticity
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- Lecture 52 - Texture in HCP polycrystals - II
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- Lecture 54 - Static recrystallization
- Lecture 55 - Dynamic recrystallization and recrystallization texture
- Lecture 56 - Dynamic recrystallization and grain refinement during hot large strain shear

- Lecture 1 - Classification of Mining and Bulk Solid Handling Systems
- Lecture 2 - Properties of bulk material vis-a-vis different bulk handling operations
- Lecture 3 - Fundamentals of BMH and Transport: Capacity and Productivity Concepts
- Lecture 4 - Bulk material handling in Processing plants: Crushing and Screening Flow Charts
- Lecture 5 - Introduction to Bulk Material Transport and Autonomous Vehicles
- Lecture 6 - Constructional Components: Trends of Developments
- Lecture 7 - Belt Conveyor Construction: Belting for Bulk Material Conveyor
- Lecture 8 - Idlers and Belt Cleaners
- Lecture 9 - Feeding and Discharging Devices
- Lecture 10 - Safety and Troubleshooting
- Lecture 11 - Size Selection and Power Calculation
- Lecture 12 - Principle of operations and applicability
- Lecture 13 - Basic Design Calculations
- Lecture 14 - Introduction to Pneumatic Conveying systems
- Lecture 15 - Design Calculations for Pneumatic Conveying
- Lecture 16 - Exercise with Basic Design Calculations
- Lecture 17 - Stackers and Reclaimers: Classification and Selection Criteria
- Lecture 18 - Stackers and Reclaimers: Comparison of Different Types
- Lecture 19 - Principles of Blending and Reclaiming
- Lecture 20 - Case studies of stacker and reclaimers application
- Lecture 21 - System Layout
- Lecture 22 - Introduction to Bin Bunker and Silo
- Lecture 23 - Introduction to Bunker
- Lecture 24 - Introduction to Silo
- Lecture 25 - Silo Failures and Maintenance
- Lecture 26 - Basics of Silo Design
- Lecture 27 - Feeder Selection and Design
- Lecture 28 - Crushers: Classification and selection
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Lecture 32 - Concentration and Separation

Lecture 33 - Fine Size Classification: Desliming and Cycloning

Lecture 34 - Froth Flotation Techniques, Magnetic Separation, Jigs and Thickeners

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Lecture 42 - RopeCon Transportation

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Lecture 45 - Pipe Conveyor Belt: Enclosed Material Transport

Lecture 46 - Underground Mine Transport System

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Lecture 48 - Main and Tail and Endless Rope Haulage

Lecture 49 - Pit Top and Pit Bottom Layout

Lecture 50 - Haulage calculation

Lecture 51 - Locomotive

Lecture 52 - Low Profile Dumper

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Lecture 55 - Winding Calculations

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Lecture 57 - Safety Aspects in Bulk Solid Handling and Transportation

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Lecture 59 - Automating Bulk Solids Processes

Lecture 60 - Online Monitoring

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- Lecture 2 - Genesis of Materials Degradation
- Lecture 3 - Classification of degradation and Parameters Influencing it - Part I
- Lecture 4 - Parameters Influencing Degradation - Part II
- Lecture 5 - Engineering Solution to Combat Environmental Degradation of Materials
- Lecture 6 - Aqueous corrosion-thermodynamics of Wet Corrosion
- Lecture 7 - Aqueous corrosion-Classification - Part I
- Lecture 8 - Aqueous corrosion-Classification - Part II
- Lecture 9 - Classification of Aqueous corrosion - Part III
- Lecture 10 - Classification of Aqueous corrosion - Part IV
- Lecture 11 - Friction and Wear-Part - I
- Lecture 12 - Friction and Wear-Part - II
- Lecture 13 - Wear- Classification of wear - Part I
- Lecture 14 - Wear- Classification of wear - Part II
- Lecture 15 - Fatigue – Surface Dependent Property
- Lecture 16 - Failure Analysis - Part I
- Lecture 17 - Failure Analysis - Part II
- Lecture 18 - Characteristics of Failure - Part I
- Lecture 19 - Characteristics of Failure - Part II
- Lecture 20 - Characteristics of Failure - Part III
- Lecture 21 - Prevention
- Lecture 22 - Prevention of Chemical/Electrochemical Degradation
- Lecture 23 - Prevention of Chemical/Electrochemical Degradation (Continued...)
- Lecture 24 - Prevention of Chemical/Electrochemical Degradation (Continued...)
- Lecture 25 - Prevention of Mechanical Degradation
- Lecture 26 - Non Destructive Testing
- Lecture 27 - Mechanical and Electrochemical Testing - Part I
- Lecture 28 - Mechanical and Electrochemical Testing - Part II
- Lecture 29 - Mechanical and Electrochemical Testing - Part III
- Lecture 30 - Characterization
- Lecture 31 - Surface/Interface

- Lecture 32 - Scope, Classification and Objectives of Surface Engineering
- Lecture 33 - Shot Peening
- Lecture 34 - Grinding and Polishing
- Lecture 35 - Ultrasonic Peening and Laser Shock Peening
- Lecture 36 - Conventional Surface Hardening (Flame and induction)
- Lecture 37 - Pack Carburizing
- Lecture 38 - Fluidized Bed Carburizing
- Lecture 39 - Fused bath and Gas Nitriding
- Lecture 40 - Plasma Nitriding
- Lecture 41 - Diffusion Based Coatings - Solid State
- Lecture 42 - Chemical Conversion Coatings
- Lecture 43 - Electrodeposition
- Lecture 44 - Electrophoretic and Electroless deposition
- Lecture 45 - Galvanizing and Hot Dipping
- Lecture 46 - Thick Coatings by Weld Overlay and Cladding
- Lecture 47 - Introduction to thin film deposition
- Lecture 48 - Physical Vapor Deposition including Sputtering
- Lecture 49 - Chemical Vapor Deposition (CVD) and Composite Coating
- Lecture 50 - Chemical Vapor Deposition (CVD) and Composite Coating
- Lecture 51 - Spray Coating Techniques II - Plasma Spray and Cold Spray
- Lecture 52 - Ion Implantation
- Lecture 53 - Electron Beam Assisted Surface Engineering
- Lecture 54 - Laser Material Processing
- Lecture 55 - Laser Surface Engineering
- Lecture 56 - Laser Assisted Additive Manufacturing, LAM
- Lecture 57 - Strengthening Mechanisms in Surface Engineering
- Lecture 58 - Microstructural Characterization after Surface Engineering
- Lecture 59 - Compositional Characterization after Surface Engineering
- Lecture 60 - Summary of surface engineering and Conclusion

Lecture 1 - Modes of Fracture

Lecture 2 - Theoretical Strengths and Defects

Lecture 3 - Stress Concentration

Lecture 4 - Griffith Criterion

Lecture 5 - Griffith Criteria - Modification

Lecture 6 - Stress Intensity Factor

Lecture 7 - Fracture Toughness and Plane Stress-Plane Strain

Lecture 8 - Plastic Zone Size

Lecture 9 - Plane stress and plane strain fracture toughness

Lecture 10 - Plane stress and plane strain fracture toughness (Continued...)

Lecture 11 - Plane Strain Fracture Toughness Testing

Lecture 12 - Plane Strain-Plane Stress Fracture Toughness Testing

Lecture 13 - Plane Stress Fracture Toughness

Lecture 14 - Plane Stress fracture toughness-J integral

Lecture 15 - Experimental determination of JIC

Lecture 16 - J-integral and JIC

Lecture 17 - Impact Toughness

Lecture 18 - Impact Toughness (Continued...)

Lecture 19 - Impact Toughness (Continued...)

Lecture 20 - Impact Toughness (Continued...)

Lecture 21 - Impact Toughness (Continued...)

Lecture 22 - Fracture Toughness

Lecture 23 - Fracture Toughness (Continued...)

Lecture 24 - Fracture Toughness (Continued...)

Lecture 25 - Fracture Toughness (Continued...)

Lecture 26 - Fracture Toughness (Continued...)

Lecture 27 - Environment Assisted Fracture

Lecture 28 - Environment Assisted Fracture (Continued...)

Lecture 29 - Environment Assisted Fracture (Continued...)

Lecture 30 - Introduction to Fatigue

Lecture 31 - Stress Controlled Fatigue

- [Lecture 32 - Stress Controlled Fatigue \(Continued...\)](#)
- [Lecture 33 - Stress Controlled Fatigue \(Continued...\)](#)
- [Lecture 34 - Stress Controlled Fatigue \(Continued...\)](#)
- [Lecture 35 - Strain Controlled Fatigue \(Continued...\)](#)
- [Lecture 36 - Strain Controlled Fatigue \(Continued...\)](#)
- [Lecture 37 - Strain Controlled Fatigue \(Continued...\)](#)
- [Lecture 38 - Strain Controlled Fatigue \(Continued...\)](#)
- [Lecture 39 - Fatigue Crack Nucleation](#)
- [Lecture 40 - Notch Effect](#)
- [Lecture 41 - Crack in Fatigue](#)
- [Lecture 42 - Fatigue Crack Propagation](#)
- [Lecture 43 - Fatigue Crack Propagation \(Continued...\)](#)
- [Lecture 44 - Fatigue Crack Propagation \(Continued...\)](#)
- [Lecture 45 - Fatigue Crack Propagation \(Continued...\)](#)
- [Lecture 46 - Fatigue Crack Propagation \(Continued...\)](#)
- [Lecture 47 - Fatigue Crack Propagation \(Continued...\)](#)
- [Lecture 48 - Fatigue in Materials](#)
- [Lecture 49 - Fatigue in Materials \(Continued...\)](#)
- [Lecture 50 - Effect of Temperature on Fatigue](#)
- [Lecture 51 - Failure Analysis](#)
- [Lecture 52 - Failure Analysis \(Continued...\)](#)
- [Lecture 53 - Failure Analysis \(Continued...\)](#)
- [Lecture 54 - Failure Analysis - Case study - Titanic](#)
- [Lecture 55 - Failure Analysis - Case Study - ALK](#)
- [Lecture 56 - Failure Analysis - Case study - Point Pleasant Bridge](#)
- [Lecture 57 - Failure Analysis - Case Study - Rail Crash](#)
- [Lecture 58 - Failure Analysis - Case Study - Comet](#)
- [Lecture 59 - Failure Analysis - Case Study - Columbia](#)
- [Lecture 60 - Failure Analysis - Summary](#)

- Lecture 1 - Introduction to closure concept
- Lecture 2 - Mine Closure Objectives and Regulatory Aspects
- Lecture 3 - Mining Footprint and Regulatory Aspects
- Lecture 4 - Mine Closure Costs and Financing Approaches
- Lecture 5 - Decommissioning of Mines
- Lecture 6 - Demolition Techniques
- Lecture 7 - Post Closure Liabilities and Activities
- Lecture 8 - Post Closure Community Concerns and Sustainable Development Plans
- Lecture 9 - Closure oriented Resource Development-Post Mining Land Uses
- Lecture 10 - Post mining site monitoring
- Lecture 11 - Planning inputs, tools and techniques
- Lecture 12 - Tools and Techniques for Closure Plan Development and Procedures
- Lecture 13 - Closure Plan Development Procedures
- Lecture 14 - Monitoring, Review and Feedback of Closure Plan Implementation-Closure Criteria
- Lecture 15 - Failure Mode and Effect Analysis Framework for Mine Closure Planning
- Lecture 16 - Multiple Accounts Analysis (MAA) for Assessment of Closure Alternatives
- Lecture 17 - Provisioning of capital
- Lecture 18 - Closure costs and Rehabilitation Costs
- Lecture 19 - Finance and Accounting: Closure cost estimate
- Lecture 20 - Closure Economics and Audit
- Lecture 21 - Application of Remote Sensing for Mine Closure-Introduction
- Lecture 22 - Remote Sensing Sensors
- Lecture 23 - Remote Sensing media and sensors
- Lecture 24 - Image Processing and Data Interpretation
- Lecture 25 - GIS for Mine Closure: Mapping and Geo-Spatial Data Analysis
- Lecture 26 - Integration of phase operations
- Lecture 27 - Integration of Interdepartmental work and phase operations - Part 1
- Lecture 28 - Integration of Interdepartmental work and phase operations - Part 2
- Lecture 29 - Risk Analysis Techniques and Management
- Lecture 30 - Post Mine Closure Waste to Wealth Conversion
- Lecture 31 - CSR and EMP Integration

- Lecture 32 - Introduction to Asset Management
- Lecture 33 - Principle of Asset Management and Decommissioning of Assets for Site Restoration
- Lecture 34 - Brownfield Redevelopment and Value Addition to Assets
- Lecture 35 - Landform Design and Post Mining Asset Creation
- Lecture 36 - Concept of Sustainable Development and Mining industry
- Lecture 37 - Sustainability Measurement and Reporting
- Lecture 38 - Sustainability Measurement and Reporting (Continued...)
- Lecture 39 - Sustainable Mineral Industry
- Lecture 40 - Policy and Legislative Framework of Sustainability for SDG and Mine Closure
- Lecture 41 - Communicating sustainability performance
- Lecture 42 - Framework of Sustainability reporting
- Lecture 43 - Sustainable accounting
- Lecture 44 - Case studies on Sustainability initiatives in Mining Industry
- Lecture 45 - Data Analytics for Sustainability management
- Lecture 46 - Cleaner Production Based Closure Management
- Lecture 47 - Regenerative environment design for sustainable Mine Closure
- Lecture 48 - Reusable resource identification in post closure mine site
- Lecture 49 - Optimization of Residual Value of Assets
- Lecture 50 - Post Mining Site for Community wealth
- Lecture 51 - Management of water resources
- Lecture 52 - Soil Treatment and Revegetation
- Lecture 53 - Bio-diversity: Post Land reclamation and plantation
- Lecture 54 - Physical and Chemical Stability issues
- Lecture 55 - Economic Utilization of Post Mining Structures and assets
- Lecture 56 - Techniques for closing underground workings
- Lecture 57 - Application of Industry 4.0 for Mine
- Lecture 58 - Best mining practices for Sustainable mining - Case studies
- Lecture 59 - Stability Monitoring and Enhancing tools
- Lecture 60 - VR and AR Technology for Post Mining Mine site Visualization and Design

- Lecture 1 - Fundamental aspects of hybrid materials
- Lecture 2 - Materials selection basics for design with hybrid materials
- Lecture 3 - Classes of materials and material property charts
- Lecture 4 - Material property charts and concept of material indices
- Lecture 5 - Material property chart-indices and concept of hybridization
- Lecture 6 - Hybrid materials - Composite
- Lecture 7 - Cellular solids - Applications of metal foams
- Lecture 8 - Cellular solids - Applications of porous ceramics and polymer foams
- Lecture 9 - Basics of Composite Materials and Classification
- Lecture 10 - Composite Classification - Matrix and Reinforcement
- Lecture 11 - Fibers - Fundamentals, Glass fiber
- Lecture 12 - Fibers - Boron and Carbon Fibers
- Lecture 13 - Fibers - Aramid and Ceramic fibers, Alumina fiber
- Lecture 14 - Fibers - SiC fiber and Whiskers
- Lecture 15 - Metal matrix composites (MMCs) - Basic concept, Liquid state processing
- Lecture 16 - Metal matrix composites (MMCs) - Liquid and Solid state processing
- Lecture 17 - Ceramic Matrix Composites (CMCs) - Basic concept, Processing techniques
- Lecture 18 - Ceramic Matrix Composites (CMCs) - Processing techniques
- Lecture 19 - CMCs and PMCs - Processing and Application
- Lecture 20 - Fabrication of cellular ceramics
- Lecture 21 - Sintering of ceramics - Aspects and mechanisms
- Lecture 22 - Fabrication of cellular ceramics
- Lecture 23 - Processing of metal foams - Foaming techniques
- Lecture 24 - Processing of metal foams (Continued...)
- Lecture 25 - Processing of metal foams (Continued...)
- Lecture 26 - Polymer foams - Processing and properties
- Lecture 27 - Additive manufacturing - Definition and Prospects
- Lecture 28 - Cellular solids classification and Structure description
- Lecture 29 - Structure of cellular solids - Pore structure characterization
- Lecture 30 - Interfacial phenomena - Basic concept, Adhesion and Wettability
- Lecture 31 - Interfacial phenomena - Factors affecting wettability

- Lecture 32 - Interfacial phenomena - Interfacial bonding
- Lecture 33 - Interfacial phenomena - Interfacial strength measurement
- Lecture 34 - Interfacial phenomena - Case study - Al-MWCNT nanocomposite
- Lecture 35 - Interfacial phenomena - Case studies: MMCs and CMCs
- Lecture 36 - Interfacial phenomena - Case studies: MMCs and CMCs (Continued...)
- Lecture 37 - Mechanics of Composites - Unidirectional Lamina
- Lecture 38 - Mechanics: Fiber-reinforced composites - Transverse Loading
- Lecture 39 - Mechanics: Fiber-reinforced composites - Problem Solving
- Lecture 40 - Mechanics: Fiber-reinforced composites - Discontinuous fibers
- Lecture 41 - Mechanics of Composites - Discontinuous fibers
- Lecture 42 - Dependence of properties on pore structure
- Lecture 43 - Mechanics of cellular solids
- Lecture 44 - Mechanics of cellular solids (Continued...)
- Lecture 45 - Deformation behavior of honeycomb and foams
- Lecture 46 - Deformation behaviour of Foams
- Lecture 47 - Deformation behaviour of Foams (Continued...)
- Lecture 48 - Deformation behaviour of Foams (Continued...)
- Lecture 49 - Thermal properties of foams
- Lecture 50 - Other important properties of foams (Continued...)
- Lecture 51 - Advanced composites - MMCs
- Lecture 52 - Advanced composites - MMCs (Continued...)
- Lecture 53 - Advanced composites - CMCs
- Lecture 54 - Advanced composites - Advanced Processing Techniques
- Lecture 55 - Advanced composites - Advanced Processing Techniques (Continued...)
- Lecture 56 - Advanced composites - Advanced Processing Techniques (Continued...)
- Lecture 57 - Advanced composites - Application oriented advanced composites
- Lecture 58 - Microstructure and properties of natural cellular solid - wood
- Lecture 59 - Advanced hybrid material - Functionally graded composite materials (FGMs)
- Lecture 60 - Advanced hybrid material - Functionally graded composite materials (FGMs) (Continued...)

- Lecture 1 - Introduction, Classification and Uses of Metals
- Lecture 2 - Introduction, Classification and Uses of Metals (Continued...)
- Lecture 3 - Occurrence/Source of Metals
- Lecture 4 - Metal Extraction Process Overview
- Lecture 5 - Mineral Beneficiation: Overview and Mass Balances
- Lecture 6 - Crushing and Grinding (Comminution)
- Lecture 7 - Mineral Classification: Separation in Flowing Fluid
- Lecture 8 - Mineral Concentration by Froth Flotation
- Lecture 9 - Mineral Concentration by Froth Flotation
- Lecture 10 - Magnetic and Electric Separation/Concentration
- Lecture 11 - Sensor-based/Automatic Ore Sorting
- Lecture 12 - Solid-Liquid Separation
- Lecture 13 - Particle Size Estimation and Screening
- Lecture 14 - Fuels in Metallurgical Processes and Coal Characteristics
- Lecture 15 - Calorific Value and Caking Properties of Coal
- Lecture 16 - Coke: Making and Properties
- Lecture 17 - Combustion of Fuels
- Lecture 18 - Combustion: Mass and Heat Balance
- Lecture 19 - Combustion Heat Balance: Flame Temperature
- Lecture 20 - Combustion Heat Utilization in Furnace
- Lecture 21 - Heat Utilization in Furnace: Numerical Examples
- Lecture 22 - Classification of Furnaces
- Lecture 23 - Refractories for Furnace Linings
- Lecture 24 - Refractories: Testing and Production
- Lecture 25 - Agglomeration of Fines: Pelletization and Briquetting
- Lecture 26 - Agglomeration of Fines: Sintering
- Lecture 27 - Extraction of Metal from Sulfides: Roasting
- Lecture 28 - Roasting Reactors and Heat Balance
- Lecture 29 - Roasting: Predominance Area Diagram
- Lecture 30 - Roasting: Application of Predominance Area Diagram
- Lecture 31 - Reduction Smelting and Matte Smelting

Lecture 32 - Metallurgical Slag

Lecture 33 - Slag Viscosity, Surface Tention and Theories

Lecture 34 - Slag: Masson and Molecular Theory, Numerical Examples

Lecture 35 - Copper Extraction: Matte Smelting

Lecture 36 - Copper Extraction: Flash Smelting

Lecture 37 - Cu Extraction: Cyclone Flash Smelting and Numerical Examples

Lecture 38 - Cu Extraction: Conversion

Lecture 39 - Conversion of Nickel Sulphide and Numerical Examples

Lecture 40 - TSL Smelting, Continuous Conversion and Direct Cu-Production

Lecture 41 - Reduction Smelting: Lead Extraction

Lecture 42 - Reduction Smelting: Zinc Extraction and ISP

Lecture 43 - Extraction of Tin, Tungsten, Molybdenum and Numerical Examples

Lecture 44 - Extraction of Nb, V, Ferroalloys and Titania (from Ilmenite)

Lecture 45 - Silicothermy: Pyrometallurgical Magnesium Extraction

Lecture 46 - Reduction Smelting: Iron Extraction in Blast Furnace

Lecture 47 - Alternative Routes of Iron Extraction

Lecture 48 - Halide Metallurgy: Extraction of Ti, Zr, Hf, U, Si Purification

Lecture 49 - Purification of Bulk Metals: Chemical Refining

Lecture 50 - Chemical Refining: Purification of Lead

Lecture 51 - Chemical Refining of Zinc, Tin, Nickel, Ti (Zr, Hf, Th)

Lecture 52 - Physical Refining: Vacuum De-gassing, Zone Melting and Distillation

Lecture 53 - Hydrometallurgy: Unit Steps, Leaching Reagents and Methods

Lecture 54 - Physiochemical Aspect of Leaching, Bacterial Leaching, S/L Separation

Lecture 55 - Hydrometallurgy: Solution Purification and Metal Ion Reduction

Lecture 56 - Hydrometallurgy: Cementation, Electrowinning, Au Extraction and Bayer Process

Lecture 57 - Electrometallurgy: Electrowinning, Electrorefining, Current and Energy Efficiency

Lecture 58 - Electrometallurgy: Extraction of Mg and Al

Lecture 59 - Environmental Concern and Sustainable Metal Extraction

Lecture 60 - New Development in Metal Extraction: Solvometallurgy, Bio-Metallurgy, Membrane Technology

Lecture 1 - Basic definitions

Lecture 2 - Free energy, Stability, equilibrium in a unary system

Lecture 3 - Effect of Pressure on equilibrium transformations: Clausius Clapeyron equation, phase diagram for unary system

Lecture 4 - Free energy of solutions, free energy-composition diagrams

Lecture 5 - Solution models, chemical potential

Lecture 6 - Phase rule, free energy-composition diagrams and phase diagrams

Lecture 7 - Evolution of phase diagrams

Lecture 8 - Evolution of phase diagrams, miscibility gap

Lecture 9 - To concept, partition less solidification

Lecture 10 - To concept, partition less solidification (Continued...)

Lecture 11 - Eutectic solidification, glass formation

Lecture 12 - Kauzmann paradox, order of a transformation, glass forming ability

Lecture 13 - Eutectic solidification, coupled growth, heterogeneous nucleation

Lecture 14 - Peritectic solidification, metastable phase diagrams

Lecture 15 - Errors in drawing phase diagrams, Fe-C vs. Fe-Fe₃C phase diagram

Lecture 16 - Free energy of undercooled liquid, shape of nucleus

Lecture 17 - Solid state phase transformations - Precipitation

Lecture 18 - Precipitation

Lecture 19 - Precipitation - quasicrystals

Lecture 20 - Precipitate coarsening, stability of a phase, spinodal decomposition

Lecture 21 - Spinodal decomposition

Lecture 22 - Eutectoid reaction

Lecture 23 - Eutectoid reaction (Continued...)

Lecture 24 - Bainitic transformation

Lecture 25 - Kinetics of eutectoid transformations

Lecture 26 - Martensitic Transformation

Lecture 27 - Martensitic transformation, order-disorder transformation

Lecture 28 - Miscibility gap in phase diagrams

Lecture 29 - Phase diagram calculations

Lecture 30 - Thermodynamics of heterogeneous systems

Lecture 31 - Thermodynamics of heterogeneous systems (Continued...)

Lecture 1 - Properties of light, Image formation

Lecture 2 - Magnification and resolution

Lecture 3 - Depth of field, focus and field of view

Lecture 4 - Lens defects, filters and light microscopy introduction

Lecture 5 - Optical microscope demo., Bright field imaging, opaque specimen illumination

Lecture 6 - Opaque stop microscopy, Phase contrast microscopy

Lecture 7 - Dark field microscopy, Polarization microscopy

Lecture 8 - Differential interference contrast and fluorescence microscopy

Lecture 9 - Sample preparation techniques for optical microscopy

Lecture 10A - Tutorial problems (Continuation...)

Lecture 10 - Tutorial problems

Lecture 11 - Introduction to scanning electron Microscopy

Lecture 12 - Lens aberrations, Object resolution, Image quality

Lecture 13 - Interaction between electrons and sample, Imaging capabilities, Structural analysis, Elemental analysis

Lecture 14 - SEM and its mode of operation, Effect of aperture size, Working distance, condenser lens strength

Lecture 15 - SEM and its mode of operation- continuation, Relation between probe current and probe diameter, Summary

Lecture 16 - Factors affecting Interaction volume, Demonstration of SEM

Lecture 17 - Image formation and interpretation

Lecture 18 - Image formation and interpretation continued, EDS, WDS

Lecture 19 - Special contrast mechanisms, Monte Carlo simulations of Interaction volume

Lecture 20 - Electron channeling contrast imaging (ECCI), Electron back scattered diffraction (EBSD)-Theory & instrument demonstration

Lecture 21 - Tutorial Problems on SEM

Lecture 22 - Basics of X-ray emission from source, electron excitation and X-ray interaction with materials in general

Lecture 23 - Properties of X-rays

Lecture 24 - Bragg's Law Derivation

Lecture 25 - Diffraction relationship with reciprocal space

Lecture 26 - X-ray scattering

Lecture 27 - Factors affecting intensities of X-ray peaks

Lecture 28 - Factors affecting intensities of X-ray peaks- continuation

Lecture 29 - Effect of crystallite size and strain on intensity of X-rays

Lecture 30 - Profile fit, Factors affecting peak broadening

Lecture 31 - Indexing of diffraction pattern, Quantitative analysis

Lecture 32 - Indexing, Quantitative analysis-continuation, Residual stress measurements

Lecture 33 - XRD and Residual stress measurement- lab demonstration

Lecture 34 - Introduction to Transmission Electron Microscopy (TEM)

Lecture 35 - Fundamentals of Transmission Electron Microscopy (TEM)

Lecture 36 - Basics of Diffraction-1

Lecture 37 - Basics of Diffraction-2

Lecture 38 - TEM imaging-1

Lecture 39 - TEM imaging-2

Lecture 40 - TEM instrument demonstration

Lecture 41 - TEM sample preparation-1

Lecture 42 - TEM sample preparation-2

Lecture 43 - XRD Tutorial - 1

Lecture 44 - XRD tutorial - 2

Lecture 45 - TEM Tutorial - 1

Lecture 46 - TEM Tutorial - 2

Lecture 47 - Quantitative metallography - Tutorial 1

Lecture 48 - Quantitative metallography - Tutorial 2

Lecture 49 - Quantitative metallography - Tutorial 3

Lecture 50 - Quantitative metallography - Tutorial 4

Lecture 51 - Quantitative metallography - Tutorial 5

Lecture 52 - Quantitative metallography - Tutorial 6

Lecture 53 - Quantitative metallography - Tutorial 7

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Lecture 2 - Properties of Materials

Lecture 3 - Thermal Expansion

Lecture 4 - Measuring Electrical Conductivity: DC and AC

Lecture 5 - Free Electron Gas

Lecture 6 - The Ideal Gas

Lecture 7 - Drude Model: Electrical Conductivity

Lecture 8 - Drude Model: Thermal Conductivity

Lecture 9 - Drude Model: Successes and Limitations

Lecture 10 - Drude Model: Source of Shortcomings

Lecture 11 - Large Systems and Statistical Mechanics

Lecture 12 - Maxwell Boltzmann Statistics

Lecture 13 - Classical Particles and Quantum Particles

Lecture 14 - History of Quantum Mechanics - 1

Lecture 15 - History of Quantum Mechanics - 2

Lecture 16 - Introduction to Drude Sommerfeld model

Lecture 17 - Fermi-Dirac Statistics - Part 1

Lecture 18 - Fermi-Dirac Statistics - Part 2

Lecture 19 - Features of the Fermi Dirac Distribution Function

Lecture 20 - Maxwell-Boltzmann Distribution Vs Fermi-Dirac Distribution

Lecture 21 - Anisotropy and Periodic Potential in a Solid

Lecture 22 - Confinement and Quantization - Part 1

Lecture 23 - Confinement and Quantization - Part 2

Lecture 24 - Density of States

Lecture 25 - Fermi Energy, Fermi Surface, Fermi Temperature

Lecture 26 - Electronic Contribution to Specific Heat at Constant Volume

Lecture 27 - Reciprocal Space-1: Introduction to Reciprocal Space

Lecture 28 - Reciprocal Space-2: Condition for Diffraction

Lecture 29 - Reciprocal Space-3: Ewald sphere, Simple Cubic, FCC and BCC in Reciprocal Space

Lecture 30 - Wigner Seitz Cell and Introduction to Brillouin Zones

Lecture 31 - Brillouin Zones, Diffraction, and Allowed Energy Levels

[Lecture 32 - E Vs k, Brillouin Zones and the Origin of Bands](#)

[Lecture 33 - Calculating Allowed Energy Bands and Forbidden Band Gaps](#)

[Lecture 34 - Bands; Free Electron Approximation, Tight Binding Approximation](#)

[Lecture 35 - Semiconductors](#)

[Lecture 36 - Magnetic Properties](#)

[Lecture 37 - Electron Compounds; Phonons, Optoelectronic Materials](#)

[Lecture 38 - Superconductivity](#)

[Lecture 39 - Bose-Einstein Statistics](#)

[Lecture 40 - Physics of Nano Scale Materials; Course Summary](#)

- Lecture 1 - Metals, semiconductors and insulators
- Lecture 2 - Introduction to semiconductors
- Lecture 3 - Density of states and Fermi-Dirac statistics
- Lecture 4 - Assignment 1 - Bonding, DOS, and Fermi statistics
- Lecture 5 - Intrinsic semiconductors
- Lecture 6 - Intrinsic semiconductors - conductivity
- Lecture 7 - Assignment 2 - Intrinsic semiconductors
- Lecture 8 - Extrinsic semiconductors
- Lecture 9 - Extrinsic semiconductors - Fermi level
- Lecture 10 - Extrinsic semiconductors - conductivity
- Lecture 11 - Assignment 3 - Extrinsic semiconductors
- Lecture 12 - Metal-semiconductor junctions
- Lecture 13 - Assignment 4 - Metal-semiconductor junctions
- Lecture 14 - pn junctions in equilibrium
- Lecture 15 - pn junctions under bias
- Lecture 16 - pn junction breakdown and heterojunctions
- Lecture 17 - Assignment 5 - pn junctions
- Lecture 18 - Transistors
- Lecture 19 - MOSFETs
- Lecture 20 - Assignment 6 - transistors
- Lecture 21 - Optoelectronic devices: Introduction
- Lecture 22 - Optoelectronic devices: LEDs
- Lecture 23 - Optoelectronic devices: LASERS
- Lecture 24 - Optoelectronic devices: photodetector
- Lecture 25 - Optoelectronic devices: solar cells
- Lecture 26 - Assignment 7 - optical properties
- Lecture 27 - Assignment 8 - optoelectronic devices
- Lecture 28 - Semiconductor manufacturing: Introduction
- Lecture 29 - Si wafer manufacturing
- Lecture 30 - IC device manufacturing: overview
- Lecture 31 - Layering: thermal oxidation

[Lecture 32 - Doping: thermal and ion implantation](#)

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[Lecture 34 - Etching and deposition \(growth\)](#)

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Lecture 1 - Properties of light, Image formation

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Lecture 7 - Dark field microscopy, Polarization microscopy

Lecture 8 - Differential interference contrast and fluorescence microscopy

Lecture 9 - Sample preparation techniques for optical microscopy

Lecture 10 - Tutorial problems

Lecture 11 - Tutorial problems (Continued...)

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Lecture 21 - Electron channeling contrast imaging (ECCI), Electron back scattered diffraction (EBSD)-Theory & instrument demonstration

Lecture 22 - Tutorial Problems on SEM

- Lecture 1 - Electronic Materials
- Lecture 2 - Semiconductors - Introduction
- Lecture 3 - Electron statistics in a solid
- Lecture 4 - Worked numericals on week 1 lessons
- Lecture 5 - Intrinsic semiconductors
- Lecture 6 - Intrinsic semiconductors - conductivity
- Lecture 7 - Optional - worked assignment on intrinsic semiconductors
- Lecture 8 - Extrinsic semiconductors - Introduction
- Lecture 9 - Extrinsic semiconductors - Fermi level
- Lecture 10 - Extrinsic semiconductors - Mobility
- Lecture 11 - Worked assignment on extrinsic semiconductors
- Lecture 12 - Metal-semiconductor junctions
- Lecture 13 - pn junctions in equilibrium
- Lecture 14 - Optional - worked assignment on metal-semiconductor junctions
- Lecture 15 - pn junctions under bias
- Lecture 16 - Junction breakdown and heterojunctions
- Lecture 17 - Worked assignment on pn junctions
- Lecture 18 - Transistors - overview
- Lecture 19 - MOSFETs
- Lecture 20 - Worked assignment on transistors
- Lecture 21 - Optoelectronic devices - Introduction
- Lecture 22 - Light emitting diodes
- Lecture 23 - Solid state semiconductor lasers
- Lecture 24 - Optional - worked assignment on optical properties
- Lecture 25 - Photodetectors
- Lecture 26 - Solar cells
- Lecture 27 - Worked assignment on optoelectronic devices

Lecture 1 - Reciprocal space; Definition and Properties

Lecture 2 - Condition for Diffraction

Lecture 3 - Worked out examples

Lecture 4 - Ewald Sphere and lattices in reciprocal space

Lecture 5 - Wigner Sietz cells and Brillouin Zones

Lecture 6 - Worked out exmaples

Lecture 7 - Brillouin Zones, Diffraction and allowed energy levels

Lecture 8 - E Vs K, Brillouin zones and the Origin of Bands

Lecture 9 - Week 3 Worked out examples

Lecture 10 - Reciprocal space as Fourier transform of real lattice

Lecture 11 - Alternate notation of reciprocal space

Lecture 1 - Introduction to fusion welding processes: Part 1/2

Lecture 2 - Introduction to fusion welding processes: Part 2/2

Lecture 3 - Heat sources - Part 1/2

Lecture 4 - Heat sources - Part 2/2

Lecture 5 - Heat removal

Lecture 6 - Thermal Modelling - Part 1/2

Lecture 7 - Thermal Modelling - Part 2/2

Lecture 8 - Zones in a weldment

Lecture 9 - Analytical Solutions to Weld Thermal Field

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DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Designing Learner-Centric MOOCs (Multi-Disciplinary)

Co-ordinators : Prof.Sridhar Iyer, Prof.Sahana Murthy, Dr.Jayakrishnan M., Dr.Sameer Sahasrabudhe

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Lecture 3 - Key Takeaways for Online Instruction

Lecture 4 - Evolution of MOOCs

Lecture 5 - Known Challenges

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Lecture 8 - The LCM Model

Lecture 9 - What is an LeD?

Lecture 10 - Chunking a Lecture into LeD

Lecture 11 - Introducing Reflection Spot

Lecture 12 - Making Your Own LeD

Lecture 13 - Deciding Appropriateness of Various Mediums to Create LeDs

Lecture 14 - Example of Various Mediums from this course

Lecture 15 - What is an LbD?

Lecture 16 - Creating LbDs

Lecture 17 - Constructive Customized Feedback in LbDs

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Lecture 19 - What is an LxT?

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Lecture 27 - LxT 5.2b- A Primer on Licensing Essentials

Lecture 28 - Recommendations for Effective LbDs

Lecture 29 - What is an LxI

Lecture 30 - Creating LxI with Reflection Quiz

Lecture 31 - LxI- Sharing Experiences

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[Lecture 33 - LxI- Types of Focus Questions - 1](#)

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Lecture 2 - LA, EDM and Academic Analytics

Lecture 3 - Types of Learning Analytics - I

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Lecture 11 - Data Visualization

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DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Designing Learner-Centric e-Learning in STEM Disciplines (Multi-Disciplinary)

Co-ordinators : Prof.Sahana Murthy

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Lecture 2 - What is this course about?

Lecture 3 - Course Format_ Learner Centric MOOC (LCM)

Lecture 4 - E-Learning in STEM

Lecture 5 - Making online Teaching Decisions

Lecture 6 - Challenges in e-learning

Lecture 7 - What is Learner-centric Approach?

Lecture 8 - Promoting Learner Engagement with Content

Lecture 9 - Why and How to Design Interactive PDF?

Lecture 10 - What is an LeD?

Lecture 11 - Learning by Doing (LbD)

Lecture 12 - Articulation and Reflection

Lecture 13 - Construct your Own Understanding

Lecture 14 - Contextualized Learning

Lecture 15 - Feedback to Learners

Lecture 16 - Collaboration and Peer Learning

Lecture 17 - Addressing Diversity

Lecture 18 - Putting it All Together

Lecture 19 - Selection and Analysis of Effective Technology

Lecture 20 - Effective Integration of Technology

Lecture 21 - Instructional Design in e-learning

Lecture 22 - ADDIE Process of Instructional Design

Lecture 23 - Constructive Alignment

Lecture 24 - Implementing constructive alignment

Lecture 25 - Multimedia Principle and Contiguity Principle

Lecture 26 - Modality Principle and Redundancy Principle

Lecture 27 - Coherence Principle

Lecture 28 - Segmenting and Personalization Principles

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NPTEL : NOC:Sustainable and Affordable Sanitation Solutions for Small Towns: Policy, Planning and Practice (Multi-Disciplinary)

Co-ordinators : Prof. N.C Narayanan

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Lecture 2 - Overview of Sanitation in the country

Lecture 3 - Centralised or Decentralised?

Lecture 4 - Need for Participatory Planning

Lecture 5 - Context setting for the Alappuzha Project

Lecture 6 - Environmental Policy

Lecture 7 - Environmental Impact Assessment 2006 and National Urban Sanitation Plan

Lecture 8 - Environmental Governance - Challenges and Alternatives

Lecture 9 - Municipal Solid Waste Management

Lecture 10 - MSWM - Status, Policy, governance structure

Lecture 11 - Integrated Municipal Solid Waste Management

Lecture 12 - Plastic Waste Management

Lecture 13 - Municipal Solid Waste Management in Alappuzha

Lecture 14 - Liquid Waste Management - an Overview

Lecture 15 - Introduction to Faecal Sludge Management

Lecture 16 - Faecal Sludge Management for Alappuzha town

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Lecture 23 - Inorganic waste management - Role of Kudumbashree and Haritha Karma Sena

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Lecture 25 - Significance of institution building in reclaiming canals

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- Lecture 2 - Consequences of Axioms
- Lecture 3 - Interpretation of Probability
- Lecture 4 - Total Probability law and Baye's Theorem - I
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- Lecture 6 - Random variables and Cumulative Density Function
- Lecture 7 - Discrete and Continuous random variables - I
- Lecture 8 - Discrete and Continuous random variables - II
- Lecture 9 - Expectation and Variance
- Lecture 10 - Function of Random variables
- Lecture 11 - Generating RVs, Joint Distribution of RVs
- Lecture 12 - Joint Distribution of RVs and Marginal densities
- Lecture 13 - Covariance of Random variables
- Lecture 14 - Moment Generating Functions
- Lecture 15 - Conditional PMF and PDF
- Lecture 16 - Law of Large numbers, Central Limit Theorem
- Lecture 17 - Application of Central Limit Theorem - I
- Lecture 18 - Application of Central Limit Theorem - II
- Lecture 19 - Gamma and Chi-square distributions
- Lecture 20 - Beta distributions and Exponential families
- Lecture 21 - Random Sampling, Sample mean and Sample variance
- Lecture 22 - Sampling from Gaussian distribution and t-distribution
- Lecture 23 - Student's t- distribution
- Lecture 24 - F-distribution and its properties
- Lecture 25 - Convergence of Random variables and Consistency
- Lecture 26 - Order statistics, Median and Percentiles
- Lecture 27 - Generating random sample-Direct method
- Lecture 28 - Generating random sample-Indirect method
- Lecture 29 - Introduction to python
- Lecture 30 - Python- Loops and Numpy library
- Lecture 31 - Sufficiency Principles and Sufficient Statistics

- Lecture 32 - Sufficient Statistics and Characterization of Sufficient Statistics
- Lecture 33 - Characterization of Sufficient Statistics and Factorization Theorem
- Lecture 34 - Example of Factorization Theorem, Minimal Sufficient Statistics
- Lecture 35 - Minimal sufficient statistics
- Lecture 36 - Test for minimal sufficient statistics with examples, Ancillary Statistics
- Lecture 37 - Likelihood Functions, Maximum Likelihood Estimator
- Lecture 38 - Method of moments, Baye's Estimator
- Lecture 39 - Evaluating Estimator, Cramer Rao Bound, Fisher Information
- Lecture 40 - Evaluating Estimator, Cramer Rao Bound, Fisher Information (Continued...)
- Lecture 41 - Hypothesis Testing, Likelihood Ratio Test
- Lecture 42 - Hypothesis Testing, Bayes Test
- Lecture 43 - Type I and II errors, Power Functions
- Lecture 44 - Type I and II errors, Power Functions (Continued...)
- Lecture 45 - Calculations of Power Functions
- Lecture 46 - Unbiased Test, Uniformly Most Powerful Test, Neyman- Pearson Lemma, Interval Estimation
- Lecture 47 - Interval Estimation
- Lecture 48 - Interval Estimation (Continued...)
- Lecture 49 - Construction of Confidence Intervals from tests
- Lecture 50 - Python- numpy and pandas functions II
- Lecture 51 - Tutology of tests and confidence intervals
- Lecture 52 - Tutology of tests and confidence intervals (Continued...)
- Lecture 53 - p-value, p-test of significance of a statistical test
- Lecture 54 - t-test and F-test, ANOVA
- Lecture 55 - Non-parametric test, Goodness of fit, Chi- squared test
- Lecture 56 - Distribution of Chi-squared test statistics
- Lecture 57 - Kolmogrov-Smirnov test
- Lecture 58 - Lilliefors's test and Explorator Data Analysis, Q-Q Plot and P-P Plot
- Lecture 59 - Generating random samples using Python, Hypothesis Testing using Python
- Lecture 60 - Generating random samples using Python, Hypothesis Testing using Python (Continued...)

- Lecture 1 - Understanding PID Control
- Lecture 2 - Process Model: Experimental Methods
- Lecture 3 - Model Reduction
- Lecture 4 - Disturbance Models and PID
- Lecture 5 - PID Tuning Methods
- Lecture 6 - PID Tuning Methods (Continued...)
- Lecture 7 - Selection of PID Controller
- Lecture 8 - Designing Controllers in a Jugaad Way
- Lecture 9 - To explain why jugaad works....
- Lecture 10 - Feedforward Design
- Lecture 11 - State-space methods - Feedforward Control
- Lecture 12 - Internal Model Control (IMC)
- Lecture 13 - Overview of Control Techniques
- Lecture 14 - Multivariable Control
- Lecture 15 - Multivariable Control (Continued...)
- Lecture 16 - Decoupler Design
- Lecture 17 - Feedback Decouplers and Centralized Controllers
- Lecture 18 - Large Scale MIMO Systems
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- Lecture 20 - Data Driven PID Control
- Lecture 21 - Data Driven PID Control (Continued...)
- Lecture 22 - Control and Learning
- Lecture 23 - Control using Reinforcement Learning (RL)
- Lecture 24 - Reinforcement learning based control for inverted pendulum
- Lecture 25 - Policy Gradient based Reinforcement Learning
- Lecture 26 - Using MATLAB for Reinforcement Learning
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Lecture 80 - Anxiety Depression Distress

Lecture 81 - Counsellor in PC

Lecture 82 - Caregiver Burnout Yoga

Lecture 83 - PC in Elderly

Lecture 84 - Spirituality

Lecture 85 - Spirituality and Religion

Lecture 86 - Laws of Karma

Lecture 87 - Last Days of Life

Lecture 88 - Care of Dying and Bereavement

Lecture 89 - Quality of Death

Lecture 90 - Death

Lecture 91 - Grief and Bereavement

Lecture 92 - Ethics in PC

Lecture 93 - Volunteering

Lecture 94 - Volunteers

Lecture 95 - Volunteers

Lecture 96 - Community

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[Lecture 98 - Community Based PC](#)

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[Lecture 102 - Safety Precaution](#)

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[Lecture 105 - IT in PC](#)

[Lecture 106 - COC](#)

[Lecture 107 - Sandhi](#)

[Lecture 108 - Cancer Aid Society](#)

[Lecture 109 - Alpha](#)

[Lecture 110 - PC Services in Punjab](#)

Lecture 1 - Example 01, 02, 03

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Lecture 3 - Example 04, 05, 06 (Continued...)

Lecture 4 - Example 06 (Continued...), Example 07

Lecture 5 - Example 06 (Continued...), Example 07

Lecture 6 - MCDM: Definitions, Theory of Choice, MCDM Axioma, Condorcet Paradox

Lecture 7 - Theory of Choice, MCDM Axioms, Condorcet Paradox

Lecture 8 - MCDM Axioms, Condorcet Paradox, Utility Theory

Lecture 9 - Utility Theory, Expected value of Utility Function, Lotteries, Rational Choice, Properties of Utility Function

Lecture 10 - Rational Choice, Properties of Utility Function, Risk Aversion, Neutrality, Seeking Properties, Marginal Utility, Absolute Risk Aversion, Relative Risk Aversion

Lecture 11 - Utility Theory Examples, Properties of Utility Function, Risk Aversion, Neutrality, Seeking Properties, Marginal Utility, Absolute Risk Aversion, Relative Risk Aversion

Lecture 12 - Properties of Utility Function, Risk Aversion, Neutrality, Seeking Properties, Marginal Utility, Absolute Risk Aversion, Relative Risk Aversion, Example of Utility Functions

Lecture 13 - Example of Utility Functions, Certainty Equivalent, Geometric Mean Methods, Safety First Principle, Stochastic Dominance, Hyperbolic Absolute Risk Aversion Function

Lecture 14 - Example of Utility Functions, Certainty Equivalent, Geometric Mean Methods, Safety First Principle, Stochastic Dominance, Hyperbolic Absolute Risk Aversion Function

Lecture 15 - Certainty Equivalent, Geometric Mean Methods, Safety First Principle, Stochastic Dominance, Hyperbolic Absolute Risk Aversion Function

Lecture 16 - Geometric Mean Methods, Safety First Principle, Stochastic Dominance, Hyperbolic Absolute Risk Aversion Function

Lecture 17 - Safety First Principle, Stochastic Dominance, Hyperbolic Absolute Risk Aversion Function

Lecture 18 - Safety First Principle, Stochastic Dominance, Hyperbolic Absolute Risk Aversion Function

Lecture 19 - Stochastic Dominance, Hyperbolic Absolute Risk Aversion Function

Lecture 20 - Stochastic Dominance, Hyperbolic Absolute Risk Aversion Function

Lecture 21 - Concept of Pareto Optimality in 2D Space, Effective Versus Inefficient Solutions, Karush Kuhn Tucker Condition, Scales of Measurements: Nominal Scale, Ordinal Scale, Interval Scale, Ratio Scale, Goal Programming

Lecture 22 - Concept of Pareto Optimality in 2D Space, Effective Versus Inefficient Solutions, Karush Kuhn Tucker Condition, Scales of Measurements: Nominal Scale, Ordinal Scale, Interval Scale, Ratio Scale, Goal Programming

Lecture 23 - Pareto Optimality, Property of Dominance, Strong Pareto Optimality, Weak Pareto Optimality, Concepts of Pareto Optimality in 2D Space, Effective versus Inefficient Solutions

Lecture 24 - Concept of Pareto Optimality in 2D Space, Effective Versus Inefficient Solutions, Karush Kuhn Tucker Condition, Scales of Measurements: Nominal Scale, Ordinal Scale, Interval Scale, Ratio Scale, Goal Programming

Lecture 25 - Concept of Pareto Optimality in 2D Space, Effective Versus Inefficient Solutions, Karush Kuhn Tucker Condition, Scales of Measurements: Nominal Scale, Ordinal Scale, Interval Scale, Ratio Scale, Goal Programming

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Lecture 26 - Concept of Pareto Optimality in 2D Space, Effective Versus Inefficient Solutions, Karusch Kuhn Tucker Condition, Scales of Measurements: Nominal Scale, Ordinal Scale, Interval Scale, Ratio Scale, Goal Programming

Lecture 27 - Concept of Pareto Optimality in 2D Space, Effective Versus Inefficient Solutions, Karusch Kuhn Tucker Condition, Scales of Measurements: Nominal Scale, Ordinal Scale, Interval Scale, Ratio Scale, Goal Programming

Lecture 28 - Scales of Measurements: Nominal Scale, Ordinal Scale, Interval Scale, Ratio Scale, Goal Programming

Lecture 29 - Pareto Optimality, Concept of Pareto Optimality, Goal Programming

Lecture 30 - Pareto Optimality, Pareto Curves, Goal Programming

Lecture 31 - Goal Programming, Concepts of Pareto Optimality in 2D Space for LP, Concepts of Pareto Optimality in 3D Space for QP

Lecture 32 - Concepts of Pareto Optimality in 2D Space for LP, Concepts of Pareto Optimality in 3D Space for QP

Lecture 33 - LP Example of Goal Programming/MCDM, NLP Example of Goal Programming/MCDM

Lecture 34 - LP Example of Goal Programming/MCDM, NLP Example of Goal Programming/MCDM (Continued...)

Lecture 35 - LP Example of Goal Programming/MCDM, NLP Example of Goal Programming/MCDM (Continued...)

Lecture 36 - LP Example of Goal Programming/MCDM, NLP Example of Goal Programming/MCDM (Continued...)

Lecture 37 - Quadratic Programming, Goal Programming

Lecture 38 - Multi Attribute Utility Theory, TOPSIS

Lecture 39 - Multi Attribute Utility Theory, TOPSIS

Lecture 40 - Technique For Order Preference by Similarity to Ideal Solutions (TOPSIS)

Lecture 41 - Technique For Order Preference by Similarity to Ideal Solutions (TOPSIS)

Lecture 42 - Technique For Order Preference by Similarity to Ideal Solutions (TOPSIS)

Lecture 43 - Technique For Order Preference by Similarity to Ideal Solutions (TOPSIS), Elimination and Choice Translating Reality (ELECTRE)

Lecture 44 - Elimination and Choice Translating Reality (ELECTRE)

Lecture 45 - Elimination and Choice Translating Reality (ELECTRE)

Lecture 46 - Elimination and Choice Translating Reality (ELECTRE)

Lecture 47 - Elimination and Choice Translating Reality (ELECTRE)

Lecture 48 - Elimination and Choice Translating Reality (ELECTRE), e-ELECTRE

Lecture 49 - Elimination and Choice Translating Reality (ELECTRE), e-ELECTRE

Lecture 50 - Elimination and Choice Translating Reality (ELECTRE), e-ELECTRE, VIKOR

Lecture 51 - VIKOR (VIsekriterijumska Optimizacija I Kompromisno Resenje)

Lecture 52 - VIKOR (VIsekriterijumska Optimizacija I Kompromisno Resenje)

Lecture 53 - Analytical Hierarchy Process (AHP)

Lecture 54 - Analytical Hierarchy Process (AHP) (Continued...)

Lecture 55 - Analytical Hierarchy Process (AHP) (Continued...)

Lecture 56 - Data Envelopment Analysis (DEA)

Lecture 57 - Data Envelopment Analysis (DEA)

[Lecture 58 - Decision Tree Analysis](#)

[Lecture 59 - Decision Tree Analysis \(Continued...\)](#)

[Lecture 60 - Example in Multi Objective Decision Making](#)

Lecture 1 - Prelude

Lecture 2 - Prologue BCPC

Lecture 3 - Introductory Dialogue - Week 1

Lecture 4 - Basics of Palliative Care

Lecture 5 - Community Participation

Lecture 6 - Communication Skills in Palliative Care - Part I

Lecture 7 - Communication Skills in Palliative Care - Part II

Lecture 8 - Introductory Dialogue - Week 2

Lecture 9 - What is Active Listening ?

Lecture 10 - Are You Really Listening ?

Lecture 11 - Active Listening Skills

Lecture 12 - Communication Skills for Health Professionals

Lecture 13 - Communication Competency in Health Professional

Lecture 14 - Talking About Death

Lecture 15 - Introductory Dialogue - Week 3

Lecture 16 - Psychological Aspects in PC

Lecture 17 - What is Psychological Distress ?

Lecture 18 - Types of Psychological Distress

Lecture 19 - Kessler Psychological Distress Scale

Lecture 20 - Generalized Anxiety Disorder (GAD)

Lecture 21 - Guilt and Regret

Lecture 22 - Introductory Dialogue - Week 4

Lecture 23 - Cultural Aspects in Palliative Care

Lecture 24 - Spirituality (FAQs)

Lecture 25 - Spiritual Distress

Lecture 26 - Ways to Lead Spiritual Life !

Lecture 27 - Introductory Dialogue - Week 5

Lecture 28 - What is Stress and Burnout

Lecture 29 - Some Tips to Manage Stress

Lecture 30 - Burnout in Health Care Professionals

Lecture 31 - Avoiding Burnout in Health Care Professionals

Lecture 32 - Voluteers to Prevent Burnout !

Lecture 33 - Self Care

Lecture 34 - Introductory Dialogue - Week 6

Lecture 35 - Ethical Aspects of End of Life

Lecture 36 - Impact of Bereavement on Family

Lecture 37 - Kubler-Ross Model

Lecture 38 - Theoretical Models of Grief and Bereavement

Lecture 39 - Psychology of Grief and Bereavement

Lecture 40 - Management of Grief and Bereavement

Lecture 41 - Introductory Dialogue - Week 7

Lecture 42 - Metastatic Bone Pain Management

Lecture 43 - How to Prescribe ENDS ?

