NPTEL Video Course - Mathematics - Elementary Numerical Analysis

Subject Co-ordinator - Prof. Rekha P. Kulkarni

Co-ordinating Institute - IIT - Bombay

Sub-Titles - Available / Unavailable  |  MP3 Audio Lectures - Available / Unavailable

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
Lecture 11 - Composite Numerical Integration
Lecture 12 - Gauss 2-point Rule
Lecture 13 - Gauss 2-point Rule
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

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NPTEL Video Course - Mathematics - Measure and Integration

Subject Co-ordinator - Prof. Inder K Rana

Co-ordinating Institute - IIT - Bombay

Sub-Titles - Available / Unavailable  |  MP3 Audio Lectures - Available / Unavailable

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 R^2
Lecture 31 - Properties of Lebesgue Measure and integral on R^n
Lecture 32 - Lebesgue integral on 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
NPTEL Video Course - Mathematics - Mathematics in India - From Vedic Period to Modern Times

Subject Co-ordinator - Prof. M.D. Srinivas, Prof. K. Ramasubramanian, Prof. M.S. Sriram

Co-ordinating Institute - Centre for Policy Studies, Chennai | IIT - Bombay | University of Madras, Chennai

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Lecture 1 - Indian Mathematics
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

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NPTEL Video Course - Mathematics - NOC:Measure Theory

Subject Co-ordinator - Prof. Inder K Rana

Co-ordinating Institute - IIT - Bombay

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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
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Lecture 8 - (4B) Monotone Class
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Lecture 12 - (6B) The Length Function and its Properties
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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
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NPTEL Video Course - Mathematics - NOC: Calculus for Economics, Commerce and Management

Subject Co-ordinator - Prof. Inder Kumar Rana

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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

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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
NPTEL Video Course - Mathematics - NOC: Basic Linear Algebra

Subject Co-ordinator - Prof. Inder Kumar Rana

Co-ordinating Institute - IIT - Bombay

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction - I
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 R^2 - I
Lecture 26 - Orthonormal Basis, Geometry in R^2 - II
Lecture 27 - Orthonormal Basis, Geometry in R^2 - III
Lecture 28 - Isometries, Eigenvalues and Eigenvectors - I
Lecture 29 - Isometries, Eigenvalues and Eigenvectors - II
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NPTEL Video Course - Mathematics - NOC:Commutative Algebra

Subject Co-ordinator - Prof. Dilip P. Patil
Co-ordinating Institute - IIT - Bombay

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Zariski Topology and K-Spectrum
Lecture 2 - Algebraic Varieties and Classical Nullstelensatz
Lecture 3 - Motivation for Krulls Dimension
Lecture 4 - Chevalleys 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 Krullâ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 Algebras
Lecture 16 - Nagataâ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 - Hilbertâs Nullstelensatz
Lecture 21 - Computational rules for Poincarâ© Series
Lecture 22 - Graded Rings, Modules and Poincarâ© 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

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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
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NPTEL Video Course - Mathematics - NOC: Galois Theory

Subject Co-ordinator - Prof. Dilip P. Patil

Co-ordinating Institute - IIT - Bombay

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

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 - Gaussâ¬â¢â¬â¢s Theorem (Uniqueness of factorization)
Lecture 11 - Digression on Rings homomorphism, Algebras
Lecture 12 - Kernel of homomorphisms and ideals in K[X], 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

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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
Lecture 33 - Fundamental Theorem of Galois Theory (Continued...)
Lecture 34 - Cyclotomic extensions
Lecture 35 - Cyclotomic Polynomials
Lecture 36 - Irreducibility of Cyclotomic Polynomials over Q
Lecture 37 - Reducibility of Cyclotomic Polynomials over Finite Fields
Lecture 38 - Galois Group of Cyclotomic Polynomials
Lecture 39 - Extension over a fixed Field of a finite subGroup is Galois Extension
Lecture 40 - Digression on Group action - II
Lecture 41 - Correspondence of Normal SubGroups and Galois sub-extensions
Lecture 42 - Correspondence of Normal SubGroups and Galois sub-extensions (Continued...)
Lecture 43 - Inverse Galois problem for Abelian Groups
Lecture 44 - Elementary Symmetric Polynomials
Lecture 45 - Fundamental Theorem on Symmetric Polynomials
Lecture 46 - Gal (K[X1,X2,Â³â³,Xn]/K[S1,S2,...,Sn])
Lecture 47 - Digression on Symmetric and Alternating Group
Lecture 48 - Discriminant of a Polynomial
Lecture 49 - Zeroes and Embeddings
Lecture 50 - Normal Extensions
Lecture 51 - Existence of Algebraic Closure
Lecture 52 - Uniqueness of Algebraic Closure
Lecture 53 - Proof of The Fundamental Theorem of Algebra
Lecture 54 - Galois Group of a Polynomial
Lecture 55 - Perfect Fields
Lecture 56 - Embeddings
Lecture 57 - Characterization of finite Separable extension
Lecture 58 - Primitive Element Theorem
Lecture 59 - Equivalence of Galois extensions and Normal-Separable extensions
Lecture 60 - Operation of Galois Group of Polynomial on the set of zeroes
Lecture 61 - Discriminants
Lecture 62 - Examples for further study
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NPTEL Video Course - Mathematics - Stochastic Processes

Subject Co-ordinator - Dr. S. Dharmaraja

Co-ordinating Institute - IIT - Delhi

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Stochastic Processes
Lecture 2 - Introduction to Stochastic Processes (Continued.)
Lecture 3 - Problems in Random Variables and Distributions
Lecture 4 - Problems in Sequences of Random Variables
Lecture 5 - Definition, Classification and Examples
Lecture 6 - Simple Stochastic Processes
Lecture 7 - Stationary Processes
Lecture 8 - Autoregressive Processes
Lecture 9 - Introduction, Definition and Transition Probability Matrix
Lecture 10 - Chapman-Kolmogrov Equations
Lecture 11 - Classification of States and Limiting Distributions
Lecture 12 - Limiting and Stationary Distributions
Lecture 13 - Limiting Distributions, Ergodicity and Stationary Distributions
Lecture 14 - Time Reversible Markov Chain, Application of Irreducible Markov Chain in Queueing Models
Lecture 15 - Reducible Markov Chains
Lecture 16 - Definition, Kolmogrov Differential Equations and Infinitesimal Generator Matrix
Lecture 17 - Limiting and Stationary Distributions, Birth Death Processes
Lecture 18 - Poisson Processes
Lecture 19 - M/M/1 Queueing Model
Lecture 20 - Simple Markovian Queueing Models
Lecture 21 - Queueing Networks
Lecture 22 - Communication Systems
Lecture 23 - Stochastic Petri Nets
Lecture 24 - Conditional Expectation and Filtration
Lecture 25 - Definition and Simple Examples
Lecture 26 - Definition and Properties
Lecture 27 - Processes Derived from Brownian Motion
Lecture 28 - Stochastic Differential Equations
Lecture 29 - Ito Integrals

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Lecture 30 - Ito Formula and its Variants
Lecture 31 - Some Important SDE's and Their Solutions
Lecture 32 - Renewal Function and Renewal Equation
Lecture 33 - Generalized Renewal Processes and Renewal Limit Theorems
Lecture 34 - Markov Renewal and Markov Regenerative Processes
Lecture 35 - Non Markovian Queues
Lecture 36 - Non Markovian Queues Cont,,
Lecture 37 - Application of Markov Regenerative Processes
Lecture 38 - Galton-Watson Process
Lecture 39 - Markovian Branching Process
NPTEL Video Course - Mathematics - NOC:Stochastic Processes - 1

Subject Co-ordinator - Dr. S. Dharmaraja

Co-ordinating Institute - IIT - Delhi

Lecture 1 - Introduction and motivation for studying stochastic processes
Lecture 2 - Probability space and conditional probability
Lecture 3 - Random variable and cumulative distributive function
Lecture 4 - Discrete Uniform Distribution, Binomial Distribution, Geometric Distribution, Continuous Uniform Distribution, Exponential Distribution, Normal Distribution and Poisson Distribution
Lecture 5 - Joint Distribution of Random Variables
Lecture 6 - Independent Random Variables, Covariance and Correlation Coefficient and Conditional Distribution
Lecture 7 - Conditional Expectation and Covariance Matrix
Lecture 8 - Generating Functions, Law of Large Numbers and Central Limit Theorem
Lecture 9 - Problems in Random variables and Distributions
Lecture 10 - Problems in Random variables and Distributions (Continued...)
Lecture 11 - Problems in Random variables and Distributions (Continued...)
Lecture 12 - Problems in Random variables and Distributions (Continued...)
Lecture 13 - Problems in Sequences of Random Variables
Lecture 14 - Problems in Sequences of Random Variables (Continued...)
Lecture 15 - Problems in Sequences of Random Variables (Continued...)
Lecture 16 - Problems in Sequences of Random Variables (Continued...)
Lecture 17 - Definition of Stochastic Processes, Parameter and State Spaces
Lecture 18 - Classification of Stochastic Processes
Lecture 19 - Examples of Classification of Stochastic Processes
Lecture 20 - Examples of Classification of Stochastic Processes (Continued...)
Lecture 21 - Bernoulli Process
Lecture 22 - Poisson Process
Lecture 23 - Poisson Process (Continued...)
Lecture 24 - Simple Random Walk and Population Processes
Lecture 25 - Introduction to Discrete time Markov Chain
Lecture 26 - Introduction to Discrete time Markov Chain (Continued...)
Lecture 27 - Examples of Discrete time Markov Chain
Lecture 28 - Examples of Discrete time Markov Chain (Continued...)
Lecture 29 - Introduction to Chapman-Kolmogorov equations

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Lecture 30 - State Transition Diagram and Examples
Lecture 31 - Examples
Lecture 32 - Introduction to Classification of States and Periodicity
Lecture 33 - Closed set of States and Irreducible Markov Chain
Lecture 34 - First Passage time and Mean Recurrence Time
Lecture 35 - Recurrent State and Transient State
Lecture 36 - Introduction and example of Classification of states
Lecture 37 - Example of Classification of states (Continued...)
Lecture 38 - Example of Classification of states (Continued...)
Lecture 39 - Example of Classification of states (Continued...)
Lecture 40 - Introduction and Limiting Distribution
Lecture 41 - Example of Limiting Distribution and Ergodicity
Lecture 42 - Stationary Distribution and Examples
Lecture 43 - Examples of Stationary Distributions
Lecture 44 - Time Reversible Markov Chain and Examples
Lecture 45 - Definition of Reducible Markov Chains and Types of Reducible Markov Chains
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Lecture 47 - Type of Reducible Markov Chains (Continued...)
Lecture 48 - Gambler's Ruin Problem
Lecture 49 - Introduction to Continuous time Markov Chain
Lecture 50 - Waiting time Distribution
Lecture 51 - Chapman-Kolmogorov Equation
Lecture 52 - Infinitesimal Generator Matrix
Lecture 53 - Introduction and Example Of Continuous time Markov Chain
Lecture 54 - Limiting and Stationary Distributions
Lecture 55 - Time reversible CTMC and Birth Death Process
Lecture 56 - Steady State Distributions, Pure Birth Process and Pure Death Process
Lecture 57 - Introduction to Poisson Process
Lecture 58 - Definition of Poisson Process
Lecture 59 - Superposition and Deposition of Poisson Process
Lecture 60 - Compound Poisson Process and Examples
Lecture 61 - Introduction to Queueing Systems and Kendall Notations
Lecture 62 - M/M/1 Queueing Model
Lecture 63 - Little's Law, Distribution of Waiting Time and Response Time
Lecture 64 - Burke's Theorem and Simulation of M/M/1 queueing Model
Lecture 65 - M/M/c Queueing Model
Lecture 66 - M/M/1/N Queueing Model
Lecture 67 - M/M/c/K Model, M/M/c/c Loss System, M/M/? Self Service System
Lecture 68 - Transient Solution of Finite Birth Death Process and Finite Source Markovian Queueing Model
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NPTEL Video Course - Mathematics - NOC: Stochastic Processes

Subject Co-ordinator - Dr. S. Dharmaraja

Co-ordinating Institute - IIT - Delhi

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NPTEL Video Course - Mathematics - NOC: Introduction to Probability Theory and Stochastic Processes

Subject Co-ordinator - Dr. S. Dharmaraja

Co-ordinating Institute - IIT - Delhi

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Subject Co-ordinator - Prof. Niladri Chaterjee

Co-ordinating Institute - IIT - Delhi

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NPTEL Video Course - Mathematics - Complex Analysis

Subject Co-ordinator - Prof. P.A.S. Sree Krishna

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NPTEL Video Course - Mathematics - Applied Multivariate Analysis

Subject Co-ordinator - Dr. Sharmishtha Mitra
Co-ordinating Institute - IIT - Kanpur

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NPTEL Video Course - Mathematics - Linear programming and Extensions

Subject Co-ordinator - Prof. Prabha Sharma
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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
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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 b
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Lecture 21 - Parametric LPP-Right hand side vector
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Lecture 24 - Mini-cost flow problem-Transportation problem
Lecture 25 - Transportation problem degeneracy, cycling
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Lecture 27 - Sensitivity analysis
Lecture 28 - Bounded variable transportation problem, min-cost flow problem
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Lecture 30 - Starting feasible solution, Lexicographic method for preventing cycling, strongly feasible solution
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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
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NPTEL Video Course - Mathematics - Convex Optimization

Subject Co-ordinator - Dr. Joydeep Dutta

Co-ordinating Institute - IIT - Kanpur

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NPTEL Video Course - Mathematics - Foundations of Optimization

Subject Co-ordinator - Dr. Joydeep Dutta

Co-ordinating Institute - IIT - Kanpur

Sub-Titles - Available / Unavailable  |  MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Optimization
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Lecture 29 - Optimization

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NPTEL Video Course - Mathematics - Probability Theory and Applications

Subject Co-ordinator - Prof. Prabha Sharma
Co-ordinating Institute - IIT - Kanpur
Sub-Titles - Available / Unavailable  |  MP3 Audio Lectures - Available / Unavailable

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 square r. v., sums of independent normal r. v., Conditional distr
Lecture 15 - Conditional disti, 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
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

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Lecture 30 - Reducible Markov chains
Lecture 31 - Time reversible Markov chains
Lecture 32 - Poisson Processes
Lecture 33 - Inter-arrival times, Properties of Poisson processes
Lecture 34 - Queuing Models
Lecture 35 - Analysis of L, Lq, W and Wq, M/M/S model
Lecture 36 - M/M/S, M/M/I/K models
Lecture 37 - M/M/I/K and M/M/S/K models
Lecture 38 - Application to reliability theory failure law
Lecture 39 - Exponential failure law, Weibull law
Lecture 40 - Reliability of systems
NPTEL Video Course - Mathematics - NOC: Probability and Stochastics for finance

Subject Co-ordinator - Dr. Joydeep Dutta

Co-ordinating Institute - IIT - Kanpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

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
Lecture 11 - Brownian Motion - III
Lecture 12 - Ito Integral - I
Lecture 13 - Ito Integral - II
Lecture 14 - Ito Calculus - I
Lecture 15 - Ito Calculus - II
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
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NPTEL Video Course - Mathematics - NOC:Differential Calculus in Several Variables

Subject Co-ordinator - Prof. Sudipta Dutta
Co-ordinating Institute - IIT - Kanpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Several Variables and Notion Of distance in Rn
Lecture 2 - Continuity And Compactness
Lecture 3 - Continuity And Connectedness
Lecture 4 - Derivatives
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
Lecture 19 - Application of IFT
Lecture 20 - Application of IFT
Lecture 21 - Application of IFT

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NPTEL Video Course - Mathematics - NOC:Curves and Surfaces

Subject Co-ordinator - Prof. Sudipta Dutta
Co-ordinating Institute - IIT - Kanpur
Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

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 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

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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...)
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
Lecture 9 - Basics Calculations
Lecture 10 - Basics Calculations
Lecture 11 - Basics Calculations
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Lecture 13 - Basics Calculations
Lecture 14 - Basics Calculations
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
Lecture 32 - Data frames (Continued...)
Lecture 33 - Data frames (Continued...)
Lecture 34 - Data Handling - Importing CSV and Tabular Data Files
Lecture 35 - Data Handling - Importing Data Files from Other Software
Lecture 36 - Statistical Functions - Frequency and Partition values
Lecture 37 - Statistical Functions - Graphics and Plots
Lecture 38 - Statistical Functions - Central Tendency and Variation
Lecture 39 - Statistical Functions - Boxplots, Skewness and Kurtosis
Lecture 40 - Statistical Functions - Bivariate three dimensional plot
Lecture 41 - Statistical Functions - Correlation and Examples of Programming
Lecture 42 - Examples of Programming
Lecture 43 - Examples of More Programming
NPTEL Video Course - Mathematics - NOC: Descriptive Statistics with R Software

Subject Co-ordinator - Prof. Shalabh

Co-ordinating Institute - IIT - Kanpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

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
Lecture 16 - Quantiles
Lecture 17 - Mode, Geometric Mean and Harmonic Mean
Lecture 18 - Range, Interquartile Range and Quartile Deviation
Lecture 19 - Absolute Deviation and Absolute Mean Deviation
Lecture 20 - Mean Squared Error, Variance and Standard Deviation
Lecture 21 - Coefficient of Variation and Boxplots
Lecture 22 - Raw and Central Moments
Lecture 23 - Sheppard's Correction, Absolute Moments and Computation of Moments
Lecture 24 - Skewness and Kurtosis
Lecture 25 - Univariate and Bivariate Scatter Plots
Lecture 26 - Smooth Scatter Plots
Lecture 27 - Quantile- Quantile and Three Dimensional Plots
Lecture 28 - Correlation Coefficient
Lecture 29 - Correlation Coefficient Using R Software

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Lecture 30 - Rank Correlation Coefficient
Lecture 31 - Measures of Association for Discrete and Counting Variables - Part 1
Lecture 32 - Measures of Association for Discrete and Counting Variables - Part 2
Lecture 33 - Least Squares Method - One Variable
Lecture 34 - Least Squares Method - R Commands and More than One Variables
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 Video Course - Mathematics - Functional Analysis

Subject Co-ordinator - Prof. P.D. Srivastava
Co-ordinating Institute - IIT - Kharagpur
Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

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 Basic
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

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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.)
NPTEL Video Course - Mathematics - Numerical methods of Ordinary and Partial Differential Equations

Subject Co-ordinator - Dr. G.P. Raja Sekhar
Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable  |  MP3 Audio Lectures - Available / Unavailable

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

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NPTEL Video Course - Mathematics - Optimization

Subject Co-ordinator - Prof. A. Goswami, Dr. Debjani Chakraborty
Co-ordinating Institute - IIT - Kharagpur

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Lecture 1 - Optimization - Introduction
Lecture 2 - Formulation of LPP
Lecture 3 - Geometry of LPP and Graphical Solution of LPP
Lecture 4 - Solution of LPP
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 Optimaility 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
Lecture 22 - Unconstrained multivariable optimization
Lecture 23 - Nonlinear programming with equality constraint
Lecture 24 - Nonlinear programming KKT conditions
Lecture 25 - Numerical optimization
Lecture 26 - Numerical optimization
Lecture 27 - Fibonacci Method
Lecture 28 - Golden Section Methods
Lecture 29 - Interpolation Methods

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Lecture 30 - Unconstarined optimization techniques
Lecture 31 - Unconstarined optimization techniques
Lecture 32 - Nonlinear programming
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
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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
NPTEL Video Course - Mathematics - Statistical Inference

Subject Co-ordinator - Prof. Somesh Kumar
Co-ordinating Institute - IIT - Kharagpur
Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

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
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
Lecture 29 - Unbiased Tests for Normal Populations