Lecture 44 - Safe Use of ENDS

Lecture 45 - Neuropathic Pain and Its Management

Lecture 46 - Introduction to Intervention Pain Management

Lecture 47 - Introductory Dialogue - Week 8

Lecture 48 - Gastrointestinal Symptoms

Lecture 49 - Respiratory Symptoms Management - Part I

Lecture 50 - Respiratory Symptoms Management - Part II

Lecture 51 - Delirium and Dementia

Lecture 52 - Emergencies in Palliative Medicine

Lecture 53 - Recent Advances in Nausea and Vomiting

Lecture 54 - Introductory Dialogue - Week 9

Lecture 55 - Nursing Care Plans: Case Scenario

Lecture 56 - Bladder and Bowel Care

Lecture 57 - Stoma Care - Part I

Lecture 58 - Stoma Care - Part II

Lecture 59 - Skin Care in Colostomy

Lecture 60 - Introductory Dialogue - Week 10

Lecture 61 - Importance of Prognostication

Lecture 62 - Diagnosing the Dying !

Lecture 63 - Facing Death: How to Help ?

Lecture 64 - Subcutaneous Route

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[Lecture 66 - National Health Mission \(NHM\)](#)

[Lecture 67 - Aushman Bharat](#)

[Lecture 68 - Government Schemes for Palliative Care](#)

[Lecture 69 - NDPS Rules 2015](#)

[Lecture 70 - Delivery Models of Palliative Care](#)

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[Lecture 72 - Availability of ENDS and Advocacy](#)

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[Lecture 76 - History of Opium - Part I](#)

[Lecture 77 - History of Opium - Part II](#)

[Lecture 78 - Panel Discussion](#)

Lecture 1 - Introduction to Fuzzy Sets

Lecture 2 - Introduction to Fuzzy Sets (Continued...)

Lecture 3 - Introduction to Fuzzy Sets (Continued...)

Lecture 4 - Introduction to Fuzzy Sets (Continued...)

Lecture 5 - Introduction to Fuzzy Sets (Continued...)

Lecture 6 - Introduction to Fuzzy Sets (Continued...)

Lecture 7 - Applications of Fuzzy Sets

Lecture 8 - Applications of Fuzzy Sets (Continued...)

Lecture 9 - Applications of Fuzzy Sets (Continued...)

Lecture 10 - Applications of Fuzzy Sets (Continued...)

Lecture 11 - Applications of Fuzzy Sets (Continued...)

Lecture 12 - Applications of Fuzzy Sets (Continued...)

Lecture 13 - Applications of Fuzzy Sets (Continued...)

Lecture 14 - Applications of Fuzzy Sets (Continued...)

Lecture 15 - Applications of Fuzzy Sets (Continued...)

Lecture 16 - Applications of Fuzzy Sets (Continued...)

Lecture 17 - Optimization of Fuzzy Reasoning and Clustering Tool

Lecture 18 - Optimization of Fuzzy Reasoning and Clustering Tool (Continued...)

Lecture 19 - Optimization of Fuzzy Reasoning and Clustering Tool (Continued...)

Lecture 20 - Optimization of Fuzzy Reasoning and Clustering Tool (Continued...)

Lecture 21 - Some Examples of Neural Networks

Lecture 22 - Some Examples of Neural Networks (Continued...)

Lecture 23 - Some Examples of Neural Networks (Continued...)

Lecture 24 - Some Examples of Neural Networks (Continued...)

Lecture 25 - Some Examples of Neural Networks (Continued...)

Lecture 26 - Some Examples of Neural Networks (Continued...)

Lecture 27 - Some Examples of Neural Networks (Continued...)

Lecture 28 - Some Examples of Neural Networks (Continued...)

Lecture 29 - Some Examples of Neural Networks (Continued...)

Lecture 30 - Some Examples of Neural Networks (Continued...)

Lecture 31 - Optimal Designs of Neural Networks

[Lecture 32 - Optimal Designs of Neural Networks \(Continued...\)](#)

[Lecture 33 - Neuro-Fuzzy System](#)

[Lecture 34 - Neuro-Fuzzy System \(Continued...\)](#)

[Lecture 35 - Neuro-Fuzzy System \(Continued...\)](#)

[Lecture 36 - Neuro-Fuzzy System \(Continued...\)](#)

[Lecture 37 - Concepts of Soft Computing and Expert Systems](#)

[Lecture 38 - Concepts of Soft Computing and Expert Systems \(Continued...\)](#)

[Lecture 39 - A Few Applications](#)

[Lecture 40 - A Few Applications \(Continued...\)](#)

[Lecture 41 - A Few Applications \(Continued...\)](#)

[Lecture 42 - A Few Applications \(Continued...\)](#)

Lecture 1 - Economic Contributions of Entrepreneurs

Lecture 2 - Definition, Motivation and Types of Entrepreneurship

Lecture 3 - Vision, Mission and Values

Lecture 4 - Entrepreneurial Qualities

Lecture 5 - Two Inspiring Stories

Lecture 6 - Myths and Realities around Entrepreneurship

Lecture 7 - Causes of Failure of Startups

Lecture 8 - Why Startups Fail (Continued...)

Lecture 9 - Forms of Legal Entities

Lecture 10 - Factors Driving Competitive Advantages

Lecture 11 - Marketing for Startups - I

Lecture 12 - Marketing for Startups - II

Lecture 13 - Marketing for Startups - III

Lecture 14 - Marketing Research

Lecture 15 - Marketing Research (Continued...)

Lecture 16 - Business Model Canvas

Lecture 17 - Value Proposition Canvas

Lecture 18 - Illustration of Business Model Canvas

Lecture 19 - Features of Winning Business Models

Lecture 20 - Business Model Innovation

Lecture 21 - Identifying Opportunities Based on Trend

Lecture 22 - Circle of Competence and Effectuation

Lecture 23 - Lean Startup - I

Lecture 24 - Lean Startup - II

Lecture 25 - Lean Startup - III

Lecture 26 - Design and Innovation - I

Lecture 27 - Design and Innovation - II

Lecture 28 - Design and Innovation - III

Lecture 29 - Design and Innovation - IV

Lecture 30 - Design and Innovation - V

Lecture 31 - Introduction to Financial Statements

[Lecture 32 - Introduction to Financial Statements \(Continued...\)](#)

[Lecture 33 - Introduction to Financial Statements \(Continued...\)](#)

[Lecture 34 - Introduction to Financial Statements \(Continued...\)](#)

[Lecture 35 - Introduction to Financial Statements \(Continued...\)](#)

[Lecture 36 - Introduction to Financial Statements \(Continued...\)](#)

[Lecture 37 - Introduction to Financial Statements \(Continued...\)](#)

[Lecture 38 - Depreciation and Amortization and Treatment of Capital Gain or Loss from Sale of Fixed Asset](#)

[Lecture 39 - Cost, Volume, Profit: Break-Even Point Analysis - I](#)

[Lecture 40 - Cost, Volume, Profit: Break-Even Point Analysis - II](#)

[Lecture 41 - Founding Team and Early Recruits](#)

[Lecture 42 - Business Plan - I](#)

[Lecture 43 - Business Plan - II](#)

[Lecture 44 - Pitching the Business Plan - I](#)

[Lecture 45 - Pitching the Business Plan - II](#)

[Lecture 46 - Funding New Venture - I](#)

[Lecture 47 - Funding New Venture - II](#)

[Lecture 48 - Funding New Venture - III](#)

[Lecture 49 - Funding New Venture - IV](#)

[Lecture 50 - Funding New Venture - V](#)

[Lecture 51 - Some Dos and Donts](#)

[Lecture 52 - Go-To-Market Strategies - I](#)

[Lecture 53 - Go-To-Market Strategies - II](#)

[Lecture 54 - Capital Budgeting Decisions](#)

[Lecture 55 - Capital Budgeting Decisions \(Continued...\)](#)

[Lecture 56 - Start up Valuation - I](#)

[Lecture 57 - Start up Valuation - II](#)

[Lecture 58 - Human Resource Management - I](#)

[Lecture 59 - Human Resource Management - II](#)

[Lecture 60 - Growth Strategies](#)

NPTEL : NOC:Roadmap for Patent Creation (Multi-Disciplinary)

Co-ordinators : Prof. Gouri Gargate

Lecture 1 - Roadmap for patent creation - Introduction

Lecture 2 - Roadmap for patent creation - Property and IP

Lecture 3 - Roadmap for patent creation - IPR

Lecture 4 - Roadmap for patent creation - IP and future areas

Lecture 5 - Roadmap for patent creation - Patent - Introduction

Lecture 6 - Patent searching and analysis

Lecture 7 - Patent-Definition

Lecture 8 - Novelty

Lecture 9 - Non obviousness

Lecture 10 - Industrial application

Lecture 11 - Parts of patent document

Lecture 12 - Terminologies and codes used in a patent document

Lecture 13 - How to read a patent ? - I

Lecture 14 - How to read a patent ? - II

Lecture 15 - How to read a patent ? - III

Lecture 16 - Roadmap for patent creation - IP identification tool

Lecture 17 - Roadmap for patent creation - Patentability tool

Lecture 18 - Roadmap for patent creation - IP audit framework

Lecture 19 - Roadmap for patent creation - Public patent databases

Lecture 20 - Roadmap for patent creation - Capsule version

Lecture 21 - Types of patent

Lecture 22 - Patent filing procedure in India

Lecture 23 - Patent timelines - India and PCT

Lecture 24 - Inventions not patent in India

Lecture 25 - Indicators for patentability

Lecture 26 - Use of patent database for research/project topic identification

Lecture 27 - Importance of laboratory notebook

Lecture 28 - In which technical category my invention falls - IPC

Lecture 29 - Patent - Statutory differences between India, Europe and USA

Lecture 30 - Identification of inventor and applicant and their rights

Lecture 31 - Developing your own IP system

[Lecture 32 - When to publish and when to patent \(confidentiality\)](#)

[Lecture 33 - Statutory exceptions \(anticipation\)](#)

[Lecture 34 - Procedure for patent filing \(Forms and fees\)](#)

[Lecture 35 - Interaction with IP attorney \(Initial drafting, FER reply and hearing\)](#)

[Lecture 36 - Research/project planning](#)

[Lecture 37 - Post patent filing requirements](#)

[Lecture 38 - Patent commercialization](#)

[Lecture 39 - Capsule version](#)

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NPTEL : NOC:Accreditation and Outcome based Learning (Multi-Disciplinary)

Co-ordinators : Prof. Shyamal Kumar Das Mandal

Lecture 1 - Introduction

Lecture 2 - Challenges and Needs of 21st Century Education

Lecture 3 - Accreditation

Lecture 4 - Accreditation (Continued...)

Lecture 5 - Outcome based Learning

Lecture 6 - Important Steps in Outcome based education

Lecture 7 - Introduction to Taxonomies of Learning and Cognitive Domains of Learning

Lecture 8 - Psychomotor Domain and Affective Domain of Learning

Lecture 9 - Instructional Objectives or Outcome

Lecture 10 - Need and Use of Instructional Objectives or Outcome

Lecture 11 - Example of Different Instructional Objectives or Outcome and their Cognitive Level

Lecture 12 - Outcome-based Curriculum Design

Lecture 13 - Outcome-based Curriculum Design (Continued...)

Lecture 14 - Outcome-based Curriculum Design software framework

Lecture 15 - Course outcome, Module outcome and lecture/unit outcome and teaching learning process

Lecture 16 - Mapping of outcome based curriculum with Graduate attribute

Lecture 17 - Introduction to Assessment and Evaluation

Lecture 18 - Formative Assessment and Summative Assessments

Lecture 19 - Test Item analysis

Lecture 20 - Test Item analysis (Continued...)

Lecture 21 - Evaluation Rubrics

Lecture 22 - Mission and Vision, Program Educational Objectives (PEOs), Program Outcome (PO) and their Consistency

Lecture 23 - Mapping of course outcome and Program Outcome

Lecture 24 - Attainment of Program outcome and course outcome

Lecture 25 - Calculation of direct attainment

Lecture 26 - Calculation of Indirect Attainment

Lecture 27 - Introduction to Tutored Video Instruction (TVI)

Lecture 28 - TVI Learning Improvement Data - as reported in literature

Lecture 29 - Use of TVI as ELNET-3L program

Lecture 30 - Lessons on Good Teaching from ELNET-3L

Lecture 31 - Evaluation of Teaching Quality

- [Lecture 32 - Evaluation of Teaching Quality - A Research Proposal](#)
- [Lecture 33 - Evaluation of Teaching Quality - A Research Proposal \(Continued...\)](#)
- [Lecture 34 - Evaluation of Teaching Quality - A Research Proposal \(Continued...\)](#)
- [Lecture 35 - Assessment and Evaluation - to Improve Teaching](#)
- [Lecture 36 - Item Analysis - Theory and Practice](#)
- [Lecture 37 - Learning Styles and Learning Approaches](#)
- [Lecture 38 - Good Teaching Attributes and Characteristics](#)
- [Lecture 39 - Teacher Effectiveness Research](#)
- [Lecture 40 - Teacher Effectiveness Research \(Continued...\)](#)
- [Lecture 41 - Teaching Learning Process using Outcome based Education](#)

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NPTEL : NOC:Introduction to Environmental Engineering and Science - Fundamental and Sustainability Concepts (Multi-Disciplinary)

Co-ordinators : Prof. Brajesh Kumar Dubey

Lecture 1 - Sustainability Concepts - Innovations and Challenges

Lecture 2 - Sustainability Concepts - Innovations and Challenges

Lecture 3 - Basics and Sustainability Concepts and Evolution

Lecture 4 - Engineering for Sustainability

Lecture 5 - Life Cycle Thinking and Circular Economy

Lecture 6 - Mass Concentration Units

Lecture 7 - Partial Pressure Units

Lecture 8 - Other Types of Units

Lecture 9 - Units (Continued...), Qualitative and Quantitative Measurements

Lecture 10 - Quantative Measurements Basics

Lecture 11 - Ecology

Lecture 12 - Energy Flow and Ecological Concepts

Lecture 13 - Population

Lecture 14 - Population, Consumption and Biodiversity

Lecture 15 - Environmental Chemistry

Lecture 16 - Mass Balance and Reactor Systems

Lecture 17 - Mass Balance in Continuous Reactor / Continuous Stirred Tank Reactor (CSTR) and Plug Flow Reactor

Lecture 18 - Plug Flow Reactor and Energy Flow

Lecture 19 - Energy Balance and Earth Overshot Day

Lecture 20 - Mass Transport Processes

Lecture 21 - Oxygen Demand in Environmental Systems

Lecture 22 - BOD Examples, Oxygen Levels in Surface Waters, COD

Lecture 23 - Environmental Health Basics and SDGs

Lecture 24 - Field Applications

Lecture 25 - Nutrient Cycle

Lecture 26 - Environmental Risk

Lecture 27 - Risk Assessment Steps and EIA Introduction

Lecture 28 - Environmental Risk Assessments with Concepts of EIA and LCA

Lecture 29 - Environmental Risk Assessments with Concepts of EIA and LCA (Continued...)

Lecture 30 - Environmental Risk Assessments with Concepts of EIA and LCA (Continued...)

- Lecture 31 - Water Quantity
- Lecture 32 - Water Availability and Usage
- Lecture 33 - Population Forecasting
- Lecture 34 - Water Quality
- Lecture 35 - Water Quality (Continued...)
- Lecture 36 - Plain Sedimentation
- Lecture 37 - Coagulation
- Lecture 38 - Review of Sedimentation and Rapid Sand Filtration
- Lecture 39 - Disinfection and Water Supply
- Lecture 40 - Water Treatment Plant Visit
- Lecture 41 - Wastewater collection and characterization
- Lecture 42 - Sewerage System and Sewage Characteristics
- Lecture 43 - BOD Concepts and Preliminary Treatment of Wastewater
- Lecture 44 - Wastewater Treatment - I
- Lecture 45 - Activated Sludge Process and Sludge Disposal
- Lecture 46 - Introduction to Solid Waste Management
- Lecture 47 - Introduction to Solid Waste Management (Continued...)
- Lecture 48 - Components of Solid Waste Management
- Lecture 49 - Collection and Treatment
- Lecture 50 - Waste Disposal and Summary
- Lecture 51 - Basics of Air Pollution Issues - Global and Local
- Lecture 52 - Air Pollutants and Air Pollution Index
- Lecture 53 - Global Warming and Climate Change
- Lecture 54 - Air Pollution Models
- Lecture 55 - SDGs, Noise and Soil Pollution
- Lecture 56 - Present Issues and Few Case Studies
- Lecture 57 - Case Study - Solid Waste Management
- Lecture 58 - Case Study - Industrial Pollution and Disasters
- Lecture 59 - Case Study - Global Food Waste Initiatives
- Lecture 60 - Case Study - Global Food Waste and Resource Recovery

Lecture 1 - Introduction to Biophotonics - Part I

Lecture 2 - Introduction to Biophotonics - Part II

Lecture 3 - Introduction to Biophotonics - Part III

Lecture 4 - Nature of Light - Part I (As Wave)

Lecture 5 - Nature of Light - Part II (As Particle)

Lecture 6 - Fact of Matter - Part I

Lecture 7 - Fact of Matter - Part II

Lecture 8 - Basic of Light-Matter Interaction

Lecture 9 - Molecular Materials

Lecture 10 - Introduction to Fluorescence

Lecture 11 - The Cell

Lecture 12 - The Central Dogma

Lecture 13 - Genetic Code

Lecture 14 - Building Blocks

Lecture 15 - Remaining Topics

Lecture 16 - Light-Matter Interactions in Molecules (Basic of Spectroscopy)

Lecture 17 - Light-Matter Interactions in Molecules (Basic of Spectroscopy) (Continued...)

Lecture 18 - Interaction of Light with Cells

Lecture 19 - Interaction of Light with Tissues

Lecture 20 - Photoprocesses in Biopolymers

Lecture 21 - Laser Principles and Operation

Lecture 22 - Types of Lasers

Lecture 23 - Nonlinear Optical Processes

Lecture 24 - In Vivo Photoexcitation

Lecture 25 - Examples and Applications

Lecture 26 - Introduction

Lecture 27 - Microscopy Techniques

Lecture 28 - Near Field Microscopy and Optical Coherence Tomography

Lecture 29 - Fluorophores and Fluorescence Microscopy Techniques

Lecture 30 - The Future: AFM-IR

Lecture 31 - Biosensing Background

- Lecture 32 - Optical Fiber Sensors
- Lecture 33 - Metamaterials
- Lecture 34 - Metamaterials as Biosensors
- Lecture 35 - Biosensing with Optical Nano-antennas
- Lecture 36 - Introduction to Photodynamic Therapy (PDT)
- Lecture 37 - Application of Photodynamic Therapy (PDT)
- Lecture 38 - Light Irradiation for Photodynamic Therapy (PDT)
- Lecture 39 - Real Life Examples of Photodynamic Therapy (PDT)
- Lecture 40 - Future of PDT and Photothermal Therapy (PTT)
- Lecture 41 - Laser Based Tissue Engineering
- Lecture 42 - Laser Tissue Contouring: Dermatological Application
- Lecture 43 - Laser Tissue Welding and Tissue Regeneration
- Lecture 44 - Laser Tissue Contouring: Ophthalmic Application
- Lecture 45 - Laser in Dentistry
- Lecture 46 - Tools for Micromanipulation
- Lecture 47 - The Optical/Laser Tweezer
- Lecture 48 - Design of Optical Tweezers
- Lecture 49 - Optical Scissors
- Lecture 50 - Selected Examples of Application
- Lecture 51 - Introduction to nanotechnology
- Lecture 52 - Processes of Nanotechnology
- Lecture 53 - Nano-Lithography: The Art of Small
- Lecture 54 - Thin Film Deposition
- Lecture 55 - Bionanophotonics Applications
- Lecture 56 - Introduction to Optogenetics
- Lecture 57 - Controlling the Brain with Light
- Lecture 58 - Optical Neuroimaging and Tomography
- Lecture 59 - Functional Near Infrared Spectroscopy (fNIRS) of the Brain
- Lecture 60 - Summary and Revisiting Few topics

- Lecture 1 - Introduction to Vacuum, Natural Vacuum
- Lecture 2 - History of Vacuum Technology
- Lecture 3 - Kinetic Theory of Gases, Physical Parameters of Vacuum and Regions of Vacuum
- Lecture 4 - Vacuum Process Applications - I
- Lecture 5 - Vacuum Process Applications - II
- Lecture 6 - Pumping Speed and Throughput Concepts
- Lecture 7 - Rotary Vacuum Pump
- Lecture 8 - Diffusion Pump
- Lecture 9 - Roots Vacuum Pump
- Lecture 10 - Rotary Piston Pump
- Lecture 11 - Liquid Ring Pump
- Lecture 12 - Steam Jet Ejector
- Lecture 13 - Diaphragm Pump
- Lecture 14 - Claw Pump
- Lecture 15 - Screw Pump
- Lecture 16 - Scroll Pump, Sorption Concepts and Pumps
- Lecture 17 - Ion Pumping-Sputter Ion Pump
- Lecture 18 - Turbomolecular Pump
- Lecture 19 - Cryopumps
- Lecture 20 - Selection Criteria of Vacuum Pumps
- Lecture 21 - Primary vs Secondary Gauges, U Tube/McLeod gauges (Primary)
- Lecture 22 - Bourdon/Capacitance Gauges (Mechanical Deflection)
- Lecture 23 - Thermo-couple/Pirani gauges (Thermal Conductivity)
- Lecture 24 - Spinning Rotor/Ionization/Bayard Alpert Gauges
- Lecture 25 - Penning/ Inverted Magnetron gauges, Gauge calibration
- Lecture 26 - Vacuum Materials (Metals, Glasses, Ceramics, Greases and Oils)
- Lecture 27 - Vacuum Components (Flanges, Couplings, Seals, Valves)
- Lecture 28 - Vacuum Chamber Design
- Lecture 29 - Fabrication Techniques for Vacuum Systems
- Lecture 30 - Testing of Vacuum Systems for Mechanical Failures, Gas Leaks and Outgassing
- Lecture 31 - Gas Flow at Low Pressures, Conductance and Effective Pumping Speed Concepts

- Lecture 32 - Conductance Calculations in Viscous Flow Region
- Lecture 33 - Molecular Flow
- Lecture 34 - Transition and Choked Flows
- Lecture 35 - Conductance and Pump Down Calculations in Vacuum Systems
- Lecture 36 - Design Aspects of Vacuum Systems for Different Applications - Part I
- Lecture 37 - Design Aspects of Vacuum Systems for Different Applications - Part II
- Lecture 38 - Design of a Vacuum Furnace for Metallurgical Processing
- Lecture 39 - Leak Detection in Vacuum Systems
- Lecture 40 - Magnetic Deflection Leak Detector and Quadrupole Residual Gas Analyzer
- Lecture 41 - Vacuum Processes in Chemical and Pharmaceutical Industries
- Lecture 42 - Vacuum for Food Processing
- Lecture 43 - Vacuum Technology in the Packaging Industry
- Lecture 44 - Vacuum in Wood Industry
- Lecture 45 - Vacuum Systems for Medical and Dental Applications
- Lecture 46 - Vacuum for Desalination of Sea Water and Treatment of Waste Water
- Lecture 47 - Vacuum Technology for Power Sector
- Lecture 48 - Vacuum Technology In Oil and Gas Industries
- Lecture 49 - Vacuum Technology in LNG industry
- Lecture 50 - Vacuum Technology for Cryogenic Applications
- Lecture 51 - Vacuum Technology in High Speed Transportation (Hyperloop and Maglev)
- Lecture 52 - Vacuum technology for Metallurgical applications
- Lecture 53 - Vacuum Technology for Analytical Instruments
- Lecture 54 - Vacuum based coating units for thin film deposition
- Lecture 55 - Vacuum for solar energy (Thermal and PV)
- Lecture 56 - Vacuum Technology for semiconductor chip manufacturing
- Lecture 57 - Vacuum Technology for Display Systems
- Lecture 58 - Vacuum Technology for Nuclear Applications - Part I
- Lecture 59 - Vacuum Technology for Nuclear Applications - Part II
- Lecture 60 - Vacuum technology for Space Applications

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Basics of Health Promotion and Education Intervention (Multi-Disciplinary)

Co-ordinators : Prof. Sweety Suman Jha, Prof.Chandrashekhar Taklikar, Prof. Madumita Dobe, Prof. Arista Lahiri

- Lecture 1 - Brief history of public health
- Lecture 2 - Scope and Evolution of Health Promotion and Education
- Lecture 3 - Ottawa Charter
- Lecture 4 - Principles of health promotion
- Lecture 5 - Settings and audiences for health promotion
- Lecture 6 - Concepts of Health Behavior
- Lecture 7 - Health Risk Behavior Vs Health Promotion Behavior
- Lecture 8 - Concepts of Health Communication - Part I
- Lecture 9 - Concepts of Health Communication - Part II
- Lecture 10 - Health Literacy
- Lecture 11 - Information Education and Communication (IEC)
- Lecture 12 - Behavior Change Communication (BCC) - Part I
- Lecture 13 - Behavior Change Communication (BCC) - Part II
- Lecture 14 - Social and Behavior Change Communication (SBCC) - Part I
- Lecture 15 - Social and Behavior Change Communication (SBCC) - Part II
- Lecture 16 - Need Assessment for Health Promotion
- Lecture 17 - Approaches for Health Promotion and Behavior Change
- Lecture 18 - Models of Individual Health Behavior
- Lecture 19 - Models of Inter-Personal Health Behaviour
- Lecture 20 - Community and Group Models of Health Behavior Change
- Lecture 21 - Planning HPE Intervention - Part I
- Lecture 22 - Planning HPE Intervention - Part II
- Lecture 23 - Implementing HPE Intervention - Part I
- Lecture 24 - Implementing HPE Intervention - Part II
- Lecture 25 - Monitoring HPE Intervention
- Lecture 26 - Principles of Designing Messages
- Lecture 27 - Processes and Approaches of Designing Messages - Part I
- Lecture 28 - Processes and Approaches of Designing Messages - Part II
- Lecture 29 - Overview of Pretesting
- Lecture 30 - Pretesting of Health Promotion and Education Tools
- Lecture 31 - Health Education Methods - Part I

[Lecture 32 - Health Education Methods - Part II](#)

[Lecture 33 - Health Education Material - Part I](#)

[Lecture 34 - Health Education Material - Part II](#)

[Lecture 35 - Technology-based approaches to health behavior change](#)

[Lecture 36 - Evaluation of Theory-based HPE Interventions - Part I](#)

[Lecture 37 - Evaluation of Theory-based HPE Interventions - Part II](#)

[Lecture 38 - Analyzing Health Behavior Change Data](#)

[Lecture 39 - RE-AIM Framework for Health Promotion Program Evaluation](#)

[Lecture 40 - Health Impact Assessment](#)

Lecture 1 - Introduction to Neuroanatomy

Lecture 2 - Cerebellum

Lecture 3 - Basal Ganglia

Lecture 4 - Thalamus and Hypothalamus

Lecture 5 - Cerebral Cortex

Lecture 6 - Synapse and Neurotransmitters - 1

Lecture 7 - Synapse and Neurotransmitters - 2

Lecture 8 - Limbic System

Lecture 9 - Physiology of Emotions

Lecture 10 - Reticular Formation

Lecture 11 - Electrical activity of brain

Lecture 12 - Descriptive Psychopathology

Lecture 13 - Principles of Personality Development

Lecture 14 - Schizophrenia

Lecture 15 - Mood Disorders - 1

Lecture 16 - Mood Disorders - 2

Lecture 17 - Anxiety Disorders - I

Lecture 18 - Anxiety Disorders - II

Lecture 19 - Eating Disorders

Lecture 20 - Physiology of sleep

Lecture 21 - Sleep Disorders

Lecture 22 - Learning and Memory - 1

Lecture 23 - Learning and Memory - 2

Lecture 24 - Neurocognitive Disorders - I

Lecture 25 - Neurocognitive Disorders - II

Lecture 26 - Substance - I

Lecture 27 - Substance - II

Lecture 28 - Physiology of sensations

Lecture 29 - Psychosomatic Illness

Lecture 30 - Emergency Psychiatry

Lecture 31 - Child Psychiatry - I

[Lecture 32 - Child Psychiatry - II](#)

[Lecture 33 - Psychotherapy - I](#)

[Lecture 34 - Psychotherapy - II](#)

[Lecture 35 - Psychological Tests](#)

[Lecture 36 - Anti-psychotic drugs](#)

[Lecture 37 - Antidepressants](#)

[Lecture 38 - Mood Stabilizer](#)

[Lecture 39 - Anti-anxiety drugs](#)

[Lecture 40 - Forensic Psychiatry](#)

Lecture 1 - Introduction to Reliability Engineering

Lecture 2 - Introduction to Reliability Engineering

Lecture 3 - Introduction to Reliability Engineering

Lecture 4 - Probability Basics

Lecture 5 - Probability Basics (Continued...)

Lecture 6 - Constant Failure Rate Model - I

Lecture 7 - Constant Failure Rate Model - II

Lecture 8 - Constant Failure Rate Model - III

Lecture 9 - Two Parameter Exponential Distribution

Lecture 10 - Weibull Distribution (2 Parmeter)

Lecture 11 - Burn-in Screening for Weibull

Lecture 12 - Weibull Distribution

Lecture 13 - Normal Distribution

Lecture 14 - Lognormal Distribution

Lecture 15 - System Reliability Modelling

Lecture 16 - System Reliability Modelling (Continued...)

Lecture 17 - System Reliability Modelling (Continued...)

Lecture 18 - System Reliability Modelling (Continued...)

Lecture 19 - System Reliability Modelling (Continued...)

Lecture 20 - System Reliability Modelling (Continued...)

Lecture 21 - Markov Analysis

Lecture 22 - Markov Analysis (Continued...)

Lecture 23 - Markov Analysis (Continued...)

Lecture 24 - Markov Analysis (Continued...)

Lecture 25 - Markov Analysis (Continued...)

Lecture 26 - Failure Data Analysis: Non-Parametric Approach

Lecture 27 - Failure Data Analysis: Non-Parametric Approach (Continued...)

Lecture 28 - Failure Data Analysis: Non-Parametric Approach (Continued...)

Lecture 29 - Failure Data Analysis: Non-Parametric Approach (Continued...)

Lecture 30 - Failure Data Analysis (Parametric)

Lecture 31 - Failure data analysis (Parametric) (Continued...)

[Lecture 32 - Failure data analysis \(Parametric\) \(Continued...\)](#)

[Lecture 33 - Goodness of fit](#)

[Lecture 34 - Goodness of Fit \(GoF\) Tests](#)

[Lecture 35 - Goodness of Fit \(GoF\) Tests \(Continued...\)](#)

[Lecture 36 - Maintainability and Availability](#)

[Lecture 37 - Maintainability and Availability \(Continued...\)](#)

[Lecture 38 - Maintainability and Availability \(Continued...\)](#)

[Lecture 39 - Maintainability and Availability \(Continued...\)](#)

[Lecture 40 - Summary of the course Introduction to Reliability Engineering](#)

Lecture 1 - Introduction

Lecture 2 - Biosensors and its Application

Lecture 3 - Translational Research and Nano Biosensing

Lecture 4 - Nanomaterials for Healthcare Biosensing

Lecture 5 - Signal Amplification for Ultrasensitive Biosensors

Lecture 6 - Signal Amplification for Ultrasensitive Biosensors (Continued...)

Lecture 7 - Signal Amplification for Ultrasensitive Biosensors (Continued...)

Lecture 8 - Signal Amplification for Ultrasensitive Biosensors (Continued...)

Lecture 9 - Different Measurement Techniques for Electrochemical Biosensors

Lecture 10 - Limit of Detection and Wash-Free Detection for Biosensors

Lecture 11 - Wash-Free Detection for Biosensors (Continued...)

Lecture 12 - Label-Free Detection for Biosensors

Lecture 13 - Label-free detection and Multiplex Biosensors

Lecture 14 - Multiplex Biosensors (Continued...)

Lecture 15 - Strategy for Electrochemical Detection and Tuning of Electrocatalytic Activities

Lecture 16 - Enhanced electrocatalytic activity for biosensors

Lecture 17 - Strategy for Electrochemical Detection and Tuning of Electrocatalytic Activities

Lecture 18 - Strategy for Electrochemical Detection and Tuning of Electrocatalytic Activities

Lecture 19 - Strategy for Electrochemical Detection and Tuning of Electrocatalytic Activities

Lecture 20 - Strategy for Electrochemical Detection and Tuning of Electrocatalytic Activities

Lecture 21 - Strategy for Electrochemical Detection and Tuning of Electrocatalytic Activities

Lecture 22 - Strategy for Electrochemical Detection and Tuning of Electrocatalytic Activities

Lecture 23 - Effect of pretreatment on PCB and biosensor development

Lecture 24 - Impact of surface Roughness of PCB and PCB for Glucose sensors

Lecture 25 - Tutorial on Biosensors Fabrication

Lecture 26 - Tutorial on Biosensors Fabrication (Continued...)

Lecture 27 - Tutorial on Biosensors Fabrication (Continued...)

Lecture 28 - Tutorial on Biosensors Fabrication (Continued...)

Lecture 29 - Tutorial on Biosensors Fabrication (Continued...)

Lecture 30 - Tutorial on Biosensors Fabrication (Continued...)

Lecture 31 - Self-Powered Biosensors

[Lecture 32 - Biosensors for Safety and Security](#)

[Lecture 33 - Research Proposal and Ethical Clearance](#)

[Lecture 34 - Special Chemistry for Biosensing](#)

[Lecture 35 - Tutorial - 2](#)

[Lecture 36 - Tutorial - 3](#)

[Lecture 37 - Tutorial - 4](#)

[Lecture 38 - Lab Demonstration - 1](#)

[Lecture 39 - Lab Demonstration - 2](#)

[Lecture 40 - Lab Demonstration - 3](#)

- Lecture 1 - Adolescent Health Statistics
- Lecture 2 - Introduction to Nutrition and Dietetics
- Lecture 3 - Role of Macronutrients
- Lecture 4 - Role of Micronutrients
- Lecture 5 - Basics of Adolescent Mental Health
- Lecture 6 - Physiological and Psychological changes during Adolescence
- Lecture 7 - Special Nutritional Requirements in Adolescents
- Lecture 8 - Malnutrition in Adolescents and their effects in Adult life
- Lecture 9 - Adolescent Immunization
- Lecture 10 - High risk behaviour in Adolescents
- Lecture 11 - Nutrition Care Process
- Lecture 12 - Dietary Counseling and Nutrition Planning
- Lecture 13 - Common Micronutrient Deficiency in Adolescents
- Lecture 14 - Eating Disorders in Adolescents
- Lecture 15 - National Initiatives related to Adolescents
- Lecture 16 - Behavior Modification for Weight Management
- Lecture 17 - Adolescents And Physical Activity
- Lecture 18 - Combating Special Situations
- Lecture 19 - Legislations for Adolescents
- Lecture 20 - Innovations for Holistic Well-being of Adolescents

- Lecture 1 - Basics of Health Promotion
- Lecture 2 - Basic Principles of Health Promotion
- Lecture 3 - The Health Promotion Research Process
- Lecture 4 - Process of Health Promotion Research: Integrity and Rigor
- Lecture 5 - Ethics in Health Promotion Research
- Lecture 6 - Health Behavior and Health Behavior Change
- Lecture 7 - Theory, Research and Behavior Change Techniques
- Lecture 8 - Intervention Mapping
- Lecture 9 - Ecological Models of Health Behavior
- Lecture 10 - Social Science Techniques
- Lecture 11 - Precede-Proceed Model
- Lecture 12 - Models of Individual Health Behavior - I
- Lecture 13 - Models of Individual Health Behavior - II
- Lecture 14 - Models of Interpersonal Health Behavior
- Lecture 15 - Community and Group Models of Health Behavior Change
- Lecture 16 - Research design and techniques
- Lecture 17 - Observational research designs
- Lecture 18 - Experimental Research Designs
- Lecture 19 - Experimental Research Designs: Issues and Challenges
- Lecture 20 - Measurements in Health promotion
- Lecture 21 - Qualitative methods in Health Promotion - Part I
- Lecture 22 - Qualitative Methods in Health Promotion - Part II
- Lecture 23 - Qualitative Methods in Health Promotion - Part III
- Lecture 24 - Qualitative Methods in Health Promotion - Part IV
- Lecture 25 - Qualitative Methods in Health Promotion - Part V
- Lecture 26 - Introduction to Mixed Methods Research
- Lecture 27 - The Convergent Design
- Lecture 28 - The Explanatory Sequential Design
- Lecture 29 - The Exploratory Sequential Design (Continued...)
- Lecture 30 - The Embedded Design
- Lecture 31 - Different study tools and their application in health promotion research

- Lecture 32 - Formulating an appropriate study tool (Quantitative data collection tools)
- Lecture 33 - Validity and reliability of study tools in quantitative research - Part I
- Lecture 34 - Validity and reliability of study tools in quantitative research - Part II
- Lecture 35 - Formulating an appropriate study tool(Qualitative data collection tools)
- Lecture 36 - Designing messages - Part I
- Lecture 37 - Designing messages - Part II
- Lecture 38 - Materials and Methods of Intervention Delivery - Part I
- Lecture 39 - Materials and Methods of Intervention Delivery - Part II
- Lecture 40 - Pretesting of an intervention tool
- Lecture 41 - BCC and SBCC - Part I
- Lecture 42 - BCC and SBCC - Part II
- Lecture 43 - BCC and SBCC - Part III
- Lecture 44 - BCC and SBCC - Part IV
- Lecture 45 - BCC and SBCC - Part V
- Lecture 46 - Community-Based Participatory Research in context to Health Promotion - Part I
- Lecture 47 - Community-Based Participatory Research in context to Health Promotion - Part II
- Lecture 48 - Community-Based Participatory Research in context to Health Promotion - Part III
- Lecture 49 - Community-Based Participatory Research in context to Health Promotion - Part IV
- Lecture 50 - Community-Based Participatory Research in context to Health Promotion - Part V
- Lecture 51 - Quantitative analytical methods - Part I
- Lecture 52 - Quantitative analytical methods - Part II
- Lecture 53 - Quantitative analytical methods - Part III
- Lecture 54 - Analysis of Qualitative data
- Lecture 55 - Analyzing Mixed Methods data
- Lecture 56 - Developing a research proposal in health promotion
- Lecture 57 - Report writing in health Promotion: An Overview
- Lecture 58 - Report writing: quantitative research in health promotion - Part I
- Lecture 59 - Report writing: quantitative research in health promotion - Part II
- Lecture 60 - Report Writing: Qualitative and Mixed Methods research

Lecture 1 - Introduction

Lecture 2 - Urban Heritage - Global Conventions and Declarations

Lecture 3 - Historical Urban Landscape (HUL) - Approach, Toolkit, and Actions

Lecture 4 - Urban Heritage - The Indian Context

Lecture 5 - SDG(s) 11(.4) - Transdisciplinary Possibilities, Pathways, and Actions

Lecture 6 - Historicizing lakes of Bangalore - social-ecological perspectives

Lecture 7 - Urban environmentalisms - lake-based and rights-based

Lecture 8 - Example 1: The Jakkur Lake

Lecture 9 - Example 2: The Puttenahalli Lake

Lecture 10 - Example 3: The Kaikondrahalli Lake

Lecture 11 - Kolkata's heritage - Applying the urban ecological heritage lens

Lecture 12 - Kolkata and EKW - conveying the co-evolutionary narrative

Lecture 13 - Living Systems infrastructure of Kolkata

Lecture 14 - Case study 1: The Nalban and Goltala Fisheries

Lecture 15 - Case study 2: Baro Chaynavi Cooperative

Lecture 16 - Case study 3: Jhagrashisha

Lecture 17 - EKW as heritage - Lessons from a Practical Empirical Implementation Project - I

Lecture 18 - EKW as heritage - Lessons from a Practical Empirical Implementation Project - I

Lecture 19 - Conclusions

Lecture 1 - Introduction

Lecture 2 - Experiment 1: Teaching of Serial Manipulator

Lecture 3 - Experimentation I

Lecture 4 - Experiment 1: Teaching of Serial Manipulator (Continued...)

Lecture 5 - Experiment 2: Control of Tracked Mobile Manipulator

Lecture 6 - Experimentation II

Lecture 7 - Experiment 2: Control of Tracked Mobile Manipulator (Continued...)

Lecture 8 - Experiment 3: Path and Gait Planning of Six-legged Robot

Lecture 9 - Experimentation III

Lecture 10 - Experiment 3: Path and Gait Planning of Six-legged Robot (Continued...)

Lecture 11 - Experiment 4: Navigation of Drone

Lecture 12 - Experimentation IV

Lecture 13 - Experimentation IV (Continued...)

Lecture 14 - Experiment 5: Path and Gait Planning of 25 dof NAO Humanoid Robot

Lecture 15 - Experimentation V

Lecture 16 - Experiment 5: Path and Gait Planning of 25 dof NAO Humanoid Robot (Continued...)

Lecture 17 - Current Trends in Robotics Research

Lecture 18 - Summary of the Course

- Lecture 1 - Interface between Medical Profession and Law
- Lecture 2 - Role of Medical practitioners in Justice Administration
- Lecture 3 - Dos and Don'ts of Doctors
- Lecture 4 - Dos and Don'ts for Legal Practitioners
- Lecture 5 - Knowledge exchange between Medical and Legal Practitioners
- Lecture 6 - Consent in Law
- Lecture 7 - Types of Consent in Medical Field
- Lecture 8 - Ethics in Medical Profession
- Lecture 9 - Importance of Documentation in Medical practice
- Lecture 10 - Legal Implications of Improper Documentation
- Lecture 11 - Legal Responsibilities of Medical Practitioners
- Lecture 12 - Medical Negligence and Legal Implications
- Lecture 13 - Legal Implications of Medical Malpractice
- Lecture 14 - Landmark Judgments on Medical Negligence
- Lecture 15 - Testimony of Doctors in Medical Negligence
- Lecture 16 - Healthcare Policy and Law
- Lecture 17 - Clinical Establishment Law
- Lecture 18 - Legal liability of Hospitals/Clinical Establishments
- Lecture 19 - Legal responsibility in Diagnostics
- Lecture 20 - Penalties for non-compliance
- Lecture 21 - Role of IPR in promoting medical innovation and technologies
- Lecture 22 - Health Policy formulation and Role of IPR
- Lecture 23 - Intellectual Property and Access to Medicine
- Lecture 24 - Neglected diseases and Role of IPR
- Lecture 25 - Patenting Therapeutic Practices and Techniques
- Lecture 26 - Duties of Doctor in Courts
- Lecture 27 - Evidence Law and Medical experts
- Lecture 28 - Admissibility of Forensic Evidence
- Lecture 29 - Various Legal procedures in Medical practice
- Lecture 30 - Collection, preservation and dispatch of Forensic Evidence
- Lecture 31 - Ethical insight into different aspects of Surrogacy practice

[Lecture 32 - Surrogacy Regulation in India](#)

[Lecture 33 - Assisted Reproductive Technology Regulation in India](#)

[Lecture 34 - Pre-Conception and Pre-Natal Diagnostic](#)

[Lecture 35 - Penalties for non-compliance](#)

[Lecture 36 - Ethical Issues in Organ Transplantation](#)

[Lecture 37 - Law governing organ transplantation](#)

[Lecture 38 - Comparative Law on Organ Transplantation](#)

[Lecture 39 - Medico-Legal Issues in Clinical Trials](#)

[Lecture 40 - Regulatory Law for Clinical Trials in India](#)

- Lecture 1 - Overview of Obstetrics
- Lecture 2 - Anatomy of Vulva or pudendum
- Lecture 3 - Anatomy of Vagina
- Lecture 4 - Anatomy of Cervix and Uterus
- Lecture 5 - Anatomy of Uterus
- Lecture 6 - Anatomy of fallopian tubes and ovary
- Lecture 7 - Anatomy of plvic floor and perineum
- Lecture 8 - Gametogenesis
- Lecture 9 - Fertilisation and Embryogenesis
- Lecture 10 - Implantation
- Lecture 11 - Placentation (normal and abnormal)
- Lecture 12 - Placentation (normal and abnormal) (Continued...)
- Lecture 13 - Umbilical cord and Fetal membranes - Part 1
- Lecture 14 - Umbilical cord and Fetal membranes - Part 2
- Lecture 15 - FETUS (physiology and circulation)
- Lecture 16 - Physiological changes in pregnancy - Part 1
- Lecture 17 - Physiological changes in pregnancy - Part 2
- Lecture 18 - Physiological changes in pregnancy - Part 3
- Lecture 19 - Hormones in pregnancy
- Lecture 20 - Hormones in pregnancy (Continued...)
- Lecture 21 - Diagnosis of pregnancy - 1
- Lecture 22 - Diagnosis of Pregnancy - 2
- Lecture 23 - Obstetrical Examination
- Lecture 24 - Obstetrical Examinationon antenatal mother (Clinical Study)
- Lecture 25 - Maternal Pelvis \$ Foetal Skill - Part 1
- Lecture 26 - Fetal Skull
- Lecture 27 - Pre-conceptional counselling and care
- Lecture 28 - Nutrition in Pregnancy
- Lecture 29 - Antenatal Care - Part 1
- Lecture 30 - Antenatal Care - Part 2
- Lecture 31 - Antenatal Care - Part 3

- Lecture 32 - Antenatal Assessment of Fetal Well-Being - Part 1
- Lecture 33 - Antenatal Assessment of Fetal Well-Being - Part 2
- Lecture 34 - Antenatal Assessment of Fetal Well-Being - Part 3
- Lecture 35 - Prenatal Screening and Diagnosis of aneuploidies
- Lecture 36 - Invasive and non-invasive Prenatal Diagnostic Test
- Lecture 37 - Invasive and non-invasive Prenatal Diagnostic Test (Continued...)
- Lecture 38 - Fetal Imaging and Amniotic Fluid Study
- Lecture 39 - Fetal Imaging and Amniotic Fluid Study
- Lecture 40 - Teratology, Teratogens and fetotoxic agents - Part 1
- Lecture 41 - Teratology, Teratogens and fetotoxic agents - Part 2
- Lecture 42 - Normal Labour - Stages and cause of onset
- Lecture 43 - Physiology of Labor
- Lecture 44 - Events of Normal Labour
- Lecture 45 - Mechanism of Normal Labour
- Lecture 46 - Mechanism of Normal Labour (Continued...)
- Lecture 47 - Clinical course of Labour
- Lecture 48 - Monitoring of Normal Labour - Part 1
- Lecture 49 - Monitoring of Normal Labour - Part 2
- Lecture 50 - Labour Analgesia
- Lecture 51 - Labour Analgesia (Continued...)
- Lecture 52 - Abnormal Labour
- Lecture 53 - Intrapartum Fetal Monitoring - Partogram
- Lecture 54 - Intrapartum Fetal Monitoring - Cardiotocography (CTG)
- Lecture 55 - Intrapartum Fetal Monitoring - Cardiotocography (CTG) (Continued...)
- Lecture 56 - Induction and Augmentation of Labour
- Lecture 57 - WHO Labour Guide
- Lecture 58 - Episiotomy
- Lecture 59 - Instrumental Vaginal Delivery
- Lecture 60 - Obstetric anal sphincter injuries OASIS
- Lecture 61 - Lower Segment Caesarean Section
- Lecture 62 - Normal Puerperal changes
- Lecture 63 - Management of Puerperium
- Lecture 64 - Post-Natal care and postpartum contraception

[Lecture 65 - Maternal Health Indicators and demographic scenario](#)

[Lecture 66 - Government health programmes related to Maternal Health](#)

[Lecture 67 - Government health programmes related to Maternal Health \(Continued...\)](#)

[Lecture 68 - Comprehensive Abortion Care \(MTP Amendment Act 2021\)](#)

- Lecture 1 - Recommender system and its business value
- Lecture 2 - Types of recommender system - I
- Lecture 3 - Types of recommender system - II
- Lecture 4 - Data Collection
- Lecture 5 - Data Description
- Lecture 6 - Data preprocessing
- Lecture 7 - Dimensionality Reduction
- Lecture 8 - Introduction to machine learning - I
- Lecture 9 - Introduction to machine learning - II
- Lecture 10 - Introduction to machine learning - III
- Lecture 11 - Distance and Similarity
- Lecture 12 - Distance and Similarity (Continued...)
- Lecture 13 - User-Based Approach
- Lecture 14 - Item-Based Approach
- Lecture 15 - Additional Topics in Neighbourhood Based Approach
- Lecture 16 - Association rule based model
- Lecture 17 - UV Decomposition
- Lecture 18 - The latent factor model
- Lecture 19 - Basic latent factor models
- Lecture 20 - Other advanced models
- Lecture 21 - Introduction to content based recommender system: Foundations
- Lecture 22 - Feature Engineering - I
- Lecture 23 - Feature Engineering - II
- Lecture 24 - Feature Engineering - III
- Lecture 25 - Feature Engineering - IV
- Lecture 26 - Decision Trees for content based recommendation
- Lecture 27 - Naïve Bayes classifier for content based recommendation
- Lecture 28 - kNN Classifier for Recommender System
- Lecture 29 - Rule based classification
- Lecture 30 - Regression methods and conclusions
- Lecture 31 - Introduction to evaluation of recommender system

[Lecture 32 - Resampling methods](#)

[Lecture 33 - Evaluation metrics for accuracy](#)

[Lecture 34 - Drawing reliable conclusions - I](#)

[Lecture 35 - Drawing reliable conclusions - II](#)

[Lecture 36 - Hybrid recommender systems](#)

[Lecture 37 - Knowledge based recommender systems](#)

[Lecture 38 - Context-Sensitive recommender systems](#)

[Lecture 39 - Structural Recommendations in Networks](#)

[Lecture 40 - Trust aware recommender systems](#)

Lecture 1 - Foundation of Molecular Biology

Lecture 2 - DNA Replication and Repair Mechanism

Lecture 3 - Transcription (RNA Synthesis)

Lecture 4 - Protein Synthesis (Translation)

Lecture 5 - Nucleic Acid Isolation and Detection Methods

Lecture 6 - PCR (Polymerase Chain Reaction) Fundamentals

Lecture 7 - Realtime PCR - Part 1

Lecture 8 - Realtime PCR - Part 2

Lecture 9 - Variations of the PCR - Part 1

Lecture 10 - Variations of the PCR - Part 2

Lecture 11 - DNA Cloning and Recombinant DNA technology - I

Lecture 12 - DNA Cloning and Recombinant DNA technology - II

Lecture 13 - DNA Cloning and Recombinant DNA technology - III

Lecture 14 - Genome Editing Technologies - I

Lecture 15 - Genome Editing Technologies - II

Lecture 16 - DNA Microarray

Lecture 17 - FISH (Fluorescence in situ Hybridization)

Lecture 18 - Methods to study DNA-protein interaction - I

Lecture 19 - Methods to study DNA-protein interaction - II

Lecture 20 - Epigenetics and DNA methylation analysis

Lecture 21 - DNA Sequencing - Part 1 - Maxam Gilbert Sequencing

Lecture 22 - DNA Sequencing - Part 2 - Sanger Sequencing

Lecture 23 - Next Generation Sequencing - Part 1

Lecture 24 - Next Generation Sequencing - Part 2

Lecture 25 - Next Generation Sequencing - Part 3

Lecture 26 - Overview, Importance, Methods in Proteomics

Lecture 27 - Proteomic Techniques - High performance liquid chromatography (HPLC)

Lecture 28 - Proteomic Techniques - Mass Spectrometry

Lecture 29 - Proteomic Techniques - Differential in-gel electrophoresis

Lecture 30 - Proteomic Techniques - Protein Microarray

Lecture 31 - Label-based Protein Quantification Technologies - Part 1

Lecture 32 - Label-based Protein Quantification Technologies - Part 2

Lecture 33 - Label free methods of protein quantification

Lecture 34 - Next Generation Proteomics

Lecture 35 - Proteomic Data Analysis and Bioinformatic Tools

Lecture 36 - Syndromic Panels and Multiplex Assay : Molecular identification of Microorganism

Lecture 37 - Molecular Diagnostics in Antimicrobial Resistance Testing

Lecture 38 - RNA Sequencing: Role in Infectious diseases - I

Lecture 39 - RNA Sequencing: Role in Infectious diseases - II

Lecture 40 - Point of Care (POC) diagnostics in Infectious diseases

Lecture 41 - Molecular genetics in tumorigenesis

Lecture 42 - Liquid biopsies in cancer detection

Lecture 43 - Digital PCR in Cancer detection

Lecture 44 - Mutation Detection Methods

Lecture 45 - Isothermal Nucleic Acid Amplification

Lecture 46 - Genetic Testing and Inherited Disorders - Part 1

Lecture 47 - Genetic Testing and Inherited Disorders - Part 2

Lecture 48 - Prenatal diagnostics and NIPT

Lecture 49 - Reproductive genetics and genetic counselling

Lecture 50 - Genetic counselling and patient education

Lecture 51 - Serial Analysis of Gene Expression

Lecture 52 - Metabolomics in Molecular Diagnostics

Lecture 53 - Immunoassay and Luminex Multiplex Assay

Lecture 54 - Molecular diagnostics in Metabolic, Cardiovascular and Gastrointestinal disorders

Lecture 55 - Molecular diagnostics in Endocrine, Neurodegenerative and Transplantation disorders

Lecture 56 - Pharmacogenomics and Personalized Medicine

Lecture 57 - Quality control (QC) in molecular diagnostics

Lecture 58 - Ethical concerns in molecular diagnostics

Lecture 59 - Artificial Intelligence and Machine learning in Genomics

Lecture 60 - Integration of Multiomics Data in Molecular Diagnostics

Lecture 1 - General Introduction

Lecture 2 - Thin Film Materials and Components

Lecture 3 - Semiconductor Films and Heterostructures

Lecture 4 - Chemical Methods

Lecture 5 - Physical Vapor Deposition (PVD) : Thermal Evaporation

Lecture 6 - Thermal Evaporation

Lecture 7 - Sources of Thermal Evaporation

Lecture 8 - Evaporation of Elements and Compounds

Lecture 9 - Compound Evaporation and Thickness Uniformity

Lecture 10 - Film Thickness Monitoring and Control

Lecture 11 - Pulsed Laser Deposition

Lecture 12 - Sputtering Process and Mechanism

Lecture 13 - Plasma Discharge and DC Sputtering

Lecture 14 - RF Sputtering Process

Lecture 15 - Magnetron Sputtering

Lecture 16 - Sputtering of Binary Alloys and Compounds

Lecture 17 - Ion Beam and Hybrid Deposition

Lecture 18 - Introduction to CVD Process

Lecture 19 - Thermal CVD Process

Lecture 20 - Gas Transport and Growth Kinetics

Lecture 21 - CVD Processes and Systems

Lecture 22 - Plasma Enhanced CVD (PECVD)

Lecture 23 - Liquid Phase Epitaxy

Lecture 24 - Vapor Phase Epitaxy - Compound Semiconductors

Lecture 25 - Metal-Organic CVD (MOCVD)

Lecture 26 - Introduction and Film Purity

Lecture 27 - MBE System and Growth Mechanism

Lecture 28 - Effusion Source and Growth Rate

Lecture 29 - Insitu Growth Monitoring - RHEED Oscillation

Lecture 30 - Atomic Layer Deposition / Atomic Layer Epitaxy

Lecture 31 - Thin Film Growth Modes

- Lecture 32 - Homogeneous Nucleation
- Lecture 33 - Heterogenous Nucleation
- Lecture 34 - Stranski-Krastanov (2D-3D) Growth Mode
- Lecture 35 - SiGe Strained Layer Epitaxy (2D) and Ge Islands (3D)
- Lecture 36 - Thickness Measurement
- Lecture 37 - Thickness Measurement - Interference Method
- Lecture 38 - Thickness and Optical Constants - Ellipsometry
- Lecture 39 - Mechanical Properties - Film Porosity and Adhesion
- Lecture 40 - Mechanical Properties - Residual Stress
- Lecture 41 - Electron Beam Techniques - SEM
- Lecture 42 - Scanning Electron Microscopy
- Lecture 43 - Microprobe and Transmission Electron Microscopy
- Lecture 44 - Transmission Electron Microscopy
- Lecture 45 - Scanning Probe Microscopy
- Lecture 46 - X-ray Photoelectron Spectroscopy
- Lecture 47 - Auger Electron Spectroscopy
- Lecture 48 - Secondary Ion Mass Spectrometry (SIMS)
- Lecture 49 - Different SIMS Techniques and Depth Profile Analysis
- Lecture 50 - Rutherford Backscattering Spectrometry (RBS)
- Lecture 51 - Basic Device Fabrication Techniques
- Lecture 52 - Metal-Oxide-Semiconductor (MOS) Capacitor
- Lecture 53 - n-MOSFET and CMOS FET Devices
- Lecture 54 - Scaled Si MOSFET Devices
- Lecture 55 - Heterostructure FET and Bipolar Transistors
- Lecture 56 - Optoelectronic Materials and Devices
- Lecture 57 - Light Emitting Devices
- Lecture 58 - Photodetector Devices
- Lecture 59 - Photovoltaic Devices
- Lecture 60 - Nanotechnology and Photonic Devices

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NPTEL : NOC:An Integrated Approach to Common Childhood Diseases and Developmental Disorders in India (Multi-Disciplinary)

Co-ordinators : Prof. Nabarun Karmakar, Prof. Soumi Kundu, Prof. Parama Banerjee

- Lecture 1 - Neonatal screening in India - Clinical Aspect
- Lecture 2 - Neonatal Screening - Biochemical Aspect - Part I
- Lecture 3 - Neonatal Screening - Biochemical Aspect - Part II
- Lecture 4 - Neonatal Screening - Biochemical Aspect - Part III
- Lecture 5 - India Newborn Action Plan (INAP)
- Lecture 6 - Congenital Adrenal Hyperplasia - Biochemical Aspect
- Lecture 7 - Congenital Adrenal Hyperplasia
- Lecture 8 - Congenital and Acquired hypothyroidism
- Lecture 9 - National Program for Hemoglobinopathies
- Lecture 10 - Common Genetic Disorders in children
- Lecture 11 - Congenital Hearing Disorders
- Lecture 12 - Congenital Ophthalmological Disorders
- Lecture 13 - Congenital Orthopedic Disorders
- Lecture 14 - Congenital Structural Disorders
- Lecture 15 - Malnutrition in Indian Children
- Lecture 16 - Clinical features and management of Protein Energy Malnutrition
- Lecture 17 - Medico-Social aspects and Prevention of Malnutrition in India
- Lecture 18 - Integrated Child Developmental Services (ICDS)
- Lecture 19 - Community Nutrition Programs
- Lecture 20 - Vitamin A
- Lecture 21 - Vitamin A disorders in Children
- Lecture 22 - Vitamin B 1, 2, 3
- Lecture 23 - Vitamin B 6, 9
- Lecture 24 - Vitamin B 9, 12
- Lecture 25 - Vitamin C
- Lecture 26 - Vitamin B and C disorders in Children
- Lecture 27 - Vitamin D
- Lecture 28 - Vitamin D disorders in Children
- Lecture 29 - Iodine
- Lecture 30 - National program for Vitamin A and Iodine deficiency disorders

[Lecture 31 - Iron](#)

[Lecture 32 - Iron \(Anaemia\)](#)

[Lecture 33 - Anemia in Children - Part I](#)

[Lecture 34 - Anemia in Children - Part II](#)

[Lecture 35 - Anemia Mukht Bharat](#)

[Lecture 36 - Universal Immunization Program and Mission Indradhanush](#)

[Lecture 37 - Vaccine preventable disease - Part I](#)

[Lecture 38 - Vaccine preventable disease - Part II](#)

[Lecture 39 - Vaccine preventable disease - Part III](#)

[Lecture 40 - IAP immunization schedule and VPD surveillance](#)

[Lecture 41 - NVBDCP - Part I](#)

[Lecture 42 - NVBDCP - Part II](#)

[Lecture 43 - NVBDCP - Part III \(Program aspect\)](#)

[Lecture 44 - National program for TB and Leprosy](#)

[Lecture 45 - National program for AIDS and Hepatitis](#)

[Lecture 46 - Pneumonia](#)

[Lecture 47 - Diarrhea](#)

[Lecture 48 - IMNCI - Part I](#)

[Lecture 49 - IMNCI - Part II](#)

[Lecture 50 - RMNCH+A](#)

[Lecture 51 - Common Congenital Heart Diseases](#)

[Lecture 52 - Rheumatic Heart Disease](#)

[Lecture 53 - Childhood Asthma](#)

[Lecture 54 - Seizures in Childhood](#)

[Lecture 55 - Nephrotic syndrome](#)

[Lecture 56 - Developmental Delay and Cerebral Palsy](#)

[Lecture 57 - Common behavioral and psychiatric Disorders in Childhood - Part I](#)

[Lecture 58 - Common behavioral and psychiatric Disorders in Childhood - Part II](#)

[Lecture 59 - Learning and Developmental Disorders in Children](#)

[Lecture 60 - School Health Programme and Rashtriya Bal Swasthya Karyakram \(RBSK\)](#)

Lecture 0 - Neuroscience of Human Movement

Lecture 1 - Membrane Physiology - Part 1

Lecture 2 - Membrane Physiology - Part 2

Lecture 3 - Nernst Equation

Lecture 4 - Goldman Equation

Lecture 5 - Action Potential - Part 1

Lecture 6 - Action Potential - Part 2

Lecture 7 - Action Potential - Part 3

Lecture 8 - Action Potential - Part 4

Lecture 9 - Action Potential - Part 5

Lecture 10 - Review of Action Potential and Neurotransmitters

Lecture 11 - Neuromuscular Junction

Lecture 12 - Disorders of Neuromuscular Junction

Lecture 13 - Skeletal Muscles - Part 1

Lecture 14 - Skeletal Muscles - Part 2

Lecture 15 - Skeletal Muscles - Part 3

Lecture 16 - Skeletal Muscles - Part 4

Lecture 17 - Muscle force production

Lecture 18 - Motor Units - Part 1

Lecture 19 - Motor Units - Part 2

Lecture 20 - Motor Units - PIC and EMG

Lecture 21 - Receptors - Part 1

Lecture 22 - Receptors - Part 2

Lecture 23 - Spine and Spinal Cord

Lecture 24 - Excitation and Inhibition within Spinal Cord - Part 1

Lecture 25 - Excitation and Inhibition within Spinal Cord - Part 2

Lecture 26 - Monosynaptic Reflexes - Part 1

Lecture 27 - Monosynaptic Reflexes - Part 2

Lecture 28 - Monosynaptic Reflexes - Part 3

Lecture 29 - Oligosynaptic and Polysynaptic Reflexes - Part 1

Lecture 30 - Oligosynaptic and Polysynaptic Reflexes - Part 2

[Lecture 31 - Pre-Programmed Reactions - Part 1](#)

[Lecture 32 - Pre-Programmed Reactions - Part 2](#)

[Lecture 33 - Spinal Cord Injuries and Central Pattern Generators](#)

[Lecture 34 - Animal Preparations for Neuroscience Experiments](#)

[Lecture 35 - Overview of motor control system](#)

[Lecture 36 - Terminology : Directional Terms and Planes \(Primary Motor Cortex - Part - 1\)](#)

[Lecture 37 - Primary Motor Cortex - Part 2](#)

[Lecture 38 - Primary Motor Cortex - Part 3](#)

[Lecture 39 - Primary Motor Cortex - Part 4](#)

[Lecture 40 - Primary Motor Cortex - Part 5](#)

[Lecture 41 - Primary Motor Cortex - Part 6](#)

[Lecture 42 - Primary Motor Cortex - Part 7](#)

[Lecture 43 - Primary Motor Cortex - Part 8](#)

[Lecture 44 - Primary Motor Cortex - Part 9](#)

[Lecture 45 - Primary Motor Cortex - Part 10](#)

[Lecture 46 - Primary Motor Cortex - Part 11](#)

[Lecture 47 - Primary Motor Cortex - Part 12](#)

[Lecture 48 - Primary Motor Cortex - Part 13](#)

[Lecture 49 - Primary Motor Cortex - Part 14](#)

[Lecture 50 - Primary Motor Cortex - Part 15](#)

[Lecture 51 - Cerebellum - Part 1](#)

[Lecture 52 - Cerebellum - Part 2](#)

[Lecture 53 - Cerebellum - Part 3](#)

[Lecture 54 - Cerebellum - Part 4](#)

[Lecture 55 - Cerebellum - Part 5](#)

[Lecture 56 - Cerebellum - Part 6](#)

[Lecture 57 - Cerebellum - Part 7](#)

[Lecture 58 - Cerebellum - Part 8](#)

[Lecture 59 - Cerebellum - Part 9](#)

[Lecture 60 - Cerebellum - Part 10](#)

[Lecture 61 - Cerebellum - Part 11](#)

[Lecture 62 - Cerebellum - Part 12](#)

[Lecture 63 - Basal Ganglia - Part 1](#)

[Lecture 64 - Basal Ganglia - Pathways](#)

[Lecture 65 - Basal Ganglia - Inputs](#)

[Lecture 66 - Basal Ganglia - Outputs](#)

[Lecture 67 - Basal Ganglia - Various Functions](#)

[Lecture 68 - Basal Ganglia - Motor Functions](#)

[Lecture 69 - Basal Ganglia - Motor Functions.](#)

[Lecture 70 - Basal Ganglia - Dopamine and Acetylcholine](#)

[Lecture 71 - Basal Ganglia - Disorders](#)

[Lecture 72 - Parkinson's Disease - Intro](#)

[Lecture 73 - Parkinson's Disease - Rate Model, Pathophysiology](#)

[Lecture 74 - Parkinson's Disease - Current therapeutic approaches and the future](#)

[Lecture 75 - Basal Ganglia - Various Disorders](#)

[Lecture 76 - Neuropsychiatric disorders due to BG dysfunction](#)

[Lecture 77 - Parietal and Premotor Cortex - Part 1](#)

[Lecture 78 - Parietal and Premotor Cortex - Part 2](#)

[Lecture 79 - Parietal and Premotor Cortex - Part 3](#)

[Lecture 80 - Parietal and Premotor Cortex - Part 4](#)

[Lecture 81 - Parietal and Premotor Cortex - Part 5](#)

[Lecture 82 - Parietal and Premotor Cortex - Part 6](#)

Lecture 1 - How is TB affecting public health Globally and Nationally

Lecture 2 - Epidemiology of TB-Session - 1

Lecture 3 - Epidemiology of TB-Session - 2

Lecture 4 - Pathogenesis of TB-Session - 1

Lecture 5 - Pathogenesis of TB-Session - 2

Lecture 6 - Clinical manifestations of TB-Session - 1

Lecture 7 - Clinical manifestations of TB-Session - 2

Lecture 8 - Clinical manifestations of TB-Session - 3

Lecture 9 - Bacteriological Diagnosis of Tuberculosis - Smear and Culture

Lecture 10 - Demonstration of processing of sputum specimen for culture for diagnosis of tuberculosis

Lecture 11 - Demonstration of sputum smear examination for diagnosis of tuberculosis

Lecture 12 - Demonstration of solid culture method for diagnosis of tuberculosis

Lecture 13 - Demonstration of liquid culture method for diagnosis of tuberculosis in sputum

Lecture 14 - Phenotypic drug susceptibility testing in Tuberculosis

Lecture 15 - Demonstration of drug susceptibility testing of first line anti-TB drugs by liquid culture

Lecture 16 - Molecular Diagnosis of Tuberculosis-Session - 1

Lecture 17 - Molecular Diagnosis of Tuberculosis-Session - 2

Lecture 18 - Demonstration of Xpert MTB-RIF assay for diagnosis of tuberculosis from sputum specimens

Lecture 19 - Demonstration of Line Probe Assay (LPA) (Direct detection of tuberculosis and resistance to isoniazid and rifampicin) in sputum

Lecture 20 - Radiology in diagnosis of Tuberculosis-Session - 1

Lecture 21 - Radiology in diagnosis of Tuberculosis-Session - 2

Lecture 22 - Radiology in diagnosis of Tuberculosis-Session - 3

Lecture 23 - Radiology in diagnosis of Tuberculosis-Session - 4

Lecture 24 - Approach to diagnosis of Pulmonary TB

Lecture 25 - Case Discussion-Approach to diagnosis of TB in a person with presumptive pulmonary TB

Lecture 26 - Case Discussion-Approach to diagnosis of pulmonary TB in a patient with negative sputum smear for AFB

Lecture 27 - Approach to diagnosis of Extra-pulmonary TB

Lecture 28 - Case Discussion-Approach to diagnosis of TB in a person with swelling in the neck

Lecture 29 - Case Discussion-Approach to diagnosis of TB spine

Lecture 30 - Diagnosis of Childhood Tuberculosis-Session - 1

Lecture 31 - Diagnosis of Childhood Tuberculosis-Session - 2

Lecture 32 - Video demonstration of gastric fluid aspiration technique in a child

Lecture 33 - Case Discussion-Approach to diagnosis of TB in a child with presumptive pulmonary TB

Lecture 34 - Case Discussion-Approach to diagnosis of TB meningitis in a child

Lecture 35 - Drugs for treating Tuberculosis and Principles of Chemotherapy-Session - 1

Lecture 36 - Drugs for treating Tuberculosis and Principles of Chemotherapy-Session - 2

Lecture 37 - Treatment of Drug Sensitive Pulmonary Tuberculosis

Lecture 38 - Case discussion-Approach to treatment of drug sensitive TB

Lecture 39 - Management of drug resistant Tuberculosis-Session - 1

Lecture 40 - Management of drug resistant Tuberculosis-Session - 2

Lecture 41 - Case discussion-Approach to treatment of Multi-drug resistant TB (MDR-TB)/ Extensively drug resistant TB (XDR-TB)

Lecture 42 - Management of Extra-pulmonary Tuberculosis-Session - 1

Lecture 43 - Management of Extra-pulmonary Tuberculosis-Session - 2

Lecture 44 - Panel discussion-Practical difficulties in the management of Extra-pulmonary TB

Lecture 45 - Management of patients with HIV-TB coinfection-Session - 1

Lecture 46 - Management of patients with HIV-TB coinfection-Session - 2

Lecture 47 - Case discussion-Approach to management of HIV-TB

Lecture 48 - Management of TB in special situations

Lecture 49 - Case discussion-Approach to management of TB in pregnancy

Lecture 50 - Treatment of Pediatric Tuberculosis-Session - 1

Lecture 51 - Treatment of Pediatric Tuberculosis-Session - 2

Lecture 52 - Management of Adverse effects to anti-TB drugs-Session - 1

Lecture 53 - Management of Adverse effects to anti-TB drugs-Session - 2

Lecture 54 - Case discussion-Approach to management of jaundice during anti-TB treatment

Lecture 55 - Case discussion-Approach to management of skin rashes during anti-TB treatment

Lecture 56 - Non-tuberculous Mycobacteria- Diagnosis and Clinical management-Session - 1

Lecture 57 - Non-tuberculous Mycobacteria - Diagnosis and Clinical Management Session - 2

Lecture 58 - Newer Anti-TB drugs and regimens-Session - 1

Lecture 59 - Newer Anti-TB drugs and regimens-Session - 2

Lecture 60 - Management of Latent TB Infection-Session - 1

Lecture 61 - Management of Latent TB Infection-Session - 2

Lecture 62 - Airborne infection control in tuberculosis-Session - 1

Lecture 63 - Airborne infection control in tuberculosis-Session - 2

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[Lecture 64 - Vaccine for Tuberculosis-Session - 1](#)

[Lecture 65 - Vaccine for Tuberculosis-Session - 2](#)

[Lecture 66 - Services offered by Revised National TB Control Programme \(RNTCP\)-Session - 1](#)

[Lecture 67 - Services offered by Revised National TB Control Programme \(RNTCP\)-Session - 2](#)

[Lecture 68 - Services offered by Revised National TB Control Programme \(RNTCP\)-Session - 3](#)

[Lecture 69 - Services offered by Revised National TB Control Programme \(RNTCP\)-Session - 4](#)

[Lecture 70 - Tuberculosis notification-Session - 1](#)

[Lecture 71 - Tuberculosis notification-Session - 2](#)

[Lecture 72 - Addressing Social Barriers in Tuberculosis Control-Session - 1](#)

[Lecture 73 - Addressing Social Barriers in Tuberculosis Control-Session - 2](#)

[Lecture 74 - Standards for TB Care in India-Session - 1](#)

[Lecture 75 - Standards for TB Care in India-Session - 2](#)

[Lecture 76 - Global Tuberculosis Control Strategies](#)

Lecture 1 - Sustainability

Lecture 2 - Dams

Lecture 3 - Dams

Lecture 4 - Adayar River

Lecture 5 - Adayar River

Lecture 6 - Urbanisation in Western Ghats and Biodiesel

Lecture 7 - Use And Throw Plastic

Lecture 8 - Nano Materials Information Technology

Lecture 9 - Definition of Health Risk

Lecture 10 - Transport Of Pollutants in the Environment

Lecture 11 - Assesment of Risk

Lecture 12 - Remediation and Liability

Lecture 13 - Remendiation and Liability

Lecture 14 - Life Cycle Analysis

Lecture 15 - Energy and Environment module - 1

Lecture 16 - Energy and Environment module - 2

Lecture 17 - Energy and Environment module - 3

Lecture 18 - Energy and Environment module - 4

Lecture 19 - Energy and Environment module - 5

Lecture 20 - Energy and Environment module - 6

Lecture 21 - Energy and Environment module - 7

Lecture 22 - Drinking Water Supply: Need and Challenges

Lecture 23 - Drinking Water Supply: Need and Challenges

Lecture 24 - Water Quality Standards And Philosophy of Water Treatment

Lecture 25 - Water Treatment: Point Of Use Filters

Lecture 26 - Wastewater Management in Developing Urban Environments: Indian Scenario

Lecture 27 - Wastewater Recycling: A Sustainable Option For Water Management

Lecture 28 - Sustainable Water Management In Urban Areas - Part 1

Lecture 29 - Sustainable Water Management In Urban Areas - Part 2

Lecture 30 - Ground Water Contamination

Lecture 31 - Groundwater - Sanitation Nexus

[Lecture 32 - Chasing Sustainability - The Challenge - Part 1](#)

[Lecture 33 - Chasing Sustainability - The Challenge - Part 2](#)

[Lecture 34 - Developing Frame Works Of Action: Ethics - Part 1](#)

[Lecture 35 - Developing Frame Works Of Action: Ethics - Part 2](#)

[Lecture 36 - Social And sanitation](#)

[Lecture 37 - Promoting Policies For Eco-Productive Cities in the global House - Part 1](#)

[Lecture 38 - Promoting Policies For Eco-Productive Cities in the global House - Part 2](#)

[Lecture 39 - The need to study ecology](#)

[Lecture 40 - Ecosystem functions and services](#)

[Lecture 41 - What is studied in ecology?](#)

[Lecture 42 - Ecological footprint](#)

[Lecture 43 - Energy and Material flow in ecosystems and ecological efficiency](#)

[Lecture 44 - Energy flow, productivity and Biodiversity](#)

[Lecture 45 - Biodiversity, population and ecological principles](#)

[Lecture 1 - C1 - L00](#)

[Lecture 2 - C1 - Introduction Assorted Interviews](#)

[Lecture 3 - C1 - L01](#)

[Lecture 4 - C1 - L02](#)

[Lecture 5 - C1 - L03](#)

[Lecture 6 - C1 - L04](#)

[Lecture 7 - C1 - L05](#)

[Lecture 8 - C1 - L06](#)

[Lecture 9 - C1 - L07](#)

[Lecture 10 - C1 - L08](#)

[Lecture 11 - C1 - L09](#)

[Lecture 12 - C1 - L10A](#)

[Lecture 13 - C1 - L10B](#)

[Lecture 1 - C2 - Introduction Assorted Interviews](#)

[Lecture 2 - C2 - L00](#)

[Lecture 3 - C2 - L01](#)

[Lecture 4 - C2 - L02](#)

[Lecture 5 - C2 - L03](#)

[Lecture 6 - C2 - L04](#)

[Lecture 7 - C2 - L05](#)

[Lecture 8 - C2 - L06](#)

[Lecture 9 - C2 - L07](#)

[Lecture 10 - C2 - L08](#)

[Lecture 11 - C2 - L09](#)

Lecture 1 - Introduction

Lecture 2 - Overview of Learning Modules

Lecture 3 - Course Plan

Lecture 4 - Tutorial: Excel

Lecture 5 - Errors and Approximations

Lecture 6 - Truncation and Round-Off Errors

Lecture 7 - Binary Numbers: Introduction

Lecture 8 - Floating Point: Real numbers in decimal system

Lecture 9 - Floating Point in Binary system

Lecture 10 - Iterative Method

Lecture 11 - Direct Method

Lecture 12 - Sequential Method

Lecture 13 - Linear Algebra: Basics

Lecture 14 - Introduction to Linear Equations

Lecture 15 - Rank Condition for Solving Linear Equations

Lecture 16 - Motivating Gauss Elimination

Lecture 17 - Gauss Elimination

Lecture 18 - Tutorial Recap: Gauss Elimination

Lecture 19 - Back Substitution to find solution

Lecture 20 - Gauss Jordan and LU Decomposition

Lecture 21 - Partial Pivoting in Gauss Elimination

Lecture 22 - Analysis of Gauss Elimination

Lecture 23 - Tri-Diagonal Systems: Practical Relevance

Lecture 24 - Thomas Algorithm for Tri-Diagonal Systems

Lecture 25 - Gauss Siedel Method

Lecture 26 - Analysis of Gauss Siedel Method

Lecture 27 - Gauss Siedel vs. Jacobi Methods

Lecture 28 - Bonus: Example using MS Excel

Lecture 29 - Summary: Linear Equations

Lecture 30 - Introduction to Nonlinear Equations

Lecture 31 - Bisection Method

- Lecture 32 - Analysis of Bisection Method
- Lecture 33 - Bonus: Excel Solution for Bisection Method
- Lecture 34 - Regula-Falsi Method
- Lecture 35 - Bonus: Excel Solution for Regula-Falsi Method
- Lecture 36 - Regula-Falsi vs. Secant Method
- Lecture 37 - Bonus: Excel Solution for Secant Method
- Lecture 38 - Some special cases
- Lecture 39 - Fixed-Point Iteration
- Lecture 40 - Newton-Raphson Method
- Lecture 41 - Analysis of Fixed-Point Iteration
- Lecture 42 - Analysis of Newton-Raphson
- Lecture 43 - Problems with Newton-Raphson
- Lecture 44 - Multi-Variable Fixed-Point Iteration
- Lecture 45 - Multi-Variable Newton-Raphson
- Lecture 46 - Out of Syllabus: Improvements to NR Methods
- Lecture 47 - Out of Syllabus: Roots of a polynomial
- Lecture 48 - Summary
- Lecture 49 - Introduction: Regression and Interpolation
- Lecture 50 - Linear Regression in One Variable
- Lecture 51 - Recap: Formula for Linear Regression
- Lecture 52 - Bonus: Linear Regression using MS-Excel
- Lecture 53 - Linear Regression in Multiple Variables
- Lecture 54 - Matrix Method for Multi-Linear Regression
- Lecture 55 - Polynomial Regression
- Lecture 56 - Functional Regression
- Lecture 57 - Bonus: X-Y versus Y-X data (Using MS Excel)
- Lecture 58 - Interpolation: Introduction and A Na^{ve} Extension
- Lecture 59 - Bonus: MS-Excel for Na^{ve} Interpolation
- Lecture 60 - Lagrange Interpolating Polynomials
- Lecture 61 - Newton's Forward Difference Polynomial
- Lecture 62 - Newton's Divided Differences: Derivation
- Lecture 63 - Interpolation Examples
- Lecture 64 - Bonus: MS-Excel for Newton's Polynomial

Lecture 65 - Summary: Regression and Interpolation

Lecture 66 - Numerical Differentiation: Introduction

Lecture 67 - Numerical Differentiation Formula and Analysis

Lecture 68 - Derivation using Method of undetermined coefficients

Lecture 69 - Three-point differentiation formulae

Lecture 70 - Bonus: Differentiation using MS-Excel

Lecture 71 - Truncation vs. Round-Off Errors

Lecture 72 - Numerical Differentiation Examples

Lecture 73 - Summary of Numerical Differentiation

Lecture 74 - Numerical Integration: Introduction

Lecture 75 - Trapezoidal rule and Derivation

Lecture 76 - Simpson's Rules for Integration

Lecture 77 - Bonus: MS-Excel for Numerical Integration

Lecture 78 - Error Analysis for Simpson's Rules

Lecture 79 - Numerical Integration Examples

Lecture 80 - Bonus: Integration using MS-Excel

Lecture 81 - Summary of Newton Cotes Formulae

Lecture 82 - Richardson's Extrapolation

Lecture 83 - Gauss Quadrature

Lecture 84 - Summary of Numerical Integration

Lecture 85 - Introduction to ODE-IVP

Lecture 86 - Motivation using an Example (Bonus)

Lecture 87 - Euler's Methods and Second-Order Methods

Lecture 88 - Second-Order Runge-Kutta Methods

Lecture 89 - Summary of RK-2

Lecture 90 - Higher order RK Methods

Lecture 91 - Bonus: ODE-IVP using MS-Excel

Lecture 92 - Bonus: RK-2 and RK-4 Methods using MS-Excel

Lecture 93 - Summary and Recap

Lecture 94 - Introduction to Predictor-Corrector Methods

Lecture 95 - Stability of Implicit Methods: Overview

Lecture 96 - Stability Analysis of Euler's Methods

Lecture 97 - Extension to multiple variables

[Lecture 98 - Local vs. Global Truncation Errors](#)

[Lecture 99 - Richardson's Extrapolation](#)

[Lecture 100 - Stiff System of ODEs: Introduction](#)

[Lecture 101 - Adaptive Step-sizing](#)

[Lecture 102 - Adaptive step-sizing and Embedded Methods](#)

[Lecture 103 - Bonus: Errors and Extrapolation using MS-Excel](#)

[Lecture 104 - Summary and Recap \(Weeks 10 and 11\)](#)

[Lecture 105 - Introduction to ODE-BVP](#)

[Lecture 106 - Shooting Method: An Overview](#)

[Lecture 107 - Finite Difference Method: An Overview](#)

[Lecture 108 - Solution using Shooting Method](#)

[Lecture 109 - Algorithm for Shooting Method](#)

[Lecture 110 - Problems with Shooting Method](#)

[Lecture 111 - Solving ODE-BVP using Finite Difference Method](#)

[Lecture 112 - Microsoft Excel based Solution](#)

[Lecture 113 - Recap of Week-12 \(ODE-BVP\)](#)

- Lecture 1 - Introduction to health research
- Lecture 2 - Formulating research question
- Lecture 3 - Literature review
- Lecture 4 - Measures of disease frequency
- Lecture 5 - Descriptive study designs
- Lecture 6 - Analytical study designs
- Lecture 7 - Experimental study designs: Clinical trials
- Lecture 8 - Validity of epidemiological studies
- Lecture 9 - Qualitative research methods: An overview
- Lecture 10 - Measurement of study variables
- Lecture 11 - Sampling methods
- Lecture 12 - Calculating sample size and power
- Lecture 13 - Selection of study population
- Lecture 14 - Study plan and project management
- Lecture 15 - Designing data collection tools
- Lecture 16 - Principles of data collection
- Lecture 17 - Data management
- Lecture 18 - Overview of data analysis
- Lecture 19 - Ethical framework for health research
- Lecture 20 - Conducting clinical trails
- Lecture 21 - Preparing a concept paper for research projects
- Lecture 22 - Elements of a protocol for research studies

- Lecture 1 - Basic concepts and definitions - Part 1
- Lecture 2 - Basic concepts and definitions - Part 2
- Lecture 3 - Basic concepts and definitions - Part 3
- Lecture 4 - Tutorial problems on exact and inexact differential
- Lecture 5 - Basic concepts and definitions - Part 4
- Lecture 6 - Work - Part 1
- Lecture 7 - Work - Part 2
- Lecture 8 - Work - Part 3
- Lecture 9 - Work - Part 4
- Lecture 10 - Work - Part 5
- Lecture 11 - Tutorial problem on 'Work' - Part 1
- Lecture 12 - Tutorial problem - Part 2
- Lecture 13 - Tutorial problem on 'Work' - Part 3
- Lecture 14 - Tutorial problem on 'Work' - Part 4
- Lecture 15 - Zeroth law of thermodynamics
- Lecture 16 - Methods of temperature measurement
- Lecture 17 - Modes of heat transfer
- Lecture 18 - Tutorial problem on 'Modes of heat transfer'
- Lecture 19 - Tutorial problem on 'Methods of temperature measurement'
- Lecture 20 - First law of thermodynamics
- Lecture 21 - Tutorial problem - Part 1
- Lecture 22 - Tutorial problem - Part 2
- Lecture 23 - Heat and work interactions for a system
- Lecture 24 - Tutorial problem - Part 1
- Lecture 25 - Pure substance
- Lecture 26 - Tutorial problem - Part 2
- Lecture 27 - Ideal gas - Part 1
- Lecture 28 - Ideal gas - Part 2
- Lecture 29 - Tutorial problem - Part 3
- Lecture 30 - Tutorial problem - Part 4
- Lecture 31 - Tutorial problem - Part 5

- Lecture 32 - Specific heats at constant pressure and constant volume
- Lecture 33 - Tutorial problem - Part 6
- Lecture 34 - Tutorial problem - Part 7
- Lecture 35 - Ideal gas - Part 3
- Lecture 36 - Ideal gas - Part 4
- Lecture 37 - Ideal gas - Part 5
- Lecture 38 - Tutorial problem - Part 1
- Lecture 39 - Tutorial problem - Part 2
- Lecture 40 - Tutorial problem - Part 3
- Lecture 41 - Tutorial problem - Part 4
- Lecture 42 - Beyond ideal gases - Part 1
- Lecture 43 - Beyond ideal gases - Part 2
- Lecture 44 - Two phase system - Part 1
- Lecture 45 - Two phase system - Part 2
- Lecture 46 - Two phase system: water and steam
- Lecture 47 - Tutorial problems (2 numbers)
- Lecture 48 - Tutorial problem - Part 1
- Lecture 49 - Tutorial problem - Part 2
- Lecture 50 - Tutorial problem - Part 3
- Lecture 51 - Tutorial problems on two-phase systems (2 numbers)
- Lecture 52 - Tutorial problem (1 number)
- Lecture 53 - Rate equation of the first law of thermodynamics for a control mass and a control volume
- Lecture 54 - Energy equation for a steady-state, steady-flow process in selected engineering devices
- Lecture 55 - Tutorial problems (3 numbers)
- Lecture 56 - Tutorial problem - Part 1
- Lecture 57 - Tutorial problem - Part 2
- Lecture 58 - Quasi-static process revisited: Work against an external force
- Lecture 59 - Second law of thermodynamics: limitations of the first law of thermodynamics
- Lecture 60 - Second law of thermodynamics: direct and reverse heat engine
- Lecture 61 - Second law of thermodynamics: Kelvin-Planck and Clausius statements
- Lecture 62 - Second law of thermodynamics: reversible process
- Lecture 63 - Second law of thermodynamics: Carnot's cycle and theorems
- Lecture 64 - Second law of thermodynamics: absolute temperature scale

- Lecture 65 - Tutorial problems (2 numbers)
- Lecture 66 - Tutorial problem (1 number)
- Lecture 67 - Tutorial problem (1 number)
- Lecture 68 - Tutorial problem (2 numbers)
- Lecture 69 - Second law of thermodynamics: Clausius's inequality
- Lecture 70 - Entropy - Part 1
- Lecture 71 - Tutorial problem (1 number)
- Lecture 72 - Entropy - Part 2
- Lecture 73 - Entropy - Part 3
- Lecture 74 - Entropy - Part 4
- Lecture 75 - Tutorial problem (1 number)
- Lecture 76 - Tutorial problem (1 number)
- Lecture 77 - Tutorial problems (2 numbers)
- Lecture 78 - Entropy - Part 5
- Lecture 79 - Entropy - Part 6
- Lecture 80 - Entropy - Part 7
- Lecture 81 - Exergy - Part 1
- Lecture 82 - Exergy - Part 2
- Lecture 83 - Exergy - Part 3
- Lecture 84 - Thermodynamics cycles: Rankine cycle
- Lecture 85 - Tutorial problem (1 number)
- Lecture 86 - Thermodynamics cycles: Brayton cycle
- Lecture 87 - Tutorial problem (1 number)
- Lecture 88 - Thermodynamics cycles: vapor compression refrigeration cycle
- Lecture 89 - Tutorial problem (1 number)

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NPTEL : NOC:Regulatory Requirements for Medical Devices including in Vitro Diagnostics in India (Version 2.0) (Multi-Disciplinary)

Co-ordinators : Prof. Malay Mitra, Prof. Aseem Sahu, Prof. Arun B.Ramteke

Lecture 1 - Courses Overview

Lecture 2 - Medical device and in vitro diagnostics: Introduction and types of devices including combination devices

Lecture 3 - Medical Device Rules, 2017: Implications on medical devices

Lecture 4 - Classification of medical devices

Lecture 5 - Labelling of medical devices and in vitro diagnostics

Lecture 6 - Standards of medical device, quality assurance and testing

Lecture 7 - Regulatory requirements of biocompatibility of medical devices and ISO 10993

Lecture 8 - Clinical investigation of medical devices, regulation of investigational medical devices

Lecture 9 - Quality assurance and quality management system

Lecture 10 - How to obtain a licence to manufacture a medical device?

Lecture 11 - ISO 14971 (Medical devices: Application of risk management to medical devices)

Lecture 12 - Inspection of medical device and IVD establishments

Lecture 13 - Import and export of medical devices and IVDs

Lecture 14 - Medical device regulation: International practices

**NPTEL : NOC:Current Regulatory Requirements for Conducting Clinical Trials in India for Investigational New Drugs
(Version 2.0) (Multi-Disciplinary)**

Co-ordinators : Prof. Nandini K Kumar, Prof. Y. K. Gupta, Prof. D. K. Sable, Prof. Arun B. Ramteke, Prof. Rubina Bose, Prof. Sucheta Banerjee Kurundkar, Prof. Vishnu Rao

Lecture 1 - Courses Overview

Lecture 2 - Overview of Indian regulatory system

Lecture 3 - Overview of Drugs and Cosmetics Act and Rules thereunder

Lecture 4 - Overview of New Drugs and Clinical Trials Rules, 2019

Lecture 5 - Pre-Clinical Data Requirements

Lecture 6 - Rules Governing Clinical Trials

Lecture 7 - Phases of clinical trial, forms, and fees

Lecture 8 - Regulatory pathway and data requirements for NDCT, 2019

Lecture 9 - BA/BE study and study centers: Legal provisions

Lecture 10 - Guidelines to conduct BA/BE studies

Lecture 11 - Ethics Committee registration and re-registration

Lecture 12 - Ethical Considerations

Lecture 13 - Good Clinical Practice

Lecture 14 - Requirements for import/manufacture of new drug/IND for conducting clinical trials in India

Lecture 15 - Requirements for import/manufacture of new drug/IND for sale/ distribution and unapproved new drug for patients

Lecture 16 - Important issues

Lecture 17 - Special concern

Lecture 18 - Clinical trial related guidelines (NDCT Rules)

Lecture 19 - Content of Proposed Clinical Trial Protocol

Lecture 20 - Content of a Clinical Trial Report

Lecture 21 - Post Marketing Assessment and Clinical Trial Compensation

Lecture 22 - Common observations during submission of CT/BA/BE protocol

Lecture 23 - Common observations during CT/BA/BE centre inspections

Lecture 24 - Drug development process: Overview

Lecture 25 - Salient feature of NDCT 2019 - what's new in NDCT?

Lecture 26 - Online Submission 23A: Sugam

Lecture 27 - Online Submission (CTRI)

Lecture 28 - Tables Given in NDCT 2019 and its Content

Lecture 1 - Course Background: Model Predictive Control

Lecture 2 - Course Outline

Lecture 3 - Additional MATLAB Video - Array Operations

Lecture 4 - Additional MATLAB Video - Array Operations

Lecture 5 - Recap: Linear Algebra

Lecture 6 - Recap: Differential and Difference Equations

Lecture 7 - Recap: Process Control Basics

Lecture 8 - Introduction to Model Predictive Control

Lecture 9 - MPC: Salient Features

Lecture 10 - MPC: Historical Perspective

Lecture 11 - Vectors and Matrices

Lecture 12 - Vector Spaces

Lecture 13 - Linear Operation

Lecture 14 - Null and Image Spaces

Lecture 15 - Eigenvalues and Eigenvectors

Lecture 16 - Eigenvalue Decomposition and Tutorial

Lecture 17 - Recap of Week-2

Lecture 18 - Model Classification

Lecture 19 - Discrete-Time Models Overview

Lecture 20 - Discrete-Time Models

Lecture 21 - Finite Impulse Response Models

Lecture 22 - Finite Step Response Models

Lecture 23 - Recap and Plan for Week-4

Lecture 24 - State Space and Step Response Models

Lecture 25 - Nonlinear Models and Model Linearization

Lecture 26 - Model Types and Model Conversion

Lecture 27 - Model Conversion - 2

Lecture 28 - Model Conversion: TF to SS

Lecture 29 - How to handle MIMO systems

Lecture 30 - Discretization of State-Space Models

Lecture 31 - Introduction to Dynamic Matrix Control (DMC)

[Lecture 32 - The DMC Algorithm: Future Predictions](#)

[Lecture 33 - The DMC Algorithm: Objective and Constraints](#)

[Lecture 34 - The DMC Algorithm: Optimization](#)

[Lecture 35 - Coding for DMC Algorithm: Setup](#)

[Lecture 36 - Coding for DMC Algorithm: Populate Matrices](#)

[Lecture 37 - Recap of DMC Algorithm](#)

[Lecture 38 - Extensions of DMC Algorithm](#)

[Lecture 39 - LTI Models and Coordinate Transform](#)

[Lecture 40 - LTI Models: Stability](#)

[Lecture 41 - LTI Models: Controllability](#)

[Lecture 42 - LTI Models: Conditions for controllability](#)

[Lecture 43 - Tutorial by Arvind \(Recap of Controllability\)](#)

[Lecture 44 - LTI Models: Observability](#)

[Lecture 45 - Linear Control: Introduction](#)

[Lecture 46 - Pole Placement Controller](#)

[Lecture 47 - Linear Quadratic Regulator: Batch Solution](#)

[Lecture 48 - LQR: Dynamic Programming Solution](#)

[Lecture 49 - State Estimation: Introduction](#)

[Lecture 50 - Stochastic Processes and Random Variables](#)

[Lecture 51 - State Estimation: Pole Placement Observer](#)

[Lecture 52 - Kalman Filter: Terminology](#)

[Lecture 53 - Kalman Filter: Derivation](#)

[Lecture 54 - Recap of Modules 7-9](#)

[Lecture 55 - Recap and Plan for this week](#)

[Lecture 56 - Linear Quadratic Gaussian](#)

[Lecture 57 - LQG Derivation and Separation Principle](#)

[Lecture 58 - Setpoint Tracking in LQ Control](#)

[Lecture 59 - Disturbance Rejection in LQ Control](#)

[Lecture 60 - Disturbance Modeling for Estimation](#)

[Lecture 61 - Estimation with Disturbance Modeling](#)

[Lecture 62 - Recap and Plan for this week](#)

[Lecture 63 - State-Space MPC: Deterministic case](#)

[Lecture 64 - Extension to Measured Disturbances](#)

[Lecture 65 - Offset-Free State Space MPC](#)

[Lecture 66 - Comparison of State-Space MPC with DMC](#)

[Lecture 67 - State-Space MPC: Disturbance Modeling](#)

[Lecture 68 - Disturbance Modeling: Background and Setup](#)

[Lecture 69 - Stochastic Output-Feedback State-Space MPC](#)

[Lecture 70 - Bonus Video: Disturbance Modeling for State Space MPC](#)

[Lecture 71 - Self-Guided Tutorial of MPC Toolbox](#)

[Lecture 72 - Help Session: Using MPC Toolbox](#)

[Lecture 73 - Recap of LQ Control and Linear MPC](#)

[Lecture 74 - Linear MPC - Key Features and Results](#)

[Lecture 75 - Practical Issues: Inferential Control](#)

[Lecture 76 - Practical Issues: Measurement Delay](#)

[Lecture 77 - Other Practical Issues](#)

[Lecture 78 - Some Classical Examples of MPC](#)

Lecture 1 - What is Science? - Part 1

Lecture 2 - What is Science? - Part 2

Lecture 3 - Subjective Thinking Versus Objective Thinking

Lecture 4 - Idealism Versus Materialism

Lecture 5 - Causality - Part 1

Lecture 6 - Causality - Part 2

Lecture 7 - Logical Reasoning: Inductive Logic

Lecture 8 - Logical Reasoning: Deductive Logic - Part 1

Lecture 9 - Logical Reasoning: Deductive Logic - Part 2

Lecture 10 - Logical Reasoning: Syllogistic Logic - Part 1

Lecture 11 - Logical Reasoning: Syllogistic Logic - Part 2

Lecture 12 - Logical Reasoning: Syllogism Logic, Truth and Validity

Lecture 13 - Historical Perspective: Emergence of Materialism and Idealism - Part 1

Lecture 14 - Historical Perspective: Emergence of Materialism and Idealism - Part 2

Lecture 15 - Historical Perspective:Renaissance to the Development of Mechanical Materialism - Part 1

Lecture 16 - Historical Perspective:Renaissance to the Development of Mechanical Materialism - Part 2

Lecture 17 - Historical Perspective: The Advent of Empiricism and the Idea of Evolution

Lecture 18 - Historical Perspective: Science in Ancient India

Lecture 19 - Historical Perspective: The Advent of Scientific Materialism - Part 1

Lecture 20 - Historical Perspective: The Advent of Scientific Materialism - Part 2

Lecture 21 - Historical Perspective: The Rise and Fall of Positivism - Part 1

Lecture 22 - Historical Perspective: The Rise and Fall of Positivism - Part 2

Lecture 23 - What Scientists Actually Do - Part 1

Lecture 24 - What Scientists Actually Do - Part 2

Lecture 25 - Falsifiability and Reproducibility - Part 1

Lecture 26 - Falsifiability and Reproducibility - Part 2

Lecture 27 - Proposing a Hypothesis - Part 1

Lecture 28 - Proposing a Hypothesis - Part 2

Lecture 29 - Elements of Scientific Measurement - Part 1

Lecture 30 - Elements of Scientific Measurement - Part 2

Lecture 31 - The Central Limit Theorem and its Applications - Part 1

- Lecture 32 - The Central Limit Theorem and its Applications - Part 2
- Lecture 33 - Error Bars and Confidence Interval - Part 1
- Lecture 34 - Error Bars and Confidence Interval - Part 2
- Lecture 35 - Measurement of a Proportion - Part 1
- Lecture 36 - Measurement of a Proportion - Part 2
- Lecture 37 - Examples of Proportion Measurement
- Lecture 38 - Box and Whisker Plot
- Lecture 39 - Propagation of Errors - Part 1
- Lecture 40 - Propagation of Errors - Part 2
- Lecture 41 - Issues in Hypothesis Testing - Part 1
- Lecture 42 - Issues in Hypothesis Testing - Part 2
- Lecture 43 - Statistical Methods in Hypothesis Testing: Z-Test and T-Test - Part 1
- Lecture 44 - Statistical Methods in Hypothesis Testing: Z-Test and T-Test - Part 2
- Lecture 45 - Hypothesis Testing: The Chi-Square Test - Part 1
- Lecture 46 - Hypothesis Testing: The Chi-Square Test - Part 2
- Lecture 47 - Hypothesis Testing: The Chi-Square Test - Part 3
- Lecture 48 - Hypothesis Testing: The Chi-Square Test - Part 4
- Lecture 49 - Theoretical Research: Functional Relationships from Experimental Data - Part 1
- Lecture 50 - Theoretical Research: Functional Relationships from Experimental Data - Part 2
- Lecture 51 - Theoretical Research: Mathematical Models of Physical Systems
- Lecture 52 - Order of Magnitude Calculations
- Lecture 53 - Theoretical Research: Modeling Using Dimensional Analysis - Part 1
- Lecture 54 - Theoretical Research: Modeling Using Dimensional Analysis - Part 2
- Lecture 55 - An Example of Mathematical Modeling
- Lecture 56 - Importance of Theory-Building in Science
- Lecture 57 - Scientific Writing: Journal Papers - Part 1
- Lecture 58 - Scientific Writing: Journal Papers - Part 2
- Lecture 59 - Scientific Writing: Journal Papers - Part 3
- Lecture 60 - Scientific Writing: Journal Papers - Part 4
- Lecture 61 - Scientific Writing: PhD Thesis
- Lecture 62 - Scientific Writing: Text Stylistics
- Lecture 63 - Presentation in Scientific Conferences - Part 1
- Lecture 64 - Presentation in Scientific Conferences - Part 2

[Lecture 65 - Writing Grant Proposals - Part 1](#)

[Lecture 66 - Writing Grant Proposals - Part 2](#)

[Lecture 67 - Ethical Conduct in Science: Aspects of Scientific Ethics](#)

[Lecture 68 - Ethical Conduct in Science: Research Misconduct](#)

[Lecture 69 - Ethical Conduct in Science: Ethics in Scientific Publication - Part 1](#)

[Lecture 70 - Ethical Conduct in Science: Ethics in Scientific Publication - Part 2](#)

[Lecture 71 - Ethical Conduct in Science: Cases of Scientific Misconduct - Part 1](#)

[Lecture 72 - Ethical Conduct in Science: Cases of Scientific Misconduct - Part 2](#)

Lecture 1 - Vasovagal Syncope

Lecture 2 - Vasovagal Syncope - Clinical Scenario

Lecture 3 - Postural Hypotension

Lecture 4 - Postural Hypotension - Clinical Scenario

Lecture 5 - Hyperventilation

Lecture 6 - Hyperventilation - Clinical Scenario

Lecture 7 - Asthma - Status Asthmaticus - Part 1

Lecture 8 - Asthma - Status Asthmaticus - Part 2

Lecture 9 - Asthma - Clinical Scenario

Lecture 10 - Chest Pain Of Cardiac Origin - Myocardial Infarction And Anigina Pectoris - Part 1

Lecture 11 - Chest Pain Of Cardiac Origin - Myocardial Infarction And Anigina Pectoris - Part 2

Lecture 12 - Chest Pain - Clinical Scenario

Lecture 13 - Acute Adrenal Insufficiency

Lecture 14 - Acute Adrenal Insufficiency - Clinical Scenario

Lecture 15 - Diabetes Mellitus

Lecture 16 - Diabetes Mellitus - Clinical Scenario

Lecture 17 - Throid Dysfunction

Lecture 18 - Allergies/Hypersensitivity Reaction - Part 1

Lecture 19 - Allergies/Hypersensitivity Reaction - Part 2

Lecture 20 - Epilepsy- Status Epilepticus

Lecture 21 - Chronic Kidney Disease

Lecture 22 - Hepatic Dysfunction

Lecture 23 - Basic Life Support - Part 1

Lecture 24 - Basic Life Support - Part 2

Lecture 1 - Introduction to Ornithology

Lecture 2 - Diversity and Classification - Part 1

Lecture 3 - Diversity and Classification - Part 2

Lecture 4 - Evolution and Speciation - Part 1

Lecture 5 - Evolution and Speciation - Part 2

Lecture 6 - Anatomy

Lecture 7 - Physiology

Lecture 8 - Colour

Lecture 9 - Life History

Lecture 10 - Foraging Behaviour

Lecture 11 - Mating and Breeding Behaviour

Lecture 12 - Social Behaviour

Lecture 13 - Methods of Science and Research Questions

Lecture 14 - Vocal Behaviour: Mechanisms - Part 1

Lecture 15 - Vocal Behaviour: Mechanisms - Part 2

Lecture 16 - Vocal Behaviour: Ecology and Evolution - Part 1

Lecture 17 - Vocal Behaviour: Ecology and Evolution - Part 2

Lecture 18 - Vocal Mimicry in Birds

Lecture 19 - Basics of Research Design

Lecture 20 - Bird Migration - LIVE Guest Lectuer

Lecture 21 - Bird Populations: Concepts

Lecture 22 - Bird Communities: Concepts - Part 1

Lecture 23 - Bird Communities: Concepts - Part 2

Lecture 24 - Interactive Session by Dr Mousumi Ghosh (NCF) and Dr Umesh Srinivasan (IISc)

Lecture 25 - Studying bird populations and communities - Part 1

Lecture 26 - Studying bird populations and communities - Part 2

Lecture 27 - Mixed Species Flocks - Live Session

Lecture 28 - Interactive session with Dr. Priti Bangal (NCF) and Dr. Umesh Srinivasan (IISc)

Lecture 29 - Introduction to Data Visualisation Analysis - Part 1

Lecture 30 - Introduction to Data Visualisation Analysis - Part 2

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[Lecture 31 - Basic Course in Ornithology - Guest Session on Avian Diseases](#)

[Lecture 32 - Biogeography](#)

[Lecture 33 - Macroecology](#)

[Lecture 34 - Macroecology - Case Study - LIVE](#)

[Lecture 35 - Week 10 Interactive session with Dr VV Robin and Dr Umesh Srinivasan](#)

[Lecture 36 - Bird Conservation - Concepts](#)

[Lecture 37 - Avian Conservation: Case study 1](#)

[Lecture 38 - Avian Conservation: Case study 2](#)

[Lecture 39 - Avian Conservation: Case study 3](#)

[Lecture 40 - Avian Conservation: Case study 4](#)

[Lecture 41 - Avian Conservation: Case study 5](#)

[Lecture 42 - LIVE - Citizen Science - Guest faculty by Dr Ashwin Viswanathan \(NCF\)](#)

[Lecture 43 - Molecular Techniques - Part 1](#)

[Lecture 44 - Molecular Techniques - Part 2](#)

- Lecture 1 - Craniofacial anatomy - Part 1
- Lecture 2 - Craniofacial anatomy - Part 2
- Lecture 3 - Tooth and It's Supporting Structures - Part 1
- Lecture 4 - Tooth and It's Supporting Structures - Part 2
- Lecture 5 - Specialised mucosa
- Lecture 6 - Saliva-Composition and functions
- Lecture 7 - Saliva Diagnostics
- Lecture 8 - Stem cells in the oro-dental region
- Lecture 9 - Stem cell isolation
- Lecture 10 - Mineralization dynamics - Part 1
- Lecture 11 - Mineralization dynamics - Part 2
- Lecture 12 - TMJ Anatomy and Function
- Lecture 13 - Oral defense mechanisms
- Lecture 14 - Mucosal and regional immunology
- Lecture 15 - Oral microbiome
- Lecture 16 - Evaluation of Oral microbiome
- Lecture 17 - Dysbiosis
- Lecture 18 - Molecular mechanisms in oral cancer
- Lecture 19 - Flow cytometry in cell and molecular biology
- Lecture 20 - Basics of Biomaterial science and engineering
- Lecture 21 - Biomimetics - Part 1
- Lecture 22 - Biomimetics - Part 2
- Lecture 23 - Biomaterials - Polymers
- Lecture 24 - Biomaterials - Metals
- Lecture 25 - Biomaterials - Ceramics and Colloids
- Lecture 26 - 3-D Bioprinting
- Lecture 27 - Protein mediated biomaterials
- Lecture 28 - Immune response to biomaterials
- Lecture 29 - Biomaterial Applications
- Lecture 30 - Biocompatible assays
- Lecture 31 - Immunoassay

Lecture 1 - Course overview

Lecture 2 - What is biomimicry ?

Lecture 3 - Why is biomimicry important ?

Lecture 4 - Nature's unifying patterns - Introduction

Lecture 5 - Case study

Lecture 6 - How to do biomimicry ?

Lecture 7 - Learning resources - Biomimicry Institute

Lecture 8 - Skills, attitudes and mindset for a biomimic

Lecture 9 - Course activity

Lecture 10 - Recap of Week 1

Lecture 11 - What are we mimicking ?