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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.)
NPTEL Video Course - Mathematics - A Basic Course in Real Analysis

Subject Co-ordinator - Prof. P.D. Srivastava

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable  |  MP3 Audio Lectures - Available / Unavailable

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

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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.)
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Lecture 44 - Fundamental Theorems of Integral Calculus
Lecture 45 - Improper Integrals
Lecture 46 - Convergence Test for Improper Integrals
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NPTEL Video Course - Mathematics - NOC: Probability and Statistics

Subject Co-ordinator - Prof. Somesh Kumar

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

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
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Lecture 14 - Probability Distribution of a Random Variable - I
Lecture 15 - Probability Distribution of a Random Variable - II
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Lecture 17 - Characteristics of Distributions - I
Lecture 18 - Characteristics of Distributions - II
Lecture 19 - Special Discrete Distributions - I
Lecture 20 - Special Discrete Distributions - II
Lecture 21 - Special Discrete Distributions - III
Lecture 22 - Poisson Process - I
Lecture 23 - Poisson Process - II
Lecture 24 - Special Continuous Distributions - I
Lecture 25 - Special Continuous Distributions - II
Lecture 26 - Special Continuous Distributions - III
Lecture 27 - Special Continuous Distributions - IV
Lecture 28 - Special Continuous Distributions - V
Lecture 29 - Normal Distribution

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Lecture 30 - Problems on Normal Distribution
Lecture 31 - Problems on Special Distributions - I
Lecture 32 - Problems on Special Distributions - II
Lecture 33 - Function of a random variable - I
Lecture 34 - Function of a random variable - II
Lecture 35 - Joint Distributions - I
Lecture 36 - Joint Distributions - II
Lecture 37 - Independence, Product Moments
Lecture 38 - Linearity Property of Correlation and Examples
Lecture 39 - Bivariate Normal Distribution - I
Lecture 40 - Bivariate Normal Distribution - II
Lecture 41 - Additive Properties of Distributions - I
Lecture 42 - Additive Properties of Distributions - II
Lecture 43 - Transformation of Random Variables
Lecture 44 - Distribution of Order Statistics
Lecture 45 - Basic Concepts
Lecture 46 - Chi-Square Distribution
Lecture 47 - Chi-Square Distribution (Continued...), t-Distribution
Lecture 48 - F-Distribution
Lecture 49 - Descriptive Statistics - I
Lecture 50 - Descriptive Statistics - II
Lecture 51 - Descriptive Statistics - III
Lecture 52 - Descriptive Statistics - IV
Lecture 53 - Introduction to Estimation
Lecture 54 - Unbiased and Consistent Estimators
Lecture 55 - LSE, MME
Lecture 56 - Examples on MME, MLE
Lecture 57 - Examples on MLE - I
Lecture 58 - Examples on MLE - II, MSE
Lecture 59 - UMVUE, Sufficiency, Completeness
Lecture 60 - Rao - Blackwell Theorem and Its Applications
Lecture 61 - Confidence Intervals - I
Lecture 62 - Confidence Intervals - II
Lecture 63 - Confidence Intervals - III
Lecture 64 - Confidence Intervals - IV
Lecture 65 - Basic Definitions
Lecture 66 - Two Types of Errors
Lecture 67 - Neyman-Pearson Fundamental Lemma
Lecture 68 - Applications of N-P Lemma - I
Lecture 69 - Applications of N-P Lemma - II
Lecture 70 - Testing for Normal Mean
Lecture 71 - Testing for Normal Variance
Lecture 72 - Large Sample Test for Variance and Two Sample Problem
Lecture 73 - Paired t-Test
Lecture 74 - Examples
Lecture 75 - Testing Equality of Proportions
Lecture 76 - Chi-Square Test for Goodness Fit - I
Lecture 77 - Chi-Square Test for Goodness Fit - II
Lecture 78 - Testing for Independence in rxc Contingency Table - I
Lecture 79 - Testing for Independence in rxc Contingency Table - II
NPTEL Video Lecture Topic List - Created by LinuXpert Systems, Chennai

NPTEL Video Course - Mathematics - NOC: Applied Multivariate Statistical Modeling

Subject Co-ordinator - Dr. J. Maiti
Co-ordinating Institute - IIT - Kharagpur
Sub-Titles - Available / Unavailable  |  MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to multivariate statistical modeling - Part-I
Lecture 2 - Introduction to multivariate statistical modeling - Part-II
Lecture 3 - Univariate descriptive statistics
Lecture 4 - Sampling Distribution
Lecture 5 - Estimation - Part-I
Lecture 6 - Estimation - Part-II
Lecture 7 - Hypothesis Testing
Lecture 8 - Introduction to multivariate statistical modeling - Part-I
Lecture 9 - Introduction to multivariate statistical modeling - Part-II
Lecture 10 - Multivariate Normal Distribution
Lecture 11 - Multivariate Normal Distribution (Continued...)
Lecture 12 - ANOVA - Part-I
Lecture 13 - ANOVA - Part-II
Lecture 14 - Multivariate Analysis of Variance (MANOVA)
Lecture 15 - Multivariate Analysis of Variance (MANOVA) (Continued...)
Lecture 16 - Multiple Regression - Introduction
Lecture 17 - MLR Sampling Distribution of Regression Coefficients
Lecture 18 - MLR-Model Adequacy Tests
Lecture 19 - MLR - Test of Assumptions
Lecture 20 - MLR - Model Diagnostics
Lecture 21 - Principal Component Analysis (PCA)
Lecture 22 - Principal Component Analysis (PCA)
Lecture 23 - Factor Analysis
Lecture 24 - Factor Analysis - Estimation and Model Adequacy Testing
Lecture 25 - Factor Analysis - Model Adequacy, Rotation, Factor Scores and Case Study
Lecture 26 - Introduction to Structural Equation Modeling
Lecture 27 - SEM - Measurement Model
Lecture 28 - SEM - Structural Model

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NPTEL Video Course - Mathematics - NOC: Partial Differential Equations (PDE) for Engineers: Solution by Separation of Variables

Subject Co-ordinator - Prof. S. De
Co-ordinating Institute - IIT - Kharagpur
Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to PDE
Lecture 2 - Classification of PDE
Lecture 3 - Principle of Linear Superposition
Lecture 4 - Standard Eigen Value Problem and Special ODEs
Lecture 5 - Adjoint Operator
Lecture 6 - Generalized Sturm - Louiville Problem
Lecture 7 - Properties of Adjoint Operator
Lecture 8 - Separation of Variables
Lecture 9 - Solution of 3 Dimensional Parabolic Problem
Lecture 10 - Solution of 4 Dimensional Parabolic Problem
Lecture 11 - Solution of 4 Dimensional Parabolic Problem (Continued...)
Lecture 12 - Solution of Elliptical PDE
Lecture 13 - Solution of Hyperbolic PDE
Lecture 14 - Orthogonality of Bessel Function and 2 Dimensional Cylindrical Coordinate System
Lecture 15 - Cylindrical Co-ordinate System - 3 Dimensional Problem
Lecture 16 - Spherical Polar Coordinate System
Lecture 17 - Spherical Polar Coordinate System (Continued...)
Lecture 18 - Example of Generalized 3 Dimensional Problem
Lecture 19 - Example of Application Oriented Problems
Lecture 20 - Examples of Application Oriented Problems (Continued...)
NPTEL Video Course - Mathematics - NOC: Introductory Course in Real Analysis

Subject Co-ordinator - Prof. P.D. Srivastava
Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Countable and Uncountable sets
Lecture 2 - Properties of Countable and Uncountable sets
Lecture 3 - Examples of Countable and Uncountable sets
Lecture 4 - Concepts of Metric Space
Lecture 5 - Open ball, Closed ball, Limit point of a set
Lecture 6 - Tutorial-I
Lecture 7 - Some theorems on Open and Closed sets
Lecture 8 - Ordered set, Least upper bound, Greatest lower bound of a set
Lecture 9 - Ordered set, Least upper bound, Greatest lower bound of a set (Continued...)
Lecture 10 - Compact Set
Lecture 11 - Properties of Compact sets
Lecture 12 - Tutorial-II
Lecture 13 - Heine Borel Theorem
Lecture 14 - Weierstrass Theorem
Lecture 15 - Cantor set and its properties
Lecture 16 - Derived set and Dense set
Lecture 17 - Limit of a sequence and monotone sequence
Lecture 18 - Tutorial-III
Lecture 19 - Some Important limits of sequences
Lecture 20 - Ratio Test Cauchy's theorems on limits of sequences of real numbers
Lecture 21 - Fundamental theorems on limits
Lecture 22 - Some results on limits and Bolzano-Weierstrass Theorem
Lecture 23 - Criteria for convergent sequence
Lecture 24 - Tutorial-IV
Lecture 25 - Criteria for Divergent Sequence
Lecture 26 - Cauchy Sequence
Lecture 27 - Cauchy Convergence Criteria for Sequences
Lecture 28 - Infinite Series of Real Numbers
Lecture 29 - Convergence Criteria for Series of Positive Real Numbers