Lecture 12 - Function and Strategy

Lecture 13 - Approaches to biomimicry

Lecture 14 - From Problem to Solution

Lecture 15 - Using the UNSDG to identify challenges

Lecture 16 - Recap of Week 2

Lecture 17 - Step 1 - Define the problem

Lecture 18 - Step 2 - Biologize the problem

Lecture 19 - Step 3 - Discover strategies in nature

Lecture 20 - Applying the Biomimicry Design Spiral

Lecture 21 - Step 4 - Abstract design strategies from nature

Lecture 22 - Step 5 - Emulate nature's strategies in your solution

Lecture 23 - Step 6 - Evaluate feasibility

Lecture 24 - How to apply the biomimicry process ?

Lecture 25 - Recap of Week 4

Lecture 26 - Nature's Unifying Patterns I

Lecture 27 - Systems Thinking - Introduction

Lecture 28 - Systems Thinking - Understanding consequences

Lecture 29 - Nature's Unifying Patterns II

Lecture 30 - Tools - Mind mapping

Lecture 31 - Using biomimicry to design a solution

[Lecture 32 - Recap of Week 6](#)

[Lecture 33 - Developing creative confidence](#)

[Lecture 34 - Learning from the biomimicry process](#)

[Lecture 35 - The need for creativity in our lives](#)

[Lecture 36 - Unlocking your creativity](#)

[Lecture 37 - Taking your biomimicry ideas to market](#)

[Lecture 38 - The journey so far](#)

[Lecture 39 - Finding the hero in you](#)

[Lecture 40 - Course wrap-up](#)

Lecture 1 - Introduction - Electrocardiogram - Interpretation and application in clinical practice

Lecture 2 - Basic Conduction of Heart

Lecture 3 - ECG Lead system

Lecture 4 - Recording of a Standard ECG (Lead placements and measurements)

Lecture 5 - Waveforms, Intervals and Segments

Lecture 6 - Vector Electrocardiography

Lecture 7 - From Action Potentials to Arrhythmias

Lecture 8 - Pathophysiology, Myocardial Ischemia / Injury

Lecture 9 - Myocardial Infarction (MI), Pathophysiology

Lecture 10 - Drug effects on ECG

Lecture 11 - Patient identification, preparation and interpretation of ECG

Lecture 12 - Sinus rhythms and Bradyarrhythmias

Lecture 13 - Approach to tachyarrhythmias

Lecture 14 - AV Blocks and Bundle Branch Block

Lecture 15 - Chamber enlargement and Heart Failure

Lecture 16 - Electrolyte Abnormalities on ECG

Lecture 17 - Recognizing signs and ECG changes in Myocardial Ischemia/Injury

Lecture 18 - ECG changes in myocardial infarction

Lecture 19 - Miscellaneous ECG findings and cardiac arrest

Lecture 20 - Pacemaker Rhythms

NPTEL : NOC:One Health (Multi-Disciplinary)

Co-ordinators : Multi Faculty

Lecture 1 - Introduction to the One Health Concept and National and International health/public health agencies

Lecture 2 - Global Health vs One Health

Lecture 3 - Basics of Research Ethics

Lecture 4 - Integrated human and animal disease surveillance systems

Lecture 5 - Emerging infectious diseases

Lecture 6 - Process of disease emergence and assessment of the risk factors

Lecture 7 - Mechanisms of pathogen cross over across species boundaries

Lecture 8 - Importance of disease detection, Identification and monitoring in public health

Lecture 9 - Introduction to disease vectors and basics of Medical Entomology

Lecture 10 - The factors influencing an emerging disease

Lecture 11 - Antimicrobial resistance a global threat and Importance of antibiotic stewardship program

Lecture 12 - Introduction of Food safety and food borne diseases

Lecture 13 - What are zoonotic diseases and its role in our changing world

Lecture 14 - The integration of human, animal and ecosystem health in control and prevention of these diseases

Lecture 15 - Community engagement for zoonotic disease control in humans and animals through One Health

Lecture 16 - Basics of Epidemiological Studies

Lecture 17 - Rapid Response system, Disaster Management and Outbreak Investigation Plans

Lecture 18 - Basic statistical methods and their application and the measurement of disease frequency

Lecture 19 - Principles of survey design and the concepts of sampling and Mixed method research

Lecture 20 - Introduction to health policy

Lecture 21 - Risk Communication and Pandemic Preparedness

Lecture 22 - Role of community in disease control and ways for community engagement

Lecture 23 - Uses of different types of media for communication

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NPTEL : NOC:Canning Technology, Value Addition of Seafood (Fish Processing) (Multi-Disciplinary)

Co-ordinators : Dr. Abhilash Sasidharan, Dr. Maya Raman

- Lecture 1 - Course overview Canning technology and Value addition of sea food
- Lecture 2 - Introduction and the concept of canning technology
- Lecture 3 - History of canning technology - Part 1
- Lecture 4 - History of canning technology - Part 2
- Lecture 5 - Canning Technology and Value Addition Containers and their Properties - Part 1
- Lecture 6 - Canning Technology and Value Addition Containers and their Properties - Part 2
- Lecture 7 - Canning Technology and Value Addition Containers and their Properties - Part 3
- Lecture 8 - Canning Technology and Value Addition Containers and their Properties - Part 4
- Lecture 9 - Canning Technology and Value Addition - Canning process - Part 1
- Lecture 10 - Canning Technology and Value Addition - Canning process - Part 2
- Lecture 11 - Canning Technology and Value Addition - Thermal process calculations - Part 1
- Lecture 12 - Canning Technology and Value Addition - Thermal process calculations - Part 2
- Lecture 13 - Microbiology and spoilage of canned food - Part 1
- Lecture 14 - Microbiology and spoilage of canned food - Part 2
- Lecture 15 - Process of seafood canning - Part 1
- Lecture 16 - Process of seafood canning - Part 2
- Lecture 17 - Seafood pre-processing - Part 1
- Lecture 18 - Seafood pre-processing - Part 2
- Lecture 19 - Additives - Part 1
- Lecture 20 - Additives - Part 2
- Lecture 21 - SOP for seafood canning - Part 1
- Lecture 22 - SOP for seafood canning - Part 2
- Lecture 23 - SOP for seafood canning - Part 3
- Lecture 24 - Nutritional quality of seafood
- Lecture 25 - Muscle structure of seafood
- Lecture 26 - Spoilage in seafood
- Lecture 27 - Preservation methods
- Lecture 28 - Value addition in thermally processed foods
- Lecture 29 - Quality standards for seafood value added products - Part 1
- Lecture 30 - Quality standards for seafood value added products - Part 2
- Lecture 31 - Quality standards for seafood value added products - Part 3

Lecture 1 - Course overview

Lecture 2 - Introduction

Lecture 3 - Paper as packaging material - Part 1

Lecture 4 - Paper as packaging material - Part 2

Lecture 5 - Paper as packaging material - Part 3

Lecture 6 - Glass as packaging material

Lecture 7 - Metal as packaging material - Part 1

Lecture 8 - Metal as packaging material - Part 2

Lecture 9 - Plastic as packaging material - Part 1

Lecture 10 - Plastic as packaging material - Part 2

Lecture 11 - Introduction to packaging system

Lecture 12 - Product characteristics and packaging requirements

Lecture 13 - Rigid, semi-rigid, flexible packaging forms - Part 1

Lecture 14 - Rigid, semi-rigid, flexible packaging forms - Part 2

Lecture 15 - Designing of packaging material

Lecture 16 - Testing of packaging material - Part 1

Lecture 17 - Testing of packaging material - Part 2

Lecture 18 - Testing of packaging material - Part 3

Lecture 19 - Testing of packaging material - Part 4

Lecture 20 - Testing of package performance

Lecture 21 - Principles developing safe and protective packing

Lecture 22 - Transport worthiness test - Part 1

Lecture 23 - Transport worthiness test - Part 2

Lecture 24 - Transport worthiness test - Part 3

Lecture 25 - Safety aspects of food packaging

Lecture 26 - Packaging accessories and advances in packaging

Lecture 27 - Active packaging - Part 1

Lecture 28 - Active packaging - Part 2

Lecture 29 - MA and Aseptic packaging

Lecture 30 - Edible packaging - Part 1

Lecture 31 - Edible packaging - Part 2

[Lecture 32 - Vacuum packing machine](#)

[Lecture 33 - CA and MA packing machine](#)

[Lecture 34 - Gas packing machine](#)

[Lecture 35 - Seal and shrink packing machine](#)

[Lecture 36 - Form fill sealing machine](#)

[Lecture 37 - Aseptic packaging systems](#)

[Lecture 38 - Retort pouches](#)

[Lecture 39 - Bottling machine - Part 1](#)

[Lecture 40 - Bottling machine - Part 2](#)

[Lecture 41 - Carton making machine](#)

[Lecture 42 - Package printing machines - Part 1](#)

[Lecture 43 - Package printing machines - Part 2](#)

Lecture 1 - Introduction

Lecture 2 - Fragility

Lecture 3 - Resilience

Lecture 4 - Interpreting Vulnerability, precarity of work and Access Equality for Equal Opportunity - Part I

Lecture 5 - Interpreting Vulnerability, precarity of work and Access Equality for Equal Opportunity - Part II

Lecture 6 - Social Vulnerability and Group Vulnerability

Lecture 7 - Willed Vulnerability - Endurance Sports

Lecture 8 - Illness, Storytelling and Embodiment

Lecture 9 - Illness, Storytelling and Embodiment Reading - Audre Lorde's : The Cancer Journals

Lecture 10 - Group Discussion - Vulnerable Bodies

Lecture 11 - The Aesthetics of Vulnerability - I

Lecture 12 - The Aesthetics of Vulnerability - II Traumatic Materialism

Lecture 13 - The Aesthetics of Vulnerability - III Melodrama

Lecture 14 - Vulnerability Aesthetics The Sublime

Lecture 15 - The Aesthetics of Vulnerability - Discussion

Lecture 16 - Biopolitics, biopower and vulnerability - I

Lecture 17 - Biopolitics, biopower and vulnerability - II

Lecture 18 - Pandemics and Biopolitics

Lecture 19 - Biopolitics and vulnerable populations in Contemporary Literature

Lecture 20 - Discussion on Biopolitics

Lecture 21 - Ecoprecarity

Lecture 22 - Ecodystopia - I

Lecture 23 - Ecodystopia - II

Lecture 24 - Discussion on Ecoprecarity and Ecodystopias - I

Lecture 25 - Discussion on Ecoprecarity and Ecodystopias - II

Lecture 26 - Aging and Vulnerability in Literature

Lecture 27 - Aging and Vulnerability - 2

Lecture 28 - Aging and Vulnerability - 3

Lecture 29 - Discussion on Vulnerability and Aging - 1

Lecture 30 - Discussion on Vulnerability and Aging - 2

Lecture 31 - Childhood and Vulnerability - 1

[Lecture 32 - Childhood and Vulnerability - 2](#)

[Lecture 33 - Childhood and Vulnerability - 3](#)

[Lecture 34 - Discussion on Childhood and Vulnerability - I](#)

[Lecture 35 - Discussion on Childhood and Vulnerability - II](#)

[Lecture 36 - Imperial Vulnerability - I](#)

[Lecture 37 - Imperial Vulnerability - II](#)

[Lecture 38 - Posthuman Vulnerability](#)

[Lecture 39 - Contemporary Genres of Resilience - The Graphic Novel - I](#)

[Lecture 40 - Contemporary Genres of Resilience - The Graphic Novel - II](#)

Lecture 1 - Functional Anatomy of the Respiratory Tract

Lecture 2 - Mechanics of Respiration - Section 1

Lecture 3 - Mechanics of Respiration - Section 2

Lecture 4 - Ventilation, Perfusion Ventilation Perfusion Relationship

Lecture 5 - Essential Principles of Spirometer

Lecture 6 - Types of Pulmonary function tests

Lecture 7 - Obstructive Lung Diseases: Pathophysiology

Lecture 8 - Restrictive lung Diseases: Pathophysiology

Lecture 9 - Drug Effects on Pulmonary Function

Lecture 10 - Lung Disorders in Children

Lecture 11 - Assessment of Lung Functions in Children

Lecture 12 - Static and Dynamic lung function tests

Lecture 13 - Interpretation of Normal Pulmonary Function Tests

Lecture 14 - Indications for Pulmonary Function Testing

Lecture 15 - Obstructive Airway Diseases - Approach

Lecture 16 - Clinical Diagnosis of Restrictive Lung Disease - Part 1

Lecture 17 - Clinical Diagnosis of Restrictive Lung Disease - Part 1

Lecture 18 - Essential Criteria For a Good Pulmonary Function Testing

Lecture 19 - Interpretation of pulmonary function tests in Restrictive lung disease

Lecture 20 - Interpretation of PFT in Obstructive lung diseases

Lecture 21 - Diffusion Capacity of Lungs for Carbon Monoxide DLCO

Lecture 22 - Radiological assessment of obstructive and restrictive lung disorders

Lecture 23 - Laboratory Video - Pulmonary Function tests - Interpretation and application in clinical practice

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Making Learning Engaging Through Interactive Games (Multi-Disciplinary)

Co-ordinators : Prof. Kartic Vaidyanathan

Lecture 1 - Need for interactive gamified learning

Lecture 2 - Learnings from the Master Class titled Confessions of a Converted Lectuer by Prof Eric Mazur

Lecture 3 - Understanding Play and its context in learning in 21st century

Lecture 4 - Benefits of Game Based Learning Scientific Evidences

Lecture 5 - Learning Stoichiometry calculations using board game Case Study

Lecture 6 - Benefits of Game Based Learning across age groups and subjects

Lecture 7 - Benefits of Puzzle Games

Lecture 8 - Game Based Learning Adoption by Countries Overview

Lecture 9 - Yu Kai Chow Psychology of gamification

Lecture 10 - Board Card Game Activity Game Sources

Lecture 11 - Board Card Game Mechanics Across Subjects - Part 1

Lecture 12 - Board Card Game Mechanics Across Subjects - Part 2

Lecture 13 - Growth Mindset Card Game Game Play of UNO adaptation

Lecture 14 - How Play Game Mechanics Enhance Learning in the UNO Game

Lecture 15 - Tools for bulding Board Card Games Snake and Ladder

Lecture 16 - Sample Games Created Inspired by Snake and Ladder Mechanics

Lecture 17 - Sample Card Games Created Across Subjects and Different Mechanics by Students

Lecture 18 - Tools for building Bingo Games

Lecture 19 - Puzzle Game Design Tools

Lecture 20 - Mentimeter

Lecture 21 - Quizizz

Lecture 22 - Wordwall

Lecture 23 - GIMKIT - Part 1

Lecture 24 - GIMKIT - Part 2

Lecture 25 - Raptivity Digital Tool Demo

Lecture 26 - Example scenarios of student and faculty created digital games across topic

Lecture 27 - Dr. Preeti Aghalayam's - Experience narration with interactive games

Lecture 28 - Interview with Dr. Anuradha Prashant

Lecture 29 - Interview with Dr. Ankur Gera and her faculty team

Lecture 30 - Interview with Dr. GK SuraishKumar

Lecture 31 - Interview with Dr. Jacey Lynn Minoi

[Lecture 32 - Interview with Dr. Kirupa Priyadarshini](#)

[Lecture 33 - Dave Eng Interviews Prof. Silviana Falcon Who has Written Lectuers and Play](#)

Lecture 1 - Understanding Basics

Lecture 2 - Types of IPR and Their Applications

Lecture 3 - Innovation and Intellectual Property

Lecture 4 - Understanding Various Portfolios

Lecture 5 - International and National Scenario of IP

Lecture 6 - Patent Filing Strategies

Lecture 7 - Patent Filing

Lecture 8 - Country Selection for Patent Filing in Foreign Countries

Lecture 9 - International Filing - 1

Lecture 10 - International Filing - 2

Lecture 11 - Ranking Based Tier Strategies

Lecture 12 - Centralization of Patent Renewals and Translations

Lecture 13 - Budgeting for Patent Portfolio

Lecture 14 - Monitoring Based Countermeasures

Lecture 15 - General Cost Saving Measures

Lecture 16 - Various IP Strategies (Patent)

Lecture 17 - Various IP Strategies (Trademark, Copyright, Trade secret)

Lecture 18 - Understanding Elements of IP Strategies

Lecture 19 - IP Valuation Strategy

Lecture 20 - IP SWOT (Strength, Weaknesses, Opportunities, Threats) Analysis

Lecture 21 - Generations of Innovation

Lecture 22 - Idea Generation

Lecture 23 - Innovation Management

Lecture 24 - Innovation Management System ISO 56000

Lecture 25 - Strategies to Protect Innovation

Lecture 26 - Ensuring Quality and Extracting Values from the Patent Portfolio

Lecture 27 - International Patent Classification (IPC) System

Lecture 28 - Patent Landscape

Lecture 29 - Patent Infringement

Lecture 30 - PATENTSCOPE Search System

Lecture 31 - IP Incubating

[Lecture 32 - IP Accounting](#)

[Lecture 33 - IP Commercialization](#)

[Lecture 34 - IP and Taxation](#)

[Lecture 35 - Lean IP Management](#)

[Lecture 36 - National IP Strategies](#)

[Lecture 37 - Significance of IP Audit](#)

[Lecture 38 - IP and SDGs](#)

[Lecture 39 - IP Enforcement](#)

[Lecture 40 - Case Studies](#)

Lecture 1 - Overview of TALE and Good Engineer

Lecture 2 - Education and Teaching

Lecture 3 - Learning, Instruction and Assessment

Lecture 4 - What is OBE?

Lecture 5 - Accreditation

Lecture 6 - Outcomes

Lecture 7 - Program Outcomes - 1

Lecture 8 - Program Outcomes - 2

Lecture 9 - Taxonomy of Learning

Lecture 10 - Cognitive Levels

Lecture 11 - General Categories of Knowledge

Lecture 12 - Metacognitive Knowledge

Lecture 13 - Vincenti Categories of Engineering Knowledge

Lecture 14 - Affective and Psychomotor Domains

Lecture 15 - Taxonomy Table

Lecture 16 - Course Outcomes - 1

Lecture 17 - Course Outcomes - 2

Lecture 18 - Course Outcomes - POs and PSOs

Lecture 19 - Attainment of COs

Lecture 20 - Attainment of POs and PSOs

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:Teaching and Learning in General Programs (Multi-Disciplinary)

Co-ordinators : Prof. N.J. Rao

Lecture 1 - Teaching and Learning in General Programs (TALG)

Lecture 2 - Education and Teaching

Lecture 3 - Learning, Assessment and Instruction

Lecture 4 - Outcome Based Education (OBE)

Lecture 5 - Accreditation

Lecture 6 - Program Outcomes

Lecture 7 - POs and PSOs

Lecture 8 - Taxonomy of Learning: Cognitive Levels - 1

Lecture 9 - Taxonomy of Learning: Cognitive Levels - 2

Lecture 10 - Taxonomy of Learning: Knowledge Categories

Lecture 11 - Taxonomy of Learning: Metacognitive Knowledge

Lecture 12 - Affective Domain

Lecture 13 - Psychomotor Domain

Lecture 14 - Taxonomy Tables

Lecture 15 - Course Outcomes - 1

Lecture 16 - Course Outcomes - 2

Lecture 17 - Tagging the Course Outcomes

Lecture 18 - Attainment of Course Outcomes

Lecture 19 - Attainment of POs and PSOs

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:TALE 2 - Course Design and Instruction of Engineering Courses (Multi-Disciplinary)

Co-ordinators : Prof K Rajani Kanth

Lecture 1 - Engineering Programs, NBA Accreditation and Engineering Courses

Lecture 2 - Course Design

Lecture 3 - ISD and ADDIE

Lecture 4 - Analysis Phase - 1

Lecture 5 - Analysis Phase - 2

Lecture 6 - Design Phase

Lecture 7 - Technology and Targets

Lecture 8 - Assessment Pattern and Assessment Instruments

Lecture 9 - Item Banks

Lecture 10 - Development Phase

Lecture 11 - Instruction Material and Learning Material

Lecture 12 - Implement Phase - 1

Lecture 13 - Implement Phase - 2

Lecture 14 - Evaluate Phase

Lecture 15 - Course Exit Survey

Lecture 16 - Evaluating Laboratories and Electives

Lecture 17 - Exit Surveys for Projects

Lecture 18 - Summary Feedback

Lecture 19 - Instruction: An Overview

Lecture 20 - Instructional Situations

Lecture 21 - How Brains Learn - 1

Lecture 22 - How Brains Learn - 2

Lecture 23 - How Brains Learn - 3

Lecture 24 - Instructional Components - 1

Lecture 25 - Instructional Components - 2

Lecture 26 - Merrill's Principles of Learning

Lecture 27 - ID based on Merrill's Principles

Lecture 28 - Direct Approach to Instruction

Lecture 29 - Project Based Approach to Instruction

Lecture 30 - Problem Based Approach to Instruction

Lecture 31 - Experiential Approach to Instruction

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[Lecture 35 - So, what should a teacher do?](#)

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NOC:NBA Accreditation and Teaching Learning in Engineering (NATE) (Multi-Disciplinary)

Co-ordinators : Prof. N J Rao, Prof. K. Rajanikanth

Lecture 1 - NATE

Lecture 2 - NBA Accreditation

Lecture 3 - Outcome Based Education

Lecture 4 - Self Assessment Report

Lecture 5 - Education, Teaching, Learning, Instruction, and Assessment

Lecture 6 - PEOs and POs (1-5)

Lecture 7 - POs (6-9)

Lecture 8 - POs (10-12)

Lecture 9 - PSOs

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Lecture 11 - Cognitive Processes - 1

Lecture 12 - Cognitive Processes - 2

Lecture 13 - Categories of Knowledge - 1

Lecture 14 - Categories of Knowledge - 2

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Lecture 16 - Affective and Psychomotor Domains

Lecture 17 - Course Outcomes - 1

Lecture 18 - Course Outcomes - 2

Lecture 19 - Tagging Course Outcomes

Lecture 20 - Computing Attainment of COs

Lecture 21 - Computing PO and PSO Attainment

Lecture 22 - Course Design Component of Teaching as per Fink's Model

Lecture 23 - ISD and ADDIE Models

Lecture 24 - ADDIE - Analysis Phase 1

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Lecture 26 - ADDIE - Design Phase

Lecture 27 - Technology for Assessment; Setting Targets

Lecture 28 - Assessment Plan and Assessment Instruments

Lecture 29 - Item Banks

Lecture 30 - ADDIE- Development Phase

Lecture 31 - ADDIE - Implement Phase 1

- Lecture 32 - ADDIE - Implement Phase 2
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- Lecture 34 - Exit Surveys - 2
- Lecture 35 - ADDIE - Evaluate Phase
- Lecture 36 - Instruction An Overview
- Lecture 37 - Instructional Situations
- Lecture 38 - How Brains Learn
- Lecture 39 - Instructional Components
- Lecture 40 - Principles of Instruction Design
- Lecture 41 - Direct Instruction - 1
- Lecture 42 - Direct Instruction - 2
- Lecture 43 - Project Based Approach to Instruction
- Lecture 44 - Problem Based Approach to Instruction
- Lecture 45 - Instruction for Design thinking
- Lecture 46 - Simulation Approach to Instruction
- Lecture 47 - Instruction for Metacognitive Learning
- Lecture 48 - So, What Should the teacher do?
- Lecture 49 - NBA Criterion 1 Vision, Mission, PEOs - 1
- Lecture 50 - NBA Criterion 1 Vision, Mission, PEOs - 2
- Lecture 51 - NBA Criterion 2 Teaching-Learning Processes - 1
- Lecture 52 - NBA Criterion 2 Teaching-Learning Processes - 2
- Lecture 53 - NBA Criterion 3 COs and POs - 1
- Lecture 54 - NBA Criterion 3 COs and POs - 2
- Lecture 55 - NBA Criterion 4 Students' Performance
- Lecture 56 - NBA Criterion 5 Faculty Information and Contributions
- Lecture 57 - NBA Criterion 6 Facilities and Technical Support
- Lecture 58 - NBA Criterion 7 Continuous Improvement
- Lecture 59 - NBA Criterion 8 First Year Academics
- Lecture 60 - NBA Criterion 9 Student Support Systems
- Lecture 61 - NBA Criterion 10 Governance, Institutional Support and Financial Resources
- Lecture 62 - Summary

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Lecture 2 - Introduction to Nanotechnology (Continued...)

Lecture 3 - Synthetic Methodologies

Lecture 4 - Synthetic Methodologies (Continued...)

Lecture 5 - Synthetic Methodologies (Continued...)

Lecture 6 - Synthetic Methodologies (Continued...)

Lecture 7 - Synthetic Methodologies (Continued...)

Lecture 8 - Synthetic Methodologies (Continued...)

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Lecture 10 - Template Methods - II

Lecture 11 - Spray Pyrolysis

Lecture 12 - V-L-S Method

Lecture 13 - Lithography - I

Lecture 14 - Lithography - II

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Lecture 17 - Fullerenes and Carbon Nanotubes - III

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Lecture 23 - Self Assembly of Nanostructures - III

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Lecture 27 - Nanocomposites - I

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Lecture 25 - Drilling and Topsides

Lecture 26 - Topsides

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Lecture 10 - Inclining Experiment

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Lecture 16 - Healing Moment - I

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Lecture 19 - Dynamical Stability - III

Lecture 20 - Discussion

Lecture 21 - Righting Stability - I

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Lecture 4 - Basic Structural Components

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Lecture 6 - Bulkheads

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Lecture 8 - Structural Assemblies Double Bottom Construction

Lecture 9 - Wing Tanks & Duct Keels

Lecture 10 - Fore & Aft Construction

Lecture 11 - General Cargo Carrier

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Lecture 14 - Container Ship

Lecture 15 - RO-RO Ship

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Lecture 24 - Line Heating

Lecture 25 - Fusion Welding & Power Source

Lecture 26 - Welding Parameters & their Effects

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Lecture 7 - Applications of Equations of Motion (Continued...)

Lecture 8 - Two Dimensional Flows

Lecture 9 - Two Dimensional Flows (Continued...)

Lecture 10 - Source, Sink and Doublet

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Lecture 13 - Uniform Flow Past an Elliptic Cylinder

Lecture 14 - Aerofoil theory

Lecture 15 - Aerofoil theory (Continued...)

Lecture 16 - Aerofoil theory (Continued...)

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Lecture 18 - Motion of a cylinder

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Lecture 22 - Basic Equation and Conditions of Water Waves

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Lecture 27 - Wave motion in two layer fluids

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Lecture 31 - Gravity wave transformation and energy rotation (Continued...)

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- Lecture 2 - Regular Water Waves - II
- Lecture 3 - Definition of Ship Motions & Encounter Frequency
- Lecture 4 - Single Degree of Freedom Motions in Regular Waves
- Lecture 5 - Uncoupled Heave, Pitch and Roll - I
- Lecture 6 - Uncoupled Heave, Pitch and Roll - II
- Lecture 7 - Uncoupled Heave, Pitch and Roll - III
- Lecture 8 - Uncoupled Heave, Pitch and Roll - IV
- Lecture 9 - Uncoupled Heave, Pitch and Roll - V
- Lecture 10 - Coupled Motions
- Lecture 11 - Irregular Waves
- Lecture 12 - Description of Irregular Waves by Spectrum
- Lecture 13 - Theoretical Wave Spectrum
- Lecture 14 - Ship Motion in Irregular Waves - I
- Lecture 15 - Ship Motion in Irregular Waves - II
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- Lecture 17 - Description of Short-Crested Sea
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- Lecture 20 - Derived Responses & Dynamic Effects - II
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- Lecture 22 - Seakeeping Considerations in Design
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Lecture 7 - Ideal Gas Laws, Different Processes

Lecture 8 - Introduction to Vapour Power Cycle

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Lecture 11 - Basic Concept of Turbine, Velocity Diagram

Lecture 12 - Steam Turbine-Impulse

Lecture 13 - Reaction Turbine Compounding

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Lecture 25 - Gas Turbine Cycles

Lecture 26 - Modification of Brayton Cycle

Lecture 27 - Introduction to Convective Heat Transfer Forced & Free Convection

NPTEL : Performance of Marine Vehicles at Sea (Ocean Engineering)

Co-ordinators : Prof. Debabrata Sen, Prof. S.C. Misra

- Lecture 1 - Components of Resistance - I
- Lecture 2 - Components of Resistance - II
- Lecture 3 - Dimensional Analysis
- Lecture 4 - Frictional Resistance
- Lecture 5 - Wave Making Resistance
- Lecture 6 - Other Components of Resistance
- Lecture 7 - Model Experiments
- Lecture 8 - Shallow Water Effects
- Lecture 9 - Ship hull form and Resistance
- Lecture 10 - Propeller Geometry - Part I
- Lecture 11 - Propeller Geometry - Part II
- Lecture 12 - Introduction to High Speed Crafts - Part I
- Lecture 13 - Introduction to High Speed Crafts - Part II
- Lecture 14 - Propeller in Open Water - Part I
- Lecture 15 - Propeller in Open Water - Part II
- Lecture 16 - Propeller 'behind' a ship
- Lecture 17 - Propeller experiments
- Lecture 18 - Propeller theories - Part I
- Lecture 19 - Propeller Theories
- Lecture 20 - Cavitation
- Lecture 21 - Regular Sea Waves - I
- Lecture 22 - Regular Sea Waves - II
- Lecture 23 - Irregular sea Waves - I
- Lecture 24 - Irregular Sea Waves - II
- Lecture 25 - Ship Motion in Regular Waves - I
- Lecture 26 - Ship Motion in Regular Waves - II
- Lecture 27 - Ship Motion in Regular Waves - III
- Lecture 28 - Ship Motion in irregular Waves - I
- Lecture 29 - Ship Motion in irregular Waves - II
- Lecture 30 - Ship Motion in irregular Waves - III
- Lecture 31 - Motion in Short Crested Sea,Coupled Motions

[Lecture 32 - Derived Responses](#)

[Lecture 33 - Ship Controllability : Introductory Notes](#)

[Lecture 34 - Equation of Motion in Horizontal Plane](#)

[Lecture 35 - Hydrodynamic Derivatives and Stability](#)

[Lecture 36 - Hydrodynamic Derivatives and Stability](#)

[Lecture 37 - Ship Trials and Maneuvers - I](#)

[Lecture 38 - Ship Trials and Maneuvers - II](#)

[Lecture 39 - Heel During Turn, IMO Requirements](#)

[Lecture 40 - Rudder Hydrodynamics](#)

NPTEL : Strength and Vibration of Marine Structures (Ocean Engineering)

Co-ordinators : Prof. S.K. Satsangi, Prof. A.H. Sheikh

- Lecture 1 - Introduction to Ship Structures - I
- Lecture 2 - Introduction to Ship Structures - II
- Lecture 3 - Deflection of Structure Beam - I
- Lecture 4 - Deflection of Structure Beam - II
- Lecture 5 - Deflection of Structure Beam - III
- Lecture 6 - Deflection of Structure Beam - IV
- Lecture 7 - Statically Indeterminate Structures - I
- Lecture 8 - Statically Indeterminate Structures - II
- Lecture 9 - Statically Indeterminate Structures - III
- Lecture 10 - Statically Indeterminate Structures - IV
- Lecture 11 - Statically Indeterminate Structures - V
- Lecture 12 - Statically Indeterminate Structures - VI
- Lecture 13 - Longitudinal Bending of Hull Girder - I
- Lecture 14 - Longitudinal Bending of Hull Girder - II
- Lecture 15 - Longitudinal Bending of Hull Grider - III
- Lecture 16 - Theory of Column - I
- Lecture 17 - Theory of Column - II
- Lecture 18 - Theory of Column - III
- Lecture 19 - Theory of Column - IV
- Lecture 20 - Calculation of Momentum of Inertia of Main Section
- Lecture 21 - Bending in Inclined Condition
- Lecture 22 - Calculation of Deflection/Shear Stress
- Lecture 23 - Ship Vibration - I
- Lecture 24 - Ship Vibration - II
- Lecture 25 - Ship Vibration - III
- Lecture 26 - Ship Vibration - IV
- Lecture 27 - Ship Vibration - V
- Lecture 28 - Propeller Induced Vibration & Hull Frequency Estimation
- Lecture 29 - Hull Frequency Estimation from Basic Group (Continued...)
- Lecture 30 - Analysis of Bulkhead - I
- Lecture 31 - Analysis of Bulkhead - II

[Lecture 32 - Stress Concentration/Structural Discontinuities](#)

[Lecture 33 - Composite Construction](#)

[Lecture 34 - Method of Plastic Analysis](#)

[Lecture 35 - Calculation of Natural Frequency of Hull Girder](#)

[Lecture 36 - Hull Resonance Diagram](#)

Lecture 1 - Introduction

Lecture 2 - Global Water Availability and Uses

Lecture 3 - Water Availability and Uses in India

Lecture 4 - Surface Water and Ground Water Resources

Lecture 5 - Water Use Practices and Major Challenges

Lecture 6 - Background to Water Rights

Lecture 7 - Water Rights

Lecture 8 - Right to Sanitation

Lecture 9 - Rights to Water and Sanitation - Underline Principals and Implementation

Lecture 10 - Water Rights : Challenges

Lecture 11 - Water Sustainability : Basic Concept

Lecture 12 - The Dublin Statement on Water Sustainability

Lecture 13 - Action Agenda in the Dublin Statement on Water Sustainability

Lecture 14 - Water Sustainability : Viewpoints

Lecture 15 - Water Sustainability : Conflicts

Lecture 16 - Valuing Water : Economic Value of Water

Lecture 17 - Valuing Water : Use and Non-Use Values

Lecture 18 - Valuing Water : Valuation of Water

Lecture 19 - Valuing Water : Water Valuation Methods

Lecture 20 - Valuing Water : Full Value and Losses

Lecture 21 - Pricing Water : Sustainable Water Pricing

Lecture 22 - Pricing Water : Setting Water Tariffs

Lecture 23 - Pricing Water : Water Tariff Models

Lecture 24 - Pricing Water : Water Tariff Models

Lecture 25 - Pricing Water : Water Tariff Models

Lecture 26 - Water Pricing : Need of Reforms

Lecture 27 - Conflicts in Water Pricing

Lecture 28 - Conflicts in Water Pricing

Lecture 29 - Conflicts in Water Pricing

Lecture 30 - Water Pricing Case Studies

Lecture 31 - Economics of Water Projects

- Lecture 32 - Economics of Water Projects : Economic Analysis
- Lecture 33 - Economics of Water Projects : Financial Analysis
- Lecture 34 - Economics of Water Projects : Benefit-Cost Analysis
- Lecture 35 - Economics of Demand and Sectoral Allocation
- Lecture 36 - Economics Evaluation of Water Projects
- Lecture 37 - Evaluation of Water Projects : Capital Budgeting Methods
- Lecture 38 - Evaluation of Water Projects : Capital Budgeting Methods
- Lecture 39 - Evaluation of Water Projects : Capital Budgeting Methods
- Lecture 40 - Evaluation of Water Projects : Capital Budgeting Methods
- Lecture 41 - Evaluation of Water Projects : Selection of Capital Budgeting Methods (Continued...)
- Lecture 42 - Evaluation of Water Projects : Selection of Capital Budgeting Methods (Continued...)
- Lecture 43 - Water Governance
- Lecture 44 - Elements, Dimensions and Principles of Water Governance
- Lecture 45 - Principles of Water Governance
- Lecture 46 - Principles of Water Governance and Effective Water Governance Schemes
- Lecture 47 - Effective Water Governance Schemes and its Benchmarking
- Lecture 48 - Decision Making and Implementation in Water Governance and its Benchmarking
- Lecture 49 - Water Governance in India : Historical Perspective
- Lecture 50 - Water Governance in India : Pre- and Post- Independent
- Lecture 51 - Water Governance in India : Water Programmes and Policies
- Lecture 52 - Water Governance in India : Water Programmes and Policies (Continued...)
- Lecture 53 - Water Governance in India : Environmental Protection and Water Reforms
- Lecture 54 - Water Dispute Management : Water Conflicts
- Lecture 55 - Water Dispute Management : Interstate and Interstate Water Disputes
- Lecture 56 - Water Dispute Management : Interstate Water Dispute Resolution
- Lecture 57 - Water Dispute Management : Case Studies
- Lecture 58 - Global Water Diplomacy : Trans-boundary Water
- Lecture 59 - Global Water Diplomacy : Conflict Vs Cooperation
- Lecture 60 - Global Water Diplomacy : Cooperation for Water
- Lecture 61 - Course Summary
- Lecture 62 - Course Summary (Continued...)
- Lecture 63 - Live Session-1
- Lecture 64 - Live Session-2

[Lecture 65 - Live Session-2 \(April 20, 2018\)](#)

Lecture 1 - Introduction

Lecture 2 - Propeller Geometry

Lecture 3 - Propeller Geometry (Continued...)

Lecture 4 - Propeller Theory - I

Lecture 5 - Propeller Theory - II

Lecture 6 - Propeller Theory - III

Lecture 7 - Propeller Theory - IV

Lecture 8 - Propeller Theory - V

Lecture 9 - Propeller Theory - VI

Lecture 10 - Propeller Theory - VII

Lecture 11 - Propeller in Open Water

Lecture 12 - Dimensional Analysis and Similarity

Lecture 13 - Propeller Open Water Characteristics

Lecture 14 - Propeller Open Water Characteristics (Continued...)

Lecture 15 - Methodical Propeller Series

Lecture 16 - Hull-Propeller Interaction

Lecture 17 - Hull-Propeller Interaction (Continued...)

Lecture 18 - Ship Powering and Efficiency Components

Lecture 19 - Engine-Propeller Matching - Part I

Lecture 20 - Engine-Propeller Matching - Part II

Lecture 21 - Propeller Model Tests - Part I

Lecture 22 - Propeller Model Tests - Part II

Lecture 23 - Propeller Model Tests - Part III

Lecture 24 - Propeller Cavitation - Part I

Lecture 25 - Propeller Cavitation - Part II

Lecture 26 - Propeller Strength - Part I

Lecture 27 - Propeller Strength - Part II

Lecture 28 - Propeller Design - Part I

Lecture 29 - Propeller Design - Part II

Lecture 30 - Propeller Design - Part III

Lecture 31 - Controllable Pitch Propeller

[Lecture 32 - Ducted Propeller](#)

[Lecture 33 - Ducted Propeller \(Continued...\)](#)

[Lecture 34 - Problems on Propeller Performance](#)

[Lecture 35 - Surface Piercing Propeller, Podded Propeller, Thruster](#)

[Lecture 36 - Waterjet Propulsion](#)

[Lecture 37 - Unconventional Propulsors](#)

[Lecture 38 - Unconventional Propulsors \(Continued...\)](#)

[Lecture 39 - Miscellaneous Topics](#)

[Lecture 40 - Energy Saving Devices](#)

Lecture 1 - Introduction

Lecture 2 - Introduction to Seakeeping - 1

Lecture 3 - Introduction to Seakeeping - 2

Lecture 4 - Seakeeping - 3

Lecture 5 - Seakeeping - 4

Lecture 6 - Seakeeping - 5

Lecture 7 - Seakeeping - 6

Lecture 8 - Seakeeping - 7

Lecture 9 - Hydrodynamics - 1

Lecture 10 - Hydrodynamics - 2

Lecture 11 - Wave and Wave Effect

Lecture 12 - Waves - 2

Lecture 13 - Waves - 3

Lecture 14 - Introduction to BEM

Lecture 15 - Introduction to BEM (Continued...)

Lecture 16 - Lower Order Panel Method

Lecture 17 - Lower Order Panel Method (Continued...)

Lecture 18 - Case Study - Part 1

Lecture 19 - Case Study - Part 2

Lecture 20 - Demonstration of Panel Method Code

Lecture 21 - Frequency Domain Panel Method

Lecture 22 - Frequency Domain Panel Method (Continued...)

Lecture 23 - Frequency Domain Panel Method (Continued...)

Lecture 24 - Frequency Domain Panel Method (Continued...)

Lecture 25 - Frequency Domain Panel Method (Continued...)

Lecture 26 - Frequency Domain Panel Method (Continued...)

Lecture 27 - Frequency Domain Panel Method (Continued...)

Lecture 28 - Frequency Domain Panel Method (Continued...)

Lecture 29 - Cummins Equation

Lecture 30 - IRF Based Solution - Part 1

Lecture 31 - IRF Based Solution - Part 2

- [Lecture 32 - Time Domain Solution Using IRF](#)
- [Lecture 33 - Time Domain Solution Using IRF \(Continued...\)](#)
- [Lecture 34 - Numerical Computation of IRF Based Method](#)
- [Lecture 35 - Numerical Computation of IRF Based Method \(Continued...\)](#)
- [Lecture 36 - Forward Speed Effects](#)
- [Lecture 37 - Strip Theory - Part 1](#)
- [Lecture 38 - Strip Theory - Part 2](#)
- [Lecture 39 - Strip Theory - Part 3](#)
- [Lecture 40 - Strip Theory - Part 4](#)
- [Lecture 41 - Strip Theory - Part 5](#)
- [Lecture 42 - Strip Theory - Part 6](#)
- [Lecture 43 - Strip Theory - Part 7](#)
- [Lecture 44 - Time Domain Panel Method](#)
- [Lecture 45 - Time Domain Panel Method \(Continued...\)](#)
- [Lecture 46 - Time Domain Panel Method \(Continued...\)](#)
- [Lecture 47 - Time Domain Panel Method \(Continued...\)](#)
- [Lecture 48 - Time Domain Panel Method \(Continued...\)](#)
- [Lecture 49 - Non Linear Time Domain Panel Method](#)
- [Lecture 50 - Non Linear Time Domain Panel Method \(Continued...\)](#)
- [Lecture 51 - Time Domain Panel Method - Code Development](#)
- [Lecture 52 - Ship Hydroelasticity](#)
- [Lecture 53 - Hydroelasticity](#)
- [Lecture 54 - Hydroelasticity \(Continued...\)](#)
- [Lecture 55 - Hydroelasticity \(Continued...\)](#)
- [Lecture 56 - Semi Analytic Method](#)
- [Lecture 57 - Semi Analytic Method \(Continued...\)](#)
- [Lecture 58 - Including Non linear Forces in BEM Code](#)
- [Lecture 59 - Including Non linear Forces in BEM Code \(Continued...\)](#)
- [Lecture 60 - Closer](#)

NPTEL : Design of Offshore Structures (Ocean Engineering)

Co-ordinators : Dr. S. Nallayarasu

Lecture 1 - Loads On Offshore Structures - 1

Lecture 2 - Loads On Offshore Structures - 2

Lecture 3 - Loads On Offshore Structures - 3

Lecture 4 - Loads On Offshore Structures - 4

Lecture 5 - Loads On Offshore Structures - 5

Lecture 6 - Loads On Offshore Structures - 6

Lecture 7 - Loads On Offshore Structures - 7

Lecture 8 - Concepts of Fixed Offshore Platform Deck and Jacket - 1

Lecture 9 - Concepts of Fixed Offshore Platform Deck and Jacket - 2

Lecture 10 - Concepts of Fixed Offshore Platform Deck and Jacket - 3

Lecture 11 - Concepts of Fixed Offshore Platform Deck and Jacket - 4

Lecture 12 - Concepts of Fixed Offshore Platform Deck and Jacket - 5

Lecture 13 - Steel Tubular Member Design - 1

Lecture 14 - Steel Tubular Member Design - 2

Lecture 15 - Steel Tubular Member Design - 3

Lecture 16 - Steel Tubular Member Design - 4

Lecture 17 - Steel Tubular Member Design - 5

Lecture 18 - Tubular Joint Design for Static and Cyclic Loads - 1

Lecture 19 - Tubular Joint Design for Static and Cyclic Loads - 2

Lecture 20 - Tubular Joint Design for Static and Cyclic Loads - 3

Lecture 21 - Tubular Joint Design for Static and Cyclic Loads - 4

Lecture 22 - Tubular Joint Design for Static and Cyclic Loads - 5

Lecture 23 - Tubular Joint Design for Static and Cyclic Loads - 6

Lecture 24 - Tubular Joint Design for Static and Cyclic Loads - 7

Lecture 25 - Tubular Joint Design for Static and Cyclic Loads - 8

Lecture 26 - Tubular Joint Design for Static and Cyclic Loads - 9

Lecture 27 - Tubular Joint Design for Static and Cyclic Loads - 10

Lecture 28 - Tubular Joint Design for Static and Cyclic Loads - 11

Lecture 29 - Tubular Joint Design for Static and Cyclic Loads - 12

Lecture 30 - Jackup RIGS-Analysis and Design - 1

Lecture 31 - Jackup RIGS-Analysis and Design - 2

[Lecture 32 - Jackup RIGS-Analysis and Design - 3](#)

[Lecture 33 - Jackup RIGS-Analysis and Design - 4](#)

[Lecture 34 - Jackup RIGS-Analysis and Design - 5](#)

[Lecture 35 - Design Against Accidental Loads - 1](#)

[Lecture 36 - Design Against Accidental Loads - 2](#)

[Lecture 37 - Design Against Accidental Loads - 3](#)

[Lecture 38 - Design Against Accidental Loads - 4](#)

[Lecture 39 - Design Against Accidental Loads - 5](#)

[Lecture 40 - Design Against Accidental Loads - 6](#)

[Lecture 41 - Design Against Accidental Loads - 7](#)

[Lecture 42 - Design Against Accidental Loads - 8](#)

Lecture 1 - Basics of Soil Mechanics - I

Lecture 2 - Basics of Soil Mechanics - II

Lecture 3 - Basics of Soil Mechanics - III

Lecture 4 - Basics of Soil Mechanics - IV

Lecture 5 - Basics of Soil Mechanics - V

Lecture 6 - Basics of Soil Mechanics - VI

Lecture 7 - Basics of Soil Mechanics - VII

Lecture 8 - Bearing Capacity of Foundations - I

Lecture 9 - Bearing Capacity of Foundations - II

Lecture 10 - Pile Foundation - I

Lecture 11 - Pile Foundation - II

Lecture 12 - Pile Foundation - III

Lecture 13 - Pile Foundation - IV

Lecture 14 - Pile Foundation - V

Lecture 15 - Pile Foundation - VI

Lecture 16 - Pile Installation - I

Lecture 17 - Pile Installation - II

Lecture 18 - Pile Driveability Analysis - I

Lecture 19 - Pile Driveability Analysis - II

Lecture 20 - Pile Driveability Analysis - III

Lecture 21 - Pile Driveability Analysis - IV

Lecture 22 - Pile Driveability Analysis - V

Lecture 23 - Onbottom Stability of Jackets - I

Lecture 24 - Onbottom Stability of Jackets - II

Lecture 25 - Pile Load Test - I

Lecture 26 - Pile Load Test - II

Lecture 27 - Pile Load Test - III

Lecture 28 - Special Topics

Lecture 29 - Special Foundations - I

Lecture 30 - Special Foundations - II

Lecture 31 - Special Foundations - III

[Lecture 32 - Pile Group Effects](#)

[Lecture 33 - Two Pile Group Effect For Axial Load](#)

Lecture 1 - Introduction and Terminologies

Lecture 2 - Introduction to HSE

Lecture 3 - Safety assurance and assessment

Lecture 4 - Safety assurance and assessment (Continued...)

Lecture 5 - Safety in design and operations

Lecture 6 - Organizing for safety

Lecture 7 - Hazard classification and assessment, Hazard evaluation and hazard control

Lecture 8 - HaZOP

Lecture 9 - HaZOP (Continued...)

Lecture 10 - Hazard evaluation and hazard control

Lecture 11 - Hazard Identification and Management in Oil & Gas Industry using HAZOP

Lecture 12 - FMEA

Lecture 13 - FMEA (Continued...)

Lecture 14 - Environmental Issues and Management

Lecture 15 - Impact of Oil and Gas Industry on Marine Environment

Lecture 16 - Oil Hydrocarbon in Marine Environment

Lecture 17 - Chemicals and Wastes from Offshore and Oil Industry

Lecture 18 - Dispersion Models “ Atmospheric Pollution

Lecture 19 - Atmospheric Pollution (Continued...)

Lecture 20 - Hazard Assessment and Accident Scenario

Lecture 21 - Dose Assessment, Safety Regulation

Lecture 22 - Toxic Release and Dispersion Modeling

Lecture 23 - Chemical Exposure Index (CEI)

Lecture 24 - Chemical Exposure Index (Continued.)

Lecture 25 - Quantitative Risk Assessment

Lecture 26 - Quantitative Risk Assessment (Liquid Release Models Case Study - Continued...)

Lecture 27 - Fire and Explosion Modeling

Lecture 28 - Fire and Explosion Modeling Flammability Diagrams

Lecture 29 - Explosion Modeling

Lecture 30 - Fire and Explosion Preventive Measures

Lecture 31 - Probabilistic Risk Analysis

[Lecture 32 - Safety Measures in Design and Process Operations](#)

[Lecture 33 - Case Studies](#)

[Lecture 34 - Case Studies \(Continued...\)](#)

[Lecture 35 - Software Used in HSE an Over View](#)

NPTEL : Port and Harbour Structures (Ocean Engineering)

Co-ordinators : Prof. R. Sundaravadivelu

- Lecture 1 - Layout of ports
- Lecture 2 - Continuation of layout of ports
- Lecture 3 - Visakhapatnam port
- Lecture 4 - Ships and size of ships
- Lecture 5 - Port planning
- Lecture 6 - Harbour layout
- Lecture 7 - Site characteristics & navigation channel
- Lecture 8 - Bathymetric survey
- Lecture 9 - Tide, surge, tsunami and wave
- Lecture 10 - Wave rose diagram
- Lecture 11 - Breakwater
- Lecture 12 - Design of breakwater - Part-1
- Lecture 13 - Design of breakwater - Part-2
- Lecture 14 - Berm breakwater
- Lecture 15 - Dredging & methods of disposal
- Lecture 16 - Berthing structures modelling
- Lecture 17 - Berthing structures - analyses
- Lecture 18 - Loads
- Lecture 19 - Types of berthing structures
- Lecture 20 - Design of berthing, structures-1
- Lecture 21 - Design of offshore berthing, structures-1
- Lecture 22 - Estimation of mooring, berthing and seismic forces
- Lecture 23 - Estimation seismic forces
- Lecture 24 - Active and passive earth pressure and differential water pressure
- Lecture 25 - Load combinations and design
- Lecture 26 - Fenders
- Lecture 27 - Mechanical handling system
- Lecture 28 - Single buoy mooring and open sea jetty - Part 1
- Lecture 29 - Single buoy mooring and open sea jetty - Part 2
- Lecture 30 - Slipway, drydock, floating dock, shiplift
- Lecture 31 - Soil structure interaction

- Lecture 32 - Calculation of fixity depth
- Lecture 33 - Pile load test
- Lecture 34 - Ground improvement techniques
- Lecture 35 - Analysis of pile with spring support
- Lecture 36 - UPV,Half cell potential, Low high Integrity Test
- Lecture 37 - Mooring Dolphin at KPT
- Lecture 38 - Coastal structures and environmental management
- Lecture 39 - BOQ and Cost Estimate
- Lecture 40 - Proposed Mega Terminal Chennai
- Lecture 41 - Preliminary Project Report on Shipyard
- Lecture 42 - Procedures & clearances before implementation of a project
- Lecture 43 - Detailed project report
- Lecture 44 - Environmental studies of a project
- Lecture 45 - Design of pile
- Lecture 46 - Design and construction of diaphragm wall
- Lecture 47 - Empirical relationship between spt and several soil properties
- Lecture 48 - Model studies for a deep water port_case study

Lecture 1 - Syllabus and Introduction

Lecture 2 - Seaway Effects on Resistance

Lecture 3 - Ship Types and Powering Aspects

Lecture 4 - Frictional Resistance and Turbulence Stimulation

Lecture 5 - Wave Making Resistance

Lecture 6 - Bulbous Bow on Ship Resistance

Lecture 7 - Air and Wind Resistance Dimensional Analysis - I

Lecture 8 - Dimensional Analysis - II, Model Tests and Ship Resistance Prediction Methods - I

Lecture 9 - Model Tests and Ship Resistance Prediction Methods - II

Lecture 10 - Model Tests and Ship Resistance Prediction Methods - III

Lecture 11 - Resistance in Shallow Water

Lecture 12 - Canal Effects on Resistance Holtrap-Mennen Method for Ship Resistance Prediction

Lecture 13 - Ship Resistance Prediction Methods - I

Lecture 14 - Ship Resistance Prediction Methods - II

Lecture 15 - Resistance of Advanced Marine Vehicles - I

Lecture 16 - Resistance of Advanced Marine Vehicles - II

Lecture 17 - Resistance of Advanced Marine Vehicles - III

Lecture 1 - Wave deformation - I

Lecture 2 - Wave deformation - II

Lecture 3 - wave deformation (problems - I)

Lecture 4 - wave deformation (problems - II)

Lecture 5 - wave deformation (problems - III)

Lecture 6 - Sediment charecteristics - I

Lecture 7 - Sediment charecteristics - II

Lecture 8 - Radiation stresses - I

Lecture 9 - Radiation stresses - II

Lecture 10 - Longshore sediment transport - I

Lecture 11 - Longshore sediment transport - II

Lecture 12 - Longshore sediment transport (problems - I)

Lecture 13 - Longshore sediment transport (problems - II)

Lecture 14 - Coastal erosion protection measures - I

Lecture 15 - Coastal erosion protection measures - II

Lecture 16 - Coastal erosion protection measures - III

Lecture 17 - Coastal erosion protection measures - IV

Lecture 18 - Coastal erosion protection measures - V

Lecture 19 - Coastal erosion protection measures - VI

Lecture 20 - Coastal erosion protection measures - VII

Lecture 21 - Coastal erosion protection measures - VIII

Lecture 22 - Coastal erosion protection measures - IX

Lecture 23 - Coastal erosion protection measures - X

Lecture 24 - Cheaper CEP methods - XI

Lecture 25 - Geosynthetics - I

Lecture 26 - Geosynthetics - II

Lecture 27 - Breakwaters - I

Lecture 28 - Breakwaters - II

Lecture 29 - Breakwaters - III

Lecture 30 - Breakwaters - IV

Lecture 31 - Forces on coastal structures - I

[Lecture 32 - Forces on coastal structures - II](#)

[Lecture 33 - Scour under marine structures](#)

[Lecture 34 - Physical modelling of coastal structures - I](#)

[Lecture 35 - Physical modelling of coastal structures - II](#)

[Lecture 36 - Tsunami - I](#)

[Lecture 37 - Tsunami - II](#)

NPTEL : Wave Hydrodynamics (Ocean Engineering)

Co-ordinators : Prof. V. Sundar

Lecture 1 - Basic Fluid Dynamics - I

Lecture 2 - Basic Fluid Dynamics - II

Lecture 3 - Introduction

Lecture 4 - Wave Motion - I

Lecture 5 - Wave Motion - II

Lecture 6 - Wave Motion - III

Lecture 7 - Wave Motion Problems

Lecture 8 - Standing Wave Theory

Lecture 9 - Wave Deformation - I

Lecture 10 - Wave Deformation - II

Lecture 11 - Wave Deformation and Problems

Lecture 12 - Random Waves

Lecture 13 - Random Waves and Problems - I

Lecture 14 - Random Waves and Problems - II

Lecture 15 - Random Waves and Problems - III

Lecture 16 - Simulation of Random Waves

Lecture 17 - Directional waves

Lecture 18 - Wave Loads on Structures - I

Lecture 19 - Wave Loads on Structures - II

Lecture 20 - Wave Loads on Structures and Problems - I

Lecture 21 - Wave Loads on Structures and Problems - II

Lecture 22 - Wave loads on Large Boies

Lecture 23 - Finite Amplitude Wave Theories

Lecture 24 - Hydrodynamic Testing Facility

Lecture 25 - Hydrodynamic Testing Facility at IITM

- Lecture 1 - Introduction and objectives
- Lecture 2 - Fixed type offshore structures
- Lecture 3 - Compliant type offshore structures - I
- Lecture 4 - Compliant type offshore structures - II
- Lecture 5 - Drill ships and basics of drilling
- Lecture 6 - Subsea production systems
- Lecture 7 - Environmental loads - I
- Lecture 8 - Environmental loads - II
- Lecture 9 - Types of coastal structures - I
- Lecture 10 - Types of coastal structures - II
- Lecture 11 - Summary of coastal structures
- Lecture 12 - Tutorials on Module - I
- Lecture 13 - Outline of planning of ocean structures
- Lecture 14 - Introduction to design
- Lecture 15 - Construction techniques
- Lecture 16 - Dredging - I
- Lecture 17 - Dredging - II
- Lecture 18 - Uncertainties in analysis and design
- Lecture 19 - Design adequacy - Example I
- Lecture 20 - Design adequacy - Example II
- Lecture 21 - Dredging equipments' specifications
- Lecture 22 - Ocean Pollution
- Lecture 23 - Foundation and sea bed anchors
- Lecture 24 - Introduction to materials - I
- Lecture 25 - Introduction to materials - II
- Lecture 26 - Concrete in marine environment
- Lecture 27 - Concrete: problems and solutions
- Lecture 28 - Repair materials for marine structures
- Lecture 29 - Corrosion in concrete - I
- Lecture 30 - Corrosion in concrete - II
- Lecture 31 - Material sin repair and rehabilitation

[Lecture 32 - Materials for special repair](#)

[Lecture 33 - New materials for coastal embankments - I](#)

[Lecture 34 - New materials for coastal embankments - II](#)

[Lecture 35 - Non-destructive testing](#)

[Lecture 36 - Structural health monitoring](#)

[Lecture 37 - Wireless sensor networking](#)

[Lecture 38 - Repair and rehabilitation-Fenders](#)

NPTEL : Dynamics of Ocean Structures (Ocean Engineering)

Co-ordinators : Dr. Srinivasan Chandrasekaran

- Lecture 1 - Introduction to different types of ocean structures - I
- Lecture 2 - Introduction to different types of ocean structures - II
- Lecture 3 - Introduction to different types of ocean structures - III
- Lecture 4 - Types of Compliant towers
- Lecture 5 - New Generation offshore and Coastal structures
- Lecture 6 - Environmental forces
- Lecture 7 - Wave forces, Current
- Lecture 8 - Introduction to Structural dynamics
- Lecture 9 - Characteristics of single degree - of - freedom model
- Lecture 10 - Methods of writing equation of motion
- Lecture 11 - Free and forced vibration of single degree - of - freedom systems
- Lecture 12 - Undamped and damped systems - I
- Lecture 13 - Undamped and damped systems - II
- Lecture 14 - Undamped and damped systems - III
- Lecture 15 - Comparison of methods
- Lecture 16 - Examples
- Lecture 17 - Numerical problems in single degree - of - freedom systems
- Lecture 18 - Two degrees - of - freedom systems
- Lecture 19 - Eigenvalues and Eigenvectors
- Lecture 20 - Orthogonality of modes
- Lecture 21 - Study of Multi degrees - of - freedom systems
- Lecture 22 - Equations of motion
- Lecture 23 - Natural frequencies and mode shapes
- Lecture 24 - Stodla, Rayleigh - Ritz and influence coefficient methods, Dunkerley
- Lecture 25 - Continuous system
- Lecture 26 - Structural action of offshore structures
- Lecture 27 - Fluid - Structure interaction - I
- Lecture 28 - Fluid - Structure interaction - II Dynamic analysis of offshore jacket platforms
- Lecture 29 - Steps of analysis using software
- Lecture 30 - Steps of analysis using software (Continued...)
- Lecture 31 - Dynamic analysis of articulated towers

Lecture 32 - Iterative frequency domain - I

Lecture 33 - Iterative frequency domain - II

Lecture 34 - Multi - legged articulated towers

Lecture 35 - Response control of multi-legged articulated towers using tuned mass dampers Experimental and analytical studies on MLAT

Lecture 36 - Development of Tension Leg Platforms and geometric optimization

Lecture 37 - Dynamic analyses of TLPs

Lecture 38 - Development of Mass, stiffness and damping matrices of TLP from first principles

Lecture 39 - Estimate of classical damping

Lecture 40 - TLPs under seismic excitation

Lecture 41 - Direct Integration method

Lecture 42 - Development of new generation offshore structures

Lecture 43 - Introduction to stochastic dynamics of ocean structures

Lecture 44 - Response spectrum

Lecture 45 - Narrow band process

Lecture 46 - Return period, Fatigue prediction

Lecture 47 - Modal response method, Modal mass contribution

Lecture 48 - Missing mass correction, Example problems

Lecture 49 - Duhamel's integral

Lecture 1 - Introduction and Scope

Lecture 2 - Fixed type structures

Lecture 3 - Compliant type structures

Lecture 4 - New generation marine structures

Lecture 5 - Environmental loads - I

Lecture 6 - Environmental loads - II

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- Lecture 3 - Drilling and Completion - 1
- Lecture 4 - Drilling and Completion - 2
- Lecture 5 - Well Completion
- Lecture 6 - Basics of Surface Facilities
- Lecture 7 - Fluid Properties
- Lecture 8 - Introduction to Separators - 1
- Lecture 9 - Introduction to Separators - 2
- Lecture 10 - Flow Control - 1
- Lecture 11 - Flow Control - 2
- Lecture 12 - Principle of Separation - 1
- Lecture 13 - Principle of Separation - 2
- Lecture 14 - Heat calculations for separation
- Lecture 15 - Fluid Properties and Two-Phase Separator - 1
- Lecture 16 - Fluid Properties and Two-Phase Separator - 2
- Lecture 17 - Introduction to Separators
- Lecture 18 - Horizontal Separator and Sizing - 1
- Lecture 19 - Horizontal Separator and Sizing - 2
- Lecture 20 - Horizontal Separator and Sizing: Numerical
- Lecture 21 - Three Phase Separation - 1
- Lecture 22 - Three Phase Separation - 2
- Lecture 23 - Vertical Separator Sizing - 1
- Lecture 24 - Vertical Separator Sizing - 2
- Lecture 25 - Horizontal and Vertical Separator: Numerical
- Lecture 26 - Heater Treater - 1
- Lecture 27 - Heater Treater - 2
- Lecture 28 - Gunbarrel
- Lecture 29 - Gunbarrel: Numericals
- Lecture 30 - Heat Calculation - 1
- Lecture 31 - Heat Calculation - 2

[Lecture 32 - Introduction to Electrostatic Treater - 1](#)

[Lecture 33 - Introduction to Electrostatic Treater - 2](#)

[Lecture 34 - Heater Treater and Gunbarrel - 1](#)

[Lecture 35 - Heater Treater and Gunbarrel - 2](#)

[Lecture 36 - Heater Treater and Gunbarrel: Numerical - Part 1](#)

[Lecture 37 - Heater Treater and Gunbarrel: Numerical - Part 2](#)

[Lecture 38 - Desalting of Crude Oil - 1](#)

[Lecture 39 - Desalting of Crude Oil - 2](#)

[Lecture 40 - Water Treatment - 1](#)

[Lecture 41 - Water Treatment - 2](#)

[Lecture 42 - Produced Water Treatment - 1](#)

[Lecture 43 - Produced Water Treatment - 2](#)

[Lecture 44 - Produced Water Treatment - 3](#)

[Lecture 45 - Produced Water Treatment: Numerical](#)

[Lecture 46 - Natural Gas Processing - 1](#)

[Lecture 47 - Natural Gas Processing - 2](#)

[Lecture 48 - Acid Gas Treating](#)

[Lecture 49 - Amine System for Gas Sweetening - 1](#)

[Lecture 50 - Amine System for Gas Sweetening - 2](#)

[Lecture 51 - Gas Dehydration](#)

[Lecture 52 - Crude Oil Storage Facilities - 1](#)

[Lecture 53 - Crude Oil Storage Facilities - 2](#)

[Lecture 54 - Crude Oil Storage Facilities - 3](#)

[Lecture 55 - Flow Measurement Techniques - 1](#)

[Lecture 56 - Flow Measurement Techniques - 2](#)

[Lecture 57 - Heat Transfer Mechanisms](#)

[Lecture 58 - Thermodynamic Laws](#)

[Lecture 59 - Introduction to Heat Exchanger - 1](#)

[Lecture 60 - Introduction to Heat Exchanger - 2](#)

[Lecture 61 - Introduction to Heat Exchanger - 3](#)

[Lecture 62 - Introduction to Heat Exchanger - 4](#)

[Lecture 63 - Pressure Vessel - 1](#)

[Lecture 64 - Pressure Vessel - 2](#)

[Lecture 65 - Pressure Vessel - 3](#)

[Lecture 66 - Wall Thickness Criteria](#)

[Lecture 67 - Introduction to Pumps - 1](#)

[Lecture 68 - Introduction to Pumps - 2](#)

[Lecture 69 - Introduction to Pumps - 3](#)

[Lecture 70 - Introduction to Reciprocating Pumps](#)

[Lecture 71 - Introduction to Compressor](#)

[Lecture 72 - Introduction to IC/CI Engine - 1](#)

[Lecture 73 - Introduction to IC/CI Engine - 2](#)

Lecture 1 - Course Overview

Lecture 2 - Basics of Thermodynamics

Lecture 3 - Work and Heat transfer

Lecture 4 - Second law of thermodynamics

Lecture 5 - Reversible Heat Engine

Lecture 6 - Basic mode of heat transfer

Lecture 7 - Conduction

Lecture 8 - Convection

Lecture 9 - Radiation

Lecture 10 - Concept of Resistance

Lecture 11 - Heat flow through pipes and walls

Lecture 12 - Heat Exchangers

Lecture 13 - Fins

Lecture 14 - LMTD

Lecture 15 - Pumps and its types

Lecture 16 - Centrifugal pump

Lecture 17 - Characteristic curves of pumps

Lecture 18 - Cavitation

Lecture 19 - Positive displacement pump

Lecture 20 - Pumps in series/parallel

Lecture 21 - Compressors

Lecture 22 - Intercooler

Lecture 23 - Rankine cycle

Lecture 24 - Injectors and Pumps

Lecture 25 - Numerical problem

Lecture 26 - Boilers

Lecture 27 - Fouling and Scaling

Lecture 28 - Fuel and method of firing

Lecture 29 - Boiler efficiency

Lecture 30 - Turbine Basics

Lecture 31 - Turbine aerodynamics

Lecture 32 - Cascade view and Meridional view

Lecture 33 - Impulse and Reaction Turbine

Lecture 34 - Steam Turbine

Lecture 35 - Regenerative thermal power plant

Lecture 36 - Mollier diagram

Lecture 37 - IC Engines

Lecture 38 - Otto/Diesel Cycle

Lecture 39 - Components of IC engines - Part 1

Lecture 40 - Components of IC engines - Part 2

Lecture 41 - Fuel Injection/Scavenging

Lecture 42 - IC engine: Numerical problems

Lecture 43 - IC Engine - Fuel

Lecture 44 - Marine Fuel and Properties

Lecture 45 - Combustion

Lecture 46 - Fuel Oil properties

Lecture 47 - Lubrication/Cooling

Lecture 48 - IC engine-Numerical Problems

Lecture 49 - Gas turbine - Basics

Lecture 50 - Gas turbine - Basics (Continued...)

Lecture 51 - Gas turbine, formula, calculations

Lecture 52 - Gas turbine: Regeneration, Reheat, Intercooling

Lecture 53 - Numerical Problems

Lecture 54 - Binary cycle/Rankine-Brayton cycle

Lecture 55 - Numerical problems

Lecture 56 - HVAC- Heating, ventilation, and air conditioning

Lecture 57 - Refrigerants

Lecture 58 - Vapor compression Refrigeration system

Lecture 59 - HVAC - VCRC components

Lecture 60 - HVAC - Psychrometric

Lecture 61 - HVAC - Numerical problems

Lecture 62 - Fire Fighting Machinery

Lecture 63 - Desalination

Lecture 64 - Energy recovery device (ERD)

[Lecture 65 - Desalination/Fire fighting/Numerical problems](#)

[Lecture 66 - Numerical problems](#)

[Lecture 67 - Steering gear/propeller/rudder/incin](#)

[Lecture 68 - Power transmission system, shafting, bearing, gear, lubrication, Electric propulsion](#)

[Lecture 69 - Stern Tube Bearings and Misalignment](#)

[Lecture 70 - Shaft](#)

[Lecture 71 - Shaft Design](#)

[Lecture 72 - Gears](#)

[Lecture 73 - Seals and Bearings](#)

[Lecture 74 - Oil water separation, electrical systems](#)

[Lecture 75 - Bilge water flocculant](#)

[Lecture 76 - Gravity OWS](#)

[Lecture 77 - Centrifuge](#)

[Lecture 78 - Membrane Technologies](#)

[Lecture 79 - Electrical systems](#)

[Lecture 80 - Motor](#)

Lecture 1 - Scalar field and its Gradient

Lecture 2 - Line and Surface Integrals

Lecture 3 - Divergence and Curl of Vector Fields

Lecture 4 - Conservative Field, Stoke's Theorem

Lecture 5 - Laplacian

Lecture 6 - Electric Field Potential

Lecture 7 - Gauss's Law, Potential

Lecture 8 - Electric Field and Potential

Lecture 9 - Potential and Potential Energy - I

Lecture 10 - Potential and Potential Energy - II

Lecture 11 - Potential and Potential Energy - III

Lecture 12 - Coefficients of Potential and Capacitance

Lecture 13 - Poission and Laplace Equation

Lecture 14 - Solutions of Laplace Equation - I

Lecture 15 - Solutions of Laplace Equation - II

Lecture 16 - Solutions of Laplace Equation - III

Lecture 17 - Special Techniques - I

Lecture 18 - Special Techniques - II

Lecture 19 - Special Techniques - III

Lecture 20 - Dielectrics - I

Lecture 21 - Dielectrics - II

Lecture 22 - Dielectrics - III

Lecture 23 - Equation of Continuity

Lecture 24 - a) Force between current loops b) Magnetic Vector Potential

Lecture 25 - Magnetic Vector Potential

Lecture 26 - Boundary Conditions

Lecture 27 - Magnetized Material

Lecture 28 - Magentostatics (Continued...), Time Varying Field (Introduction)

Lecture 29 - Faraday's Law and Inductance

Lecture 30 - Maxwell's Equations

Lecture 31 - Maxwell's Equations and Conservation Laws

[Lecture 32 - Conservation Laws](#)

[Lecture 33 - a\) Angular Momentum Conservation b\) Electromagnetic Waves](#)

[Lecture 34 - Electromagnetic Waves](#)

[Lecture 35 - Propagation of Electromagnetic Waves in a metal](#)

[Lecture 36 - Waveguides - I](#)

[Lecture 37 - Waveguides - II](#)

[Lecture 38 - Resonating Cavity](#)

[Lecture 39 - Radiation - I](#)

[Lecture 40 - Radiation - II](#)

NPTEL : Special Theory of Relativity (Physics)

Co-ordinators : Prof. Shiva Prasad

Lecture 1 - Problem with Classical Physics

Lecture 2 - Michelson-Morley Experiment

Lecture 3 - Postulates of Special Theory of Relativity and Galilean Transformation

Lecture 4 - Look out for a New Transformation

Lecture 5 - Lorentz Transformation

Lecture 6 - Length Contraction and Time Dilation

Lecture 7 - Examples of Length Contraction and Time Dilation

Lecture 8 - Velocity Transformation and Examples

Lecture 9 - A Three Event Problem

Lecture 10 - A Problem involving Light and Concept of Casuality

Lecture 11 - Problems involving Casuality and Need to Redefine Momentum

Lecture 12 - Minkowski Space and Four Vectors

Lecture 13 - Proper Time a Four Scalar

Lecture 14 - Velocity Four Vector

Lecture 15 - Momentum Energy Four Vector

Lecture 16 - Relook at Collision Problems

Lecture 17 - Zero Rest Mass Particle and Photon

Lecture 18 - Doppler Effect in Light

Lecture 19 - Example in C-Frame

Lecture 20 - Force in Relativity

Lecture 21 - Force Four-Vector

Lecture 22 - Electric & Magnetic Field Transformation

Lecture 23 - Example of EM Field Transformation

Lecture 24 - Current Density Four Vector and Maxwell Equation

- Lecture 1 - Why Quantum Computing?
- Lecture 2 - Postulates of Quantum Mechanics - I
- Lecture 3 - Postulates of Quantum Mechanics - II
- Lecture 4 - Qubit - The smallest unit
- Lecture 5 - Qubit - Bloch sphere representation
- Lecture 6 - Multiple Qubit States and Quantum Gates
- Lecture 7 - Quantum Gates
- Lecture 8 - Quantum Circuits
- Lecture 9 - No-Cloning Theorem and Quantum Teleportation
- Lecture 10 - Super Dense Coding
- Lecture 11 - Density Matrix - I
- Lecture 12 - Density Matrix - II
- Lecture 13 - Bloch Sphere and Density Matrix
- Lecture 14 - Measurement Postulates - I
- Lecture 15 - Measurement Postulates - II
- Lecture 16 - Simple Algorithms-Deutsch Algorithm
- Lecture 17 - Deutsch-Josza and Bernstein - Vazirani Algorithms
- Lecture 18 - Simon Problem
- Lecture 19 - Grover's Search Algorithm - I
- Lecture 20 - Grover's Search Algorithm - II
- Lecture 21 - Grover's Search Algorithm - III
- Lecture 22 - Grover's Search Algorithm - IV
- Lecture 23 - Quantum Fourier Transform
- Lecture 24 - Period Finding and QFT
- Lecture 25 - Implementing QFT
- Lecture 26 - Implementing QFT-3 qubits (and more)
- Lecture 27 - Shor's Factorization Algorithm
- Lecture 28 - Shor's Factorization Algorithm-Implementation
- Lecture 29 - Shor's Algorithm-Continued Fraction
- Lecture 30 - Quantum Error Correction - I
- Lecture 31 - Quantum Error Correction - II Three Qubit Code

[Lecture 32 - Quantum Error Correction - III Shor's 9 Qubit Code - I](#)

[Lecture 33 - Quantum Error Correction - IV Shor's 9 Qubit Code - II](#)

[Lecture 34 - Classical Information Theory](#)

[Lecture 35 - Shannon Entropy](#)

[Lecture 36 - Shannon's Noiseless Coding Theorem](#)

[Lecture 37 - Von Neumann Entropy](#)

[Lecture 38 - EPR and Bell's Inequalities - I](#)

[Lecture 39 - EPR and Bell's Inequalities - II](#)

[Lecture 40 - EPR and Bell's Inequalities - III](#)

[Lecture 41 - Cryptography-RSA Algorithm - I](#)

[Lecture 42 - Cryptography-RSA Algorithm - II](#)

[Lecture 43 - Quantum Cryptography - I](#)

[Lecture 44 - Quantum Cryptography - II](#)

[Lecture 45 - Experimental Aspects of Quantum Computing - I](#)

[Lecture 46 - Experimental Aspects of Quantum Computing - II](#)

Lecture 1 - Introduction

Lecture 2 - Algebraic Preliminaries

Lecture 3 - Basic Group Concepts and Low Order Groups - I

Lecture 4 - Basic Group Concepts and Low Order Groups - II

Lecture 5 - Lagrange's Theorem and Cayley's Theorem - I

Lecture 6 - Lagrange's Theorem and Cayley's Theorem - II

Lecture 7 - Factor Group Conjugacy Classes - I

Lecture 8 - Factor Group Conjugacy Classes - II

Lecture 9 - Cycle Structures and Molecular Notation - I

Lecture 10 - Cycle Structures and Molecular Notation - II

Lecture 11 - Cycle Structures and Classification - I

Lecture 12 - Cycle Structures and Classification - II

Lecture 13 - Point Group Notation and Factor Group - I

Lecture 14 - Point Group Notation and Factor Group - II

Lecture 15 - Representation Theory - I

Lecture 16 - Representation Theory - II

Lecture 17 - Representation Theory - III

Lecture 18 - Representation Theory - IV

Lecture 19 - Schur's Lemma and Orthogonality Theorem - I

Lecture 20 - Schur's Lemma and Orthogonality Theorem - II

Lecture 21 - Orthogonality For Characters - I

Lecture 22 - Orthogonality For Characters - II

Lecture 23 - Character Tables and Molecular Applications - I

Lecture 24 - Character Tables and Molecular Applications - II

Lecture 25 - Preliminaries About The Continuum - I

Lecture 26 - Preliminaries About The Continuum - II

Lecture 27 - Classical Groups - I

Lecture 28 - Classical Groups - II

Lecture 29 - Classical Groups-Topology - I

Lecture 30 - Classical Groups-Topology - II

Lecture 31 - SO(3) And Matrix Exponent - I

- Lecture 32 - $SO(3)$ And Matrix Exponent - II
- Lecture 33 - Generators, Discussion Of Lie's Theorems - I
- Lecture 34 - Generators, Discussion Of Lie's Theorems - II
- Lecture 35 - Group Algebras; $SO(3)$ - $SU(2)$ Correspondence - I
- Lecture 36 - Group Algebras; $SO(3)$ - $SU(2)$ Correspondence - II
- Lecture 37 - $SO(3)$, $SU(2)$ Representations - I
- Lecture 38 - $SO(3)$, $SU(2)$ Representations - II
- Lecture 39 - Representation On Function Spaces - I
- Lecture 40 - Representation On Function Spaces - II
- Lecture 41 - Lorentz Boosts, $SO(3,1)$ Algebra - I
- Lecture 42 - Lorentz Boosts, $SO(3,1)$ Algebra - II
- Lecture 43 - Representation Of Lorentz Group And Clifford Algebra - I
- Lecture 44 - Representation Of Lorentz Group And Clifford Algebra - II
- Lecture 45 - $SU(3)$ And Lie's Classification - I
- Lecture 46 - $SU(3)$ And Lie's Classification - II
- Lecture 47 - Fundamental Symmetries Of Physics - I
- Lecture 48 - Fundamental Symmetries Of Physics - II

Lecture 1 - Introduction to Quantum Mechanics - I

Lecture 2 - Introduction to Quantum Mechanics - II

Lecture 3 - Review of Particle in Box, Potential Well, Barrier, Harmonic Oscillator - I

Lecture 4 - Review of Particle in Box, Potential Well, Barrier, Harmonic Oscillator - II

Lecture 5 - Tutorial 1 - Part I

Lecture 6 - Tutorial 1 - Part II

Lecture 7 - Bound States - I

Lecture 8 - Bound States - II

Lecture 9 - Conditions and Solutions for one Dimensional Bound States - I

Lecture 10 - Conditions and Solutions for one Dimensional Bound States - II

Lecture 11 - Tutorial 2

Lecture 12 - Linear Vector Space (LVS) - I

Lecture 13 - Linear Vector Space (LVS) - II

Lecture 14 - Linear Vector Space (LVS) - III

Lecture 15 - Basis for Operators and States in LVS - I

Lecture 16 - Basis for Operators and States in LVS - II

Lecture 17 - Tutorial 3 - Part I

Lecture 18 - Tutorial 3 - Part II

Lecture 19 - Function Spaces - I

Lecture 20 - Function Spaces - II

Lecture 21 - Postulates of Quantum Mechanics - I

Lecture 22 - Postulates of Quantum Mechanics - II

Lecture 23 - Tutorial 4 - Part I

Lecture 24 - Tutorial 4 - Part II

Lecture 25 - Classical vs Quantum Mechanics - I

Lecture 26 - Classical vs Quantum Mechanics - II

Lecture 27 - Compatible vs Incompatible Observable - I

Lecture 28 - Compatible vs Incompatible Observable - II

Lecture 29 - Tutorial 5 - Part I

Lecture 30 - Tutorial 5 - Part II

Lecture 31 - Tutorial 5 - Part III

[Lecture 32 - Schrodinger and Heisenberg Pictures - I](#)

[Lecture 33 - Schrodinger and Heisenberg Pictures - II](#)

[Lecture 34 - Solutions to other Coupled Potential Energies - I](#)

[Lecture 35 - Solutions to other Coupled Potential Energies - II](#)

[Lecture 36 - Tutorial 6 - Part I](#)

[Lecture 37 - Tutorial 6 - Part II](#)

[Lecture 38 - Hydrogen Atom and Wave Functions, Angular Momentum Operators, Identical Particles - I](#)

[Lecture 39 - Hydrogen Atom and Wave Functions, Angular Momentum Operators, Identical Particles - II](#)

[Lecture 40 - Identical Particles and Quantum Computer - I](#)

[Lecture 41 - Identical Particles and Quantum Computer - II](#)

[Lecture 42 - Tutorial 7 - Part I](#)

[Lecture 43 - Tutorial 7 - Part II](#)

[Lecture 44 - Harmonic Oscillator - I](#)

[Lecture 45 - Harmonic Oscillator - II](#)

[Lecture 46 - Ladder Operators - I](#)

[Lecture 47 - Ladder Operators - II](#)

[Lecture 48 - Tutorial 8 - Part I](#)

[Lecture 49 - Tutorial 8 - Part II](#)

[Lecture 50 - Stern-Gerlach Experiment - I](#)

[Lecture 51 - Stern-Gerlach Experiment - II](#)

[Lecture 52 - Oscillator Algebra](#)

[Lecture 53 - Tutorial 9 - Part I](#)

[Lecture 54 - Tutorial 9 - Part II](#)

[Lecture 55 - Angular Momentum - I](#)

[Lecture 56 - Angular Momentum - II](#)

[Lecture 57 - Rotations Groups - I](#)

[Lecture 58 - Rotations Groups - II](#)

[Lecture 59 - Tutorial 10 - Part I](#)

[Lecture 60 - Tutorial 10 - Part II](#)

[Lecture 61 - Addition of Angular Momentum - I](#)

[Lecture 62 - Addition of Angular Momentum - II](#)

[Lecture 63 - Clebsch-Gordan Coefficients - I](#)

[Lecture 64 - Clebsch-Gordan Coefficients - II](#)

[Lecture 65 - Tutorial 11 - Part I](#)

[Lecture 66 - Tutorial 11 - Part II](#)

[Lecture 67 - Clebsch-Gordan Coefficients - III](#)

[Lecture 68 - Tensor Operators and Wigner-Eckart Theorem - I](#)

[Lecture 69 - Tensor Operators and Wigner-Eckart Theorem - II](#)

[Lecture 70 - Tensor Operators and Wigner-Eckart Theorem - III](#)

[Lecture 71 - Tutorial 12](#)

- Lecture 1 - Quantum Theory Fundamental Quantisation - I
- Lecture 2 - Quantum Theory Fundamental Quantisation - II
- Lecture 3 - Path Integral Formulation - I
- Lecture 4 - Path Integral Formulation - II
- Lecture 5 - Path Integral Formulation - III
- Lecture 6 - Path Integral Formulation - IV
- Lecture 7 - Correlation Functions - I
- Lecture 8 - Correlation Functions - II
- Lecture 9 - Generating Functional, Forced Harmonic Oscillator - I
- Lecture 10 - Generating Functional, Forced Harmonic Oscillator - II
- Lecture 11 - Generating Function in Field Theory - I
- Lecture 12 - Generating Function in Field Theory - II
- Lecture 13 - Effective Potential - I
- Lecture 14 - Effective Potential - II
- Lecture 15 - Effective Potential - III
- Lecture 16 - Effective Potential - IV
- Lecture 17 - Asymptotic Theory - I
- Lecture 18 - Asymptotic Theory - II
- Lecture 19 - Asymptotic Condition Kallen-Lehmann representation - I
- Lecture 20 - Asymptotic Condition Kallen-Lehmann representation - II
- Lecture 21 - Gauge Invariance - Minimal Coupling
- Lecture 22 - Gauge Invariance - Geometric Picture
- Lecture 23 - Gauge Invariance - Abelian Case
- Lecture 24 - Gauge Invariance - Non-abelian case
- Lecture 25 - Yang Mills Theory - Coupling to Matter
- Lecture 26 - Yang Mills Theory - Physical Content
- Lecture 27 - Yang Mills Theory Constraint Dynamics - I
- Lecture 28 - Yang Mills Theory Constraint Dynamics - II
- Lecture 29 - Gauge Fixing and Faddeev Popov Ghosts - I
- Lecture 30 - Gauge Fixing and Faddeev Popov Ghosts - II
- Lecture 31 - Topological Vacuum of Yang Mills Theories - I

Lecture 1 - Introduction

Lecture 2 - DNA packing and structure

Lecture 3 - Shape and function

Lecture 4 - Numbers and sizes

Lecture 5 - Spatial scales and System variation

Lecture 6 - Timescales in Biology

Lecture 7 - Random walks and Passive diffusion

Lecture 8 - Random walks to model Biology

Lecture 9 - Derivation of FRAP equations

Lecture 10 - Drift-diffusion equations

Lecture 11 - Solutions of the drift-diffusion equations

Lecture 12 - The cell signaling problem

Lecture 13 - Cell Signalling and Capture Probability of absorbing sphere

Lecture 14 - Capture probability of reflecting sphere

Lecture 15 - Mean capture time

Lecture 16 - Introduction to fluids, viscosity and reynolds number

Lecture 17 - Introduction to the navier stokes equation

Lecture 18 - Understanding reynolds number

Lecture 19 - Life at low reynolds number

Lecture 20 - Various phenomena at low reynolds number

Lecture 21 - Bacterial flagellar motion

Lecture 22 - Rotating flagellum

Lecture 23 - Energy and equilibrium

Lecture 24 - Binding problems

Lecture 25 - Transcription and translation

Lecture 26 - Internal states of macromolecules

Lecture 27 - Protein modification problem

Lecture 28 - Haemoglobin-Oxygen binding problem

Lecture 29 - Freely jointed polymer model

Lecture 30 - Entropic springs and persistence length

Lecture 31 - Freely rotating chain model and radius of gyration

- Lecture 32 - The hierarchical chromatin packing model
- Lecture 33 - FISH and DNA looping
- Lecture 34 - Nucleosomes as barriers, Hi-C, and contact probabilities
- Lecture 35 - Deriving the full force extension curve
- Lecture 36 - Random walk models for proteins
- Lecture 37 - Hydrophobic polar protein model
- Lecture 38 - Diffusion in crowded environments
- Lecture 39 - Depletion interactions
- Lecture 40 - Examples and implications of depletion interactions
- Lecture 41 - Introduction to Biological dynamics
- Lecture 42 - Introduction to rate equations
- Lecture 43 - Separation of timescales in enzyme kinetics
- Lecture 44 - Structure and treadmilling of actins and microtubules
- Lecture 45 - Average length of polymers in equilibrium
- Lecture 46 - Growth rate of polymers
- Lecture 47 - Dynamic treadmilling in microtubules
- Lecture 48 - Introduction to molecular motors
- Lecture 49 - Force generation by molecular motors
- Lecture 50 - Models of motor motion
- Lecture 51 - molecular motors
- Lecture 52 - Free energies of motor for stepping
- Lecture 53 - Two state models
- Lecture 54 - cooperative transport of cargo
- Lecture 55 - Cytoskeleton as a motor
- Lecture 56 - translocation ratchet
- Lecture 57 - Spatial pattern in biology
- Lecture 58 - Some common spatial patterns in biology
- Lecture 59 - reaction diffusion and spatial pattern
- Lecture 60 - Pattern formation in reaction diffusion system with stability
- Lecture 61 - Condition for destabilization in pattern formation
- Lecture 62 - Schnakenberg kinetics

Lecture 1 - Introduction - I

Lecture 2 - Introduction - II

Lecture 3 - Normal subgroup, Coset, Conjugate group

Lecture 4 - Factor group, Homomorphism, Isomorphism

Lecture 5 - Factor group, Homomorphism, Isomorphism

Lecture 6 - Conjugacy Classes

Lecture 7 - Permutation Groups

Lecture 8 - Cycle Structure

Lecture 9 - Cycle Structure (Continued...)

Lecture 10 - Young Diagram and Molecular Symmetry

Lecture 11 - Point Groups

Lecture 12 - Symmetries of Molecules, Schoenflies Notation

Lecture 13 - Symmetries of Molecules, Stereographic Projection

Lecture 14 - Examples of Molecular Symmetries and Proof of Cayley Theorem

Lecture 15 - Matrix Representation of Groups - I

Lecture 16 - Matrix Representation of Groups - II

Lecture 17 - Reducible and Irreducible Representation - I

Lecture 18 - Reducible and Irreducible Representation - II

Lecture 19 - Great Orthogonality Theorem and Character Table - I

Lecture 20 - Great Orthogonality Theorem and Character Table - II

Lecture 21 - Mulliken Notation, Character Table and Basis

Lecture 22 - Tensor Product of Representation

Lecture 23 - Tensor Product and Projection Operator - I

Lecture 24 - Tensor Product and Projection Operator - II

Lecture 25 - Tensor Product and Projection Operator with an example

Lecture 26 - Binary Basis and Observables

Lecture 27 - Selection Rules

Lecture 28 - Selection Rules and Molecular Vibrations

Lecture 29 - Molecular vibration normal modes: Classical Mechanics approach

Lecture 30 - Molecular vibration normal modes: Group Theory approach

Lecture 31 - Molecular vibration modes using projection operator

Lecture 32 - Vibrational representation of character

Lecture 33 - Infrared Spectra and Raman Spectra

Lecture 34 - Introduction to continuous group

Lecture 35 - Generators of translational and rotational transformation

Lecture 36 - Generators of Lorentz transformation

Lecture 37 - Introduction to $O(3)$ and $SO(3)$ group

Lecture 38 - $SO(n)$ and Lorentz group

Lecture 39 - Generalised orthogonal group and Lie algebra

Lecture 40 - Subalgebra of Lie algebra

Lecture 41 - $gl(2,C)$ and $sl(2,C)$ group

Lecture 42 - $U(n)$ and $SU(n)$ group

Lecture 43 - Symplectic group

Lecture 44 - $SU(2)$ and $SU(3)$ groups

Lecture 45 - Rank, weight and weight vector

Lecture 46 - Weight vector, root vector, comparison between $SU(2)$ and $SU(3)$ algebra

Lecture 47 - Root diagram, simple roots, adjoint representation

Lecture 48 - $SU(2)$ sub-algebra, Dynkin diagrams

Lecture 49 - Fundamental weights, Young diagrams, dimension of irreducible representation

Lecture 50 - Young diagrams and tensor products

Lecture 51 - Tensor product, Wigner - Eckart theorem

Lecture 52 - Tensor product of irreducible representation 1: Composite objects from fundamental particles

Lecture 53 - Tensor product of irreducible representation 2: Decimet and octet diagrams in the Quark Model

Lecture 54 - Clebsch - Gordan coefficients

Lecture 55 - 1) Quadrupole moment tensor (Wigner-Eckart theorem) 2) Decimet Baryon wavefunction

Lecture 56 - Higher dimensional multiplets in the quark model

Lecture 57 - Symmetry breaking in continuous groups

Lecture 58 - Dynamical symmetry in hydrogen atom: $SO(4)$ algebra

Lecture 59 - Hydrogen atom energy spectrum and degeneracy using Runge-Lenz vector

Lecture 1 - Neutrons as Probe of Condensed Matter

Lecture 2 - Sources for thermal neutrons used in neutron scattering

Lecture 3

Lecture 4 - Calculating Neutron Scattering cross-section

Lecture 5

Lecture 6 - Scattering theory and introducing dynamics in the formalism

Lecture 7 - Scattering theory and introducing dynamics in the formalism

Lecture 8 - Scattering theory and introducing dynamics in the formalism

Lecture 9 - Scattering law's correlation with double-Fourier transform of real space correlation function

Lecture 10 - Scattering law's correlation with double-Fourier transform of real space correlation function

Lecture 11 - Correlation function to resolution and accessible($Q, \Delta\theta$). Introducing experimental facilities

Lecture 12 - Correlation function to resolution and accessible($Q, \Delta\theta$). Introducing experimental facilities

Lecture 13 - Correlation function to resolution and accessible($Q, \Delta\theta$). Introducing experimental facilities

Lecture 14 - Correlation function to resolution and accessible($Q, \Delta\theta$). Introducing experimental facilities

Lecture 15 - Introducing resolution and components of neutron scattering facilities.

Lecture 16 - Introducing resolution and components of neutron scattering facilities.

Lecture 17 - Continue with neutron scattering set up and its components like collimators, filters, detectors etc

Lecture 18 - Continue with neutron scattering set up and its components like collimators, filters, detectors etc

Lecture 19 - Describe the operation of various kinds of neutron detectors

Lecture 20 - Describe the operation of various kinds of neutron detectors

Lecture 21 - Introducing neutron choppers, velocity selectors and polarizers, some important components of beam tailoring devices

Lecture 22 - Introducing neutron choppers, velocity selectors and polarizers, some important components of beam tailoring devices

Lecture 23 - Neutron polarizers and spin-flippers

Lecture 24 - Neutron polarizers and spin-flippers

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NPTEL : Quantum Mechanics and Applications (Physics)

Co-ordinators : Prof. Ajoy Ghatak

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NPTEL : Semiconductor Optoelectronics (Physics)

Co-ordinators : Prof. M.R. Shenoy

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Lecture 7 - Occupation Probability and Carrier Concentration

Lecture 8 - Carrier Concentration and Fermi Level

Lecture 9 - Quasi Fermi Levels

Lecture 10 - Semiconductor Materials

Lecture 11 - Semiconductor Hetrostructures-Lattice-Matched Layers

Lecture 12 - Strained -Layer Epitaxy and Quantum Well Structures

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Lecture 14 - Hetrostructure p-n junctions

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Lecture 16 - Fabrication of Heterostructure Devices

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NPTEL : NOC:Scientific Computing Using Python (Physics)

Co-ordinators : Prof. Mahendra K. Verma

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Lecture 13 - Basics analysis (Continued...)

Lecture 14 - Basics analysis (Continued...)

Lecture 15 - Basics analysis (Continued...)

Lecture 16 - Basics analysis (Continued...)

Lecture 17 - Basics analysis (Continued...)

Lecture 18 - Basics analysis (Continued...)

Lecture 19 - Basics analysis (Continued...)

Lecture 20 - Determination of Young's modulus

Lecture 21 - Demonstration on the experiment of Young's modulus of mettalic bar and data collection

Lecture 22 - Calculate the value of young's modulus of given metallic bar form the recorded datas

Lecture 23 - Experimental demonstration to calculate the spring constant of a given spring

Lecture 24 - Calculate the value of calculate the spring constant of a given spring form the recorded datas

Lecture 25 - Theory regarding Moment of inertia of a flywheel

Lecture 26 - Experimental demonstration to calculate the moment of inertia of a given flywheel

Lecture 27 - How to calculate the value of moment of inertia of a flywheelform the recorded data

Lecture 28 - Theory regarding surface tension of the liquid

Lecture 29 - Demonstration on the experiment of surface tension and data collection

Lecture 30 - How to calculate the value of surface tension of water from the recorded data

Lecture 31 - Theory regarding viscosity of liquid

Lecture 32 - Demonstration on the experiment of viscosity

Lecture 33 - Data analysis of recorded data on viscosity

Lecture 34 - Forced Oscillations Pohls pendulum

Lecture 35 - Coupled Pendulum

Lecture 36 - Demonstration on the experiment of compound pendulum

Lecture 37 - Theory regarding compound pendulum has been discussed

Lecture 38 - Experimental demonstration on the standing Waves on a String has been shown clearly how to determine the linear mass density of the string.

Lecture 39 - Linear expansion of metal

Lecture 40 - Expt. to study linear expansion

Lecture 41 - Determine the coefficient of thermal conductivity of a bad conductor

Lecture 42 - Determination of electrical equivalent of heat

Lecture 43 - Determination of specific heat of the given solid metals using Dulong-Petit's law

Lecture 44 - Determination of the calibration curve of a given (Type K chromel- α alumel) thermocouple and hence determination of Seebeck coefficient

Lecture 45 - Theory and Demonstration Platinum Resistance thermometer

Lecture 46 - Experiment on Platinum Resistance thermometer

Lecture 47 - To study the current-voltage relationship of an L-R circuit

Lecture 48 - To study the variation in current and voltage in a series LCR circuit

Lecture 49 - Sensitivity of Blastic Galvanometer

Lecture 50 - Expt. for Sensitivity of Blastic Galvanometer

Lecture 51 - Theory on RC Circuit

Lecture 52 - Expt. on RC Circuit

Lecture 53 - Theory regarding the magnetic field along the axis of a circular coil

Lecture 54 - Experiment regarding the magnetic field along the axis of a circular coil

Lecture 55 - Study the induced e.m.f of inductance coil

Lecture 56 - Mutual inductance

Lecture 57 - Theory regarding permeability of air

Lecture 58 - Experiment to determination the permeability of air

Lecture 59 - Devices around us

Lecture 60 - Devices around us (Continued...)

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Lecture 2 - Summary of Experimental Physics - I

Lecture 3 - Summary of Experimental Physics - I (Continued...)

Lecture 4 - Summary of Experimental Physics - I (Continued...)

Lecture 5 - Summary of Experimental Physics - I (Continued...)

Lecture 6 - Basic analysis

Lecture 7 - Basic analysis (Continued...)

Lecture 8 - Basic components

Lecture 9 - Basic components (Continued...)

Lecture 10 - Basic components (Continued...)

Lecture 11 - Basic idea on mirrors and lenses and their applications

Lecture 12 - Determination of focal length of concave mirror

Lecture 13 - Determination of focal length of concave mirror (Continued...)

Lecture 14 - Determination of focal length of convex mirror

Lecture 15 - Determination of focal length of convex lens

Lecture 16 - Determination of focal length of concave lens

Lecture 17 - Determination of focal length of convex lens by displacement method

Lecture 18 - Applications of mirrors and lenses

Lecture 19 - Determination of refractive index of liquid using travelling microscope

Lecture 20 - Basic discussion on spectrometer and prism

Lecture 21 - Basic discussion on spectrometer and prism (Continued...)

Lecture 22 - Basic discussion on spectrometer and prism (Continued...)

Lecture 23 - Schuster's method

Lecture 24 - Discussion on angle of the prism, angular dispersion and dispersive power of given prism

Lecture 25 - Determination of the angle of prism

Lecture 26 - Determination of the angle of minimum deviation for a given prism and hence to determine the refractive index of the given prism

Lecture 27 - Discussion on the angle of incidence and corresponding deviation of light through a prism and determination of the angle of minimum deviation for a given prism from the plot of the angle of incidence versus deviation.

Lecture 28 - Determination of the angle of minimum deviation from (i-D) plot for a given prism and hence to determine the refractive index of the given prism.

Lecture 29 - Determination of the calibration plot of deviation versus wavelength for a given prism and hence determination of the wavelength of the unknown light source using the calibration plot

Lecture 30 - Determination of the dispersive power, Cauchy constant and resolving power of a given prism.

Lecture 31 - Interference Phenomena

Lecture 32 - Interference Phenomena (Continued...)

Lecture 33 - Interference Phenomena (Continued...)

Lecture 34 - Bi-prism

Lecture 35 - Bi-prism (Continued...)

Lecture 36 - Interference phenomena by Newton ring (Theory)

Lecture 37 - Interference phenomena by Newton ring (Experiment)

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Lecture 39 - Michelson interferometer (Experiment)

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Lecture 41 - Theory of diffraction (Continued...)

Lecture 42 - Theory of diffraction (Continued...)

Lecture 43 - Single slit diffraction

Lecture 44 - Double slit diffraction

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Lecture 49 - Experiment for Verification of Malus law

Lecture 50 - Experiment for Brewster

Lecture 51 - Experiment for Brewster angle

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Lecture 57 - Experiment on Photoelectric Effect

Lecture 58 - Thomson experiment to determine the specific charge of an electron (e/m)

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Lecture 61 - Experiment on Rydberg constant (Continued...)

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Lecture 4 - Cathode Ray Oscilloscope (CRO) (Continued...)

Lecture 5 - Electro Magnet and Constant Current Power Supply

Lecture 6 - Electro Magnet and Constant Current Power Supply (Continued...)

Lecture 7 - Electro Magnet and Constant Current Power Supply (Continued...)

Lecture 8 - Gaussmeter/Teslameter

Lecture 9 - Gaussmeter/Teslameter (Continued...)

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Lecture 17 - To study the variation of resistivity of metal and semiconductor at low temperature region (Continued...)

Lecture 18 - To study the variation of resistivity of metal and semiconductor at low temperature region (Continued...)

Lecture 19 - Measurement of magnetisation of ferromagnetic material

Lecture 20 - Measurement of magnetisation of ferromagnetic material (Continued...)

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Lecture 22 - Experiment of Quincke's Tube Method

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[Lecture 37 - P-N Junction \(Continued...\)](#)

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Lecture 6 - Properties of Degenerate Fermi Gas

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Lecture 8 - Sommerfeld Expansion and Band Formation: Temperature dependent densities, Chemical Potential, Specific Heat

Lecture 9 - Bonding and Band Formation: N=2 solid Molecular Orbitals, Linear combinations of Atomic Orbitals (LCAO)

Lecture 10 - Variational Method: Molecular Orbitals, Bonding and anti-bonding Orbitals

Lecture 11 - Bonding and Band Formation (LCAO)

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Lecture 13 - Bloch's Theorem

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Lecture 21 - Graphene and Fermi Surfaces

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- Lecture 32 - Curie's law for any J, Susceptibility
- Lecture 33 - Susceptibility and Thermal Properties
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- Lecture 35 - Pauli Paramagnetism
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- Lecture 40 - Magnetic Order of different types and Heisenberg model
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- Lecture 58 - Josephson junction
- Lecture 59 - Vortices, SQUID, Quantum Supremacy and Qubits
- Lecture 60 - Topological state of matter, XY Model, Topological Insulators

Lecture 1 - Wave Equation, Maxwell's equation, Plane wave

Lecture 2 - EM wave in vacuum, Poynting vector, Maxwell's equation in Dielectric Medium

Lecture 3 - Poynting Vector, Maxwell's equation in dielectric medium (Continued...)

Lecture 4 - Total Internal reflection, Evanescent wave

Lecture 5 - Step-index fiber (SIF), Light guidance in SIF

Lecture 6 - Light guidance in SIF (Skew Ray), V-Parameter, Discrete Ray

Lecture 7 - Cutoff wavelength, Fiber characteristics

Lecture 8 - Fiber Loss, dB units, Dispersion

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Lecture 16 - Material Dispersion (Continued...), Dispersion Coefficient

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Lecture 18 - Pulse Propagation in Dispersive Medium

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Lecture 4 - Solar Photovoltaic Systems

Lecture 5 - Origin of Band Structure and Energy Band Gap

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Lecture 19 - Tidal Power and Geothermal Energy

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Lecture 2 - Maxwell's law for speed distribution of gas molecules

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Lecture 5 - Maxwell's law for energy distribution of gas molecules

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Lecture 16 - Brownian motion: concept, features, theory of fluctuation

Lecture 17 - Brownian motion: mean square displacement and vertical distribution of particles

Lecture 18 - Perrin's experiment on Brownian motion - Part 1

Lecture 19 - Perrin's experiment on Brownian motion - Part 2

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Lecture 21 - Specific heat of solids: Dulong-Petit law and Einstein theory

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Lecture 25 - Van der Waals equation of state

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Lecture 30 - The platinum resistance thermometer

Lecture 31 - Basic concepts of classical thermodynamics

Lecture 32 - Basic concepts of classical thermodynamics (Continued...)

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Lecture 35 - General discussion on Heat conduction and elastic properties

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Lecture 37 - The reversible heat engine: Carnot cycle

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Lecture 3 - An electron in a magnetic field, magnetism of isolated atoms

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Lecture 5 - Magnetism of atoms-dia and paramagnetic susceptibilities. Hund's rules, Van Vleck paramagnetism

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Lecture 8 - Paramagnetism of conduction electrons - Pauli paramagnetism

Lecture 9 - Ions in a solid: crystal field, orbital quenching, Jahn-Teller effect

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Lecture 12 - Recapitulation, interacting moments and long range order, dipolar exchange

Lecture 13 - Interacting moments, 2-electron system, origin of exchange and spin Hamiltonian

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Lecture 15 - GMR, spin model and mean-field theory, Ising model

Lecture 16 - Ising model and its properties

Lecture 17 - Ising model and its properties (Continued...), absence of LRO in $d=1$, mean-field theory

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Lecture 19 - Exact solution of Ising model in $d=1$, exact results in $d=2$. Mermin-Wagner theorem

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- Lecture 8 - Differential calculus, Gradient
- Lecture 9 - Gradient operator, Concept of divergence
- Lecture 10 - Divergence operator, Divergence Theorem
- Lecture 11 - Curl operator, Stokes Theorem
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Lecture 5 - Introduction to Nanomaterials and functionality

Lecture 6 - Synthesis protocols - I

Lecture 7 - Synthesis protocols - II

Lecture 8 - Synthesis protocols - III

Lecture 9 - Crystal structure - I

Lecture 10 - Crystal structure - II

Lecture 11 - Crystal structure - III

Lecture 12 - Crystal imperfections

Lecture 13 - Alloys and Melts

Lecture 14 - Theory of Solids

Lecture 15 - Nearly free electron model

Lecture 16 - Bonds in molecules and solids

Lecture 17 - Transformations kinetics and reaction rates

Lecture 18 - Thermodynamics

Lecture 19 - Phase and phase transitions

Lecture 20 - Diffusion and various properties

Lecture 21 - Mechanical properties of solids

Lecture 22 - Thermal Properties of Solids

Lecture 23 - Negative and Zero Expansion Ceramics

Lecture 24 - Heat Capacity

Lecture 25 - Thermogravimetric (TGA) analysis

Lecture 26 - Introduction to magnetism and Magnetic properties of solids

Lecture 27 - From magnetic to multiferroic materials

Lecture 28 - Magnetic materials and their applications

Lecture 29 - Magnetism at nanoscale

Lecture 30 - GMR materials

Lecture 31 - CMR materials

[Lecture 32 - Ferrofluids](#)

[Lecture 33 - Spintronics and devices](#)

[Lecture 34 - Introduction to the basic properties of liquids and melts](#)

[Lecture 35 - Heat capacity and diffusion of liquids and melts](#)

[Lecture 36 - Viscosity, electric and thermal conduction of liquids and melts](#)

[Lecture 37 - Sensors](#)

[Lecture 38 - Electrochemical Sensors](#)

[Lecture 39 - Introduction to energy storage devices and basics of supercapacitors](#)

[Lecture 40 - Supercapacitors - II](#)

[Lecture 41 - Magnetic supercapacitors](#)

[Lecture 42 - Battery - I](#)

[Lecture 43 - Battery - II](#)

[Lecture 44 - Solar Cells - I](#)

[Lecture 45 - Solar Cells - II](#)

[Lecture 46 - X-ray Diffraction \(XRD\)](#)

[Lecture 47 - Fourier Transform Infrared Spectroscopy](#)

[Lecture 48 - UV- Vis Spectroscopy](#)

[Lecture 49 - Scanning and Transmission Electron Microscopy](#)

[Lecture 50 - Summary](#)

Lecture 1 - Introduction to waves, 1D wave equation and its solutions

Lecture 2 - 1D Light waves

Lecture 3 - Characteristics of light waves - amplitude, absolute phase, wavelength and frequency

Lecture 4 - Phase, Phase velocity and Phase delay

Lecture 5 - Complex notation for the description light waves and superposition

Lecture 6 - Maxwell's equations to the 3D wave equation and its solutions

Lecture 7 - Recap of Week 1

Lecture 8 - 3D wave equation and plane waves

Lecture 9 - Complex notation for Electric fields, Superposition and interference

Lecture 10 - Fabry-Perot interferometer and its transmittance

Lecture 11 - Physical interpretation of FP transmittance

Lecture 12 - Recap of Fabry-Perot modes

Lecture 13 - Free spectral range of a Fabry-Perot etalon

Lecture 14 - Resonator modes and optical pulses - insight

Lecture 15 - Table - Top Coherent and Incoherent Imaging

Lecture 16 - Recap of Etalon free spectral range

Lecture 17 - Line width and finesse of an etalon

Lecture 18 - Actual resonator modes

Lecture 19 - Resonator configurations and stability

Lecture 20 - Recap of optical resonators

Lecture 21 - Introduction of light pulses

Lecture 22 - Complex amplitude, Gaussian pulse

Lecture 23 - Recap of light pulses

Lecture 24 - Introduction of Fourier Transforms

Lecture 25 - Tutorial 1

Lecture 26 - Motivating Fourier Transforms

Lecture 27 - Fourier Transform Properties

Lecture 28 - Frequency domain electric field

Lecture 29 - Recap of Fourier transform properties

Lecture 30 - Frequency domain description of pulses

Lecture 31 - Spectral Phase

Lecture 32 - Recap of spectral phase

Lecture 33 - Instantaneous Frequency and group delay

Lecture 34 - Phase wrapping, blanking, and Taylor series expansion

Lecture 35 - Recap of instantaneous frequency, phase wrapping, and phase blanking

Lecture 36 - Frequency domain phase expansion, group delay dispersion

Lecture 37 - Absolute Phase

Lecture 38 - Recap of concepts + discussion

Lecture 39 - Absolute Phase (revisited)

Lecture 40 - Carrier envelope phase, frequency comb

Lecture 41 - Discussion

Lecture 42 - Recap of concepts

Lecture 43 - First order phase

Lecture 44 - Second order phase

Lecture 45 - Recap of first order and second order phase

Lecture 46 - Chirped pulse: Instantaneous frequency and Fourier transform

Lecture 47 - Group delay, nonlinearly chirped pulse

Lecture 48 - Recap of chirped pulses

Lecture 49 - Quadratic chirp pulses

Lecture 50 - Higher order spectral phase

Lecture 51 - Recap and discussion on higher order phase

Lecture 52 - Relative importance of intensity and phase

Lecture 53 - Pulse propagation through a medium

Lecture 54 - Recap of pulse propagation and pulse length

Lecture 55 - Discussion of RMS pulse width and uncertainty principle

Lecture 56 - Time-bandwidth product

Lecture 57 - Recap of previous module

Lecture 58 - Introduction of Lorentz Oscillator Model

Lecture 59 - Effect of matter on light

Lecture 60 - Recap of Lorentz oscillator, Polarization tensor

Lecture 61 - Dynamics of electrons in the Lorentz oscillator

Lecture 62 - Solving the inhomogeneous wave equation

Lecture 63 - Inhomogeneous wave equation, absorption coefficient, refractive index

Lecture 64 - Nonlinear response of matter

[Lecture 65 - Origin of nonlinear optical effects](#)

[Lecture 66 - Wave equation in an inert gas](#)

[Lecture 67 - Perturbation theory and second harmonics](#)

[Lecture 68 - Numerical simulation strategy](#)

[Lecture 69 - Atoms in the presence of fields](#)

[Lecture 70 - Ionization models](#)

[Lecture 71 - Attosecond pulse generation and metrology](#)

[Lecture 72 - Nonlinear optics review](#)

[Lecture 73 - Nonlinear response of matter to light](#)

[Lecture 74 - Sum and difference frequency generation](#)

[Lecture 75 - Recap of sum and difference frequency generation, second harmonic generation](#)

[Lecture 76 - Generalized nonlinear effects, conservation laws in SHG](#)

[Lecture 77 - Phase matching in SHG, polarization dependent refractive index](#)

Lecture 1 - Introduction

Lecture 2 - Introduction (Continued...)