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Lecture 30 - Tutorial-V
Lecture 31 - Comparison Test for Series
Lecture 32 - Absolutely and Conditionally Convergent Series
Lecture 33 - Rearrangement Theorem and Test for Convergence of Series
Lecture 34 - Ratio and Integral Test for Convergence of Series
Lecture 35 - Raabe's Test for Convergence of Series
Lecture 36 - Tutorial-VI
Lecture 37 - Limit of Functions and Cluster Point
Lecture 38 - Limit of Functions (Continued...)
Lecture 39 - Divergence Criteria for Limit
Lecture 40 - Various Properties of Limit of Functions
Lecture 41 - Left and Right Hand Limits for Functions
Lecture 42 - Tutorial-VII
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Lecture 44 - Continuous Functions (Cauchy's Definition)
Lecture 45 - Continuous Functions (Heine's Definition)
Lecture 46 - Properties of Continuous Functions
Lecture 47 - Properties of Continuous Functions (Continued...)
Lecture 48 - Tutorial-VIII
Lecture 49 - Boundness Theorem and Max-Min Theorem
Lecture 50 - Location of Root and Bolzano's Theorem
Lecture 51 - Uniform Continuity and Related Theorems
Lecture 52 - Absolute Continuity and Related Theorems
Lecture 53 - Types of Discontinuities
Lecture 54 - Tutorial-IX
Lecture 55 - Types of Discontinuities (Continued...)
Lecture 56 - Relation between Continuity and Compact Sets
Lecture 57 - Differentiability of Real Valued Functions
Lecture 58 - Local Max. - Min. Cauchy's and Lagrange's Mean Value Theorem
Lecture 59 - Rolle's Mean Value Theorems and Its Applications
Lecture 60 - Tutorial-X
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Lecture 30 - EOF near heterogeneous surface potential
Lecture 31 - Electroosmosis in hydrophobic surface
Lecture 32 - Numerical Methods for Boundary Value Problems (BVP)
Lecture 33 - Numerical Methods for nonlinear BVP
Lecture 34 - Numerical Methods for coupled set of BVP
Lecture 35 - Numerical Methods for PDEs
Lecture 36 - Numerical Methods for transport equations, Part-I
Lecture 37 - Numerical Methods for transport equations, Part-II
Lecture 38 - Electrophoresis of charged colloids, Part-I
Lecture 39 - Electrophoresis of charged colloids, Part-II
Lecture 40 - Gel Electrophoresis
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NPTEL Video Course - Mathematics - NOC:Constrained and Unconstrained Optimization

Subject Co-ordinator - Dr. Debjani Chakraborty, Prof. A. Goswami

Co-ordinating Institute - IIT - Kharagpur

Lecture 1 - Introduction to Optimization
Lecture 2 - Assumptions and Mathematical Modeling of LPP
Lecture 3 - Geometry of LPP
Lecture 4 - Graphical Solution of LPP - I
Lecture 5 - Graphical Solution of LPP - II
Lecture 6 - Solution of LPP
Lecture 7 - Simplex Method
Lecture 8 - Introduction to BIG-M Method
Lecture 9 - Algorithm of BIG-M Method
Lecture 10 - Problems on BIG-M Method
Lecture 11 - Two Phase Method
Lecture 12 - Two Phase Method
Lecture 13 - Special Cases of LPP
Lecture 14 - Degeneracy in LPP
Lecture 15 - Sensitivity Analysis - I
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Lecture 17 - Problems on Sensitivity Analysis
Lecture 18 - Introduction to Duality Theory - I
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Lecture 20 - Dual Simplex Method
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Lecture 23 - Integer Linear Programming
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Lecture 25 - Mixed Integer Programming Problem
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Lecture 32 - Graphical Solution of NLP
Lecture 33 - Types of NLP
Lecture 34 - One dimensional unconstrained optimization
Lecture 35 - Unconstrained Optimization
Lecture 36 - Region Elimination Technique - 1
Lecture 37 - Region Elimination Technique - 2
Lecture 38 - Region Elimination Technique - 3
Lecture 39 - Unconstrained Optimization
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Lecture 41 - Multivariate Unconstrained Optimization - 1
Lecture 42 - Multivariate Unconstrained Optimization - 2
Lecture 43 - Unconstrained Optimization
Lecture 44 - NLP with Equality Constrained - 1
Lecture 45 - NLP with Equality Constrained - 2
Lecture 46 - Constrained NLP - 1
Lecture 47 - Constrained NLP - 2
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Lecture 49 - Constrained Optimization
Lecture 50 - KKT
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Lecture 52 - Constrained Optimization
Lecture 53 - Feasible Direction
Lecture 54 - Penalty and barrier method
Lecture 55 - Penalty method
Lecture 56 - Penalty and barrier method
Lecture 57 - Penalty and barrier method
Lecture 58 - Dynamic programming
Lecture 59 - Multi-Objective decision making
Lecture 60 - Multi-Attribute decision making
NPTEL Video Lecture Topic List - Created by LinuXpert Systems, Chennai

NPTEL Video Course - Mathematics - NOC: Matrix Solver
Subject Co-ordinator - Prof. Somnath Roy
Co-ordinating Institute - IIT - Kharagpur
Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Matrix Algebra - I
Lecture 2 - Introduction to Matrix Algebra - II
Lecture 3 - System of Linear Equations
Lecture 4 - Determinant of a Matrix
Lecture 5 - Determinant of a Matrix (Continued...)
Lecture 6 - Gauss Elimination
Lecture 7 - Gauss Elimination (Continued...)
Lecture 8 - LU Decomposition
Lecture 9 - Gauss-Jordon Method
Lecture 10 - Representation of Physical Systems as Matrix Equations
Lecture 11 - Tridiagonal Matrix Algorithm
Lecture 12 - Equations with Singular Matrices
Lecture 13 - Introduction to Vector Space
Lecture 14 - Vector Subspace
Lecture 15 - Column Space and Nullspace of a Matrix
Lecture 16 - Finding Null Space of a Matrix
Lecture 17 - Solving Ax=b when A is Singular
Lecture 18 - Linear Independence and Spanning of a Subspace
Lecture 19 - Basis and Dimension of a Vector Space
Lecture 20 - Four Fundamental Subspaces of a Matrix
Lecture 21 - Left and right inverse of a matrix
Lecture 22 - Orthogonality between the subspaces
Lecture 23 - Best estimate
Lecture 24 - Projection operation and linear transformation
Lecture 25 - Creating orthogonal basis vectors
Lecture 26 - Gram-Schmidt and modified Gram-Schmidt algorithms
Lecture 27 - Comparing GS and modified GS
Lecture 28 - Introduction to eigenvalues and eigenvectors
Lecture 29 - Eigenvalues and eigenvectors for real symmetric matrix

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| Lecture 30 | Positive definiteness of a matrix |
| Lecture 31 | Positive definiteness of a matrix (Continued...) |
| Lecture 32 | Basic Iterative Methods |
| Lecture 33 | Basic Iterative Methods |
| Lecture 34 | Convergence Rate and Convergence Factor for Iterative Methods |
| Lecture 35 | Numerical Experiments on Convergence |
| Lecture 36 | Steepest Descent Method |
| Lecture 37 | Steepest Descent Method |
| Lecture 38 | Steepest Descent Method |
| Lecture 39 | Introduction to General Projection Methods |
| Lecture 40 | Residue Norm and Minimum Residual Algorithm |
| Lecture 41 | Developing computer programs for basic iterative methods |
| Lecture 42 | Developing computer programs for projection based methods |
| Lecture 43 | Introduction to Krylov subspace methods |
| Lecture 44 | Krylov subspace methods for linear systems |
| Lecture 45 | Iterative methods for solving linear systems using Krylov subspace methods |
| Lecture 46 | Conjugate gradient methods |
| Lecture 47 | Conjugate gradient methods (Continued...) |
| Lecture 48 | Conjugate gradient methods (Continued...) and Introduction to GMRES |
| Lecture 49 | GMRES (Continued...) |
| Lecture 50 | Lanczos Biorthogonalization and BCG Algorithm |
| Lecture 51 | Numerical issues in BICG and polynomial based formulation |
| Lecture 52 | Conjugate gradient squared and Biconjugate gradient stabilized |
| Lecture 53 | Line relaxation method |
| Lecture 54 | Block relaxation method |
| Lecture 55 | Domain Decomposition and Parallel Computing |
| Lecture 56 | Preconditioners |
| Lecture 57 | Preconditioned conjugate gradient |
| Lecture 58 | Preconditioned GMRES |
| Lecture 59 | Multigrid methods - I |
| Lecture 60 | Multigrid methods - II |
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Lecture 2 - Set Operations
Lecture 3 - Set Operations (Continued...)
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Lecture 6 - Equivalence relation
Lecture 7 - Mapping
Lecture 8 - Permutation
Lecture 9 - Binary Composition
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Lecture 11 - Group
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Lecture 17 - Right Cosets
Lecture 18 - Normal Subgroup
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Lecture 22 - Sub-Spaces
Lecture 23 - Linear Span
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Lecture 25 - Dimension of a Vector space
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Lecture 29 - More on linear mapping
Lecture 30 - Linear Space
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Lecture 32 - Rank of a matrix (Continued...)
Lecture 33 - System of linear equations
Lecture 34 - Row rank and Column rank
Lecture 35 - Eigen value of a matrix
Lecture 36 - Eigen Vector
Lecture 37 - Geometric multiplicity
Lecture 38 - More on eigen value
Lecture 39 - Similar matrices
Lecture 40 - Diagonalisable
Lecture 1 - Rolle’s Theorem
Lecture 2 - Mean Value Theorems
Lecture 3 - Indeterminate Forms - Part 1
Lecture 4 - Indeterminate Forms - Part 2
Lecture 5 - Taylor Polynomial and Taylor Series
Lecture 6 - Limit of Functions of Two Variables
Lecture 7 - Evaluation of Limit of Functions of Two Variables
Lecture 8 - Continuity of Functions of Two Variables
Lecture 9 - Partial Derivatives of Functions of Two Variables
Lecture 10 - Partial Derivatives of Higher Order
Lecture 11 - Derivative and Differentiability
Lecture 12 - Differentiability of Functions of Two Variables
Lecture 13 - Differentiability of Functions of Two Variables (Continued...)
Lecture 14 - Differentiability of Functions of Two Variables (Continued...)
Lecture 15 - Composite and Homogeneous Functions
Lecture 16 - Taylor’s Theorem for Functions of Two Variables
Lecture 17 - Maxima and Minima of Functions of Two Variables
Lecture 18 - Maxima and Minima of Functions of Two Variables (Continued...)
Lecture 19 - Maxima and Minima of Functions of Two Variables (Continued...)
Lecture 20 - Constrained Maxima and Minima
Lecture 21 - Improper Integrals
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Lecture 23 - Improper Integrals (Continued...)
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Lecture 30 - Double Integrals (Continued...)
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Lecture 45 - Linear Transformations (Continued....)
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Lecture 48 - Eigenvalues and Eigenvectors (Continued...)
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Lecture 52 - First Order Differential Equations
Lecture 53 - Exact Differential Equations
Lecture 54 - Exact Differential Equations (Continued...)
Lecture 55 - First Order Linear Differential Equations
Lecture 56 - Higher Order Linear Differential Equations
Lecture 57 - Solution of Higher Order Homogeneous Linear Equations
Lecture 58 - Solution of Higher Order Non-Homogeneous Linear Equations
Lecture 59 - Solution of Higher Order Non-Homogeneous Linear Equations (Continued...)
Lecture 60 - Cauchy-Euler Equations
NPTEL Video Course - Mathematics - NOC: Integral and Vector Calculus