Lecture 3 - Concept of wave, Wave Equation

Lecture 4 - Plane wave, Spherical wave

Lecture 5 - Maxwell's wave equation, Poynting Vector

Lecture 6 - Superposition of waves

Lecture 7 - Superposition of wave (Complex method)

Lecture 8 - Random and coherent source, standing wave formation

Lecture 9 - Group and Phase velocity

Lecture 10 - Material Dispersion

Lecture 11 - Material Dispersion (Continued...)

Lecture 12 - Concept of Coherence

Lecture 13 - Concept of Coherence (Continued...)

Lecture 14 - Concept of Coherence (Continued...)

Lecture 15 - Concept of Coherence (Continued...)

Lecture 16 - Two beam interference

Lecture 17 - Young's double slit experiment

Lecture 18 - Young's double slit experiment (Continued...)

Lecture 19 - Interference by division of amplitude

Lecture 20 - Interference by division of amplitude (Continued...)

Lecture 21 - Newton's Ring

Lecture 22 - Newton's Ring (Continued...)

Lecture 23 - Newton's Ring (Continued...)

Lecture 24 - Optical Interferometers

Lecture 25 - Michelson Interferometer

Lecture 26 - Multiple beam interference

Lecture 27 - Fabry-Perot Interferometer

Lecture 28 - Fabry-Perot Interferometer (Continued...)

Lecture 29 - Resolving power of Fabry-Perot interferometer

Lecture 30 - Diffraction of Light

Lecture 31 - Huygen's Theory

- [Lecture 32 - Fraunhofer Diffraction](#)
- [Lecture 33 - Single-slit Diffraction](#)
- [Lecture 34 - Single-slit Diffraction \(Continued...\)](#)
- [Lecture 35 - Double-slit Diffraction](#)
- [Lecture 36 - Multi-slit Diffraction](#)
- [Lecture 37 - Multi-Slit Diffraction \(Continued...\)](#)
- [Lecture 38 - Grating spectra](#)
- [Lecture 39 - Grating spectra \(Continued...\)](#)
- [Lecture 40 - Resolving power of grating](#)
- [Lecture 41 - Fraunhofer diffraction for a circular aperture](#)
- [Lecture 42 - Fraunhofer diffraction for a rectangular aperture](#)
- [Lecture 43 - Fresnel Diffraction](#)
- [Lecture 44 - Fresnel's half period zone](#)
- [Lecture 45 - Fresnel's half period zone \(Continued...\)](#)
- [Lecture 46 - Zone Plate](#)
- [Lecture 47 - Fresnel's diffraction from an aperture](#)
- [Lecture 48 - Fresnel's diffraction for a circular aperture](#)
- [Lecture 49 - Fresnel's diffraction for a rectangular aperture](#)
- [Lecture 50 - Fresnel's diffraction for a rectangular aperture \(Continued...\)](#)
- [Lecture 51 - Fresnel's diffraction for semi-infinite opaque screen](#)
- [Lecture 52 - Polarization of light \(Basic concept\)](#)
- [Lecture 53 - Circularly polarized light](#)
- [Lecture 54 - Matrix treatment of polarization](#)
- [Lecture 55 - Jones Matrix for polarization](#)
- [Lecture 56 - Jones Matrix for polarization \(Continued...\)](#)
- [Lecture 57 - Jones Matrix for polarization \(Continued...\)](#)
- [Lecture 58 - Jones Matrix for polarization \(Continued...\)](#)
- [Lecture 59 - Jones matrix for polarization \(Continued...\)](#)
- [Lecture 60 - Production of polarized light](#)
- [Lecture 61 - Production of polarized light \(Continued...\)](#)
- [Lecture 62 - Birefringent Crystal](#)
- [Lecture 63 - Birefringent Crystal \(Continued...\)](#)
- [Lecture 64 - Index Ellipsoid](#)

[Lecture 65 - Analyzing Polarised Light](#)

[Lecture 66 - Babinet Compensator](#)

NPTEL : Special Topics in Atomic Physics (Physics)

Co-ordinators : Prof. P.C. Deshmukh

Lecture 1 - Introductory lecture about this course

Lecture 2 - Quantum Mechanics and Symmetry of the Hydrogen Atom

Lecture 3 - Hydrogen atom: Rotational and Dynamical Symmetry of the $1/r$ Potential

Lecture 4 - Hydrogen atom: Dynamical Symmetry of the $1/r$ Potential

Lecture 5 - Degeneracy of the Hydrogen Atom: $SO(4)$

Lecture 6 - Wavefunctions of the Hydrogen Atom

Lecture 7 - Angular Momentum in Quantum Mechanics

Lecture 8 - Angular Momentum in Quantum Mechanics: half-odd-integer and integer quantum numbers: $SU(2)$ & $SO(3)$

Lecture 9 - Angular Momentum in Quantum Mechanics: Addition Theorem for Spherical Harmonics - Coupling of Angular Momenta

Lecture 10 - Angular Momentum in Quantum Mechanics Dimensionality of the Direct-Product (Composite) Vector Space CGC recursion relations

Lecture 11 - Angular Momentum in Quantum Mechanics CGC matrix, Wigner D Rotation Matrix, Irreducible Tensor Operators

Lecture 12 - Angular Momentum in Quantum Mechanics - more on ITO, and the Wigner-Eckart Theorem

Lecture 13 - Angular Momentum in Quantum Mechanics Wigner-Eckart Theorem - 2

Lecture 14 - Relativistic Quantum Mechanics of the Hydrogen Atom - 1

Lecture 15 - Relativistic Quantum Mechanics of the Hydrogen Atom - 2

Lecture 16 - Relativistic Quantum Mechanics of the Hydrogen Atom - PAULI Equation - Foldy - Wouthysen Transformations - 1

Lecture 17 - Relativistic Quantum Mechanics of the Hydrogen Atom - Foldy - Wouthysen Transformations - 2

Lecture 18 - Relativistic Quantum Mechanics of the Hydrogen Atom - Foldy - Wouthysen Transformations - 3

Lecture 19 - Relativistic Quantum Mechanics of the Hydrogen Atom - Spherical Symmetry of the Coulomb Potential

Lecture 20 - Hartree-Fock Self-Consistent Field formalism - 1

Lecture 21 - Hartree-Fock Self-Consistent Field formalism - 2

Lecture 22 - Hartree-Fock Self-Consistent Field formalism - 3

Lecture 23 - Hartree-Fock Self-Consistent Field formalism - 4

Lecture 24 - Hartree-Fock Self-Consistent Field formalism - 5

Lecture 25 - Perturbative treatment of relativistic effectsâ€| Schrodinger's and Dirac QM

Lecture 26 - Perturbative treatment of relativistic effectsâ€| Schrodinger's and Dirac QM

Lecture 27 - Probing the atom - Collisions and Spectroscopy - boundary conditions - 1

Lecture 28 - Atomic Probes - Collisions and Spectroscopy - boundary conditions - 2

Lecture 29 - Atomic Probes - Collisions and Spectroscopy - Scattering phase shifts and boundary conditions

Lecture 30 - Atomic Probes - Time reversal symmetry - applications in atomic collisions and photoionization processes

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Lecture 31 - Atomic Photoionization cross sections, angular distributions of photoelectrons - 1

Lecture 32 - Atomic Photoionization cross sections, angular distributions of photoelectrons - 2

Lecture 33 - Atomic Photoionization cross sections, angular distributions of photoelectrons - 3

Lecture 34 - Atomic Photoionization cross sections, angular distributions of photoelectrons - 4

Lecture 35 - Atomic Photoionization cross sections, angular distributions of photoelectrons Cooper Zare Formula

Lecture 36 - Stark- Zeeman Spectroscopy - Stark effect

Lecture 37 - Stark- Zeeman Spectroscopy - Stark effect on $n=2$ excited state of the H atom Zeeman effect

Lecture 38 - Stark- Zeeman Spectroscopy - Normal, Anomalous Zeeman effect; Paschen- Back effect

Lecture 39 - Stark- Zeeman Spectroscopy - Anomalous Zeeman effect

Lecture 40 - Zeeman effect Fine structure, Hyperfine structure - Elemental, rudimentary introduction to Laser Cooling, BEC, Atomic Clock / Attosecond metrology

Lecture 1 - What is Classical Field Theory?

Lecture 2 - Symmetries and Invariances - I

Lecture 3 - Symmetries and Invariances - II

Lecture 4 - Group Theory in Physics - I

Lecture 5 - Group Theory in Physics - II

Lecture 6 - Finite Groups - I

Lecture 7 - Finite Groups - II

Lecture 8 - Basics of CFT - I

Lecture 9 - Basics of CFT - II

Lecture 10 - Basics of CFT - III

Lecture 11 - Green Functions - I

Lecture 12 - Green Functions - II

Lecture 13 - Noether's Theorem - I

Lecture 14 - Noether's Theorem - II

Lecture 15 - Kink Soliton

Lecture 16 - Hidden Symmetry

Lecture 17 - Local Symmetries

Lecture 18 - The Abelian Higgs model

Lecture 19 - Lie Algebras - I

Lecture 20 - Lie Algebras - II

Lecture 21 - Magnetic Vortices - I

Lecture 22 - Magnetic Vortices - II

Lecture 23 - Non-abelian gauge theories - I

Lecture 24 - Non-abelian gauge theories - II

Lecture 25 - Irreps of Lie algebras - I

Lecture 26 - Irreps of Lie algebras - II

Lecture 27 - The Standard Model - I

Lecture 28 - The Standard Model - II

Lecture 29 - Irreps of the Lorentz/Poincare algebras

Lecture 30 - The Dirac monopole

Lecture 31 - The 't Hooft-Polyakov monopole

[Lecture 32 - Revisiting Derrick's Theorem](#)

[Lecture 33 - The Julia-Zee dyon](#)

[Lecture 34 - Instantons - I](#)

[Lecture 35 - Instantons - II](#)

[Lecture 36 - Instantons - III](#)

[Lecture 37 - Instantons - IV](#)

[Lecture 38 - Dualities](#)

[Lecture 39 - Geometrization of Field Theory](#)

NPTEL : Topics in Nonlinear Dynamics (Physics)

Co-ordinators : Prof. V. Balakrishnan

Lecture 1 - Overview

Lecture 2 - Critical points of a dynamical system

Lecture 3 - Two-dimensional flows

Lecture 4 - Stable and unstable manifolds

Lecture 5 - Hamiltonian dynamics - Part I

Lecture 6 - Hamiltonian dynamics - Part II

Lecture 7 - Hamiltonian dynamics - Part III

Lecture 8 - Hamiltonian dynamics - Part IV

Lecture 9 - Hamiltonian dynamics - Part V

Lecture 10 - Elementary bifurcations

Lecture 11 - Limit cycles

Lecture 12 - Poincaré index

Lecture 13 - Illustrative examples

Lecture 14 - Quiz 1. Questions and answers

Lecture 15 - Bead on a rotating hoop

Lecture 16 - Types of dynamical behaviour

Lecture 17 - Discrete time dynamics - Part I

Lecture 18 - Discrete time dynamics - Part II

Lecture 19 - Discrete time dynamics - Part III

Lecture 20 - Discrete time dynamics - Part IV

Lecture 21 - Coarse-grained dynamics in phase space - Part I

Lecture 22 - Coarse-grained dynamics in phase space - Part II & Stochastic dynamics - Part I

Lecture 23 - Stochastic dynamics - Part II

Lecture 24 - Stochastic dynamics - Part III

Lecture 25 - Coarse-grained dynamics in phase space - Part IV & Stochastic dynamics - Part IV

Lecture 26 - Discrete time dynamics - Part V

Lecture 27 - Quiz 2. Questions and answers

Lecture 28 - Stochastic dynamics - Part V

Lecture 29 - Stochastic dynamics - Part VI

Lecture 1 - Principles of Condensed Matter Physics

Lecture 2 - Symmetry in Perfect Solids

Lecture 3 - Symmetry in Perfect Solids (Continued...)

Lecture 4 - Symmetry in Perfect Solids - Worked Examples

Lecture 5 - Diffraction Methods For Crystal Structures

Lecture 6 - Diffraction Methods For Crystal Structures (Continued...)

Lecture 7 - Diffraction Methods For Crystal Structures - Worked Examples

Lecture 8 - Physical Properties of Crystals

Lecture 9 - Physical Properties of Crystals (Continued...)

Lecture 10 - Physical Properties of Crystals - Worked Examples

Lecture 11 - Cohesion in Solids

Lecture 12 - Cohesion in Solids - Worked Examples

Lecture 13 - The Free Electron Theory of Metals

Lecture 14 - The Free Electron Theory of Metals - Worked Examples

Lecture 15 - The Free Electron Theory of Metals - Electrical Conductivity

Lecture 16 - The Free Electron Theory of Metals - Electrical Conductivity - Worked Examples

Lecture 17 - Thermal Conductivity of Metals

Lecture 18 - Thermal Conductivity of Metals - Worked Examples

Lecture 19 - The Concept of Phonons

Lecture 20 - Debye Theory of Specific Heat, Lattice Vibrations

Lecture 21 - Debye Theory of Specific Heat, Lattice Vibrations - Worked Examples

Lecture 22 - Lattice Vibrations (Continued) Phonon thermal conductivity

Lecture 23 - Lattice Vibrations (Continued) Phonon Thermal Conductivity - Worked Examples

Lecture 24 - Anharmonicity and Thermal Expansion

Lecture 25 - Dielectric (Insulating) Solids

Lecture 26 - Dispersion and Absorption of Electromagnetic Waves in Dielectric Media, Ferro-and Antiferroelectrics

Lecture 27 - Optical Properties of Metals; Ionic Polarization in Alkali Halides; Piezoelectricity

Lecture 28 - Dielectric Solids - Worked Examples

Lecture 29 - Dia - and Paramagnetism

Lecture 30 - Paramagnetism of Transition Metal and Rare Earth Ions

Lecture 31 - Quenching of Orbital Angular Momentum; Ferromagnetism

- Lecture 32 - Exchange Interactions, Magnetic Order, Neutron Diffraction
- Lecture 33 - Hysteresis and Magnetic Domains; Spin Waves and Magnons
- Lecture 34 - Magnetic Resonance
- Lecture 35 - Magnetism and Magnetic Resonance - Worked Examples
- Lecture 36 - Magnetism - Worked Examples (Continued...)
- Lecture 37 - Pauli Paramagnetism and Landau Diamagnetism
- Lecture 38 - Band Magnetism; Itinerant Electrons; Stoner Model
- Lecture 39 - Superconductivity - Perfect Electrical Conductivity and Perfect Diamagnetism
- Lecture 40 - Type I and Type II Superconductors
- Lecture 41 - Ginsburg - Landau Theory, Flux Quantization
- Lecture 42 - Cooper Pairs
- Lecture 43 - Microscopic (BCS) Theory of Superconductivity
- Lecture 44 - BCS Theory (Continued...): Josephson Tunneling: Quantum Interference
- Lecture 45 - Josephson Effect (Continued...); High Temperature Superconductors
- Lecture 46 - Superconductors - Worked Examples
- Lecture 47 - Energy Bands in Solids
- Lecture 48 - Electron Dynamics in a Periodic Solid
- Lecture 49 - Semiconductors
- Lecture 50 - Semiconductors (Continued...)
- Lecture 51 - Semiconductors - Worked Examples
- Lecture 52 - Defects in Solids - Point Defects
- Lecture 53 - Point Defects in Solids - Worked Examples
- Lecture 54 - Defects in Solids - Line and Surface Defects
- Lecture 55 - Dislocations in Solids - Worked Examples
- Lecture 56 - Quantum Fluids and Quantum Solids
- Lecture 57 - Quantum Liquids and Quantum Solids - Worked Examples
- Lecture 58 - Epilogue

NPTEL : Quantum Field Theory (Physics)

Co-ordinators : Dr. Prasanta Tripathy

Lecture 1 - Introduction

Lecture 2 - Introduction to Classical Field Theory

Lecture 3 - Quantization of Real Scalar Field - I

Lecture 4 - Quantization of Real Scalar Field - II

Lecture 5 - Quantization of Real Scalar Field - III

Lecture 6 - Quantization of Real Scalar Field - IV

Lecture 7 - Quantization of Complex Scalar Field

Lecture 8 - Interacting Field Theory - I

Lecture 9 - Interacting Field Theory - II

Lecture 10 - Interacting Field Theory - III

Lecture 11 - Interacting Field Theory - IV

Lecture 12 - Interacting Field Theory - V

Lecture 13 - Interacting Field Theory - VI

Lecture 14 - Interacting Field Theory - VII

Lecture 15 - Quantization of Electromagnetic Field - I

Lecture 16 - Quantization of Electromagnetic Field - II

Lecture 17 - Fermion Quantization - I

Lecture 18 - Fermion Quantization - II

Lecture 19 - Fermion Quantization - III

Lecture 20 - Fermion Quantization - IV

Lecture 21 - Fermion Quantization - V

Lecture 22 - Fermion Quantization - VI

Lecture 23 - The S-Matrix Expansion in QED - I

Lecture 24 - The S-Matrix Expansion in QED - II

Lecture 25 - Feynman Rules in QED - I

Lecture 26 - Feynman Rules in QED - II

Lecture 27 - Compton Scattering - I

Lecture 28 - Compton Scattering - II

Lecture 29 - Compton Scattering - III

Lecture 30 - Moller Scattering - I

Lecture 31 - Moller Scattering - II

[Lecture 32 - Vertex Correction - I](#)

[Lecture 33 - Vertex Correction - II](#)

[Lecture 34 - Vertex Correction - III](#)

[Lecture 35 - Vertex Correction - IV](#)

[Lecture 36 - Electron Selfenergy](#)

[Lecture 37 - Photon Selfenergy - I](#)

[Lecture 38 - Photon Selfenergy - II](#)

NPTEL : Quantum Mechanics I (Physics)

Co-ordinators : Prof. S. Lakshmi Bala

- Lecture 1 - Quantum Mechanics " An Introduction
- Lecture 2 - Linear Vector Spaces - I
- Lecture 3 - Linear Vector Spaces - II: The two-level atom
- Lecture 4 - Linear Vector Spaces - III: The three-level atom
- Lecture 5 - Postulates of Quantum Mechanics - I
- Lecture 6 - Postulates of Quantum Mechanics - II
- Lecture 7 - The Uncertainty Principle
- Lecture 8 - The Linear Harmonic Oscillator
- Lecture 9 - Introducing Quantum Optics
- Lecture 10 - An Interesting Quantum Superposition: The Coherent State
- Lecture 11 - The Displacement and Squeezing Operators
- Lecture 12 - Exercises in Finite Dimensional Linear Vector Spaces
- Lecture 13 - Exercises on Angular Momentum Operators and their algebra
- Lecture 14 - Exercises on Quantum Expectation Values
- Lecture 15 - Composite Systems
- Lecture 16 - The Quantum Beam Splitter
- Lecture 17 - Addition of Angular Momenta - I
- Lecture 18 - Addition of Angular Momenta - II
- Lecture 19 - Addition of Angular Momenta - III
- Lecture 20 - Infinite Dimensional Linear Vector Spaces
- Lecture 21 - Square-Integrable Functions
- Lecture 22 - Ingredients of Wave Mechanics
- Lecture 23 - The Schrodinger equation
- Lecture 24 - Wave Mechanics of the Simple Harmonic Oscillator
- Lecture 25 - One-Dimensional Square Well Potential: The Bound State Problem
- Lecture 26 - The Square Well and the Square Potential Barrier
- Lecture 27 - The Particle in a one-dimensional Box
- Lecture 28 - A Charged Particle in a Uniform Magnetic Field
- Lecture 29 - The Wavefunction: Its Single-valuedness and its Phase
- Lecture 30 - The Central Potential
- Lecture 31 - The Spherical Harmonics

[Lecture 32 - Central Potential: The Radial Equation](#)

[Lecture 33 - Illustrative Exercises - I](#)

[Lecture 34 - Illustrative Exercises - II](#)

[Lecture 35 - Ehrenfest's Theorem](#)

[Lecture 36 - Perturbation Theory - I](#)

[Lecture 37 - Perturbation Theory - II](#)

[Lecture 38 - Perturbation Theory - III](#)

[Lecture 39 - Perturbation Theory - IV](#)

[Lecture 40 - Time-dependent Hamiltonians](#)

[Lecture 41 - The Jaynes-Cummings model](#)

NPTEL : Special Topics in Classical Mechanics (Physics)

Co-ordinators : Prof. P.C. Deshmukh

Lecture 1 - Course Overview

Lecture 2 - Equations of Motion (i)

Lecture 3 - Equations of Motion (ii)

Lecture 4 - Equations of Motion (iii)

Lecture 5 - Equations of Motion (iv)

Lecture 6 - Equations of Motion (v)

Lecture 7 - Oscillators, Resonances, Waves (i)

Lecture 8 - Oscillators, Resonances, Waves (ii)

Lecture 9 - Oscillators, Resonances, Waves (iii)

Lecture 10 - Oscillators, Resonances, Waves (iv)

Lecture 11 - Polar Coordinates (i)

Lecture 12 - Polar Coordinates (ii)

Lecture 13 - Dynamical Symmetry in the Kepler Problem (i)

Lecture 14 - Dynamical Symmetry in the Kepler Problem (ii)

Lecture 15 - Real Effects of Pseudo-Forces (i)

Lecture 16 - Real Effects of Pseudo-Forces (ii)

Lecture 17 - Real Effects of Pseudo-Forces (iii)

Lecture 18 - Real Effects of Pseudo-Forces (iv)

Lecture 19 - Special Theory of Relativity (i)

Lecture 20 - Special Theory of Relativity (ii)

Lecture 21 - Special Theory of Relativity (iii)

Lecture 22 - Special Theory of Relativity (iv)

Lecture 23 - Potentials Gradients Fields (i)

Lecture 24 - Potentials Gradients Fields (ii)

Lecture 25 - Potentials Gradients Fields (iii)

Lecture 26 - Gauss Law Eq of continuity (i)

Lecture 27 - Gauss Law Eq of continuity (ii)

Lecture 28 - Gauss Law Eq of continuity (iii)

Lecture 29 - Fluid Flow Bernoulli Principle (i)

Lecture 30 - Fluid Flow Bernoulli Principle (ii)

Lecture 31 - Classical Electrodynamics (i)

[Lecture 32 - Classical Electrodynamics \(ii\)](#)

[Lecture 33 - Classical Electrodynamics \(iii\)](#)

[Lecture 34 - Classical Electrodynamics \(iv\)](#)

[Lecture 35 - Chaotic Dynamical Systems \(i\)](#)

[Lecture 36 - Chaotic Dynamical Systems \(ii\)](#)

[Lecture 37 - Chaotic Dynamical Systems \(iii\)](#)

[Lecture 38 - Chaotic Dynamical Systems \(iv\)](#)

[Lecture 39 - Chaotic Dynamical Systems \(v\)](#)

[Lecture 40 - The Scope and Limitations of Classical Mechanics](#)

Lecture 1 - Introduction to the STiTACS course

Lecture 2 - Quantum Theory of collisions

Lecture 3 - Quantum Theory of collisions: optical Theorem

Lecture 4 - Quantum Theory of collisions: Optical Theorem (Continued...)

Lecture 5 - Quantum Theory of collisions: Differential scattering cross section

Lecture 6 - Quantum Theory of collisions: Differential scattering cross section, Partial wave analysis

Lecture 7 - Quantum Theory of collisions: Optical Theorem – Unitarity of the Scattering Operator

Lecture 8 - Quantum Theory of collisions: Reciprocity Theorem, Phase shift analysis

Lecture 9 - Quantum Theory of collisions: More on Phase shift analysis

Lecture 10 - Quantum Theory of collisions: resonant condition in the l th partial wave.

Lecture 11 - Quantum Theory of collisions: Levinson's theorem

Lecture 12 - Quantum Theory of collisions: Levinson's theorem (Continued...)

Lecture 13 - Many body theory, electron correlations

Lecture 14 - Second Quantization Creation, Destruction and Number operators

Lecture 15 - Many-particle Hamiltonian & Schrodinger Equation in 2nd Quantization

Lecture 16 - Many-electron problem in quantum mechanics

Lecture 17 - Hartree-Fock Self-Consistent-Field

Lecture 18 - Exchange, Statistical, Fermi-Dirac correlations

Lecture 19 - Limitations of the Hartree-Fock Self-Consistent-Field formalism

Lecture 20 - Many-Body formalism, II Quantization

Lecture 21 - Density fluctuations in an electron gas

Lecture 22 - Bohm-Pines approach to Random Phase Approximation

Lecture 23 - Bohm-Pines approach to Random Phase Approximation (Continued...)

Lecture 24 - Bohm-Pines approach to Random Phase Approximation (Continued...)

Lecture 25 - Schrodinger, Heisenberg and Dirac "pictures" of QM

Lecture 26 - Dyson's chronological operator

Lecture 27 - Gell-Mann-Low Theorem

Lecture 28 - Reyleigh-Schrodinger perturbation methods and adiabatic switching

Lecture 29 - Feynman Diagrams

Lecture 30 - I Order Feynman Diagrams

Lecture 31 - II and higher order Feynman Diagrams

- [Lecture 32 - Linear response of electron correlations](#)
- [Lecture 33 - Lippman Schwinger equation of potential scattering](#)
- [Lecture 34 - Born Approximation](#)
- [Lecture 35 - Coulomb scattering](#)
- [Lecture 36 - Scattering of partial waves](#)
- [Lecture 37 - Scattering at high energy](#)
- [Lecture 38 - Resonances in Quantum Collisions](#)
- [Lecture 39 - Breit-Wigner Resonances](#)
- [Lecture 40 - Fano parameterization of Breit-Wigner formula](#)
- [Lecture 41 - Discrete state embedded in the continuum](#)
- [Lecture 42 - Resonance life times](#)
- [Lecture 43 - Wigner-Eisenbud formalism of time-delay in scattering](#)
- [Lecture 44 - Photoionization and Photoelectron Angular Distributions](#)
- [Lecture 45 - Ionization and Excitation of Atoms by Fast Charged Particles](#)
- [Lecture 46 - Photo-absorption by Free and Confined Atoms and Ions: Recent Developments](#)

Lecture 1 - Analytic functions of a complex variable - Part I

Lecture 2 - Analytic functions of a complex variable - Part II

Lecture 3 - Calculus of residues - Part I

Lecture 4 - Calculus of residues - Part II

Lecture 5 - Calculus of residues - Part III

Lecture 6 - Calculus of residues - Part IV

Lecture 7 - Linear response; dispersion relations - Part I

Lecture 8 - Linear response; dispersion relations - Part II

Lecture 9 - Analytic continuation and the gamma function - Part I

Lecture 10 - Analytic continuation and the gamma function - Part II

Lecture 11 - Möbius transformations - Part I

Lecture 12 - Möbius transformations - Part II

Lecture 13 - Möbius transformations - Part III

Lecture 14 - Multivalued functions; integral representations - Part I

Lecture 15 - Multivalued functions; integral representations - Part II

Lecture 16 - Multivalued functions; integral representations - Part III

Lecture 17 - Multivalued functions; integral representations - Part IV

Lecture 18 - Laplace transforms - Part I

Lecture 19 - Laplace transforms - Part II

Lecture 20 - Fourier transforms - Part I

Lecture 21 - Fourier transforms - Part II

Lecture 22 - Fourier transforms - Part III

Lecture 23 - Fundamental Green function for \hat{p}^2 - Part I

Lecture 24 - Fundamental Green function for \hat{p}^2 - Part II

Lecture 25 - The diffusion equation - Part I

Lecture 26 - The diffusion equation - Part II

Lecture 27 - The diffusion equation - Part III

Lecture 28 - The diffusion equation - Part IV

Lecture 29 - Green function for $(\hat{p}^2 + k^2)$; nonrelativistic scattering - Part I

Lecture 30 - Green function for $(\hat{p}^2 + k^2)$; nonrelativistic scattering - Part II

Lecture 31 - Green function for $(\hat{p}^2 + k^2)$; nonrelativistic scattering - Part III

[Lecture 32 - The wave equation - Part I](#)

[Lecture 33 - The wave equation - Part II](#)

[Lecture 34 - The rotation group and all that - Part I](#)

[Lecture 35 - The rotation group and all that - Part II](#)

[Lecture 36 - The rotation group and all that - Part III](#)

NPTEL : Nuclear Reactors and Safety - An Introduction (Physics)

Co-ordinators : Dr.G.Vaidyanathan

- Lecture 1 - Energy Sources
- Lecture 2 - Nuclear Power Production Cycle
- Lecture 3 - Basic Physics of Nuclear Fission
- Lecture 4 - Basic Physics of Nuclear Fission (Continued...)
- Lecture 5 - Nuclear Reactors
- Lecture 6 - Reactors Generation
- Lecture 7 - Radiation Sources and Protection
- Lecture 8 - Biological Effects of Radiation
- Lecture 9 - Safety Principles
- Lecture 10 - Safety Principles (Continued...)
- Lecture 11 - Safety Approach
- Lecture 12 - Risk and Probabilistic safety analysis (PSA)
- Lecture 13 - History of Events in Nuclear Power Plants and Radiation facilities
- Lecture 14 - Other Events
- Lecture 15 - Validation and Dynamic Analysis
- Lecture 16 - Validation and Dynamic Analysis (Continued...)
- Lecture 17 - Quality Assurance
- Lecture 18 - Siting of Nuclear Plants
- Lecture 19 - Siting of Nuclear Plants (Continued...)
- Lecture 20 - Engineered Safety Systems
- Lecture 21 - Engineered Safety Systems (Continued...)
- Lecture 22 - Assessment of Radiological Consequences of Incidents
- Lecture 23 - Safety Regulation in India
- Lecture 24 - Safety Regulation in India (Continued...)
- Lecture 25 - Safety Regulation in India (Continued...)
- Lecture 26 - Safety Practices in Indian NPPs
- Lecture 27 - Safety Practices in Indian NPPs (Continued...)
- Lecture 28 - Safety Practices in Indian NPPs (Continued...)
- Lecture 29 - Passive Safety
- Lecture 30 - Passive Safety (Continued...)

NPTEL : Physical Applications of Stochastic Processes (Physics)

Co-ordinators : Prof. V. Balakrishnan

- Lecture 1 - Discrete probability distributions - Part 1
- Lecture 2 - Discrete probability distributions - Part 2
- Lecture 3 - Continuous random variables
- Lecture 4 - Central Limit Theorem
- Lecture 5 - Stable distributions
- Lecture 6 - Stochastic processes
- Lecture 7 - Markov processes - Part 1
- Lecture 8 - Markov processes - Part 2
- Lecture 9 - Markov processes - Part 3
- Lecture 10 - Birth-and-death processes
- Lecture 11 - Continuous Markov processes
- Lecture 12 - Langevin dynamics - Part 1
- Lecture 13 - Langevin dynamics - Part 2
- Lecture 14 - Langevin dynamics - Part 3
- Lecture 15 - Langevin dynamics - Part 4
- Lecture 16 - Itô and Fokker-Planck equations for diffusion processes
- Lecture 17 - Level-crossing statistics of a continuous random process
- Lecture 18 - Diffusion of a charged particle in a magnetic field
- Lecture 19 - Power spectrum of noise
- Lecture 20 - Elements of linear response theory
- Lecture 21 - Random pulse sequences
- Lecture 22 - Dichotomous diffusion
- Lecture 23 - First passage time (Part 1)
- Lecture 24 - First passage time (Part 2)
- Lecture 25 - First passage and recurrence in Markov chains
- Lecture 26 - Recurrent and transient random walks
- Lecture 27 - Non-Markovian random walks
- Lecture 28 - Statistical aspects of deterministic dynamics (Part 1)
- Lecture 29 - Statistical aspects of deterministic dynamics (Part 2)

- Lecture 1 - The Nature of Physical Laws
- Lecture 2 - Fundamental Constants and Dimensional Analysis
- Lecture 3 - Dimensional analysis and scaling
- Lecture 4 - sketching Elementary Functions
- Lecture 5 - The fundamental forces of nature
- Lecture 6 - Scalars, Vectors and All That
- Lecture 7 - Plane Polar Coordinates
- Lecture 8 - Vectors In a Plane, Scalars and Pseudoscalars
- Lecture 9 - Kinematics In a Plane
- Lecture 10 - Vectors in 3-Dimensional Space
- Lecture 11 - Vectors in 3-Dimensional space (Continued...)
- Lecture 12 - The Finite Rotation Formula, Polar Coordinates in 3-dimensions
- Lecture 13 - Cylindrical and Spherical polar coordinates
- Lecture 14 - Motion in a circle - Acceleration
- Lecture 15 - Newtons laws of motion
- Lecture 16 - Conservation Laws and Newtons Equations
- Lecture 17 - Conservation of Angular Momentum
- Lecture 18 - Two-Body Scattering
- Lecture 19 - Two-Body Collision Kinematics
- Lecture 20 - Conservative Forces - The Concept of a Potential
- Lecture 21 - Central Potential and Central Force
- Lecture 22 - The 2-Body Central Force Problem
- Lecture 23 - Keplers Laws of Planetary Motion
- Lecture 24 - Non-Inertial Forces (Pseudo-forces)
- Lecture 25 - More on the Kepler problem; Satellite motion
- Lecture 26 - Linear Elasticity of Solids
- Lecture 27 - Simple Harmonic Motion
- Lecture 28 - Some Physical Examples of Simple Harmonic Motion
- Lecture 29 - More on Simple Harmonic Motion
- Lecture 30 - Damped Simple Harmonic Motion
- Lecture 31 - Wave Motion - Travelling and Standing Waves

[Lecture 32 - Wave Motion - Wave Equation, General Solution](#)

[Lecture 33 - Fluid Dynamics - Hydrostatic Equilibrium](#)

[Lecture 34 - Fluid Dynamics - Equation of Continuity](#)

[Lecture 35 - Fluid Flow - Bernoullis Principle](#)

[Lecture 36 - Circulation and Vorticity](#)

[Lecture 37 - What is Thermodynamics?](#)

[Lecture 38 - The Classical Ideal Gas](#)

[Lecture 39 - The Laws of Thermodynamics](#)

[Lecture 40 - Specific Heat of an Ideal Gas](#)

[Lecture 41 - Van der Waals Equation](#)

[Lecture 42 - Phase Transitions](#)

[Lecture 43 - Summary](#)

Lecture 1 - Recapitulation of equilibrium statistical mechanics

Lecture 2 - The Langevin model (Part 1)

Lecture 3 - The Langevin model (Part 2)

Lecture 4 - The Langevin model (Part 3)

Lecture 5 - The Langevin model (Part 4)

Lecture 6 - Linear response theory (Part 1)

Lecture 7 - Linear response theory (Part 2)

Lecture 8 - Linear response (Part 3)

Lecture 9 - Linear response(Part 4)

Lecture 10 - Linear response (Part 5)

Lecture 11 - Linear response (Part 6)

Lecture 12 - Linear response theory (Part 7)

Lecture 13 - Quiz 1 - Questions and answers

Lecture 14 - Linear response theory (Part 8)

Lecture 15 - Linear response theory (Part 9)

Lecture 16 - The dynamic mobility

Lecture 17 - Fokker-Planck equations (Part 1)

Lecture 18 - Fokker-Planck equations (Part 2)

Lecture 19 - Fokker-Planck equations (Part 3)

Lecture 20 - The generalized Langevin equation (Part 1)

Lecture 21 - The generalized Langevin equation (Part 2)

Lecture 22 - Diffusion in a magnetic field

Lecture 23 - The Boltzmann equation for a dilute gas (Part 1)

Lecture 24 - The Boltzmann equation for a dilute gas (Part 2)

Lecture 25 - The Boltzmann equation for a dilute gas (Part 3)

Lecture 26 - The Boltzmann equation for a dilute gas (Part 4)

Lecture 27 - The Boltzmann equation for a dilute gas (Part 5)

Lecture 28 - Quiz 2 - Questions and answers

Lecture 29 - Critical phenomena (Part 1)

Lecture 30 - Critical phenomena (Part 2)

Lecture 31 - Critical phenomena (Part 3)

[Lecture 32 - Critical phenomena \(Part 4\)](#)

[Lecture 33 - Critical phenomena \(Part 5\)](#)

[Lecture 34 - Critical phenomena \(Part 6\)](#)

[Lecture 35 - Critical phenomena \(Part 7\)](#)

[Lecture 36 - The Wiener process \(standard Brownian motion\)](#)

- Lecture 1 - Discrete Probability
- Lecture 2 - Continuous Probability
- Lecture 3 - Characteristic Function
- Lecture 4 - Gaussian Distribution
- Lecture 5 - Binomial Distribution
- Lecture 6 - Poisson Distribution
- Lecture 7 - Central Limit Theorem
- Lecture 8 - Many Random Variables
- Lecture 9 - Entropy and Probability
- Lecture 10 - Entropy Maximization
- Lecture 11 - Transformation of Random Variables
- Lecture 12 - Tutorial
- Lecture 13 - Mathematical Preliminaries - 1
- Lecture 14 - Microcanonical Ensemble
- Lecture 15 - Two Level System (Microcanonical Ensemble)
- Lecture 16 - Classical Ideal Gas (Microcanonical Ensemble)
- Lecture 17 - Entropy of Mixing
- Lecture 18 - Canonical Ensemble
- Lecture 19 - Two Level System (Canonical Ensemble)
- Lecture 20 - Classical Ideal Gas (Canonical Ensemble)
- Lecture 21 - Gibbs Canonical Ensemble
- Lecture 22 - Classical Ideal Gas (Gibbs Canonical Ensemble)
- Lecture 23 - N Spins in a Uniform Magnetic Field
- Lecture 24 - Grand Canonical Ensemble
- Lecture 25 - Ideal Gas (Grand Canonical Ensemble)
- Lecture 26 - N Non - Interacting Spins in Constant Magnetic Field
- Lecture 27 - Quantum Statistical Mechanics
- Lecture 28 - Statistics of Fermions and Bosons
- Lecture 29 - Quantum to Classical Correspondance
- Lecture 30 - Vibrations of Solid (Low Temperature)
- Lecture 31 - Vibrations of Solid (Continuation)

[Lecture 32 - Free Electrons\(Fermi Gas\) in a Metal](#)

[Lecture 33 - Free Electrons\(Fermi Gas\) in a Metal \(Continuation\)](#)

[Lecture 34 - Problem solving demo - Part 1](#)

[Lecture 35 - Problem solving demo - Part 2](#)

Lecture 1 - Introduction to Fortran - Part 1

Lecture 2 - Introduction to Fortran - Part 2

Lecture 3 - Introduction to Fortran - Part 3

Lecture 4 - Introduction to Fortran - Part 4

Lecture 5 - Introduction to Fortran - Part 5

Lecture 6 - Numerical Integration - Part 1

Lecture 7 - Numerical Integration - Part 2

Lecture 8 - Numerical Integration - Part 3

Lecture 9 - Numerical Integration - Part 4

Lecture 10 - Numerical Integration - Part 5

Lecture 11 - Numerical Integration - Part 6

Lecture 12 - Numerical Integration - Part 7

Lecture 13 - Numerical Integration - Part 8

Lecture 14 - Numerical Integration - Part 9

Lecture 15 - Numerical Integration - Part 10

Lecture 16 - Monte Carlo Simulation Introduction - Part 1

Lecture 17 - Monte Carlo Simulation Introduction - Part 2

Lecture 18 - Implementing the Ising model on computer

Lecture 19 - Periodic Boundary conditions and the Metropolis scheme

Lecture 20 - Testing the simulation and relaxation to equilibrium, finite size effects

Lecture 21 - Monte Carlo Simulation Analysis - Part 1

Lecture 22 - Monte Carlo Simulation Analysis - Part 2

Lecture 23 - Monte Carlo Simulation Analysis: Thermodynamic Quantities - Part 1

Lecture 24 - Monte Carlo Simulation Analysis: Thermodynamic Quantities - Part 2

Lecture 25 - Calculating T_c using Binder's cumulant; Principle of detailed balance

Lecture 26 - Differential Equations Euler and Runge Kutta - Part 1

Lecture 27 - Differential Equations Euler and Runge Kutta - Part 2

Lecture 28 - Differential Coupled Equation Non Linear Equation - Part 1

Lecture 29 - Differential Coupled Equation Non Linear Equation - Part 2

Lecture 30 - Coupled Differential Equation Visualisation and Making Movie

Lecture 31 - Differential Equations With Specified Boundary Conditions - Part 1

[Lecture 32 - Differential Equations With Specified Boundary Conditions - Part 2](#)

[Lecture 33 - Partial Differential equations - 1](#)

[Lecture 34 - Partial Differential equations - 2](#)

[Lecture 35 - Partial Differential equations - 3](#)

[Lecture 36 - Differential Equation for Quantum Mechanical Problems: Numerov Algorithm - 1](#)

[Lecture 37 - Differential Equation for Quantum Mechanical Problems: Numerov Algorithm - 2](#)

[Lecture 38 - Differential Equation for Quantum Mechanical Problems: Numerov Algorithm - 3](#)

[Lecture 39 - Differential Equation for Quantum Mechanical Problems: Numerov Algorithm - 4](#)

[Lecture 40 - Differential Equation for Quantum Mechanical Problems: Numerov Algorithm - 5](#)

[Lecture 41 - Differential Equation for Quantum Mechanical Problems: Variational principle - 1](#)

[Lecture 42 - Differential Equation for Quantum Mechanical Problems: Variational principle - 2](#)

[Lecture 43 - Differential Equation for Quantum Mechanical Problems: Variational principle - 3](#)

[Lecture 44 - Differential Equation for Quantum Mechanical Problems: Variational principle - 4](#)

[Lecture 45 - Differential Equation for Quantum Mechanical Problems: Variational principle - 5](#)

[Lecture 46 - Molecular Dynamics Introduction - Part 1](#)

[Lecture 47 - Molecular Dynamics Introduction - Part 2](#)

[Lecture 48 - Molecular Dynamics Details and Algorithm - Part 1](#)

[Lecture 49 - Molecular Dynamics Details and Algorithm - Part 2](#)

[Lecture 50 - Molecular Dynamics Details and Algorithm - Part 3](#)

[Lecture 51 - Molecular Dynamics Analysis - Part 1](#)

[Lecture 52 - Molecular Dynamics Analysis - Part 2](#)

[Lecture 53 - Molecular Dynamics Neighbours Lists - Part 1](#)

[Lecture 54 - Molecular Dynamics Neighbours Lists - Part 2](#)

[Lecture 55 - Molecular Dynamics: Calculation Of Thermodynamics Quantities](#)

[Lecture 56 - Molecular Dynamics Diffusion Constant Calculation - Part 1](#)

[Lecture 57 - Molecular Dynamics Diffusion Constant Calculation - Part 2](#)

[Lecture 58 - Molecular Dynamics Diffusion Constant Calculation - Part 3](#)

- Lecture 1 - Simple Harmonic Motion
- Lecture 2 - Superposition of Oscillations : Beats
- Lecture 3 - Superposition of Oscillations : Beats
- Lecture 4 - Superposition of Oscillations : Lissajous Figures
- Lecture 5 - Simple Harmonic Motion : Problems
- Lecture 6 - Damped oscillator - Part 1
- Lecture 7 - Damped oscillator - Part 2
- Lecture 8 - Damped oscillator and Q-factor
- Lecture 9 - Damped oscillator : Problems
- Lecture 10 - Forced oscillator - Part 1
- Lecture 11 - Forced oscillator - Part 2
- Lecture 12 - Resonances
- Lecture 13 - Q-factor of forced oscillator
- Lecture 14 - Applications of forced oscillator
- Lecture 15 - Forced Oscillator : Problems
- Lecture 16 - Coupled Oscillations - Part 1
- Lecture 17 - Coupled Oscillations - Part 2
- Lecture 18 - Solving for normal modes
- Lecture 19 - Coupled oscillations - More examples
- Lecture 20 - Coupled oscillator : Problems
- Lecture 21 - Coupled Oscillations of Loaded String
- Lecture 22 - Solutions for Loaded String
- Lecture 23 - Oscillations of Loaded String
- Lecture 24 - Continuum Limit of Loaded String
- Lecture 25 - Wave equation and its solutions
- Lecture 26 - Wave equation - impedance and velocities
- Lecture 27 - Standing waves
- Lecture 28 - Transverse waves in periodic structures
- Lecture 29 - Wave equation : Problems
- Lecture 30 - Reflection and transmission of waves
- Lecture 31 - Impedance matching

- Lecture 32 - Energy of vibrating string
- Lecture 33 - Dispersion of waves
- Lecture 34 - Bandwidth theorem and problems
- Lecture 35 - Longitudnal Waves and Speed of Sound
- Lecture 36 - Longitudnal Standing Waves
- Lecture 37 - Sound Intensity
- Lecture 38 - Longitudnal Waves: Problems
- Lecture 39 - Fourier Series - Part 1
- Lecture 40 - Fourier Series - Part 2
- Lecture 41 - Fourier Series and Energy of Vibrating String
- Lecture 42 - Frequency Spectrum and Fourier Transforms
- Lecture 43 - Fourier Series : Problems
- Lecture 44 - Waves in Optical Systems
- Lecture 45 - Waves in Optical Systems: Applying Fermat's Principle
- Lecture 46 - Waves in Optical Systems: Thin Lens
- Lecture 47 - Waves in Optical Systems: Matrix Method
- Lecture 48 - Waves in Optical Systems: Problems
- Lecture 49 - Interference: Part 1
- Lecture 50 - Interference: Newton's rings
- Lecture 51 - Michelson and Fabry-Perot Interferometers
- Lecture 52 - Young's Double Slit Experiment
- Lecture 53 - Diffraction
- Lecture 54 - Beyond Linear Oscillators: Non-linear Pendulum
- Lecture 55 - Beyond Linear Oscillators: Forced Oscillator
- Lecture 56 - Beyond Linear Oscillators: Chaotic Oscillator
- Lecture 57 - Beyond Linear Waves: Solitary Waves
- Lecture 58 - Waves in Quantum Mechanics and Summary

Lecture 1 - Introduction to Mathematica, Wolfram language and Wolfram Cloud

Lecture 2 - Technical Prelim 1

Lecture 3 - Plotting Simple Functions

Lecture 4 - Function Behaviour near Extrema

Lecture 5 - Radicals and Logarithms

Lecture 6 - Properties of Functions

Lecture 7 - Vector Fields, Vector and Streamline Plots and Contour Plots

Lecture 8 - Introduction to Non-dimesionalisation

Lecture 9 - Non-dimensionalization and visual thinking

Lecture 10 - Non-dimensionalisation and Parametric Plot

Lecture 11 - Technical Prelim 2: Loops

Lecture 12 - Introduction to Simple Harmonic Oscillator

Lecture 13 - Simple Harmonic Oscillator with a spring mass system

Lecture 14 - More Examples of Simple Harmonic Oscillator

Lecture 15 - Anharmonic Oscillator

Lecture 16 - Introduction to Data Analysis - 1

Lecture 17 - Introduction to Data Analysis - 2

Lecture 18 - Curve fitting

Lecture 19 - Linear superposition of oscillations

Lecture 20 - Technical Prelim 3: Introduction to Calculus Tools

Lecture 21 - Damped Harminic Oscillator: LCR Circuit

Lecture 22 - Solving Initial Value Problem with Mathematica

Lecture 23 - Damped Harmonic Oscillator: Spring-mass System with Friction

Lecture 24 - Technical Prelim 4: Manipulation of Lists using @, @@, /@ operators

Lecture 25 - Introduction to Euler's Method for Solving Differential Equation

Lecture 26 - Technical Prelim 5: Writing Custom Functions

Lecture 27 - Writing Euler's Method as a custom function

Lecture 28 - Mean Global Error in Euler's method and Application of Euler's method to damped oscillator

Lecture 29 - Improved Euler (RK2) and RK4 Methods for solving ODEs

Lecture 30 - Driven oscillations

Lecture 31 - Driven oscillations using the Improved Euler method

[Lecture 32 - Falling Bodies](#)

[Lecture 33 - Escape velocity](#)

[Lecture 34 - Driven oscillations: Variations](#)

[Lecture 35 - Linear systems: Insights from the phase space picture - 1](#)

[Lecture 36 - Linear systems: Insights from the phase space picture - 2](#)

[Lecture 37 - Linearization - 1](#)

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[Lecture 39 - The Monte Carlo Method - 1](#)

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[Lecture 41 - The Monte Carlo Method - 3](#)

[Lecture 42 - The Monte Carlo Method - 4](#)

[Lecture 43 - The Monte Carlo Method - 5](#)

[Lecture 44 - Random Walks - 1](#)

[Lecture 45 - Random Walks - 2](#)

[Lecture 46 - Random Walks - 3](#)

[Lecture 47 - Random Walks - 4](#)

[Lecture 48 - Random Walks - 5](#)

[Lecture 49 - Random Walks - 6](#)

[Lecture 50 - Random Walks - 7](#)

Lecture 1 - Vector algebra

Lecture 2 - Vector algebra in component form

Lecture 3 - Vector triple products

Lecture 4 - Vector differential calculus: Gradient

Lecture 5 - Divergence

Lecture 6 - Curl

Lecture 7 - Tutorial on differential vector calculus

Lecture 8 - More problems on vector differential calculus

Lecture 9 - Vector integral calculus: Line integral

Lecture 10 - Surface integral

Lecture 11 - Volume integral

Lecture 12 - Fundamental theorems of vector calculus: The gradient theorem

Lecture 13 - The divergence theorem (Gauss's theorem)

Lecture 14 - The curl theorem (Stokes' theorem)

Lecture 15 - Curvilinear coordinates: Cartesian vs. Polar

Lecture 16 - Generic curvilinear coordinate systems: Unit vectors and components

Lecture 17 - Differential vector calculus in curvilinear coordinate systems

Lecture 18 - Special curvilinear coordinate systems: Cylindrical and spherical

Lecture 19 - Vector calculus in spherical coordinate system

Lecture 20 - Vector calculus in cylindrical coordinate system

Lecture 21 - Introduction to Dirac delta function

Lecture 22 - Tutorial on vector calculus and curvilinear coordinates

Lecture 23 - Introduction to electrostatics

Lecture 24 - Continuous charge distribution: Line charge

Lecture 25 - Electric field due to a line charge distribution

Lecture 26 - Electric field lines, Flux, Gauss law

Lecture 27 - Application of Gauss law with cylindrical symmetry

Lecture 28 - Application of Gauss law on a flat 2D surface

Lecture 29 - Tutorial on Dirac delta function and electrostatics

Lecture 30 - Tutorial on electrostatics

Lecture 31 - The curl of an electric field

Lecture 32 - Scalar potential

Lecture 33 - Calculation of electric potential from different approaches

Lecture 34 - Boundary conditions on electric field and potential

Lecture 35 - Work and energy of an assembly of point charges

Lecture 36 - General idea of energy in electrostatics

Lecture 37 - Electrostatics with conductors

Lecture 38 - Capacitors

Lecture 39 - Laplace equation

Lecture 40 - Boundary conditions and the uniqueness theorems

Lecture 41 - The method of images

Lecture 42 - Induced charge

Lecture 43 - Force and energy

Lecture 44 - Another example of the method of images

Lecture 45 - Electric dipoles

Lecture 46 - Multipole expansion, continuous charge distribution, and assembly of point charges

Lecture 47 - Electric field due to a dipole

Lecture 48 - Introduction to electric polarization in matter

Lecture 49 - Electric polarization and bound charges

Lecture 50 - Electric displacement vector and Gauss law

Lecture 51 - Boundary conditions on the displacement vector and linear dielectric materials

Lecture 52 - Parallel plate capacitors

Lecture 53 - Energy in dielectric materials

Lecture 54 - Force on dielectric materials

Lecture 55 - Motion of a charged particle in electromagnetic field

Lecture 56 - Work done by a magnetic field

Lecture 57 - Electric current

Lecture 58 - Surface and volume current

Lecture 59 - Biot Savart law

Lecture 60 - Biot Savart law with surface and volume currents

Lecture 61 - A tutorial on currents and magnetic field

Lecture 62 - Straight line current: Curl of the magnetic field

Lecture 63 - Divergence and curl of a generic magnetic field

Lecture 64 - Ampere's law in integral form and its applications

- Lecture 65 - Magnetic field in a long solenoid
- Lecture 66 - A comparison between electrostatics and magnetostatics
- Lecture 67 - Magnetic vector potential
- Lecture 68 - Tutorial on magnetic fields
- Lecture 69 - Calculation of vector potential
- Lecture 70 - Boundary conditions on magnetic field
- Lecture 71 - Magnetic dipole
- Lecture 72 - Multipole expansion of the vector potential
- Lecture 73 - Magnetism, force and torque on magnetic dipole
- Lecture 74 - Fringing magnetic field
- Lecture 75 - Magnetization
- Lecture 76 - A tutorial on the magnetic dipole moment
- Lecture 77 - Ampere's law in magnetized materials
- Lecture 78 - Electrodynamics
- Lecture 79 - Electromagnetic induction
- Lecture 80 - Laws of electromagnetism so far
- Lecture 81 - Maxwell's correction to electromagnetism
- Lecture 82 - Fictitious discussion about symmetry
- Lecture 83 - Maxwell's equations in matter and the boundary conditions

Lecture 1 - Introduction. Symmetries of space and time

Lecture 2 - Generalized coordinates and degrees of freedom

Lecture 3 - Virtual Work

Lecture 4 - Virtual Work (rigid body)

Lecture 5 - d'Alembert Principle

Lecture 6 - Euler Lagrange Equation for a holonomic system

Lecture 7 - Euler Lagrange Equations. Examples

Lecture 8 - Euler Lagrange Equations. Examples (Continued...)

Lecture 9 - Properties of Lagrangian

Lecture 10 - Kinetic term in generalized coordinates

Lecture 11 - Cyclic coordinates

Lecture 12 - Conservation laws - Conservation of Energy

Lecture 13 - Energy Function, Jacobi's Integral

Lecture 14 - Momentum conservation

Lecture 15 - Matrices and all that

Lecture 16 - Matrices, Forms, and all that

Lecture 17 - Principal axis transformation

Lecture 18 - Small Oscillations

Lecture 19 - Oscillations, Normal Coordinates

Lecture 20 - Oscillations, Triatomic molecule

Lecture 21 - Triatomic molecule normal coordinates

Lecture 22 - Coupled pendulums, normal modes

Lecture 23 - Coupled pendulums, Beats

Lecture 24 - Oscillations, General solution

Lecture 25 - Forced oscillations

Lecture 26 - Damped oscillations

Lecture 27 - Forced Damped oscillations

Lecture 28 - one dimensional systems

Lecture 29 - Two-body problem

Lecture 30 - Two-body problem, Kepler's second law

Lecture 31 - Two-body problem, Kepler problem

- Lecture 32 - Two-body problem, Conic Sections in Polar Coordinates
- Lecture 33 - Two-body problem, Ellipse in polar coordinates
- Lecture 34 - Orbits in Kepler Problem
- Lecture 35 - Apsidal distances, eccentricity of orbits
- Lecture 36 - Kepler's Third law; Laplace-Runge-Lenz vector
- Lecture 37 - Rigid Body, degrees of freedom
- Lecture 38 - Rigid Body, Transformation matrix
- Lecture 39 - Rigid Body, Euler Angles
- Lecture 40 - Parameterization using Euler Angles
- Lecture 41 - Rigid Body, Euler's Theorem
- Lecture 42 - General motion of a rigid body
- Lecture 43 - Moment of Inertia Tensor
- Lecture 44 - Principal Moments
- Lecture 45 - Lagrangian of a rigid body
- Lecture 46 - Motion of a free symmetric top
- Lecture 47 - Angular velocity using Euler angles
- Lecture 48 - Lagrangian of a heavy symmetric top
- Lecture 49 - First integrals of a heavy symmetric top
- Lecture 50 - Nutation and Precession of a heavy symmetric top
- Lecture 51 - Sleeping Top
- Lecture 52 - Rotating Frames. Euler Equations
- Lecture 53 - Calculus of Variations: Functionals
- Lecture 54 - Method of Lagrange Multipliers
- Lecture 55 - Calculus of Variations: Condition for extremum
- Lecture 56 - Calculus of Variations: Several variables
- Lecture 57 - Cartesian Tensors
- Lecture 58 - Hamiltonian Mechanics: Hamilton's equations of motion
- Lecture 59 - Hamiltonian Mechanics: Liouville's theorem
- Lecture 60 - Hamiltonian Mechanics: Poisson Bracket
- Lecture 61 - Hamiltonian Mechanics: Canonical Coordinates
- Lecture 62 - Hamiltonian Mechanics: Generating Function of Canonical Transformations
- Lecture 63 - Hamiltonian Mechanics: Generating functions of the 4 kinds
- Lecture 64 - Examples of Generating Functions

[Lecture 65 - Harmonic Oscillator \(Canonical Transformations\)](#)

[Lecture 66 - Invariance of Poisson Brackets](#)

[Lecture 67 - Normal modes of triatomic molecule using Mathematica](#)

Lecture 1 - Introduction to the course

Lecture 2 - Continuum hypothesis, distribution function and stress-viscosity relation

Lecture 3 - Continuum hypothesis, distribution function and stress-viscosity relation - Recap

Lecture 4 - Fluid Kinematics

Lecture 5 - Fluid Kinematics - Recap

Lecture 6 - Conservation laws: Mass conservation and incompressibility

Lecture 7 - Conservation laws: Momentum conservation and Euler equation

Lecture 8 - Conservation laws - Recap

Lecture 9 - Potential flows

Lecture 10 - Bernoulli constant, its applications and vorticity equation

Lecture 11 - Recap - Potential flows, Bernoulli constant and its applications

Lecture 12 - Vorticity dynamics -- Kelvin's vorticity theorem and Magnus effect

Lecture 13 - Navier-Stokes equation

Lecture 14 - Navier-Stokes equation (Continued....) and energy equation

Lecture 15 - Energy equation in a conservative form

Lecture 16 - Boundary conditions in Navier-Stokes equation, d'Alembert's paradox

Lecture 17 - Poiseuille flow, deriving viscosity from microscopies

Lecture 18 - Dimensionless numbers -- Mach number, Reynolds number

Lecture 19 - Dimensionless numbers (Continued...) -- plasma beta, magnetic Reynolds number, Alfvén Mach number, Prandtl number, dimensionless numbers -- Mach number, Reynolds number

Lecture 20 - Reynolds number and dynamic similarity

Lecture 21 - Reynolds number recap, Low Re flows, and drag on a sphere (Stokes law)

Lecture 22 - High Re flows -- turbulent drag law, vortex shedding and drag crisis

Lecture 23 - Lift on a body, introduction to compressible flows

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Lecture 18 - Introduction of Atmospheric Waves - Part 1

Lecture 19 - Introduction of Atmospheric Waves - Part 2

Lecture 20 - Problems based on Total Derivative - Part 1

Lecture 21 - Problems based on Total Derivative - Part 2

Lecture 22 - Shallow Water Gravity Waves - Part 1

Lecture 23 - Shallow Water Gravity Waves - Part 2

Lecture 24 - Acoustic Waves

Lecture 25 - Internal Gravity Waves - Part 1

Lecture 26 - Internal Gravity Waves - Part 2

Lecture 27 - Internal Gravity Waves - Part 3

Lecture 28 - Pressure as a vertical coordinate - Part 1

Lecture 29 - Pressure as a vertical coordinate - Part 2

Lecture 30 - Pressure as a vertical coordinate - Part 3

Lecture 31 - General circulation and global winds

- Lecture 32 - Introduction to different types of Fronts
- Lecture 33 - Geostrophic winds
- Lecture 34 - Natural coordinate and Inertial flows
- Lecture 35 - Cyclostrophic winds and Rossby number
- Lecture 36 - Gradient winds
- Lecture 37 - Thermal winds
- Lecture 38 - Problems on thermal winds
- Lecture 39 - Ionosphere introduction (Basics)- Part 1
- Lecture 40 - Ionosphere introduction (Different layers) - Part 2
- Lecture 41 - Ionosphere introduction (Photochemistry) - Part 3
- Lecture 42 - Ionosphere introduction (Recombination) - Part 4
- Lecture 43 - Composite F layer - Part 1
- Lecture 44 - Composite F layer - Part 2
- Lecture 45 - Composite F layer H/He ions - Part 3
- Lecture 46 - The Sun - Earth Energetics and Aurora
- Lecture 47 - Airglows and Aurora
- Lecture 48 - Sun's magnetic field, Formation of Aurora, and Solar cycle
- Lecture 49 - Sun's internal structure, Prominences
- Lecture 50 - Solar wind - Magnetosphere interactions
- Lecture 51 - Solar wind interactions with different planets
- Lecture 52 - Solar wind properties and its interaction with different planets
- Lecture 53 - Static Model of Corona
- Lecture 54 - Parker's Theory of Solar Wind Acceleration - Part 1
- Lecture 55 - Parker's Theory of Solar Wind Acceleration - Part 2
- Lecture 56 - Parker's Theory of Solar Wind Acceleration - Part 3
- Lecture 57 - Parker's Theory of Solar Wind Acceleration - Part 4
- Lecture 58 - Introduction to Space Weather - Part 1
- Lecture 59 - Introduction to Space Weather - Part 2
- Lecture 60 - Introduction to Space Weather - Part 3

Lecture 1 - Historical Background, Observational Astronomy, Properties of Sun and of Stars

Lecture 2 - Properties of Galaxies and Universe

Lecture 3 - Background of elemental abundance curve

Lecture 4 - Evidences of Nucleosynthesis - I

Lecture 5 - Evidences of Nucleosynthesis - II

Lecture 6 - Evidences of Nucleosynthesis - III and Mass gaps

Lecture 7 - H-R Diagram

Lecture 8 - M-L relation, Hubble's Law and Echo of Big Bang

Lecture 9 - Thermonuclear reactions and Reaction cross-section

Lecture 10 - Reaction rate

Lecture 11 - Reaction rate and Neutron induced reactions

Lecture 12 - Gamma induced reactions and Inverse reactions

Lecture 13 - Inverse reactions

Lecture 14 - Inverse reactions and Mean life time of a nuclei

Lecture 15 - Mean life time of a nuclei and Time dependent abundance evolution

Lecture 16 - Non-resonant charged particle induced reactions

Lecture 17 - Astrophysical S-factor and Non-resonant charged particle induced reactions

Lecture 18 - Gamow peak and Electron screening effect

Lecture 19 - Resonant reactions

Lecture 20 - Resonant reactions

Lecture 21 - Neutron induced non-resonant reactions

Lecture 22 - Burning stages of stars and Hydrogen burning

Lecture 23 - pp chain

Lecture 24 - pp chain and CN cycle

Lecture 25 - CNO cycle, Shell model and Gamma decay

Lecture 26 - Formation of ^{12}C

Lecture 27 - Survival of ^{12}C

Lecture 28 - Carbon, Neon, Oxygen and Silicon burning

Lecture 29 - Nucleosynthesis beyond Iron

Lecture 30 - s-, r- and p-process

Lecture 31 - Charged particle and Neutron beams

[Lecture 32 - Accelerators and Targets](#)

[Lecture 33 - Backing materials and Target preparation](#)

[Lecture 34 - Contaminants and Radiation sources](#)

[Lecture 35 - Detectors - I](#)

[Lecture 36 - Detectors - II](#)

[Lecture 37 - Activity method](#)

[Lecture 38 - Kinematics - I](#)

[Lecture 39 - Kinematics - II](#)

[Lecture 40 - Time of flight method and Indirect methods](#)

Lecture 1 - Course Overview

Lecture 2 - Introduction to Geometrical Optics

Lecture 3 - Ray Theory, Fermat's Principle

Lecture 4 - Refraction from Single Interface

Lecture 5 - Refraction from double interface

Lecture 6 - Matrix method in paraxial optics - I

Lecture 7 - Matrix Method in Paraxial Optics - II

Lecture 8 - Thick and Thin Lenses, Unit Planes

Lecture 9 - Nodal Planes, System of Thin Lenses

Lecture 10 - Problems on Geometrical Optics

Lecture 11 - Concept of Wavefront, Huygens Principle - I

Lecture 12 - Concept of Wavefront, Huygens Principle - II

Lecture 13 - Superposition of Waves

Lecture 14 - Introduction to Polarization, Linear and Circular Polarization

Lecture 15 - Elliptical Polarization

Lecture 16 - Interference of Light Waves, Interference of Polarized Light - I

Lecture 17 - Interference of Light Waves, Interference of Polarized Light - II

Lecture 18 - Young's Double Slit Experiment - I

Lecture 19 - Young's Double Slit Experiment - II

Lecture 20 - Interference with White Light, Displacement of Fringes, Fresnel's Biprism

Lecture 21 - Interference by Division of Amplitude

Lecture 22 - Thin Parallel Films, Wedge Shaped Films

Lecture 23 - Newton's Rings

Lecture 24 - Michelson Interferometer and Its Applications - I

Lecture 25 - Michelson Interferometer and Its Applications - II

Lecture 26 - Multiple Beam Interference

Lecture 27 - Fabry-Perot Interferometer and Etalon - I

Lecture 28 - Fabry-Perot Interferometer and Etalon - II

Lecture 29 - Concept of Coherence - I

Lecture 30 - Concept of Coherence - II

Lecture 31 - Introduction to Diffraction

- Lecture 32 - Fraunhofer Diffraction
- Lecture 33 - Single Slit Diffraction
- Lecture 34 - Double Slit Diffraction
- Lecture 35 - Multiple Slit Diffraction
- Lecture 36 - Diffraction at a Rectangular Aperture
- Lecture 37 - Diffraction at a Circular Aperture
- Lecture 38 - Diffraction Grating
- Lecture 39 - Grating Spectrum and Resolving Power
- Lecture 40 - Fresnel Diffraction
- Lecture 41 - Fresnel Half Period Zones
- Lecture 42 - Vibration Curve
- Lecture 43 - Circular Obstacle, Zone Plates
- Lecture 44 - Rectangular Aperture
- Lecture 45 - Diffraction of a Plane Wave by a Long Narrow Slit
- Lecture 46 - Brewster's Law, Malus' Law
- Lecture 47 - Phenomenon of Double Refraction
- Lecture 48 - Normal and Oblique Incidence
- Lecture 49 - Production of Polarized Light
- Lecture 50 - Quarter and Half Wave Plates
- Lecture 51 - Analysis of Polarized Light and Optical Activity
- Lecture 52 - Plane Wave Propagation in Anisotropic Media - I
- Lecture 53 - Plane Wave Propagation in Anisotropic Media - II
- Lecture 54 - Antireflecting Coating
- Lecture 55 - Basic Concepts of Holography - I
- Lecture 56 - Basic Concepts of Holography - II
- Lecture 57 - Basic Concepts and Ray Optics Consideration of Optical Fiber
- Lecture 58 - Introduction to Lasers - I
- Lecture 59 - Introduction to Lasers - II
- Lecture 60 - Trifle

Lecture 1 - Scalars vectors, and tensors - basic definitions

Lecture 2 - Scalars, vectors and tensors - most general definition

Lecture 3 - Elementary vector algebra - I (unit vector, dot product)

Lecture 4 - Elementary vector algebra - II (cross product, triple product)

Lecture 5 - Review of Newton's laws of motion - tools for analysis

Lecture 6 - Newton's laws of motion - third and second law

Lecture 7 - Newton's laws of motion - first law

Lecture 8 - Solving mechanics problems - how to draw free body diagram correctly

Lecture 9 - Mechanical equilibrium (statics) using force and torque balance

Lecture 10 - Mechanical equilibrium (statics) using force and torque balance - more examples

Lecture 11 - Mechanical equilibrium of rope like structures, nature of tension force

Lecture 12 - Massless, flexible suspension cable in mechanical equilibrium

Lecture 13 - Massive flexible suspension cable in mechanical equilibrium

Lecture 14 - Mechanical equilibrium of truss (framework) - nature of internal forces

Lecture 15 - Mechanical equilibrium of truss (framework) - examples

Lecture 16 - Mechanical equilibrium of truss - uniqueness of solution, beam with distributed load

Lecture 17 - Mechanical equilibrium of truss - more on beam with distributed load

Lecture 18 - Mechanical equilibrium - more examples, principle of virtual work, constrained motion

Lecture 19 - Mechanical equilibrium: constraints, degrees of freedom, work done by constrained force

Lecture 20 - d'Alembert - Lagrange principle of virtual work - statement and examples

Lecture 21 - Equivalence of principles of force, torque balance and virtual work, stability analysis

Lecture 22 - Mechanical equilibrium: stability analysis, energy diagram technique

Lecture 23 - Friction between solids - Amontons-Coulomb laws, common misconceptions

Lecture 24 - Friction between solids - worked out examples

Lecture 25 - Friction between solid and fluid - drag force

Lecture 26 - Friction examples - projectile motion with drag force, tying a rope

Lecture 27 - Work-energy theorem in one dimension, importance of conservation laws

Lecture 28 - Work-energy theorem in higher dimensions, conservative forces

Lecture 29 - Momentum balance principle, critical review: projectile motion in real-life

Lecture 30 - Projectile motion - effect of lift and thrust force by examples

Lecture 31 - More on rocket motion - comparing effect of thrust in deep space and at lift off

Lecture 32 - Collisions in daily life - application of energy and momentum balance principles

Lecture 33 - Collision at micro-meter, atomic and sub-atomic scales - Brownian motion, Compton effect

Lecture 34 - Concepts necessary for translation and rotation of rigid bodies - centre of mass

Lecture 35 - Centre of mass of composite objects

Lecture 36 - Concepts necessary for translation and rotation of rigid bodies - moment of inertia

Lecture 37 - More on moment of inertia - 3D objects, composite objects, engineering applications

Lecture 38 - Symmetry of mass distribution - product of inertia

Lecture 39 - Determining the principal axes of rotation and moment of inertia about them

Lecture 40 - Example of finding principal axes, introduction to rotation, the angular velocity vector

Lecture 41 - Rotation of rigid bodies - the angular momentum vector

Lecture 42 - Rotation of rigid bodies - torque

Lecture 43 - Translation and rotation of rigid bodies - computing rules

Lecture 44 - Translation and rotation of rigid bodies - examples (rolling, collision with rotation)

- Lecture 1 - Introduction to Plasma - I
- Lecture 2 - Introduction to Plasma - II
- Lecture 3 - Plasma Oscillations
- Lecture 4 - Debye Shielding
- Lecture 5 - Debye Potential - I
- Lecture 6 - Debye Potential - II
- Lecture 7 - Debye Length and Plasma Criteria
- Lecture 8 - More Aspects of Debye Shielding
- Lecture 9 - Numerical Problems on Debye Shielding - I
- Lecture 10 - Plasma as a Gas and Distribution of Velocities
- Lecture 11 - Numerical Problems on Debye Shielding - II
- Lecture 12 - Single-Particle Motion in Uniform Electric Field
- Lecture 13 - Single-Particle Motion in Uniform Magnetic Field - I
- Lecture 14 - Single-Particle Motion in Uniform Magnetic Field - II
- Lecture 15 - Single-Particle Motion in Uniform Magnetic Field - III
- Lecture 16 - Single-Particle Motion Under Uniform Magnetic field - IV
- Lecture 17 - Motion in Perpendicular Electric and Magnetic fields - I
- Lecture 18 - Motion in Perpendicular Electric and Magnetic fields - II
- Lecture 19 - Gradient Drift
- Lecture 20 - Gradient and Curvature Drifts
- Lecture 21 - Vacuum Drift
- Lecture 22 - Numerical Problems on Drifts
- Lecture 23 - Magnetic Mirroring - I
- Lecture 24 - Magnetic Mirroring - II
- Lecture 25 - Magnetic Mirroring - III
- Lecture 26 - Magnetic Mirroring - IV
- Lecture 27 - Motion in Time Varying Magnetic Field - I
- Lecture 28 - Motion in Time Varying Magnetic Field - II
- Lecture 29 - Motion in Time Varying Electric field - I
- Lecture 30 - Motion in Time Varying Electric field - II
- Lecture 31 - Plasma as a Fluid: Equation of Continuity

- Lecture 32 - Plasma as a Fluid: Fluid Equation - I
- Lecture 33 - Plasma as a Fluid: Fluid Equation - II
- Lecture 34 - Plasma as a fluid: Governing Equations
- Lecture 35 - MHD Approximation - I
- Lecture 36 - MHD Approximation - II
- Lecture 37 - Plasma as a fluid: Electric and Magnetic Properties - I
- Lecture 38 - Plasma as a fluid: Electric and Magnetic Properties - II
- Lecture 39 - Plasma as a fluid: Fluid Drift - I
- Lecture 40 - Plasma as a fluid: Fluid Drift - II
- Lecture 41 - Magnetic Pressure
- Lecture 42 - Wave in Plasma: Perturbation Theory
- Lecture 43 - Wave in Plasma: Plasma Oscillation
- Lecture 44 - Wave in Plasma: Dispersion Relation
- Lecture 45 - Ion Acoustic Wave - I
- Lecture 46 - Ion Acoustic Wave - II
- Lecture 47 - Ion Acoustic Wave - III
- Lecture 48 - Invalidity of Plasma Approximation - I
- Lecture 49 - Invalidity of Plasma Approximation - II
- Lecture 50 - Electromagnetic Waves in Plasma
- Lecture 51 - Collisions and Diffusion in Plasma - I
- Lecture 52 - Collisions and Diffusion in Plasma - II
- Lecture 53 - Ambipolar Diffusion - I
- Lecture 54 - Ambipolar Diffusion - II
- Lecture 55 - Diffusion Equation
- Lecture 56 - Diffusion in Presence of B - I
- Lecture 57 - Diffusion in Presence of B - II
- Lecture 58 - Instabilities in Plasma
- Lecture 59 - Laser Produced Plasma and Pulsed Laser Deposited (PLD) Thin Film - I
- Lecture 60 - Laser Produced Plasma and Pulsed Laser Deposited (PLD) Thin Film - II
- Lecture 61 - Surface Modification of Metallic Components by Plasma Nitriding - I
- Lecture 62 - Surface Modification of Metallic Components by Plasma Nitriding - II

NPTEL : Relativistic Quantum Mechanics (Physics)

Co-ordinators : Prof. Apoorva D Patel

- Lecture 1 - Introduction, The Klein-Gordon equation
- Lecture 2 - Particles and antiparticles, Two component framework
- Lecture 3 - Coupling to electromagnetism, Solution of the Coulomb problem
- Lecture 4 - Bohr-Sommerfeld semiclassical solution of the Coulomb problem, The Dirac equation and the Clifford algebra
- Lecture 5 - Dirac matrices, Covariant form of the Dirac equation, Equations of motion, Spin, Free particle solutions
- Lecture 6 - Electromagnetic interactions, Gyromagnetic ratio
- Lecture 7 - The Hydrogen atom problem, Symmetries, Parity, Separation of variables
- Lecture 8 - The Frobenius method solution, Energy levels and wavefunctions
- Lecture 9 - Non-relativistic reduction, The Foldy-Wouthuysen transformation
- Lecture 10 - Interpretation of relativistic corrections, Reflection from a potential barrier
- Lecture 11 - The Klein paradox, Pair creation process and examples
- Lecture 12 - Zitterbewegung, Hole theory and antiparticles
- Lecture 13 - Charge conjugation symmetry, Chirality, Projection operators, The Weyl equation
- Lecture 14 - Weyl and Majorana representations of the Dirac equation, Unitary and antiunitary symmetries
- Lecture 15 - Time reversal symmetry, The PCT invariance
- Lecture 16 - Arrow of time and particle-antiparticle asymmetry, Band theory for graphene
- Lecture 17 - Dirac equation structure of low energy graphene states, Relativistic signatures in graphene properties
- Lecture 18 - Groups and symmetries, The Lorentz and Poincare groups
- Lecture 19 - Group representations, generators and algebra, Translations, rotations and boosts
- Lecture 20 - The spinor representation of $SL(2,C)$, The spin-statistics theorem
- Lecture 21 - Finite dimensional representations of the Lorentz group, Euclidean and Galilean groups
- Lecture 22 - Classification of one particle states, The little group, Mass, spin and helicity
- Lecture 23 - Massive and massless one particle states
- Lecture 24 - P and T transformations, Lorentz covariance of spinors
- Lecture 25 - Lorentz group classification of Dirac operators, Orthogonality and completeness of Dirac spinors, Projection operators
- Lecture 26 - Propagator theory, Non-relativistic case and causality
- Lecture 27 - Relativistic case, Particle and antiparticle contributions, Feynman prescription and the propagator
- Lecture 28 - Interactions and formal perturbative theory, The S-matrix and Feynman diagrams
- Lecture 29 - Trace theorems for products of Dirac matrices
- Lecture 30 - Photons and the gauge symmetry
- Lecture 31 - Abelian local gauge symmetry, The covariant derivative and invariants

Lecture 32 - Charge quantisation, Photon propagator, Current conservation and polarisations

Lecture 33 - Feynman rules for Quantum Electrodynamics, Nature of perturbative expansion

Lecture 34 - Dyson's analysis of the perturbation series, Singularities of the S-matrix, Elementary QED processes

Lecture 35 - The T-matrix, Coulomb scattering

Lecture 36 - Mott cross-section, Compton scattering

Lecture 37 - Klein-Nishina result for cross-section

Lecture 38 - Photon polarisation sums, Pair production through annihilation

Lecture 39 - Unpolarised and polarised cross-sections

Lecture 40 - Helicity properties, Bound state formation

Lecture 41 - Bound state decay, Non-relativistic potentials

Lecture 42 - Lagrangian formulation of QED, Divergences in Green's functions, Superficially divergent 1-loop diagrams and regularisation

Lecture 43 - Infrared divergences due to massless particles, Renormalisation and finite physical results

Lecture 44 - Symmetry constraints on Green's functions, Furry's theorem, Ward-Takahashi identity, Spontaneous breaking of gauge symmetry and superconductivity

Lecture 45 - Status of QED, Organisation of perturbative expansion, Precision tests

Lecture 1 - Introduction

Lecture 2 - Linear Systems

Lecture 3 - Homogeneous linear time invariant ordinary differential equations

Lecture 4 - In-homogeneous linear time invariant ordinary differential equations

Lecture 5 - Fourier transforms - Part 1

Lecture 6 - Fourier transforms - Part 2

Lecture 7 - Laplace transforms - Part 1

Lecture 8 - Laplace transforms - Part 2

Lecture 9 - Introduction to feedback control - Part 1

Lecture 10 - Introduction to feedback control - Part 2

Lecture 11 - Nyquist stability theory - Part 1

Lecture 12 - Nyquist stability theory - Part 2

Lecture 13 - Nyquist stability theory - Part 3

Lecture 14 - Bode plots

Lecture 15 - Steps for performing control design - Part 1

Lecture 16 - Steps for performing control design - Part 2

Lecture 17 - General controllers - Part 1

Lecture 18 - General controllers - Part 2

Lecture 19 - General controllers - Part 3

Lecture 20 - Bode plot-based control design - Part 1

Lecture 21 - Bode plot-based control design - Part 2

Lecture 22 - Introduction to root-locus

Lecture 23 - Control system design using root-locus

Lecture 24 - Control of systems with some known parameters - Part 1

Lecture 25 - Control of systems with some known parameters - Part 2

Lecture 26 - Limitations of 1-degree of freedom control

Lecture 27 - Introduction to 2-degree of freedom control

Lecture 28 - 2-Degree of freedom robust control design for plants with gain uncertainty - Part 1

Lecture 29 - 2-Degree of freedom robust control design for plants with uncertain gain - Part 2

Lecture 30 - 2-Degree of freedom robust control design for plants with uncertain pole

Lecture 31 - 2-Degree of freedom robust control design for plants with multiple uncertainties in their structure

[Lecture 32 - Issues connected with 2-Degree of freedom control design using root-locus](#)

[Lecture 33 - Introduction to Nichols plot](#)

[Lecture 34 - Feedback control design using Nichols plot](#)

[Lecture 35 - Robust control design using Quantitative feedback theory - Part 1](#)

[Lecture 36 - Robust control design using Quantitative feedback theory - Part 2](#)

[Lecture 37 - Tutorial on QFT Toolbox software - Part 1](#)

[Lecture 38 - Tutorial on QFT Toolbox software - Part 2](#)

[Lecture 39 - Tutorial on QFT Toolbox software - Part 3](#)

[Lecture 40 - Fundamental properties of the loop gain - Part 1](#)

[Lecture 41 - Fundamental properties of the loop gain - Part 2](#)

[Lecture 42 - Ideal Bode Characteristic - Part 1](#)

[Lecture 43 - Ideal Bode Characteristic - Part 2](#)

[Lecture 44 - Introduction to nonminimum phase systems](#)

[Lecture 45 - Fundamental properties of nonminimum phase systems - Part 1](#)

[Lecture 46 - Fundamental properties of nonminimum phase systems - Part 2](#)

[Lecture 47 - Fundamental properties of unstable systems](#)

[Lecture 48 - Consequences of actuator bandwidth limitations while controlling unstable systems](#)

[Lecture 49 - Describing functions - Part 1](#)

[Lecture 50 - Describing functions - Part 2](#)

- Lecture 1 - Born-Oppenheimer approximation
- Lecture 2 - Self-consistent field (SCF) method
- Lecture 3 - Simple MO Theory of Hydrogen Molecule
- Lecture 4 - Bloch's theorem
- Lecture 5 - Tight binding approximation
- Lecture 6 - Energy band theory - 1
- Lecture 7 - Energy band theory - 2
- Lecture 8 - Density of states
- Lecture 9 - Energy band theory - 3
- Lecture 10 - Energy band theory - 4
- Lecture 11 - Drude's classical free electron model - 1
- Lecture 12 - Drude's classical free electron model - 2
- Lecture 13 - Drude's classical free electron model - 3
- Lecture 14 - Drude's classical free electron model - 4
- Lecture 15 - Sommerfeld's quantum free electron model
- Lecture 16 - Specific heat of Fermi gas
- Lecture 17 - Energy dispersion relation in a periodic potential - 1
- Lecture 18 - Energy dispersion relation in a periodic potential - 2
- Lecture 19 - Brief overview of space groups and constant energy surface in 2D
- Lecture 20 - Energy band and effective mass
- Lecture 21 - Effective mass
- Lecture 22 - $k \cdot p$ perturbation method
- Lecture 23 - Revisiting Bloch's theorem and tight binding functions
- Lecture 24 - Symmetries in crystal Hamiltonian - 1
- Lecture 25 - Symmetries in crystal Hamiltonian - 2
- Lecture 26 - Tight binding method - 1
- Lecture 27 - Tight binding method - 2
- Lecture 28 - Tight binding method - 3
- Lecture 29 - Plane wave method
- Lecture 30 - Pseudo potential method
- Lecture 31 - Cellular method of energy band calculation

- Lecture 32 - Muffin tin potential and APW functions
- Lecture 33 - Augmented plane wave method of energy band calculation - 1
- Lecture 34 - Augmented plane wave method of energy band calculation - 2
- Lecture 35 - Greenâ€™s function method of energy band calculation - 1
- Lecture 36 - Greenâ€™s function method of energy band calculation - 2
- Lecture 37 - Cyclotron resonance technique
- Lecture 38 - De Haas-van Alphen effect
- Lecture 39 - De Haas-van Alphen effect conclusion. Introduction to point impurity effect on band structure
- Lecture 40 - Point impurity in crystal
- Lecture 41 - Friedel Oscillations
- Lecture 42 - Lindhard dielectric constant
- Lecture 43 - Dielectric anomaly. Crystal momentum
- Lecture 44 - Spatial and time reversal symmetries in crystals
- Lecture 45 - Time reversal symmetry (Continued...)
- Lecture 46 - Spin orbit interaction
- Lecture 47 - Disordered solids and transport in disordered solids
- Lecture 48 - Optical properties of semiconductors
- Lecture 49 - Excitonic states in semiconductors
- Lecture 50 - Excitonic states in semiconductors (Continued...)
- Lecture 51 - Molecular orbital calculation - I
- Lecture 52 - Mott-Hubbard transition
- Lecture 53 - Hubbard model
- Lecture 54 - Electron repulsion and magnetic exchange
- Lecture 55 - Beyond on-site electron repulsions; Pariser-Parr-Pople model
- Lecture 56 - Electron-hole symmetry and Pairing theorem. Solitons
- Lecture 57 - Density waves in 1-d systems and Lattice vibrations - I
- Lecture 58 - Lattice vibrations - II
- Lecture 59 - Lattice vibrations - III
- Lecture 60 - Lattice vibrations - IV

Lecture 1 - Introduction to NMR

Lecture 2 - NMR concepts and spin physics - I

Lecture 3 - NMR concepts and spin physics - II

Lecture 4 - Internal interaction parameters and chemical shifts

Lecture 5 - Chemical shifts

Lecture 6 - Scalar couplings

Lecture 7 - Multiplicity patterns of coupled spins and analysis of ^1H NMR spectrum

Lecture 8 - Multiplicity pattern and analysis of NMR spectra - II

Lecture 9 - Analysis of NMR spectra and their analysis

Lecture 10 - Heteronuclear NMR

Lecture 11 - Introduction to Fourier series

Lecture 12 - Complex form of Fourier series

Lecture 13 - Fourier theorems

Lecture 14 - Fourier transformation in NMR

Lecture 15 - Pople notation, construction of spin Hamiltonian

Lecture 16 - Quantum mechanical analysis of AX spectra

Lecture 17 - Quantum mechanical analysis of AB spin system

Lecture 18 - Quantum mechanical analysis of coupled spin systems

Lecture 19 - RF pulses and their phases

Lecture 20 - Receiver phase and phase cycling

Lecture 21 - Evolution of chemical shift

Lecture 22 - Evolution of J couplings: polarization transfer

Lecture 23 - selective saturation in homo and heteronuclear spin systems, coupled and decoupled INEPT

Lecture 24 - INEPT and DEPT

Lecture 25 - Coherence transfer pathway

Lecture 26 - Examples of coherence pathway selection

Lecture 27 - Pulse field gradients - I

Lecture 28 - Pulse field gradients - II

Lecture 29 - Selective excitation, selective inversion

Lecture 30 - Relaxation phenomenon

Lecture 31 - T_1 relaxation concepts and measurements

Lecture 32 - Spectral density function and relaxation mechanisms

Lecture 33 - T1 Relaxation mechanisms

Lecture 34 - T1 Relaxation mechanisms and T2 relaxation

Lecture 35 - Measurement of T1 and T2

Lecture 36 - Decoupling and NOE concepts

Lecture 37 - DQ and ZQ relaxation pathways

Lecture 38 - Positive and Negative NOE and spectral density functions

Lecture 39 - NOE and correlation time

Lecture 40 - Product operators

Lecture 41 - Product operator analysis

Lecture 42 - Product operator analysis of pulse sequences

Lecture 43 - Product operators for two J coupled spins

Lecture 44 - Spin echo sequences

Lecture 45 - Introduction to 2D NMR

Lecture 46 - 2D NMR concepts, 2D experiments

Lecture 47 - 2D COSY experiment

Lecture 48 - 2D COSY and its variants

Lecture 49 - TOCSY Heteronuclear 2D experiments

Lecture 50 - coupled and decoupled HSQC, HMBC, INADEQUATE, 2D Jresolved

Lecture 51 - Introduction to multiple quantum NMR

Lecture 52 - DQ and ZQ of coupled spins

Lecture 53 - MQ and relative signs of couplings

Lecture 54 - MQ and spin system filtering

Lecture 55 - Introduction to solid state NMR

Lecture 56 - CSA and dipolar couplings

Lecture 57 - Magic Angle Spinning

Lecture 58 - WAHUHA and Cross Polarization

Lecture 59 - Cross Polarization

Lecture 60 - CP at high speeds, Side band suppression, TOSS

Lecture 1 - Introduction to Graph Theory - Part 1

Lecture 2 - Introduction to Graph Theory - Part 2

Lecture 3 - Introduction to Graph Algorithms - Part 1

Lecture 4 - Introduction to Graph Algorithms - Part 2

Lecture 5 - Havel Hakimi Theorem - Part 1

Lecture 6 - Havel Hakimi Theorem - Part 2

Lecture 7 - Havel Hakimi Theorem - Part 3

Lecture 8 - Graph Traversals - Part 1

Lecture 9 - Graph Traversals - Part 2

Lecture 10 - Topological Sort and Mengers Theorem - Part 1

Lecture 11 - Topological Sort and Mengers Theorem - Part 2

Lecture 12 - Topological Sort and Mengers Theorem - Part 3

Lecture 13 - Hamiltonian Graphs - Part 1

Lecture 14 - Hamiltonian Graphs - Part 2

Lecture 15 - Shortest path Algorithms 1 - Part 1

Lecture 16 - Shortest path Algorithms 1 - Part 2

Lecture 17 - Shortest path Algorithms 1 - Part 3

Lecture 18 - Shortest path Algorithms 1 - Part 4

Lecture 19 - Matching in Graphs - Part 1

Lecture 20 - Matching in Graphs - Part 2

Lecture 21 - Some Graph Theoretic Puzzles - Part 1

Lecture 22 - Some Graph Theoretic Puzzles - Part 2

Lecture 23 - Network Flow Algorithms - Part 1

Lecture 24 - Network Flow Algorithms - Part 2

Lecture 25 - Network Flow Algorithms - Part 3

Lecture 26 - Network Flow Algorithms - Part 4

Lecture 27 - Network Flow Algorithms - Part 5

Lecture 28 - Network Flow Algorithms - Part 6

Lecture 29 - Network Flows - Part 1

Lecture 30 - Network Flows - Part 2

Lecture 31 - Network Flows - Part 3

- Lecture 32 - Network Flows - Part 4
- Lecture 33 - Turán's and Mader's theorem - Part 1
- Lecture 34 - Turán's and Mader's theorem - Part 2
- Lecture 35 - NP Computations - Part 1
- Lecture 36 - NP Computations - Part 2
- Lecture 37 - Spectral Graph Theory-I - Part 1
- Lecture 38 - Spectral Graph Theory-I - Part 2
- Lecture 39 - Spectral Graph Theory-I - Part 3
- Lecture 40 - NP Computations II - Part 1
- Lecture 41 - NP Computations II - Part 2
- Lecture 42 - Graph Coloring - Part 1
- Lecture 43 - Graph Coloring - Part 2
- Lecture 44 - Spectral Graph Theory-II - Part 1
- Lecture 45 - Spectral Graph Theory-II - Part 2
- Lecture 46 - NP Computations Reductions - Part 1
- Lecture 47 - NP Computations Reductions - Part 2
- Lecture 48 - NP Computations Reductions - Part 3
- Lecture 49 - Spectral Graph Theory-III - Part 1
- Lecture 50 - Planar Graphs - Part 1
- Lecture 51 - Planar Graphs - Part 2
- Lecture 52 - NP Computations and Approximation Algorithms - Part 1
- Lecture 53 - NP Computations and Approximation Algorithms - Part 2
- Lecture 54 - Spectral Graph Theory-IV - Part 1
- Lecture 55 - Spectral Graph Theory-IV - Part 2
- Lecture 56 - Approximation Algorithms I - Part 1
- Lecture 57 - Approximation Algorithms I - Part 2
- Lecture 58 - Social Network Analysis - Part 1
- Lecture 59 - Social Network Analysis - Part 2
- Lecture 60 - Spectral Graph Theory-V - Part 1
- Lecture 61 - Spectral Graph Theory-V - Part 2
- Lecture 62 - Approximation Algorithms II - Part 1
- Lecture 63 - Approximation Algorithms II - Part 2
- Lecture 64 - Spectral Graph Theory-VI - Part 1

[Lecture 65 - Spectral Graph Theory-VI - Part 2](#)

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- Lecture 19 - Program Semantics - Prof. Subhajit Roy Session - 4
- Lecture 20 - Program Semantics - Prof. Subhajit Roy Session - 5
- Lecture 21 - Program Semantics - Prof. Subhajit Roy Session - 6
- Lecture 22 - Program Semantics - Prof. Subhajit Roy Session - 7
- Lecture 23 - Program Semantics - Prof. Subhajit Roy Session - 8
- Lecture 24 - Introduction to Optimizations - Prof. V. Krishna N Session - 1
- Lecture 25 - Introduction to Optimizations - Prof. V. Krishna N Session - 2
- Lecture 26 - Introduction to Optimizations - Prof. V. Krishna N Session - 3
- Lecture 27 - Introduction to Optimizations - Prof. V. Krishna N Session - 4
- Lecture 28 - Compiler as system - Vivek S. Buzruk Session - 1
- Lecture 29 - Compiler as system - Vivek S. Buzruk Session - 2

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : ACM Winter School 2019 on High Performance Computing (Special Lecture Series)

Co-ordinators : Dr. Mainak Chaudhuri

- Lecture 1 - Basics of Computer Architecture and OS
- Lecture 2 - An Introduction to High Performance Computing
- Lecture 3 - Introduction to OpenMP
- Lecture 4 - Advanced OpenMP
- Lecture 5 - Introduction to MPI
- Lecture 6 - Advanced MPI
- Lecture 7 - Supercomputing in India
- Lecture 8 - Job Scheduling
- Lecture 9 - Introduction to GPU
- Lecture 10 - Introduction to Open ACC
- Lecture 11 - CPU and GPU Memory
- Lecture 12 - Optimizations and GPU Profiling
- Lecture 13 - CUDA C
- Lecture 14 - HPC Networking - I
- Lecture 15 - HPC Networking - II
- Lecture 16 - Research in HPS
- Lecture 17 - Case Study - Parallel Graph Algorithms
- Lecture 18 - Case Study - Solving PDEs at Extreme Scale

Lecture 1 - Basic thermodynamic functions: Enthalpy, entropy, configurational entropy, Gibbs free energy

Lecture 2 - State of equilibrium: Chemical potential, activity, equilibrium between solutions

Lecture 3 - Case study: Mechanical alloying, alloying by deformation.

Lecture 4 - Computer calculation of phase diagrams

Lecture 5 - Thermodynamics of irreversible processes: Multiple irreversible processes

Lecture 6 - Quasichemical solutions

- Lecture 1 - ACM Summer School on Program Execution - Introduction
- Lecture 2 - Basics of Architecture - Part 1
- Lecture 3 - Basics of Architecture - Part 2
- Lecture 4 - Basics of Architecture - Part 3
- Lecture 5 - Basics of Architecture - Part 4
- Lecture 6 - A Review of Architectural Features for supporting Program Execution - Part 1
- Lecture 7 - A Review of Architectural Features for supporting Program Execution - Part 2
- Lecture 8 - A Review of Architectural Features for supporting Program Execution - Part 3
- Lecture 9 - A Review of Architectural Features for supporting Program Execution - Part 4
- Lecture 10 - Review of OS - IPC and beyond - Part 1
- Lecture 11 - Review of OS - IPC and beyond - Part 2
- Lecture 12 - From Programs to Processes (and threads) - Part 1
- Lecture 13 - From Programs to Processes (and threads) - Part 2
- Lecture 14 - Network Protocol Fundamentals
- Lecture 15 - Web protocols and Web Software - Part 1
- Lecture 16 - Web protocols and Web Software - Part 2
- Lecture 17 - Storage Systems - Part 1
- Lecture 18 - Storage Systems - Part 2
- Lecture 19 - Storage Systems - Part 3
- Lecture 20 - Basics of High Performance Computing - Part 1
- Lecture 21 - Basics of High Performance Computing - Part 2
- Lecture 22 - Basics of High Performance Computing - Part 3
- Lecture 23 - The Evolution of Linux as an Enterprise Operating System
- Lecture 24 - The Hypervisor - Lord of the Rings - Part 1
- Lecture 25 - The Hypervisor - Lord of the Rings - Part 2
- Lecture 26 - Hands on Lab - Create a VM and Play
- Lecture 27 - Containers and Kubernetes Era - Part 1
- Lecture 28 - Containers and Kubernetes Era - Part 2
- Lecture 29 - Containers and Kubernetes Era - Part 3
- Lecture 30 - The Future of Compute - Part 1
- Lecture 31 - The Future of Compute - Part 2

Lecture 1 - Panel Discussion Q and A - Part 1

Lecture 2 - Panel Discussion Q and A - Part 2

Lecture 3 - Runtime and Linkers - Discussion - 1

Lecture 4 - Runtime and Linkers - Discussion - 2

Lecture 5 - Runtime and Linkers - Linkers

Lecture 6 - Runtime and Linkers - Program Execution - Loader

Lecture 7 - Runtime and Linkers - Static Libraries - Dynamic Linking

Lecture 8 - Code Generation and Backend - An Introduction to LLVM Backend

Lecture 9 - Code Generation and Backend - An Introduction to Loop Backend

Lecture 10 - Code Generation and Backend - Code Generation with LLVM - Part 1

Lecture 11 - Code Generation and Backend - Code Generation with LLVM - Part 2

Lecture 12 - Machine Independent Optimizations - High Level Optimizations - 1

Lecture 13 - Machine Independent optimizations - High Level Optimizations - 2

Lecture 14 - Machine Independent optimizations - High Level Optimizations - 3

Lecture 15 - Machine Independent optimizations - High Level Optimizations - 4

Lecture 16 - Machine Independent optimizations - High Level Optimizations - 5

Lecture 17 - Machine Independent optimizations - High Level Optimizations - 6

Lecture 18 - Machine Architecture and Machine Dependent Optimizations - Machine Architecture - 1

Lecture 19 - Machine Architecture and Machine Dependent Optimizations - Machine Architecture - 2

Lecture 20 - Machine Architecture and Machine Dependent Optimizations - Machine Architecture - 3

Lecture 21 - Machine Architecture and Machine Dependent Optimizations - Register Allocation - 1

Lecture 22 - Machine Architecture and Machine Dependent Optimizations - Register Allocation - 2

Lecture 23 - Machine Architecture and Machine Dependent Optimizations - Register Allocation - 3

Lecture 24 - Machine Architecture and Machine Dependent Optimizations - Instruction Scheduling - 1

Lecture 25 - Machine Architecture and Machine Dependent Optimizations - Instruction Scheduling - 2

Lecture 26 - Machine Dependent Optimizations - Dependence Analysis and Loop transformations - 1

Lecture 27 - Machine Dependent Optimizations - Dependence Analysis and Loop transformations - 2

Lecture 28 - Control-Flow Analyses and Static Single Assignment form - Control Flow Analysis - 1

Lecture 29 - Control-Flow Analyses and Static Single Assignment form - Control Flow Analysis - 2

Lecture 30 - Control-Flow Analyses and Static Single Assignment form - Depth First Analysis of Flow Graphs

Lecture 31 - Control-Flow Analyses and Static Single Assignment form - Dominators

- [Lecture 32 - Control-Flow Analyses and Static Single Assignment form - Natural Loops \(for Reducible Flow-Graphs\)](#)
- [Lecture 33 - Control-Flow Analyses and Static Single Assignment form - The Static Single Assignment SSA Form - 1](#)
- [Lecture 34 - Control-Flow Analyses and Static Single Assignment form - The Static Single Assignment SSA Form - 2](#)
- [Lecture 35 - Polyhedral Compilation and Loop Optimizations - Polyhedral Compilation I Part 1](#)
- [Lecture 36 - Polyhedral Compilation and Loop Optimizations - Polyhedral Compilation I Part 2](#)
- [Lecture 37 - Polyhedral Compilation and Loop Optimizations - Polyhedral Compilation I - Part 3](#)
- [Lecture 38 - Polyhedral Compilation and Loop Optimizations - Polyhedral Compilation I - Part 4](#)
- [Lecture 39 - Polyhedral Compilation and Loop Optimizations - Polyhedral Compilation I - Part 5](#)
- [Lecture 40 - Polyhedral Compilation and Loop Optimizations - Polyhedral Compilation I - Part 6](#)
- [Lecture 41 - Polyhedral Compilation and Loop Optimizations - Polyhedral Compilation I - Part 7](#)
- [Lecture 42 - Polyhedral Compilation and Loop Optimizations - Affine Control Loops](#)
- [Lecture 43 - Polyhedral Compilation and Loop Optimizations - Siplifying Reductions Revised - 1](#)
- [Lecture 44 - Polyhedral Compilation and Loop Optimizations - Siplifying Reductions Revised - 2](#)
- [Lecture 45 - Polyhedral Compilation and Loop Optimizations - Siplifying Reductions Revised - 3](#)
- [Lecture 46 - Polyhedral Compilation and Loop Optimizations - Classical Optimization](#)
- [Lecture 47 - Polyhedral Compilation and Loop Optimizations - What is Program Analysis](#)
- [Lecture 48 - Polyhedral Compilation and Loop Optimizations - Live Variable Analysis - 1](#)
- [Lecture 49 - Polyhedral Compilation and Loop Optimizations - Live Variable Analysis - 2](#)
- [Lecture 50 - Polyhedral Compilation and Loop Optimizations - Available Expression Analysis](#)
- [Lecture 51 - Polyhedral Compilation and Loop Optimizations - Common Features of Bit Vector Frameworks](#)
- [Lecture 52 - Polyhedral Compilation and Loop Optimizations - The Birth of a Compiler - 1](#)
- [Lecture 53 - Polyhedral Compilation and Loop Optimizations - The Birth of a Compiler - 2](#)
- [Lecture 54 - Polyhedral Compilation and Loop Optimizations - The Structure of Modern Compiler Modern Challenges](#)
- [Lecture 55 - Polyhedral Compilation and Loop Optimizations - Conclusion](#)

[Lecture 1 - Linear Algebra and Optimization - 1](#)

[Lecture 2 - Linear Algebra and Optimization - 2](#)

[Lecture 3 - Linear Algebra and Optimization - 3](#)

[Lecture 4 - Linear Algebra and Optimization - 4](#)

[Lecture 5 - Curvature - Part 1](#)

[Lecture 6 - Curvature - Part 2](#)

[Lecture 7 - Curvature - Part 3](#)

[Lecture 8 - Introduction To Parametric Curves and Surfaces - 1](#)

[Lecture 9 - Introduction To Parametric Curves and Surfaces - 2](#)

[Lecture 10 - Introduction To Parametric Curves and Surfaces - 3](#)

[Lecture 11 - Introduction To Parametric Curves and Surfaces - 4](#)

[Lecture 12 - Introduction To Parametric Curves and Surfaces - 5](#)

[Lecture 13 - Introduction To Parametric Curves and Surfaces - 6](#)

[Lecture 14 - Introduction To Parametric Curves and Surfaces - 7](#)

[Lecture 15 - Introduction To Parametric Curves and Surfaces - 8](#)

[Lecture 16 - Introduction To Parametric Curves and Surfaces - 9](#)

[Lecture 17 - Implicit Surfaces - Part 1](#)

[Lecture 18 - Implicit Surfaces - Part 2](#)

[Lecture 19 - Implicit Surfaces - Part 3](#)

[Lecture 20 - MeshLab - Part 1](#)

[Lecture 21 - MeshLab - Part 2](#)

[Lecture 22 - MeshLab - Part 3](#)

[Lecture 23 - MeshLab - Part 4](#)

[Lecture 24 - Discrete Surface - Part 1](#)

[Lecture 25 - Discrete Surface - Part 2](#)

[Lecture 26 - Discrete Surface - Part 3](#)

[Lecture 27 - Discrete Surface - Part 4](#)

[Lecture 28 - Discrete Surface - Part 5](#)

[Lecture 29 - Laplace Beltrami on Manifolds and Meshes with Applications - Part 1](#)

[Lecture 30 - Laplace Beltrami on Manifolds and Meshes with Applications - Part 2](#)

[Lecture 31 - Laplace Beltrami on Manifolds and Meshes with Applications - Part 3](#)

[Lecture 32 - Laplace Beltrami on Manifolds and Meshes with Applications - Part 4](#)

[Lecture 33 - Laplace Beltrami on Manifolds and Meshes with Applications - Part 5](#)

[Lecture 34 - Laplace Beltrami on Manifolds and Meshes with Applications - Part 6](#)

[Lecture 35 - Internal Digital R and I - Part 1](#)

[Lecture 36 - Internal Digital R and I - Part 2](#)

[Lecture 37 - Internal Digital R and I - Part 3](#)

[Lecture 38 - Rigid and Non rigid Shape Matching - Part 1](#)

[Lecture 39 - Rigid and Non rigid Shape Matching - Part 2](#)

[Lecture 40 - Rigid and Non rigid Shape Matching - Part 3](#)

[Lecture 41 - Rigid and Non rigid Shape Matching - Part 4](#)

[Lecture 42 - Geometric Deep Learning - Part 1](#)

[Lecture 43 - Geometric Deep Learning - Part 2](#)

[Lecture 44 - Geometric Deep Learning - Part 3](#)

[Lecture 45 - Geometric Deep Learning - Part 4](#)

[Lecture 46 - Geometric Deep Learning - Part 5](#)

[Lecture 47 - Geometric Deep Learning - Frame Works](#)

[Lecture 48 - Geometric Deep Learning - Lab 1](#)

[Lecture 49 - Geometric Deep Learning - Lab 2](#)

[Lecture 50 - Geometric Deep Learning - Lab 3](#)

[Lecture 1 - ACM India Summer School on Shape Modelling - Introduction](#)

[Lecture 2 - Linear Algebra and Optimization Refresher - 1](#)

[Lecture 3 - Linear Algebra and Optimization Refresher - 2](#)

[Lecture 4 - Linear Algebra and Optimization Refresher - 3](#)

[Lecture 5 - Linear Algebra and Optimization Refresher - 4](#)

[Lecture 6 - Overview of Python 3 + {Numpy, Scipy, Matplotlib} - Part 1](#)

[Lecture 7 - Overview of Python 3 + {Numpy, Scipy, Matplotlib} - Part 2](#)

[Lecture 8 - Curves and Surfaces - Part 1](#)

[Lecture 9 - Curves and Surfaces - Part 2](#)

[Lecture 10 - Curves and Surfaces - Part 3](#)

[Lecture 11 - Curves and Surfaces - Part 4](#)

[Lecture 12 - Curves and Surfaces - Part 5](#)

[Lecture 13 - Curves and Surfaces - Part 6](#)

[Lecture 14 - Curves and Surfaces - Part 7](#)