Subject Co-ordinator - Prof. Hari Shankar Mahato
Co-ordinating Institute - IIT - Kharagpur
Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Partition, Riemann intergrability and One example
Lecture 2 - Partition, Riemann intergrability and One example (Continued...)
Lecture 3 - Condition of integrability
Lecture 4 - Theorems on Riemann integrations
Lecture 5 - Examples
Lecture 6 - Examples (Continued...)
Lecture 7 - Reduction formula
Lecture 8 - Reduction formula (Continued...)
Lecture 9 - Improper Integral
Lecture 10 - Improper Integral (Continued...)
Lecture 11 - Improper Integral (Continued...)
Lecture 12 - Improper Integral (Continued...)
Lecture 13 - Introduction to Beta and Gamma Function
Lecture 14 - Beta and Gamma Function
Lecture 15 - Differentiation under Integral Sign
Lecture 16 - Differentiation under Integral Sign (Continued...)
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Lecture 18 - Double Integral over a Region E
Lecture 19 - Examples of Integral over a Region E
Lecture 20 - Change of variables in a Double Integral
Lecture 21 - Change of order of Integration
Lecture 22 - Triple Integral
Lecture 23 - Triple Integral (Continued...)
Lecture 24 - Area of Plane Region
Lecture 25 - Area of Plane Region (Continued...)
Lecture 26 - Rectification
Lecture 27 - Rectification (Continued...)
Lecture 28 - Surface Integral
Lecture 29 - Surface Integral (Continued...)
NPTEL Video Course - Mathematics - NOC: Transform Calculus and its applications in Differential Equations

Subject Co-ordinator - Prof. A. Goswami

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable  |  MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Integral Transform and Laplace Transform
Lecture 2 - Existence of Laplace Transform
Lecture 3 - Shifting Properties of Laplace Transform
Lecture 4 - Laplace Transform of Derivatives and Integration of a Function - I
Lecture 5 - Laplace Transform of Derivatives and Integration of a Function - II
Lecture 6 - Explanation of properties of Laplace Transform using Examples
Lecture 7 - Laplace Transform of Periodic Function
Lecture 8 - Laplace Transform of some special Functions
Lecture 9 - Error Function, Dirac Delta Function and their Laplace Transform
Lecture 10 - Bessel Function and its Laplace Transform
Lecture 11 - Introduction to Inverse Laplace Transform
Lecture 12 - Properties of Inverse Laplace Transform
Lecture 13 - Convolutions and its Applications
Lecture 14 - Evaluation of Integrals using Laplace Transform
Lecture 15 - Solution of Ordinary Differential Equations with constant coefficients using Laplace Transform
Lecture 16 - Solution of Ordinary Differential Equations with variable coefficients using Laplace Transform
Lecture 17 - Solution of Simultaneous Ordinary Differential Equations using Laplace Transform
Lecture 18 - Introduction to Integral Equation and its Solution Process
Lecture 19 - Introduction to Fourier Series
Lecture 20 - Fourier Series for Even and Odd Functions
Lecture 21 - Fourier Series of Functions having arbitrary period - I
Lecture 22 - Fourier Series of Functions having arbitrary period - II
Lecture 23 - Half Range Fourier Series
Lecture 24 - Parseval's Theorem and its Applications
Lecture 25 - Complex form of Fourier Series
Lecture 26 - Fourier Integral Representation
Lecture 27 - Introduction to Fourier Transform
Lecture 28 - Derivation of Fourier Cosine Transform and Fourier Sine Transform of Functions
Lecture 29 - Evaluation of Fourier Transform of various functions
Lecture 30 - Linearity Property and Shifting Properties of Fourier Transform
Lecture 31 - Change of Scale and Modulation Properties of Fourier Transform
Lecture 32 - Fourier Transform of Derivative and Integral of a Function
Lecture 33 - Applications of Properties of Fourier Transform - I
Lecture 34 - Applications of Properties of Fourier Transform - II
Lecture 35 - Fourier Transform of Convolution of two functions
Lecture 36 - Parseval's Identity and its Application
Lecture 37 - Evaluation of Definite Integrals using Properties of Fourier Transform
Lecture 38 - Fourier Transform of Dirac Delta Function
Lecture 39 - Representation of a function as Fourier Integral
Lecture 40 - Applications of Fourier Transform to Ordinary Differential Equations - I
Lecture 41 - Applications of Fourier Transform to Ordinary Differential Equations - II
Lecture 42 - Solution of Integral Equations using Fourier Transform
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Lecture 45 - Solution of Heat Equation and Wave Equation using Laplace Transform
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Lecture 48 - Solution of Partial Differential Equations using Fourier Transform - I
Lecture 49 - Solution of Partial Differential Equations using Fourier Transform - II
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Lecture 53 - Solution of Boundary Value Problems using Finite Fourier Transform - II
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Lecture 55 - Properties of Mellin Transform
Lecture 56 - Examples of Mellin Transform - I
Lecture 57 - Examples of Mellin Transform - II
Lecture 58 - Introduction to Z-Transform
Lecture 59 - Properties of Z-Transform
Lecture 60 - Evaluation of Z-Transform of some functions
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Subject Co-ordinator - Prof. Somesh Kumar

Co-ordinating Institute - IIT - Kharagpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction and Motivation - I
Lecture 2 - Introduction and Motivation - II
Lecture 3 - Basic Concepts of Point Estimations - I
Lecture 4 - Basic Concepts of Point Estimations - II
Lecture 5 - Basic Concepts of Point Estimations - III
Lecture 6 - Basic Concepts of Point Estimations - IV
Lecture 7 - Finding Estimators - I
Lecture 8 - Finding Estimators - II
Lecture 9 - Finding Estimators - III
Lecture 10 - Finding Estimators - IV
Lecture 11 - Finding Estimators - V
Lecture 12 - Finding Estimators - VI
Lecture 13 - Properties of MLEs - I
Lecture 14 - Properties of MLEs - II
Lecture 15 - Lower Bounds for Variance - I
Lecture 16 - Lower Bounds for Variance - II
Lecture 17 - Lower Bounds for Variance - III
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Lecture 20 - Lower Bounds for Variance - VI
Lecture 21 - Lower Bounds for Variance - VII
Lecture 22 - Lower Bounds for Variance - VIII
Lecture 23 - Sufficiency - I
Lecture 24 - Sufficiency - II
Lecture 25 - Sufficiency and Information - I
Lecture 26 - Sufficiency and Information - II
Lecture 27 - Minimal Sufficiency, Completeness - I
Lecture 28 - Minimal Sufficiency, Completeness - II
Lecture 29 - UMVU Estimation, Ancillarity - I

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Lecture 30 - UMVU Estimation, Ancillarity - II
Lecture 31 - Testing of Hypotheses
Lecture 32 - Testing of Hypotheses
Lecture 33 - Neyman Pearson Fundamental Lemma - I
Lecture 34 - Neyman Pearson Fundamental Lemma - II
Lecture 35 - Application of NP-Lemma - I
Lecture 36 - Application of NP-Lemma - II
Lecture 37 - UMP Tests - I
Lecture 38 - UMP Tests - II
Lecture 39 - UMP Tests - III
Lecture 40 - UMP Tests - IV
Lecture 41 - UMP Unbiased Tests - I
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Lecture 44 - UMP Unbiased Tests - IV
Lecture 45 - Applications of UMP Unbiased Tests - I
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Lecture 47 - Unbiased Test for Normal Populations - I
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Lecture 58 - Likelihood Ratio Tests - VIII
Lecture 59 - Test for Goodness of Fit - I
Lecture 60 - Test for Goodness of Fit - II
Lecture 61 - Interval Estimation - I
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Lecture 64 - Interval Estimation - IV
Lecture 28 - Quotients by Kleinian Subgroups give rise to Riemann Surfaces
Lecture 29 - The Unimodular Group is Kleinian
Lecture 30 - The Necessity of Elliptic Functions for the Classification of Complex Tori
Lecture 31 - The Uniqueness Property of the Weierstrass Phe-function associated to a Lattice in the Plane
Lecture 32 - The First Order Degree Two Cubic Ordinary Differential Equation satisfied by the Weierstrass Phe-function
Lecture 33 - The Values of the Weierstrass Phe-function at the Zeros of its Derivative are nonvanishing Analytic Functions on the Upper Half-Plane
Lecture 34 - The Construction of a Modular Form of Weight Two on the Upper Half-Plane
Lecture 35 - The Fundamental Functional Equations satisfied by the Modular Form of Weight Two on the Upper Half-Plane
Lecture 36 - The Weight Two Modular Form assumes Real Values on the Imaginary Axis in the Upper Half-plane
Lecture 37 - The Weight Two Modular Form Vanishes at Infinity
Lecture 38 - The Weight Two Modular Form Decays Exponentially in a Neighbourhood of Infinity
Lecture 39 - A Suitable Restriction of the Weight Two Modular Form is a Holomorphic Conformal Isomorphism onto the Upper Half-Plane
Lecture 40 - The J-Invariant of a Complex Torus (or) of an Algebraic Elliptic Curve
Lecture 41 - A Fundamental Region in the Upper Half-Plane for the Elliptic Modular J-Invariant
Lecture 42 - The Fundamental Region in the Upper Half-Plane for the Unimodular Group
Lecture 43 - A Region in the Upper Half-Plane Meeting Each Unimodular Orbit Exactly Once
Lecture 44 - Moduli of Elliptic Curves
Lecture 45 - Punctured Complex Tori are Elliptic Algebraic Affine Plane Cubic Curves in Complex 2-Space
Lecture 46 - The Natural Riemann Surface Structure on an Algebraic Affine Nonsingular Plane Curve
Lecture 47 - Complex Projective 2-Space as a Compact Complex Manifold of Dimension Two
Lecture 48 - Complex Tori are the same as Elliptic Algebraic Projective Curves