[Lecture 15 - Algorithms in Computational Geometry - Part 1](#)

[Lecture 16 - Algorithms in Computational Geometry - Part 2](#)

[Lecture 17 - Algorithms in Computational Geometry - Part 3](#)

[Lecture 18 - Algorithms in Computational Geometry - Part 4](#)

[Lecture 19 - Algorithms in Computational Geometry - Part 5](#)

[Lecture 20 - Algorithms in Computational Geometry Lab - Part 1](#)

[Lecture 21 - Algorithms in Computational Geometry Lab - Part 2](#)

[Lecture 22 - Algorithms in Computational Geometry Lab - Part 3](#)

[Lecture 23 - Discrete Surfaces - Part 1](#)

[Lecture 24 - Discrete Surfaces - Part 2](#)

[Lecture 25 - Discrete Surfaces - Part 3](#)

[Lecture 26 - Discrete Surfaces - Part 4](#)

[Lecture 27 - Discrete Surfaces - Part 5](#)

[Lecture 28 - Implicit and Discrete Surfaces](#)

[Lecture 29 - Discrete Surfaces - Part Lab - Part 1](#)

[Lecture 30 - Discrete Surfaces - Part Lab - Part 2](#)

[Lecture 31 - Discrete Laplace Beltrami Operator - Part 1](#)

- Lecture 32 - Discrete Laplace Beltrami Operator - Part 2
- Lecture 33 - Discrete Laplace Beltrami Operator - Part 3
- Lecture 34 - Discrete Laplace Beltrami Operator - Part 4
- Lecture 35 - Discrete Laplace Beltrami Operator - Part 5
- Lecture 36 - Discrete Laplace Beltrami Operator - Part 6
- Lecture 37 - Lab Libigl-Python-Blindings - Part 1
- Lecture 38 - Lab Libigl-Python-Blindings - Part 2
- Lecture 39 - Procrustes Shape Analysis - Part 1
- Lecture 40 - Procrustes Shape Analysis - Part 2
- Lecture 41 - Procrustes Shape Analysis - Part 3
- Lecture 42 - Procrustes Shape Analysis - Part 4
- Lecture 43 - Lab Procrustes Shape Analysis Template - Part 1
- Lecture 44 - Lab Procrustes Shape Analysis Template - Part 2
- Lecture 45 - Lab Procrustes Shape Analysis Template - Part 3
- Lecture 46 - Shape Deformation/Animation, Shape Matching - Part 1
- Lecture 47 - Shape Deformation/Animation, Shape Matching - Part 2
- Lecture 48 - Shape Deformation/Animation, Shape Matching - Part 3
- Lecture 49 - Shape Deformation/Animation, Shape Matching - Part 4
- Lecture 50 - Shape Deformation/Animation, Shape Matching - Part 5
- Lecture 51 - Geometric Deep Learning - Part 1
- Lecture 52 - Geometric Deep Learning - Part 2
- Lecture 53 - Geometric Deep Learning - Part 3
- Lecture 54 - Geometric Deep Learning - Part 4
- Lecture 55 - Geometric Deep Learning - Part 5
- Lecture 56 - Geometric Deep Learning - Part 6
- Lecture 57 - Topological Descriptors For Data and Shape Analysis - Part 1
- Lecture 58 - Topological Descriptors For Data and Shape Analysis - Part 2
- Lecture 59 - Topological Descriptors For Data and Shape Analysis - Part 3
- Lecture 60 - Topological Descriptors For Data and Shape Analysis - Part 4
- Lecture 61 - Panel Discussion On Shape Modelling In Academia and Industry - Part 1
- Lecture 62 - Panel Discussion On Shape Modelling In Academia and Industry - Part 2

Lecture 1 - ACM Day 1 Session 1

Lecture 2 - ACM Day 1 Session 2 - Part I

Lecture 3 - ACM Day 1 Session 2 - Part II

Lecture 4 - ACM Day 1 Session 3 - Part I

Lecture 5 - ACM Day 1 Session 3 - Part II

Lecture 6 - ACM Day 2 Session 1 - Part I

Lecture 7 - ACM Day 2 Session 1 - Part II

Lecture 8 - ACM Day 2 Session 2 - Part I

Lecture 9 - ACM Day 2 Session 2 - Part II

Lecture 10 - ACM Day 3 Session 1 - Part 1

Lecture 11 - ACM Day 3 Session 1 - Part 2

Lecture 12 - ACM Day 3 Session 2 - Part 1

Lecture 13 - ACM Day 3 Session 2 - Part 2

Lecture 14 - ACM Day 3 Session 3 - Part I

Lecture 15 - ACM Day 3 Session 3 - Part II

Lecture 16 - ACM Day 3 Session 4 - Part I

Lecture 17 - ACM Day 3 Session 4 - Part II

Lecture 18 - ACM Day 4 session 1 - Part I

Lecture 19 - ACM Day 4 session 1 - Part II

Lecture 20 - ACM Day 4 session 2 - Part I

Lecture 21 - ACM Day 4 session 2 - Part II

Lecture 22 - ACM Day 5 session 1 - Part 1

Lecture 23 - ACM Day 5 session 1 - Part 2

Lecture 24 - ACM Day 5 session 2 - Part 1

Lecture 25 - ACM Day 5 session 2 - Part 2

Lecture 26 - ACM Day 6 session 1 - Part 1

Lecture 27 - ACM Day 6 session 1 - Part 2

Lecture 28 - ACM Day 6 session 2 - Part 1

Lecture 29 - ACM Day 6 session 2 - Part 2

Lecture 30 - ACM Day 7 session 1 - Part I

Lecture 31 - ACM Day 7 session 1 - Part II

[Lecture 32 - ACM Day 7 Session 2](#)

[Lecture 33 - ACM Day 8 Session 1](#)

[Lecture 34 - ACM Day 8 Session 2](#)

[Lecture 35 - ACM Day 8 Session 3](#)

[Lecture 36 - ACM Day 8 Session 4](#)

[Lecture 37 - ACM Day 9 Session 1](#)

[Lecture 38 - ACM Day 9 Session 2](#)

[Lecture 39 - ACM Day 9 Session 3](#)

[Lecture 40 - ACM Day 9 Session 4](#)

[Lecture 41 - ACM Day 9 Session 5 - Part 1](#)

[Lecture 42 - ACM Day 9 Session 5 - Part 2](#)

[Lecture 43 - ACM Day 10 Session 1](#)

[Lecture 44 - ACM Day 10 Session 2 - Part 1](#)

[Lecture 45 - ACM Day 10 Session 2 - Part 2](#)

[Lecture 46 - ACM Day 10 Session 3 - Part 1](#)

[Lecture 47 - ACM Day 10 Session 3 - Part 2](#)

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : ACM Winter School on Design, Implementation and Verification of Computer Systems (Special Lecture Series)

Co-ordinators : Multi-Faculty

Lecture 1 - Mathematical Logic - Session 1

Lecture 2 - Mathematical Logic - Session 2

Lecture 3 - Industry Perspectives on Compiler Design

Lecture 4 - Processor Datapath and Introduction to ILP Architecture - Session 1

Lecture 5 - Processor Datapath and Introduction to ILP Architecture - Session 2

Lecture 6 - Instruction Level Parallelism - Session 1

Lecture 7 - Multithreading and Multicores

Lecture 8 - Instruction Level Parallelism - Session 2

Lecture 9 - DRAM Memory Organization

Lecture 10 - Reactive Synthesis: A High-Level Introduction - Session 1

Lecture 11 - Reactive Synthesis: A High-Level Introduction - Session 2

Lecture 12 - Reactive Synthesis: A High-Level Introduction - Session 3

Lecture 13 - Reactive Synthesis: A High-Level Introduction - Session 4

Lecture 14 - Reduced Ordered Binary Decision Diagrams and And-Inverter Graphs - Session 1

Lecture 15 - Reduced Ordered Binary Decision Diagrams and And-Inverter Graphs - Session 2

Lecture 16 - Reduced Ordered Binary Decision Diagrams and And-Inverter Graphs - Session 3

Lecture 17 - Runtime Environments - I

Lecture 18 - Runtime Environments - II

Lecture 19 - Hexagon DSPs in Snapdragon

Lecture 20 - Types and Program Analysis

Lecture 21 - Local and Global Optimizations

Lecture 22 - Introduction to Data-Flow and Control-Flow Analyses

Lecture 23 - Code Generation and Register Allocation

Lecture 24 - The Static Single Assignment Form and Application to Program Optimizations

Lecture 25 - Garbage Collection

Lecture 26 - Program Testing and Verification - Session 1

Lecture 27 - Program Testing and Verification - Session 2

[Lecture 1 - NP-Completeness](#)

[Lecture 2 - Hilbert's Tenth Problem](#)

[Lecture 3 - SAT Solvers](#)

[Lecture 4 - Polynomial Identity Testing](#)

[Lecture 5 - Finite Graphs for Infinite Functions](#)

[Lecture 6 - A Panorama of Computational Problems](#)

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : NPTEL Special Lectures Series (Special Lecture Series)

Co-ordinators : Mr. Ravikrishnan .A, Srivastava, Raman .K

Lecture 1 - Microbial Social Networks: From Deep Sea to Outer Space

Lecture 2 - Data-Driven Analysis to Improve Road Safety

Lecture 3 - The Power of Generative AI: AI that can see and talk

Lecture 4 - Astronomical Challenges in Atomic Scale chip Manufacturing

Lecture 5 - Evaluating Fault - Tolerant Schemes for noisy hardware

Lecture 6 - Tighter and Stronger Quantum Speed Limits for General Quantum States

Lecture 7 - Robust, bright photon sources for quantum communication and quantum sensing applications

Lecture 8 - Particle transport problems at different scales: From circulating fluidized beds to dry powder

Lecture 9 - Simulation and Data: 6 Steps from Theory to Impact through Disasters, Engineering and Heritage

Lecture 10 - The Attosecond Worldâ€”there's plenty of time at the bottom

Lecture 11 - Quantum diffusion during cosmic inflation

Lecture 12 - Squashed quantum non-Markovianity: a measure of genuine quantum non-Markovianity in states

Lecture 13 - Gravitational-Wave Astronomy: New discoveries, puzzles and prospects

Lecture 14 - Bounds on the Superconducting Transition Temperature

Lecture 15 - Probing the primordial universe with electromagnetic and gravitational waves

Lecture 16 - Elephants have a bigger brain than humans, so how come they don't study you

Lecture 17 - Investigating quantum speed limits with superconducting qubits

Lecture 18 - Orbital Angular Momentum Entanglement

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NPTEL : ACM India Summer School on IoT and Embedded Systems (Special Lecture Series)

Co-ordinators : Prof. Meenakshi DSouza

[Lecture 1 - ACM India Summer School on IoT and Embedded Systems - Introduction](#)

[Lecture 2 - Embedded Sysyem: An Introduction](#)

[Lecture 3 - Introdeduction to Embedded Sysyems](#)

[Lecture 4 - Introduction to IoT](#)

[Lecture 5 - AWS IoT: Tutorial and demonstration](#)

[Lecture 6 - IoT: Components, operating systems and protocols](#)

[Lecture 7 - Arduino programming](#)

[Lecture 8 - Arduino programming: Tutorial](#)

[Lecture 9 - IoT Applications](#)

[Lecture 10 - IoT Applications: Tutorial and demonstration - 1](#)

[Lecture 11 - IoT Applications: Tutorial and demonstration - 2](#)

[Lecture 12 - Cloud, edge and fog computing for IoT - Part I](#)

[Lecture 13 - Cloud, edge and fog computing for IoT - Part II](#)

[Lecture 14 - IoT Communication](#)

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : ACM India Summer School on Algorithms for Data Science (2023) (Special Lecture Series)

Co-ordinators : Multi-Faculty

Lecture 1 - Introduction - ACM India Summer School on Algorithms for Data Science

Lecture 2 - Introduction to Probability

Lecture 3 - Selection Problems

Lecture 4 - Median from Read-Only Memory

Lecture 5 - Majority and Heavy Hitters

Lecture 6 - Introduction to Probability Tail inequalities

Lecture 7 - Chernoff Bounds

Lecture 8 - Quickselect and Quicksort

Lecture 9 - Introduction to Randomized Algorithms: Graph Minimum Cut

Lecture 10 - Introduction to Streaming Algorithm and Reservoir Sampling

Lecture 11 - Approximate Counting in Streaming: MORRIS Counter

Lecture 12 - Median of Means Technique Applied to Approximate Counting

Lecture 13 - Counting Distinct Elements in Streaming

Lecture 14 - 2-Universal Hashing and Applications for Derandomizing

Lecture 15 - Approximate Heavy Hitters

Lecture 16 - Frequency Moments

Lecture 17 - Graph Streaming Algorithms

Lecture 18 - Locality Sensitive Hashing - Part 1

Lecture 19 - Locality Sensitive Hashing - Part 2

Lecture 20 - Locality Sensitive Hashing - Part 3

Lecture 21 - Graph Streaming Lower Bounds

Lecture 22 - Bloom Filters

Lecture 23 - Frequent Pattern Mining - Part 1

Lecture 24 - Frequent Pattern Mining - Part 2

Lecture 25 - Is AI ready for The real world?

Lecture 26 - Online Learning and Multiarmed Bandits - Part 1

Lecture 27 - Online Learning and Multiarmed Bandits - Part 2

Lecture 28 - Reinforcement Learning - Part 1

Lecture 29 - Reinforcement Learning - Part 2

Lecture 30 - Singular Value Decomposition - Part 1

Lecture 31 - Singular Value Decomposition - Part 2

[Lecture 32 - Graph Centralities](#)

[Lecture 33 - Johnson Lindenstrauss Lemma](#)

[Lecture 34 - Graph Centralities Clustering and Partition](#)

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : ACM India Summer School on Cybersecurity for Women (Special Lecture Series)

Co-ordinators : Multi-Faculty

[Lecture 1 - Mathamatical Foundation for Cryptography - Part 1](#)

[Lecture 2 - Mathamatical Foundation for Cryptography - Part 2](#)

[Lecture 3 - Modern Cryptography](#)

[Lecture 4 - Modern Cryptography](#)

[Lecture 5 - Modern Cryptography - Asymmetric Cryptography](#)

[Lecture 6 - Network Security protocols and mechanisms - Part 1](#)

[Lecture 7 - Network Security protocols and mechanisms - Part 2](#)

[Lecture 8 - IOT Security Protocols - Part 1](#)

[Lecture 9 - IOT Security Protocols - Part 2](#)

[Lecture 10 - Introduction to Ethical Hacking - Part 1](#)

[Lecture 11 - Introduction to Ethical Hacking - Part 2](#)

[Lecture 12 - DevSecOps Embedding Security into DevOps - Part 1](#)

[Lecture 13 - Web App Security](#)

[Lecture 14 - Navigating the privacy landscape](#)

[Lecture 15 - Hardware security](#)

[Lecture 16 - Introduction to Blockchain](#)

[Lecture 17 - Social Engineering and OSINT - Part 1](#)

[Lecture 18 - Social Engineering and OSINT - Part 2](#)

[Lecture 19 - Cloud Security and Secure Coding Practices - Part 1](#)

[Lecture 20 - Cloud Security and Secure Coding Practices - Part 2](#)

[Lecture 21 - Career Opportunities, Challenges and Support](#)

[Lecture 22 - Quantum Cryptography - Part 1](#)

[Lecture 23 - Quantum Cryptography - Part 2](#)

[Lecture 24 - AI in cybersecurity](#)

- Lecture 1 - Introduction to Cryptography
- Lecture 2 - Classical Ciphers - Part 1
- Lecture 3 - Classical Ciphers - Part 2
- Lecture 4 - Foundations of Cryptography - Part 1
- Lecture 5 - Foundations of Cryptography - Part 2
- Lecture 6 - Foundations of Cryptography - Part 3
- Lecture 7 - Block and Stream ciphers, Fiestel Networks
- Lecture 8 - Data Encryption Standard
- Lecture 9 - Cybersecurity - Part 1
- Lecture 10 - Cybersecurity - Part 2
- Lecture 11 - Enterprise Security - Part 1
- Lecture 12 - Enterprise Security - Part 2
- Lecture 13 - Advanced Encryption Standard
- Lecture 14 - Information Gathering and Social Engineering
- Lecture 15 - Cybersecurity : A Practical Approach - Part 1
- Lecture 16 - Cybersecurity : A Practical Approach - Part 2
- Lecture 17 - Cybersecurity : A Practical Approach - Part 3
- Lecture 18 - Cybersecurity : A Practical Approach - Part 4
- Lecture 19 - Cybersecurity : A Practical Approach - Part 5
- Lecture 20 - Public Key Cryptography
- Lecture 21 - Network Security - Firewalls, ACL, NAT, AAA, FTD - Part 1
- Lecture 22 - Network Security - Firewalls, ACL, NAT, AAA, FTD - Part 2
- Lecture 23 - Network Security - VPN, PKI, Certificates, SSL,SAML - Part 1
- Lecture 24 - Network Security - VPN, PKI, Certificates, SSL,SAML - Part 2
- Lecture 25 - Virtual Private Networks (VPN)
- Lecture 26 - Hash Functions, Digital Signatures and Quantum Cryptography
- Lecture 27 - Packets, Protocols and Attacks in Cyberspace - Part 1
- Lecture 28 - Packets, Protocols and Attacks in Cyberspace - Part 2

[Lecture 1 - Representing Networks](#)

[Lecture 2 - Strategic Network Formation - Session 1](#)

[Lecture 3 - Strategic Network Formation - Session 2](#)

[Lecture 4 - Strategic Network Formation - Session 3](#)

[Lecture 5 - Strategic Network Formation - Session 4](#)

[Lecture 6 - Network Visualization - Session 1](#)

[Lecture 7 - Network Visualization - Session 2](#)

[Lecture 8 - Social Network Analysis](#)

[Lecture 9 - Neural Networks - Basics](#)

[Lecture 10 - Network Analysis in Telecom](#)

[Lecture 11 - Strong and Weak Ties](#)

[Lecture 12 - Link Analysis](#)

[Lecture 13 - Statistical Mechanics of Complex Networks - Session 1](#)

[Lecture 14 - Statistical Mechanics of Complex Networks - Session 2](#)

[Lecture 15 - Statistical Mechanics of Complex Networks - Session 3](#)

[Lecture 16 - Statistical Mechanics of Complex Networks - Session 4](#)

[Lecture 17 - Hate Speech - Session 1](#)

[Lecture 18 - Hate Speech - Session 2](#)

[Lecture 19 - Dynamics on Networks - Session 1](#)

[Lecture 20 - Dynamics on Networks - Session 2](#)

[Lecture 21 - Dynamics on Networks - Session 3](#)

[Lecture 22 - Dynamics on Networks - Session 4](#)

[Lecture 23 - Causal Discovery and Network Science](#)

[Lecture 24 - Games and Networks - Session 1](#)

[Lecture 25 - Games and Networks - Session 2](#)

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : ACM Winter School on Recent Trends in AI and ML (Special Lecture Series)

Co-ordinators : Dr. Chandranath Adak

Lecture 1 - NLP Foundation - Part I

Lecture 2 - NLP Foundation - Part II

Lecture 3 - Fundamentals of Machine Learning - Part I

Lecture 4 - Fundamentals of Machine Learning - Part II

Lecture 5 - Artificial Intelligence - An Introduction

Lecture 6 - Logistic Regression and Neural Networks

Lecture 7 - Large Scale SVM Algorithms and Applications

Lecture 8 - Ensemble Deep Learning For Alzheimer's Disease Dianosis

Lecture 9 - From Smart Sensing to Smart Living - The Era of IoT, AI:ML and Data Science

Lecture 10 - Machine Learning - Naive Bayes Classification

Lecture 11 - Cluster Analysis - Basic Concepts and Algorithms

Lecture 12 - Algorithms of Unsupervised Learning

Lecture 13 - Backbone functions of Deep Neural Networks Activation, Loss, Optimization functions

Lecture 14 - Convolutional Neural Networks

Lecture 15 - Reinforcement Learning - Experience, Adapt, Excel - Part I

Lecture 16 - Neoteric Frontiers in cloud, edge and Quantum Computing for Bigdata, IoT and AI Applications

Lecture 17 - Reinforcement Learning - Experience, Adapt, Excel - Part II

Lecture 18 - Economic Impact of New Category Recommendation Evidence from a Randomized Field Experiment

Lecture 19 - Neural Text Generation

Lecture 20 - RL Algorithms

Lecture 21 - An Overview of AI, NLP, ML Research Activities

Lecture 22 - LLMs and Ethics

Lecture 23 - Reinforcement Learning with Human Feedback

Lecture 24 - The LLM Journey

Lecture 25 - Representation Learning for Large Scale Pretrained Models

Lecture 26 - Computer Vision Application

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NPTEL : ACM India Pingala Interactions in Computing (PIC) 2024 (Special Lecture Series)

Co-ordinators : Multi-Faculty

Lecture 1 - PIC 2024 Inauguration

Lecture 2 - Exciting Trends in Machine Learning

Lecture 3 - Towards Inclusive and Responsible Language Technologies

Lecture 4 - Chat with Jeffrey Dean and Partha Talukdar

Lecture 5 - Indo-International Collaboration Case Studies - 1

Lecture 6 - Indo-International Collaboration Case Studies - 2

Lecture 7 - Indo-International Collaboration Case Studies - 3

Lecture 8 - Connectivity is the Thing

Lecture 9 - Chat with Robert Metcalfe

Lecture 10 - Bad Algorithms

Lecture 11 - Chat with Saket Saurabh

Lecture 12 - Converting Research to Business

Lecture 13 - Robust Query Processing: Where Geometry Beats ML !

Lecture 14 - Data, More Data, Too Much Data

Lecture 15 - Chat with Jayant Haritsa and Tova Milo

Lecture 16 - Efficient Verification of Computation on Untrusted Platforms

Lecture 17 - Cryptography: the Art of Paradox

Lecture 18 - Chat with Shweta Agrawal and Yael Kalai

Lecture 19 - ACM: Goals, Priorities, Initiatives

Lecture 20 - Valedictory Function

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : ACM INDIA ARCS 2024 (Special Lecture Series)

Co-ordinators : Multi-Faculty

Lecture 1 - Welcome and Opening Remarks

Lecture 2 - Keynote 1

Lecture 3 - Lightning Talks - Part 1

Lecture 4 - Academia Industry Career Opportunities - Sitare-University

Lecture 5 - Academia Industry Career Opportunities - Flame University

Lecture 6 - Academia Industry Career Opportunities - Processor Research Labs

Lecture 7 - ACMI-W Panel Discussion

Lecture 8 - ACMI-W OCCW-Award

Lecture 9 - ACM-India Activities for PhD-Students

Lecture 10 - Keynote 2

Lecture 11 - Lightning Talks - Part 2

Lecture 12 - ECR Award Talk - Siddharth Barman

Lecture 13 - Doctoral Dissertation Award Talks 1

Lecture 14 - Doctoral Dissertation Award Talks 2

Lecture 15 - ECR Talk 1 - Manas-Thakur

Lecture 16 - ECR Talk 2 - Deeksha-Bhartiya

Lecture 17 - ECR Talk 3 - Shikhar-Patranabais

DIGIMAT - The No.1 Learning Management Platform for Creative Learning

NPTEL : ACM INDIA Annual Event 2024 (Special Lecture Series)

Co-ordinators : Meenakshi D'Souza, Hirendra Nath Ghosh

[Lecture 1 - Inauguration - Meenakshi D'Souza, Hirendra Nath Ghosh](#)

[Lecture 2 - ACM: Goals, Priorities, Initiatives - Yannis Ioannidis](#)

[Lecture 3 - ACM India at a Glance - Venkatesh Raman](#)

[Lecture 4 - Fireside Chat with Robert Metcalfe - Robert Metcalfe, Pravin Bhagwat](#)

[Lecture 5 - Human Factors of Formal Methods - Shriram Krishnamurthi](#)

[Lecture 6 - ACM India Awards Ceremony 1 - Hemant Pande](#)

[Lecture 7 - ACM India Awards Ceremony 2 - Hemant Pande](#)

[Lecture 8 - Efficient Verification of Computation on Untrusted Platforms - Yael Kalai](#)

[Lecture 9 - The Story of 14Trees - Pravin Bhagwat](#)

- Lecture 1 - Introduction to Full-Stack Networking School
- Lecture 2 - Linux Networking Stack, Evolution of NICs, Evolution of Network packet processors
- Lecture 3 - Demo Session 1: Hands on with basic Linux networking commands
- Lecture 4 - Demo Session 2: Netfilter and iptables
- Lecture 5 - Intro to virtualization containers
- Lecture 6 - Demo session 1: Hands on with Docker
- Lecture 7 - Demo session 1: Hands on with Containers
- Lecture 8 - Demo session 1: Hands on with Kubernetes
- Lecture 9 - Container Networking : CNI service mesh, L7 Proxies, Overlay networks
- Lecture 10 - Container Networking : AWS, VPC, NAT, gateways
- Lecture 11 - Demo Session 1
- Lecture 12 - Multicloud
- Lecture 13 - Invited talk- Research Career
- Lecture 14 - eBPF
- Lecture 15 - eBPF for Networking
- Lecture 16 - Invited talks: Application Connectivity for the Multi-Cloud Era
- Lecture 17 - Application layer networking
- Lecture 18 - Invited talk: Performance Measurement and Optimization
- Lecture 19 - Invited talk: Chaos Engineering
- Lecture 20 - Websockets
- Lecture 21 - RPC: Remote Procedure Calls
- Lecture 22 - Invited talk: TiHAN Edge cloud testbed with WiFi/5G
- Lecture 23 - Demo Session: Application Layer Networking
- Lecture 24 - Message Queues
- Lecture 25 - Invited talks: Towards Expressive and Performant Service Meshes
- Lecture 26 - Advanced HTTP
- Lecture 27 - WiFi Tuned
- Lecture 28 - Multipath Networking
- Lecture 29 - Demo Session - Multipath networking

NPTEL : Theory of Yarn Structures (Textile Engineering)

Co-ordinators : Prof. Bohuslav Neckar

Lecture 1 - Fibers and Yarns : Terms, Definitions and Relations

Lecture 2 - Fibers and Yarns : Terms, Definitions and Relations

Lecture 3 - Compression of Fibrous Assemblies

Lecture 4 - Compression of Fibrous Assemblies (Continued...)

Lecture 5 - Pores Among Fibers

Lecture 6 - Pores Among Fibers (Continued...)

Lecture 7 - Orientation of Fibers

Lecture 8 - Orientation of Fibers (Continued...)

Lecture 9 - Mechanics of Parallel Fiber Bundles

Lecture 10 - Mechanics of Parallel Fiber Bundles (Continued...)

Lecture 11 - Modelling of Internal Yarn Geometry

Lecture 12 - Modelling of Internal Yarn Geometry

Lecture 13 - Relations Among Yarn Count T, Twist Z, Packing Density, And Diameter D

Lecture 14 - Relations Among Yarn Count T, Twist Z, Packing Density, And Diameter D (Continued...)

Lecture 15 - Relations Among Yarn Count T, Twist Z, Packing Density, And Diameter D (Continued...)

Lecture 16 - Relations Among Yarn Count T, Twist Z, Packing Density, And Diameter D (Continued...)

Lecture 17 - Bundle Theory of Yarn Unevenness

Lecture 18 - Bundle Theory of Yarn Unevenness (Continued...)

Lecture 19 - Yarn Strength as a Stochastic Process

Lecture 20 - Yarn Strength as a Stochastic Process (Continued...)

[Lecture 1 - Science of Clothing Comfort-Outline](#)

[Lecture 2 - Understanding Clothing and Clothing Comfort](#)

[Lecture 3 - Understanding Clothing and Clothing Comfort \(Continued...\)](#)

[Lecture 4 - Understanding Clothing and Clothing Comfort \(Continued...\)](#)

[Lecture 5 - Psychology and Comfort](#)

[Lecture 6 - Psychology and Comfort \(Continued...\)](#)

[Lecture 7 - Psychology and Comfort \(Continued...\)](#)

[Lecture 8 - Psychology and Comfort \(Continued...\)](#)

[Lecture 9 - Neurophysiological Processes in Clothing Comfort](#)

[Lecture 10 - Neurophysiological Processes in Clothing Comfort \(Continued...\)](#)

[Lecture 11 - Neurophysiological Processes in Clothing Comfort \(Continued...\)](#)

[Lecture 12 - Neurophysiological Processes in Clothing Comfort \(Continued...\)](#)

[Lecture 13 - Neurophysiological Processes in Clothing Comfort \(Continued...\)](#)

[Lecture 14 - Neurophysiological Processes in Clothing Comfort \(Continued...\)](#)

[Lecture 15 - Tactile Aspects of Clothing Comfort](#)

[Lecture 16 - Tactile Aspects of Clothing Comfort \(Continued...\)](#)

[Lecture 17 - Tactile Aspects of Clothing Comfort \(Continued...\)](#)

[Lecture 18 - Tactile Aspects of Clothing Comfort \(Continued...\)](#)

[Lecture 19 - Understanding Clothing and Clothing Comfort \(Continued...\)](#)

[Lecture 20 - Tactile Aspects of Clothing Comfort \(Continued...\)](#)

[Lecture 21 - Tactile Aspects of Clothing Comfort \(Continued...\)](#)

[Lecture 22 - Clothing Comfort Related to Thermal Transmission](#)

[Lecture 23 - Clothing Comfort Related to Thermal Transmission \(Continued...\)](#)

[Lecture 24 - Clothing Comfort Related to Thermal Transmission \(Continued...\)](#)

[Lecture 25 - Clothing Comfort Related to Thermal Transmission \(Continued...\)](#)

[Lecture 26 - Clothing Comfort Related to Thermal Transmission \(Continued...\)](#)

[Lecture 27 - Clothing Comfort Related to Thermal Transmission \(Continued...\)](#)

[Lecture 28 - Clothing Comfort Related to Thermal Transmission \(Continued...\)](#)

[Lecture 29 - Moisture Transmission and Clothing Comfort](#)

[Lecture 30 - Moisture Transmission and Clothing Comfort \(Continued...\)](#)

[Lecture 31 - Moisture Transmission and Clothing Comfort \(Continued...\)](#)

[Lecture 32 - Moisture Transmission and Clothing Comfort \(Continued...\)](#)

[Lecture 33 - Moisture Transmission and Clothing Comfort \(Continued...\)](#)

[Lecture 34 - Moisture Transmission and Clothing Comfort \(Continued...\)](#)

[Lecture 35 - Moisture Transmission and Clothing Comfort \(Continued...\)](#)

[Lecture 36 - Combined Heat and Mass Transmission and Clothing Comfort](#)

[Lecture 37 - Combined Heat and Mass Transmission and Clothing Comfort \(Continued...\)](#)

[Lecture 38 - Thermo-Physiological Comfort of Functional Clothing](#)

[Lecture 39 - Garment Fit and Comfort](#)

[Lecture 40 - Garment Fit and Comfort \(Continued...\)](#)

- Lecture 1 - Impurities and Contaminants in Cotton
- Lecture 2 - Opening Principle and Opening Devices
- Lecture 3 - Cleaning Principle
- Lecture 4 - Machines and their Layout
- Lecture 5 - Bale Opening Machines
- Lecture 6 - Machines in Blow Room - Part II
- Lecture 7 - Opening Cleaning Machines - Part II
- Lecture 8 - Mixing/Blending
- Lecture 9 - Transportation of Tuft
- Lecture 10 - Lap formation and Material Flow Regulation
- Lecture 11 - Process Performance
- Lecture 12 - Introduction
- Lecture 13 - Card Feed Zone
- Lecture 14 - Carding Zone
- Lecture 15 - Analysis of flat action
- Lecture 16 - Sliver Formation
- Lecture 17 - Package Formation
- Lecture 18 - Card Clothing
- Lecture 19 - Card Setting, Draft, Production
- Lecture 20 - Fibre Configuration and Neps in Card sliver
- Lecture 21 - Carding Process
- Lecture 22 - Numerical Problems and Solution
- Lecture 23 - Introduction and Drafting principle
- Lecture 24 - Design Features and operating principle of drawframe
- Lecture 25 - Drafting Rolles, Web Condensation and Packaging
- Lecture 26 - Drafting Roller Arrangement
- Lecture 27 - Drafting Theory, Wave Fromation and Control
- Lecture 28 - Drafting Force and Roller Slip
- Lecture 29 - Significance of Process Parameters
- Lecture 30 - Draft and production Calculation
- Lecture 31 - Blending on Drawframe

[Lecture 32 - Process Monitoring and Control](#)

[Lecture 33 - Drawframe Autoleveller](#)

[Lecture 34 - Card Autoleveller](#)

[Lecture 35 - Numericals on Drawing](#)

- Lecture 1 - Evaluation of Textile Materials - Outline
- Lecture 2 - Evaluation of Textile Materials - Outline (Continued...)
- Lecture 3 - Sampling Methods and Sample Size
- Lecture 4 - Sampling Methods and Sample Size (Continued...)
- Lecture 5 - Sampling Methods and Sample Size (Continued...)
- Lecture 6 - Sampling Methods and Sample Size: Practical Statistics
- Lecture 7 - Sampling Methods and Sample Size: Practical Statistics (Continued...)
- Lecture 8 - Sampling Methods and Sample Size: Practical Statistics (Continued...)
- Lecture 9 - Evaluation of Fibre Length
- Lecture 10 - Evaluation of Fibre Length (Continued...)
- Lecture 11 - Evaluation of Fibre Length (Continued...)
- Lecture 12 - Evaluation of Fibre Fineness
- Lecture 13 - Evaluation of Fibre Fineness - 1
- Lecture 14 - Evaluation of Cotton Fibre Maturity
- Lecture 15 - Evaluation of Cotton Fibre Properties: (HVI and AFIS)
- Lecture 16 - Evaluation of Linear Density of Textile Materials
- Lecture 17 - Evaluation of Linear Density of Textile Materials (Continued...)
- Lecture 18 - Evaluation of Tensile Properties of Textile Materials
- Lecture 19 - Evaluation of Tensile Properties of Textile Materials (Continued...)
- Lecture 20 - Evaluation of Tensile Properties of Textile Materials-1 (Continued...)
- Lecture 21 - Evaluation of Tensile Properties of Textile Materials-2 (Continued...)
- Lecture 22 - Evaluation of Tensile Properties of Textile Materials-3 (Continued...)
- Lecture 23 - Evaluation of Tensile Properties of Textile Materials-4 (Continued...)
- Lecture 24 - Evaluation of Tensile Properties of Textile Materials-5 (Continued...)
- Lecture 25 - Evaluation of Yarn and Fabric Hairiness
- Lecture 26 - Evaluation of Yarn and Fabric Hairiness (Continued...)
- Lecture 27 - Evaluation of Yarn Twist
- Lecture 28 - Evaluation of Yarn Twist (Continued...)
- Lecture 29 - Evaluation of Moisture in Textiles
- Lecture 30 - Evaluation of Moisture in Textiles (Continued...)
- Lecture 31 - Evaluation of Yarn Evenness

[Lecture 32 - Evaluation of Yarn Evenness-1 \(Continued...\)](#)

[Lecture 33 - Evaluation of Yarn Evenness-2 \(Continued...\)](#)

[Lecture 34 - Evaluation of Yarn Evenness-3 \(Continued...\)](#)

[Lecture 35 - Evaluation of Yarn Evenness-3 \(Continued...\)](#)

[Lecture 36 - Evaluation of Yarn Evenness-4 \(Continued...\)](#)

[Lecture 37 - Evaluation of Bursting and Tear Strength of Fabrics](#)

[Lecture 38 - Evaluation of Pilling and Abrasion Properties of Fabrics](#)

[Lecture 39 - Evaluation of Low Stress Mechanical Properties of Textile Materials](#)

[Lecture 40 - Evaluation of Low Stress Mechanical Properties of Textile Materials \(Continued...\)](#)

- Lecture 1 - Testing of Low Stress mechanical Properties of Textile Fabrics
- Lecture 2 - Testing of Low Stress mechanical Properties of Textile Fabrics (Continued...)
- Lecture 3 - Testing of Low Stress mechanical Properties of Textile Fabrics (Continued...)
- Lecture 4 - Testing of Transmission Characteristics of Textile Fabrics
- Lecture 5 - Testing of Transmission Characteristics of Textile Fabrics (Continued...)
- Lecture 6 - Testing of Transmission Characteristics of Textile Fabrics (Continued...)
- Lecture 7 - Testing of Transmission Characteristics of Textile Fabrics (Continued...)
- Lecture 8 - Testing of Transmission Characteristics of Textile Fabrics (Continued...)
- Lecture 9 - Testing of Transmission Characteristics of Textile Fabrics (Continued...)
- Lecture 10 - Testing of Fibre Reinforced Composite Materials
- Lecture 11 - Testing of Fibre Reinforced Composite Materials (Continued...)
- Lecture 12 - Testing of Fibre Reinforced Composite Materials (Continued...)
- Lecture 13 - Testing of Fibre Reinforced Composite Materials (Continued...)
- Lecture 14 - Testing of Fibre Reinforced Composite Materials (Continued...)
- Lecture 15 - Testing of Fibre Fabrics
- Lecture 16 - Testing of Fibre Fabrics (Continued...)
- Lecture 17 - Testing of Fibre Fabrics (Continued...)
- Lecture 18 - Testing of Geotextiles
- Lecture 19 - Testing of Geotextiles (Continued...)
- Lecture 20 - Testing of Geotextiles (Continued...)
- Lecture 21 - Testing of Ballistics Protective Clothing
- Lecture 22 - Testing of UV Radiation Protective Textiles
- Lecture 23 - Testing of Compression Bandages
- Lecture 24 - Testing of Electromagnetic Shielding Textiles

[Lecture 1 - The Building Block of Yarns](#)

[Lecture 2 - The Building Block of Yarns \(Continued...\)](#)

[Lecture 3 - Basic Characteristics of Yarns](#)

[Lecture 4 - Basic Characteristics of Yarns \(Continued...\)](#)

[Lecture 5 - Basic Characteristics of Yarns \(Continued...\)](#)

[Lecture 6 - Relations Among Yarn Count, Twist, and Diameter](#)

[Lecture 7 - Relations Among Yarn Count, Twist, and Diameter \(Continued...\)](#)

[Lecture 8 - Helical Model of Fibers in Yarns](#)

[Lecture 9 - Helical Model of Fibers in Yarns \(Continued...\)](#)

[Lecture 10 - Helical Model of Fibers in Yarns \(Continued...\)](#)

[Lecture 11 - Helical Model of Fibers in Yarns \(Continued...\)](#)

[Lecture 12 - Mass Irregularity of Yarns](#)

[Lecture 13 - Mass Irregularity of Yarns \(Continued...\)](#)

[Lecture 14 - Mass Irregularity of Yarns \(Continued...\)](#)

[Lecture 15 - Mass Irregularity of Yarns \(Continued...\)](#)

[Lecture 16 - Radial Migration of Fibres in Yarns](#)

[Lecture 17 - Radial Migration of Fibres in Yarns \(Continued...\)](#)

[Lecture 18 - Radial Migration of Fibres in Yarns \(Continued...\)](#)

[Lecture 19 - Yarn Shrinkage due to Washing](#)

[Lecture 20 - Tensile Mechanics of Yarns](#)

[Lecture 21 - Tensile Mechanics of Yarns \(Continued...\)](#)

[Lecture 22 - Tensile Mechanics of Yarns \(Continued...\)](#)

[Lecture 23 - Tensile Mechanics of Yarns \(Continued...\)](#)

[Lecture 24 - Tensile Mechanics of Yarns \(Continued...\)](#)

Lecture 1 - Conventional Printing

Lecture 2 - Colourants

Lecture 3 - Dyes and pigments

Lecture 4 - Thickeners

Lecture 5 - Measurement of viscosity

Lecture 6 - Discharge and resist printing

Lecture 7 - Transfer Printing

Lecture 8 - Sublimation Transfer Printing : Paper Printing

Lecture 9 - Sublimation Transfer Printing : Dyes and inks

Lecture 10 - Free path length and mechanism of transfer

Lecture 11 - Transfer Printing Machines and Other Transfer Methods

Lecture 12 - Introduction to Digital Textile Printing

Lecture 13 - Revision and Doubt Clarification Session - 1

Lecture 14 - Digital Textile Printing: Inkjet Technologies

Lecture 15 - Inkjet Technologies: drop-on-demand

Lecture 16 - Revision and Doubt Clarification Session - 2

Lecture 17 - Inkjet Technologies: Machines

Lecture 18 - Inkjet Printing

Lecture 19 - Printing inks

Lecture 20 - Water-based inks

Lecture 21 - Water-based inks (Continued...)

Lecture 1 - Introduction to texturing

Lecture 2 - General principles involved in the manufacture of textured yarns

Lecture 3 - General principles involved in the manufacture of textured yarns (Continued...)

Lecture 4 - Bulked yarns

Lecture 5 - Mechanisms of setting and texturing

Lecture 6 - Thermo-mechanical texturing

Lecture 7 - Characterization and optimization

Lecture 8 - Influence of material and process parameters

Lecture 9 - Influence of process parameters

Lecture 10 - Influence of process parameters (Continued...)

Lecture 11 - Revision and clarification of doubts - Session 1

Lecture 12 - Influence of process parameters (Continued...)

Lecture 13 - Draw Texturing

Lecture 14 - Simultaneous draw texturing with POY

Lecture 15 - Draw Texturing (Continued...)

Lecture 16 - Draw Texturing Machines and Process Parameters

Lecture 17 - Draw Texturing : Effect of Process Parameters

Lecture 18 - Draw Texturing : Positorque System

Lecture 19 - Friction Draw Texturing

Lecture 20 - Friction Draw Texturing (Continued...)

Lecture 21 - Air-Jet Texturing

Lecture 22 - Air-Jet Texturing (Continued...)

Lecture 23 - Air-Jet Texturing (Continued...)

Lecture 24 - Air-Jet Texturing : Effect of Process parameters

Lecture 25 - Air-Jet Texturing : Effect of Water parameters

Lecture 26 - Air-Texturing Jets

Lecture 27 - Interlacement: need and jet design

Lecture 28 - Bulked continuous filament yarns

Lecture 29 - Hi-bulk yarns

Lecture 30 - Revision and Clarification of Doubts Session 2

Lecture 31 - Hi-bulk yarns (Continued...)

[Lecture 32 - Texturing of spun yarns](#)

[Lecture 33 - Texturing of spun yarns \(Continued...\)](#)

[Lecture 34 - Solvent texturing](#)

Lecture 1 - Introduction to Finishing

Lecture 2 - Wrinkle Resistant Finishing

Lecture 3 - Wrinkle Resistant Finishing (Continued...)

Lecture 4 - Wrinkle Resistant Finishing : Performance characteristics

Lecture 5 - Catalysis and Catalysts

Lecture 6 - Other Crosslinking agents

Lecture 7 - Non-nitrogenous Agents

Lecture 8 - Control of Formaldehyde Release

Lecture 9 - Stiff and Soft Finishing

Lecture 10 - Soft Finishing (Continued...)

Lecture 11 - Soft Finishing (Continued...)

Lecture 12 - Emulsion Softeners

Lecture 13 - Water Proofing and Water Repellency

Lecture 14 - Water Repellency (Continued...)

Lecture 15 - Water Repellency (Continued...)

Lecture 16 - Waterproof Breathable Textiles

Lecture 17 - Soil Repellency and Soil Release

Lecture 18 - Soil Release Finishing

Lecture 19 - Fire Retardant Finishing

Lecture 20 - Chemistry of Flame Retardants

Lecture 21 - More Flame retardants and evaluation of fire retardancy

Lecture 22 - Antimicrobial Finishing

Lecture 23 - Finishing of Wool

Lecture 24 - Shrink Resistant Wool

Lecture 25 - Wool Setting

Lecture 26 - Mothproofing of Wool

Lecture 27 - Biopolishing

Lecture 28 - Finishing of synthetics

Lecture 29 - Finishing of synthetics : Antistatic Finish

Lecture 30 - Low Liquor Application

Lecture 31 - Waste heat recovery

[Lecture 32 - Principles of some Finishing machines](#)

- Lecture 1 - Pre-combing operation - Part 1
- Lecture 2 - Pre-combing operation - Part 2
- Lecture 3 - Introduction to Comber - Part 1
- Lecture 4 - Introduction to Comber - Part 2
- Lecture 5 - Sequence of Operation
- Lecture 6 - Combing Mechanism
- Lecture 7 - Timing Diagram
- Lecture 8 - Sliver Formation
- Lecture 9 - Theoretical Aspects in Combing - Part 1
- Lecture 10 - Theoretical Aspects in Combing - Part 2
- Lecture 11 - Parameters Influencing Combing Performance
- Lecture 12 - Analysis of Drive
- Lecture 13 - Calculation of Process Performance Parameters
- Lecture 14 - Introduction, Working Principle and Creel
- Lecture 15 - DRAFTING Unit - Part 1
- Lecture 16 - DRAFTING Unit - Part 2
- Lecture 17 - Flyer Twisting
- Lecture 18 - Package Formation
- Lecture 19 - Bobbin Speed Regulation
- Lecture 20 - Building Motion and Drive Analysis
- Lecture 21 - Calculation for Change Gears and Production
- Lecture 22 - Introduction and Working Principle
- Lecture 23 - Creel and Drafting Unit
- Lecture 24 - Twisting Process and Twisting Elements
- Lecture 25 - Bobbin Building
- Lecture 26 - Spinning Geometry
- Lecture 27 - Analysis of Forces on Traveller
- Lecture 28 - Analysis of Forces on Ballon
- Lecture 29 - Analysis of Drive, Production Calculation
- Lecture 30 - End Breaks

- Lecture 1 - Introduction to Knitting
- Lecture 2 - Knitting Glossary
- Lecture 3 - Loop Formation in Weft Knitting
- Lecture 4 - Lab Demo 1: Analysis of a Weft Knit Fabric
- Lecture 5 - Automation in Loop Formation
- Lecture 6 - Flat Bed Machine Needle/Cam Interaction
- Lecture 7 - Circular Knitting
- Lecture 8 - Single Bed Weft Knitting-Flat and Circular M/C
- Lecture 9 - Lab Demo 2: Single Flat Bed Machine
- Lecture 10 - Lab Demo 3: Single Bed Circular Machine
- Lecture 11 - Single Bed Weft Knitting Fabric Curling
- Lecture 12 - Weft Knitting Double Flat Beds
- Lecture 13 - Weft Knitting Double Circular Beds
- Lecture 14 - Weft Knitting V-Bed Machine
- Lecture 15 - Analysis of a Double Jersey Fabric
- Lecture 16 - Single and Double Jersey Construction
- Lecture 17 - Weft Knit Stitches - Loop, Tuck and Float
- Lecture 18 - Lab Demo 6 (Part 1) Knitting Notations
- Lecture 19 - Lab Demo 6 (Part 2) Knitting Notations
- Lecture 20 - Fabric Analysis - Influence of Loop Length
- Lecture 21 - Fabric Design - Float and Tuck Formation
- Lecture 22 - Fabric Analysis - Influence of Float and Tuck Stitches
- Lecture 23 - Fabric Analysis - Shrinkage (Relaxation)
- Lecture 24 - Fabric Analysis - Extensibility and Recovery
- Lecture 25 - Knitting Calculation - Yarn Selection
- Lecture 26 - Knitting Calculation - Production (Circular)
- Lecture 27 - Knitting Calculation - Production (Flat)
- Lecture 28 - Knitting Calculation - Fabric Calculations
- Lecture 29 - Knitting Calculation - Geometrical Modeling
- Lecture 30 - Knitting Calculation - Fabric Spirality in Single Jersey (Tubular)
- Lecture 31 - Advancement in Knitting Technology

- Lecture 32 - Knitting Designs Possibilities
- Lecture 33 - Knitting Designs Possibilities - 1
- Lecture 34 - Design Software
- Lecture 35 - Weft Knitting- Revision
- Lecture 36 - Introduction to Warp Knitting
- Lecture 37 - Warp Knitting Technology- Loop Formation
- Lecture 38 - Swinging and Shogging Motions (Overlap and Underlap)
- Lecture 39 - Warp Knit - Structural Identification
- Lecture 40 - Warp Knit Fabric Notation - Lapping Diagram and Lapping Plan
- Lecture 41 - Warp Knit Structure - Design Principles
- Lecture 42 - Single Bar Warp Knit Constructions
- Lecture 43 - Double Bar Warp Knit Constructions
- Lecture 44 - Lapping Plan Execution - Pattern Disc and Pattern Drum
- Lecture 45 - Chain Links Arrangement - Single and Double Bar Constructions
- Lecture 46 - Warp Knits : Structure - Property Relationship
- Lecture 47 - Warp Knits : Multi-bar Structures and Double Bed Designs
- Lecture 48 - Weft and Warp Knitting - Summary
- Lecture 49 - Technical Applications of Knitting
- Lecture 50 - Technical Applications of Knitting (Continued...)

- Lecture 1 - Introduction to Technical Textiles
- Lecture 2 - Introduction to Technical Textiles (Continued...)
- Lecture 3 - Textile Reinforced Composites
- Lecture 4 - Textile Reinforced Composites (Continued...)
- Lecture 5 - Textile Reinforced Composites (Continued...)
- Lecture 6 - Textile Reinforced Composites (Continued...)
- Lecture 7 - Textile Reinforced Composites (Continued...)
- Lecture 8 - Textile Reinforced Composites (Continued...)
- Lecture 9 - Textile Reinforced Composites (Continued...)
- Lecture 10 - Textile Reinforced Composites (Continued...)
- Lecture 11 - Textile Reinforced Composites (Continued...)
- Lecture 12 - Textile Reinforced Composites (Continued...)
- Lecture 13 - Filter Fabrics
- Lecture 14 - Filter Fabrics (Continued...)
- Lecture 15 - Filter Fabrics (Continued...)
- Lecture 16 - Geotextiles
- Lecture 17 - Geotextiles (Continued...)
- Lecture 18 - Geotextiles (Continued...)
- Lecture 19 - Geotextiles (Continued...)
- Lecture 20 - Extreme Cold Protective Clothing
- Lecture 21 - Extreme Cold Protective Clothing (Continued...)
- Lecture 22 - Extreme Heat Protective Clothing
- Lecture 23 - Extreme Heat Protective Clothing (Continued...)
- Lecture 24 - Sports Textiles
- Lecture 25 - Sports Textiles (Continued...)
- Lecture 26 - Sports Textiles (Continued...)
- Lecture 27 - Ultraviolet Protective Textiles
- Lecture 28 - Ultraviolet Protective Textiles (Continued...)
- Lecture 29 - Ultraviolet Protective Textiles (Continued...)
- Lecture 30 - Ballistic Protective Textiles
- Lecture 31 - Compression Bandage

[Lecture 32 - Compression Bandage \(Continued...\)](#)

[Lecture 33 - Compression Bandage \(Continued...\)](#)

[Lecture 34 - Automotive Textiles](#)

[Lecture 35 - Textiles in Hygiene](#)

[Lecture 36 - Additional Lectuer on Geotextiles](#)

[Lecture 37 - Additional Lectuer on Geotextiles \(Continued...\)](#)

[Lecture 38 - Additional Lectuer on Composites](#)

[Lecture 39 - Additional Lectuer on Composites \(Continued...\)](#)

[Lecture 40 - Additional Lectuer on Composites \(Continued...\)](#)

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- Lecture 1 - New Spinning Technology
- Lecture 2 - Sliver Feed Arrangement
- Lecture 3 - Principle of Yarn Formation
- Lecture 4 - Twist Equation
- Lecture 5 - Rotor: Construction, Geometry and Drive
- Lecture 6 - Package Formation
- Lecture 7 - Significance of Fibre and Process Parameters
- Lecture 8 - Rotor Selection
- Lecture 9 - Spinning Tension
- Lecture 10 - Production and Energy Consumption Calculation
- Lecture 11 - Rotor Yarn: Structure, Properties and Application
- Lecture 12 - Air Jet Spinning: Introduction
- Lecture 13 - High Draft System
- Lecture 14 - Yarn Formation Mechanism
- Lecture 15 - Structure and Characteristics of Air-Jet Yarn
- Lecture 16 - Material and Process Parameters
- Lecture 17 - Friction Spinning: Dref-2
- Lecture 18 - Dref-3 Friction Spinning
- Lecture 19 - Yarn Formation, Structure and Applications
- Lecture 20 - Vortex Spinning
- Lecture 21 - Influence of Machine and Process Parameters
- Lecture 22 - Wrap Spinning
- Lecture 23 - Wrap Spinning (Continued...)
- Lecture 24 - SIRO Spinning
- Lecture 25 - Compact Spinning
- Lecture 26 - Spinning by Adhesive and Felting Process
- Lecture 27 - Self Twist Spinning
- Lecture 28 - Comparative Analysis Between Spinning Technologies
- Lecture 29 - Productivity Enhancement: Limitations

NPTEL : Natural Dyes (Textile Engineering)

Co-ordinators : Dr. Padma S Vankar

[Lecture 1 - Natural Dyes](#)

[Lecture 2 - Natural Dyes](#)

[Lecture 3 - Natural Dyes](#)

[Lecture 4 - Natural Dyes](#)

[Lecture 5 - Natural Dyes](#)

[Lecture 6 - Natural Dyes](#)

[Lecture 7 - Natural Dyes](#)

[Lecture 8 - Natural Dyes](#)

[Lecture 9 - Natural Dyes](#)

[Lecture 10 - Natural Dyes](#)

[Lecture 11 - Natural Dyes](#)

[Lecture 12 - Natural Dyes](#)

[Lecture 13 - Natural Dyes](#)

[Lecture 14 - Natural Dyes](#)

[Lecture 15 - Natural Dyes](#)

[Lecture 16 - Natural Dyes](#)

[Lecture 17 - Natural Dyes](#)

[Lecture 18 - Natural Dyes](#)

[Lecture 19 - Natural Dyes](#)

[Lecture 20 - Natural Dyes](#)

[Lecture 21 - Natural Dyes](#)

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[Lecture 25 - Natural Dyes](#)

[Lecture 26 - Natural Dyes](#)

[Lecture 27 - Natural Dyes](#)

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[Lecture 30 - Natural Dyes](#)

[Lecture 31 - Natural Dyes](#)

[Lecture 32 - Natural Dyes](#)

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[Lecture 35 - Natural Dyes](#)

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[Lecture 40 - Natural Dyes](#)