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NPTEL Video Course - Mathematics - Linear Algebra

Subject Co-ordinator - Dr. K.C. Sivakumar

Co-ordinating Institute - IIT - Madras

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Lecture 1 - Introduction to the Course Contents
Lecture 2 - Linear Equations
Lecture 3a - Equivalent Systems of Linear Equations I
Lecture 3b - Equivalent Systems of Linear Equations II
Lecture 4 - Row-reduced Echelon Matrices
Lecture 5 - Row-reduced Echelon Matrices and Non-homogeneous Equations
Lecture 6 - Elementary Matrices, Homogeneous Equations and Non-homogeneous Equations
Lecture 7 - Invertible matrices, Homogeneous Equations Non-homogeneous Equations
Lecture 8 - Vector spaces
Lecture 9 - Elementary Properties in Vector Spaces. Subspaces
Lecture 10 - Subspaces (Continued...), Spanning Sets, Linear Independence, Dependence
Lecture 11 - Basis for a vector space
Lecture 12 - Dimension of a vector space
Lecture 13 - Dimensions of Sums of Subspaces
Lecture 14 - Linear Transformations
Lecture 15 - The Null Space and the Range Space of a Linear Transformation
Lecture 16 - The Rank-Nullity-Dimension Theorem. Isomorphisms Between Vector Spaces
Lecture 17 - Isomorphic Vector Spaces, Equality of the Row-rank and the Column-rank - I
Lecture 18 - Equality of the Row-rank and the Column-rank - II
Lecture 19 - The Matrix of a Linear Transformation
Lecture 20 - Matrix for the Composition and the Inverse. Similarity Transformation
Lecture 21 - Linear Functionals. The Dual Space. Dual Basis - I
Lecture 22 - Dual Basis II. Subspace Annihilators - I
Lecture 23 - Subspace Annihilators - II
Lecture 24 - The Double Dual. The Double Annihilator
Lecture 26 - Eigenvalues and Eigenvectors of Linear Operators
Lecture 27 - Diagonalization of Linear Operators. A Characterization
Lecture 28 - The Minimal Polynomial

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Lecture 29 - The Cayley-Hamilton Theorem
Lecture 30 - Invariant Subspaces
Lecture 31 - Triangulability, Diagonalization in Terms of the Minimal Polynomial
Lecture 32 - Independent Subspaces and Projection Operators
Lecture 33 - Direct Sum Decompositions and Projection Operators - I
Lecture 34 - Direct Sum Decompositions and Projection Operators - II
Lecture 35 - The Primary Decomposition Theorem and Jordan Decomposition
Lecture 36 - Cyclic Subspaces and Annihilators
Lecture 37 - The Cyclic Decomposition Theorem - I
Lecture 38 - The Cyclic Decomposition Theorem - II. The Rational Form
Lecture 39 - Inner Product Spaces
Lecture 40 - Norms on Vector spaces. The Gram-Schmidt Procedure I
Lecture 41 - The Gram-Schmidt Procedure II. The QR Decomposition
Lecture 42 - Bessel's Inequality, Parseval's Identity, Best Approximation
Lecture 43 - Best Approximation
Lecture 44 - Orthogonal Complementary Subspaces, Orthogonal Projections
Lecture 45 - Projection Theorem. Linear Functionals
Lecture 46 - The Adjoint Operator
Lecture 47 - Properties of the Adjoint Operation. Inner Product Space Isomorphism
Lecture 48 - Unitary Operators
Lecture 49 - Unitary operators - II. Self-Adjoint Operators - I.
Lecture 50 - Self-Adjoint Operators - II - Spectral Theorem
Lecture 51 - Normal Operators - Spectral Theorem
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NPTEL Video Course - Mathematics - Mathematical Logic

Subject Co-ordinator - Prof. Arindama Singh

Co-ordinating Institute - IIT - Madras

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Lecture 1 - Sets and Strings
Lecture 2 - Syntax of Propositional Logic
Lecture 3 - Unique Parsing
Lecture 4 - Semantics of PL
Lecture 5 - Consequences and Equivalences
Lecture 6 - Five results about PL
Lecture 7 - Calculations and Informal Proofs
Lecture 8 - More Informal Proofs
Lecture 9 - Normal forms
Lecture 10 - SAT and 3SAT
Lecture 11 - Horn-SAT and Resolution
Lecture 12 - Resolution
Lecture 13 - Adequacy of Resolution
Lecture 14 - Adequacy and Resolution Strategies
Lecture 15 - Propositional Calculus (PC)
Lecture 16 - Some Results about PC
Lecture 17 - Arguing with Proofs
Lecture 18 - Adequacy of PC
Lecture 19 - Compactness & Analytic Tableau
Lecture 20 - Examples of Tableau Proofs
Lecture 21 - Adequacy of Tableaux
Lecture 22 - Syntax of First order Logic (FL)
Lecture 23 - Symbolization & Scope of Quantifiers
Lecture 24 - Hurdles in giving Meaning
Lecture 25 - Semantics of FL
Lecture 26 - Relevance Lemma
Lecture 27 - Validity, Satisfiability & Equivalence
Lecture 28 - Six Results about FL
Lecture 29 - Laws, Calculation & Informal Proof

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Lecture 1 - Introduction
Lecture 2 - Functions and Relations
Lecture 3 - Finite and Infinite Sets
Lecture 4 - Countable Sets
Lecture 5 - Uncountable Sets, Cardinal Number
Lecture 6 - Real Number System
Lecture 7 - LUB Axiom
Lecture 8 - Sequences of Real Numbers
Lecture 9 - Sequences of Real Numbers - (Continued.)
Lecture 10 - Sequences of Real Numbers - (Continued.)
Lecture 11 - Infinite Series of Real Numbers
Lecture 12 - Series of nonnegative Real Numbers
Lecture 13 - Conditional Convergence
Lecture 14 - Metric Spaces
Lecture 15 - Metric Spaces
Lecture 16 - Balls and Spheres
Lecture 17 - Open Sets
Lecture 18 - Closure Points, Limit Points and isolated Points
Lecture 19 - Closed sets
Lecture 20 - Sequences in Metric Spaces
Lecture 21 - Completeness
Lecture 22 - Baire Category Theorem
Lecture 23 - Limit and Continuity of a Function defined on a Metric space
Lecture 24 - Continuous Functions on a Metric Space
Lecture 25 - Uniform Continuity
Lecture 26 - Connectedness
Lecture 27 - Connected Sets
Lecture 28 - Compactness
Lecture 29 - Compactness (Continued.)
Lecture 30 - Characterizations of Compact Sets
Lecture 31 - Continuous Functions on Compact Sets
Lecture 32 - Types of Discontinuity
Lecture 33 - Differentiation
Lecture 34 - Mean Value Theorems
Lecture 35 - Mean Value Theorems (Continued.)
Lecture 36 - Taylor's Theorem
Lecture 37 - Differentiation of Vector Valued Functions
Lecture 38 - Integration
Lecture 39 - Integrability
Lecture 40 - Integrable Functions
Lecture 41 - Integrable Functions (Continued.)
Lecture 42 - Integration as a Limit of Sum
Lecture 43 - Integration and Differentiation
Lecture 44 - Integration of Vector Valued Functions
Lecture 45 - More Theorems on Integrals
Lecture 46 - Sequences and Series of Functions
Lecture 47 - Uniform Convergence
Lecture 48 - Uniform Convergence and Integration
Lecture 49 - Uniform Convergence and Differentiation
Lecture 50 - Construction of Everywhere Continuous Nowhere Differentiable Function
Lecture 51 - Approximation of a Continuous Function by Polynomials
Lecture 52 - Equicontinuous family of Functions
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NPTEL Video Course - Mathematics - Dynamic Data Assimilation: An Introduction

Subject Co-ordinator - Prof. S. Lakshmivarahan
Co-ordinating Institute - IIT - Madras
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Lecture 1 - An Overview
Lecture 2 - Data Mining, Data assimilation and prediction
Lecture 3 - A classification of forecast errors
Lecture 4 - Finite Dimensional Vector Space
Lecture 5 - Matrices
Lecture 6 - Matrices (Continued...)
Lecture 7 - Multi-variate Calculus
Lecture 8 - Optimization in Finite Dimensional Vector spaces
Lecture 9 - Deterministic, Static, linear Inverse (well-posed) Problems
Lecture 10 - Deterministic, Static, Linear Inverse (Ill-posed) Problems
Lecture 11 - A Geometric View Â□ Projections
Lecture 12 - Deterministic, Static, nonlinear Inverse Problems
Lecture 13 - On-line Least Squares
Lecture 14 - Examples of static inverse problems
Lecture 15 - Interlude and a Way Forward
Lecture 16 - Matrix Decomposition Algorithms
Lecture 17 - Matrix Decomposition Algorithms (Continued...)
Lecture 18 - Minimization algorithms
Lecture 19 - Minimization algorithms (Continued...)
Lecture 20 - Inverse problems in deterministic
Lecture 21 - Inverse problems in deterministic (Continued...)
Lecture 22 - Forward sensitivity method
Lecture 23 - Relation between FSM and 4DVAR
Lecture 24 - Statistical Estimation
Lecture 25 - Statistical Least Squares
Lecture 26 - Maximum Likelihood Method
Lecture 27 - Bayesian Estimation
Lecture 28 - From Gauss to Kalman-Lineal Minimum Variance Estimation
Lecture 29 - Initialization Classical Method

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Lecture 30 - Optimal interpolations
Lecture 31 - A Bayesian Formation-3D-VAR methods
Lecture 32 - Linear Stochastic Dynamics - Kalman Filter
Lecture 33 - Linear Stochastic Dynamics - Kalman Filter (Continued...)
Lecture 34 - Linear Stochastic Dynamics - Kalman Filter (Continued...)
Lecture 35 - Covariance Square Root Filter
Lecture 36 - Nonlinear Filtering
Lecture 37 - Ensemble Reduced Rank Filter
Lecture 38 - Basic nudging methods
Lecture 39 - Deterministic predictability
Lecture 40 - Predictability A stochastic view and Summary
NPTEL Video Course - Mathematics - NOC:An Invitation to Mathematics

Subject Co-ordinator - Prof. Sankaran Vishwanath

Co-ordinating Institute - Institute of Mathematical Sciences

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction
Lecture 2 - Long division
Lecture 3 - Applications of Long division
Lecture 4 - Lagrange interpolation
Lecture 5 - The 0-1 idea in other contexts - dot and cross product
Lecture 6 - Taylors formula
Lecture 7 - The Chebyshev polynomials
Lecture 8 - Counting number of monomials - several variables
Lecture 9 - Permutations, combinations and the binomial theorem
Lecture 10 - Combinations with repetition, and counting monomials
Lecture 11 - Combinations with restrictions, recurrence relations
Lecture 12 - Fibonacci numbers; an identity and a bijective proof
Lecture 13 - Permutations and cycle type
Lecture 14 - The sign of a permutation, composition of permutations
Lecture 15 - Rules for drawing tangle diagrams
Lecture 16 - Signs and cycle decompositions
Lecture 17 - Sorting lists of numbers, and crossings in tangle diagrams
Lecture 18 - Real and integer valued polynomials
Lecture 19 - Integer valued polynomials revisited
Lecture 20 - Functions on the real line, continuity
Lecture 21 - The intermediate value property
Lecture 22 - Visualizing functions
Lecture 23 - Functions on the plane, Rigid motions
Lecture 24 - More examples of functions on the plane, dilations
Lecture 25 - Composition of functions
Lecture 26 - Affine and Linear transformations
Lecture 27 - Length and Area dilation, the derivative
Lecture 28 - Examples-I
Lecture 29 - Examples-II
Lecture 30 - Linear equations, Lagrange interpolation revisited
Lecture 31 - Completed Matrices in combinatorics
Lecture 32 - Polynomials acting on matrices
Lecture 33 - Divisibility, prime numbers
Lecture 34 - Congruences, Modular arithmetic
Lecture 35 - The Chinese remainder theorem
Lecture 36 - The Euclidean algorithm, the 0-1 idea and the Chinese remainder theorem
Lecture 30 - The Mean-Value Property, Harmonic Functions and the Maximum Principle
Lecture 31 - Proofs of Maximum Principles and Introduction to Schwarz Lemma
Lecture 32 - Proof of Schwarz Lemma and Uniqueness of Riemann Mappings
Lecture 33 - Reducing Existence of Riemann Mappings to Hyperbolic Geometry of Sub-domains of the Unit Disc
Lecture 34 - Differential or Infinitesimal Schwarz Lemma, Picks Lemma, Hyperbolic Arclengths, Metric and Geodesics on the Unit Disc
Lecture 35 - Differential or Infinitesimal Schwarz Lemma, Picks Lemma, Hyperbolic Arclengths, Metric and Geodesics on the Unit Disc
Lecture 36 - Hyperbolic Geodesics for the Hyperbolic Metric on the Unit Disc
Lecture 37 - Schwarz-Pick Lemma for the Hyperbolic Metric on the Unit Disc
Lecture 38 - Arzela-Ascoli Theorem
Lecture 39 - Completion of the Proof of the Arzela-Ascoli Theorem and Introduction to Montel's Theorem
Lecture 40 - The Proof of Montel's Theorem
Lecture 41 - The Candidate for a Riemann Mapping
Lecture 42 - Completion of Proof of The Riemann Mapping Theorem
Lecture 43 - Completion of Proof of The Riemann Mapping Theorem
NPTEL Video Course - Mathematics - NOC: Discrete Mathematics

Subject Co-ordinator - Prof. Sourav Chakraborty
Co-ordinating Institute - IIT - Madras
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Lecture 1 - Course Introduction
Lecture 2 - Sets, Relations and Functions
Lecture 3 - Propositional Logic and Predicate Logic
Lecture 4 - Propositional Logic and Predicate Logic (Part 2)
Lecture 5 - Elementary Number Theory
Lecture 6 - Formal Proofs
Lecture 7 - Direct Proofs
Lecture 8 - Case Study
Lecture 9 - Case Study (Part 2)
Lecture 10 - Sets, Relations, Function and Logic
Lecture 11 - Proof by Contradiction (Part 1)
Lecture 12 - Proof by Contradiction (Part 2)
Lecture 13 - Proof by Contraposition
Lecture 14 - Proof by Counter Example
Lecture 15 - Mathematical Induction (Part 1)
Lecture 16 - Mathematical Induction (Part 2)
Lecture 17 - Mathematical Induction (Part 3)
Lecture 18 - Mathematical Induction (Part 4)
Lecture 19 - Mathematical Induction (Part 5)
Lecture 20 - Mathematical Induction (Part 6)
Lecture 21 - Mathematical Induction (Part 7)
Lecture 22 - Mathematical Induction (Part 8)
Lecture 23 - Introduction to Graph Theory
Lecture 24 - Handshake Problem
Lecture 25 - Tournament Problem
Lecture 26 - Tournament Problem (Part 2)
Lecture 27 - Ramsey Problem
Lecture 28 - Ramsey Problem (Part 2)
Lecture 29 - Properties of Graphs

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Lecture 30 - Problem 1
Lecture 31 - Problem 2
Lecture 32 - Problem 3 & 4
Lecture 33 - Counting for Selection
Lecture 34 - Counting for Distribution
Lecture 35 - Counting for Distribution (Part 2)
Lecture 36 - Some Counting Problems
Lecture 37 - Counting using Recurrence Relations
Lecture 38 - Counting using Recurrence Relations (Part 2)
Lecture 39 - Solving Recurrence Relations (Part 1)
Lecture 40 - Solving Recurrence Relations (Part 2)
Lecture 41 - Asymptotic Relations (Part 1)
Lecture 42 - Asymptotic Relations (Part 2)
Lecture 43 - Asymptotic Relations (Part 3)
Lecture 44 - Asymptotic Relations (Part 4)
Lecture 45 - Generating Functions (Part 1)
Lecture 46 - Generating Functions (Part 2)
Lecture 47 - Generating Functions (Part 3)
Lecture 48 - Generating Functions (Part 4)
Lecture 49 - Proof Techniques
Lecture 50 - Modeling
Lecture 51 - Combinatorics
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NPTEL Video Course - Mathematics - Advanced Complex Analysis - Part 2

Subject Co-ordinator - Dr. T.E. Venkata Balaji
Co-ordinating Institute - IIT - Madras
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Lecture 1 - Properties of the Image of an Analytic Function - Introduction to the Picard Theorems
Lecture 2 - Recalling Singularities of Analytic Functions - Non-isolated and Isolated Removable, Pole and Essential
Lecture 3 - Recalling Riemann's Theorem on Removable Singularities
Lecture 4 - Casorati-Weierstrass Theorem; Dealing with the Point at Infinity -- Riemann Sphere and Riemann
Lecture 5 - Neighborhood of Infinity, Limit at Infinity and Infinity as an Isolated Singularity
Lecture 6 - Studying Infinity - Formulating Epsilon-Delta Definitions for Infinite Limits and Limits at Infinity
Lecture 7 - When is a function analytic at infinity?
Lecture 8 - Laurent Expansion at Infinity and Riemann's Removable Singularities Theorem for the Point at Infinity
Lecture 9 - The Generalized Liouville Theorem - Little Brother of Little Picard and Analogue of Casorati-Weierstrass
Lecture 10 - Morera's Theorem at Infinity, Infinity as a Pole and Behaviour at Infinity of Rational and Meromorphic Functions
Lecture 11 - Residue at Infinity and Introduction to the Residue Theorem for the Extended Complex Plane - Residues
Lecture 12 - Proofs of Two Avatars of the Residue Theorem for the Extended Complex Plane and Applications of
Lecture 13 - Infinity as an Essential Singularity and Transcendental Entire Functions
Lecture 14 - Meromorphic Functions on the Extended Complex Plane are Precisely Quotients of Polynomials
Lecture 15 - The Ubiquity of Meromorphic Functions - The Nerves of the Geometric Network Bridging Algebra, Analysis
Lecture 16 - Continuity of Meromorphic Functions at Poles and Topologies of Spaces of Functions
Lecture 17 - Why Normal Convergence, but Not Globally Uniform Convergence, is the Inevitable in Complex Analysis
Lecture 18 - Measuring Distances to Infinity, the Function Infinity and Normal Convergence of Holomorphic Functions
Lecture 19 - The Invariance Under Inversion of the Spherical Metric on the Extended Complex Plane
Lecture 20 - Introduction to Hurwitz's Theorem for Normal Convergence of Holomorphic Functions in the Spherical
Lecture 21 - Completion of Proof of Hurwitz's Theorem for Normal Limits of Analytic Functions in the Spherical
Lecture 22 - Hurwitz's Theorem for Normal Limits of Meromorphic Functions in the Spherical Metric
Lecture 23 - What could the Derivative of a Meromorphic Function Relative to the Spherical Metric Possibly Be?
Lecture 24 - Defining the Spherical Derivative of a Meromorphic Function
Lecture 25 - Well-definedness of the Spherical Derivative of a Meromorphic Function at a Pole and Inversion-in-
Lecture 26 - Topological Preliminaries - Translating Compactness into Boundedness
Lecture 27 - Introduction to the Arzela-Ascoli Theorem - Passing from abstract Compactness to verifiable Equi-
Lecture 28 - Proof of the Arzela-Ascoli Theorem for Functions - Abstract Compactness Implies Equicontinuity
Lecture 29 - Proof of the Arzela-Ascoli Theorem for Functions - Equicontinuity Implies Compactness

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NPTEL Video Course - Mathematics - NOC: Introduction to Commutative Algebra

Subject Co-ordinator - Prof. A.V. Jayanthan
Co-ordinating Institute - IIT - Madras
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Lecture 1 - Review of Ring Theory
Lecture 2 - Review of Ring Theory (Continued...)
Lecture 3 - Ideals in commutative rings
Lecture 4 - Operations on ideals
Lecture 5 - Properties of prime ideals
Lecture 6 - Colon and Radical of ideals
Lecture 7 - Radicals, extension and contraction of ideals
Lecture 8 - Modules and homomorphisms
Lecture 9 - Isomorphism theorems and Operations on modules
Lecture 10 - Operations on modules (Continued...)
Lecture 11 - Module homomorphism and determinant trick
Lecture 12 - Nakayama’s lemma and exact sequences
Lecture 13 - Exact sequences (Continued...)
Lecture 14 - Homomorphisms and Tensor products
Lecture 15 - Properties of tensor products
Lecture 16 - Properties of tensor products (Continued...)
Lecture 17 - Tensor product of Algebras
Lecture 18 - Localization
Lecture 19 - Localization (Continued...)
Lecture 20 - Local properties
Lecture 21 - Further properties of localization
Lecture 22 - Intergral dependence
Lecture 23 - Integral extensions
Lecture 24 - Lying over and Going-up theorems
Lecture 25 - Going-down theorem
Lecture 26 - Going-down theorem (Continued...)
Lecture 27 - Chain conditions
Lecture 28 - Noetherian and Artinian modules
Lecture 29 - Properties of Noetherian and Artinian modules, Composition Series

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Lecture 30 - Further properties of Noetherian and Artinian modules and rings
Lecture 31 - Hilbert basis theorem and Primary decomposition
Lecture 32 - Primary decomposition (Continued...)
Lecture 33 - Uniqueness of primary decomposition
Lecture 34 - 2nd Uniqueness theorem, Artinian rings
Lecture 35 - Properties of Artinian rings
Lecture 36 - Structure Theorem of Artinian rings
Lecture 37 - Noether Normalization
Lecture 38 - Hilberts Nullstellensatz
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NPTEL Video Course - Mathematics - NOC:Differential Equations

Subject Co-ordinator - Prof. Srinivasa Manam

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable  |  MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Ordinary Differential Equations (ODE)
Lecture 2 - Methods for First Order ODE's - Homogeneous Equations
Lecture 3 - Methods for First order ODE's - Exact Equations
Lecture 4 - Methods for First Order ODE's - Exact Equations (Continued...)
Lecture 5 - Methods for First order ODE's - Reducible to Exact Equations
Lecture 6 - Methods for First order ODE's - Reducible to Exact Equations (Continued...)
Lecture 7 - Non-Exact Equations - Finding Integrating Factors
Lecture 8 - Linear First Order ODE and Bernoulli's Equation
Lecture 9 - Introduction to Second order ODE's
Lecture 10 - Properties of solutions of second order homogeneous ODE's
Lecture 11 - Abel's formula to find the other solution
Lecture 12 - Abel's formula - Demonstration
Lecture 13 - Second Order ODE's with constant coefficients
Lecture 14 - Euler - Cauchy equation
Lecture 15 - Non homogeneous ODEs Variation of Parameters
Lecture 16 - Method of undetermined coefficients
Lecture 17 - Demonstration of Method of undetermined coefficients
Lecture 18 - Power Series and its properties
Lecture 19 - Power Series Solutions to Second Order ODE's
Lecture 20 - Power Series Solutions (Continued...)
Lecture 21 - Legendre Differential Equation
Lecture 22 - Legendre Polynomials
Lecture 23 - Properties of Legendre Polynomials
Lecture 24 - Power series solutions around a regular singular point
Lecture 25 - Frobenius method of solutions
Lecture 26 - Frobenius method of solutions (Continued...)
Lecture 27 - Examples on Frobenius method
Lecture 28 - Bessel differential equation
Lecture 29 - Frobenius solutions for Bessel Equation

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NPTEL Video Course - Mathematics - NOC: Numerical Analysis

Subject Co-ordinator - Prof. R. Usha

Co-ordinating Institute - IIT - Madras

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

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Lecture 21 - Numerical Integration - 4 Composite Simpsons Rule , Error Method of Undetermined Coefficients
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NPTEL Video Course - Mathematics - NOC: Graph Theory

Subject Co-ordinator - Dr. Soumen Maity

Co-ordinating Institute - IISER - Pune

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Lecture 1 - Basic Concepts
Lecture 2 - Basic Concepts - 1
Lecture 3 - Eulerian and Hamiltonian Graph
Lecture 4 - Eulerian and Hamiltonian Graph - 1
Lecture 5 - Bipartite Graph
Lecture 6 - Bipartite Graph
Lecture 7 - Diameter of a graph; Isomorphic graphs
Lecture 8 - Diameter of a graph; Isomorphic graphs
Lecture 9 - Minimum Spanning Tree
Lecture 10 - Minimum Spanning Trees (Continued...)
Lecture 11 - Minimum Spanning Trees (Continued...)
Lecture 12 - Minimum Spanning Trees (Continued...)
Lecture 13 - Maximum Matching in Bipartite Graph
Lecture 14 - Maximum Matching in Bipartite Graph - 1
Lecture 15 - Hall's Theorem and Konig's Theorem
Lecture 16 - Hall's Theorem and Konig's Theorem - 1
Lecture 17 - Independent Set and Edge Cover
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Lecture 19 - Matching in General Graphs
Lecture 20 - Proof of Halls Theorem
Lecture 21 - Stable Matching
Lecture 22 - Gale-Shapley Algorithm
Lecture 23 - Graph Connectivity
Lecture 24 - Graph Connectivity - 1
Lecture 25 - 2-Connected Graphs
Lecture 26 - 2-Connected Graphs - 1
Lecture 27 - Subdivision of an edge; 2-edge-connected graphs
Lecture 28 - Problems Related to Graphs Connectivity
Lecture 29 - Flow Network
Lecture 30 - Residual Network and Augmenting Path
Lecture 31 - Augmenting Path Algorithm
Lecture 32 - Max-Flow and Min-Cut
Lecture 33 - Max-Flow and Min-Cut Theorem
Lecture 34 - Vertex Colouring
Lecture 35 - Chromatic Number and Max. Degree
Lecture 36 - Edge Colouring
Lecture 37 - Planar Graphs and Euler's Formula
Lecture 38 - Characterization Of Planar Graphs
Lecture 39 - Colouring of Planar Graphs
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NPTEL Video Course - Mathematics - NOC: Transform Techniques for Engineers

Subject Co-ordinator - Prof. Srinivasa Manam
Co-ordinating Institute - IIT - Madras
Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Fourier series
Lecture 2 - Fourier series - Examples
Lecture 3 - Complex Fourier series
Lecture 4 - Conditions for the Convergence of Fourier Series
Lecture 5 - Conditions for the Convergence of Fourier Series (Continued...)
Lecture 6 - Use of Delta function in the Fourier series convergence
Lecture 7 - More Examples on Fourier Series of a Periodic Signal
Lecture 8 - Gibb's Phenomenon in the Computation of Fourier Series
Lecture 9 - Properties of Fourier Transform of a Periodic Signal
Lecture 10 - Properties of Fourier transform (Continued...)
Lecture 11 - Parseval's Identity and Recap of Fourier series
Lecture 12 - Fourier integral theorem - an informal proof
Lecture 13 - Definition of Fourier transforms
Lecture 14 - Fourier transform of a Heavyside function
Lecture 15 - Use of Fourier transforms to evaluate some integrals
Lecture 16 - Evaluation of an integral - Recall of complex function theory
Lecture 17 - Properties of Fourier transforms of non-periodic signals
Lecture 18 - More properties of Fourier transforms
Lecture 19 - Fourier integral theorem - proof
Lecture 20 - Application of Fourier transform to ODE's
Lecture 21 - Application of Fourier transforms to differential and integral equations
Lecture 22 - Evaluation of integrals by Fourier transforms
Lecture 23 - D'Alembert's solution by Fourier transform
Lecture 24 - Solution of Heat equation by Fourier transform
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Lecture 27 - Laplace transform of elementary functions
Lecture 28 - Properties of Laplace transforms
Lecture 29 - Properties of Laplace transforms (Continued...)

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Lecture 30 - Methods of finding inverse Laplace transform
Lecture 31 - Heavyside expansion theorem
Lecture 32 - Review of complex function theory
Lecture 33 - Inverse Laplace transform by contour integration
Lecture 34 - Application of Laplace transforms - ODEs'
Lecture 35 - Solutions of initial or boundary value problems for ODEs'
Lecture 36 - Solving first order PDE's by Laplace transform
Lecture 37 - Solution of wave equation by Laplace transform
Lecture 38 - Solving hyperbolic equations by Laplace transform
Lecture 39 - Solving heat equation by Laplace transform
Lecture 40 - Initial boundary value problems for heat equations
Lecture 41 - Solution of Integral Equations by Laplace Transform
Lecture 42 - Evaluation of Integrals by Laplace Transform
Lecture 43 - Introduction to Z-Transforms
Lecture 44 - Properties of Z-Transforms
Lecture 45 - Inverse Z-transforms
Lecture 46 - Solution of difference equations by Z-transforms
Lecture 47 - Evaluation of infinite sums by Z-transforms
Lecture 48 - conclusions
NPTEL Video Course - Mathematics - NOC: Introduction to Probability and Statistics

Subject Co-ordinator - Prof. G. Srinivasan

Co-ordinating Institute - IIT - Madras

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Lecture 1 - Introduction to probability and Statistics
Lecture 2 - Types of data
Lecture 3 - Categorical data
Lecture 4 - Describing Categorical data
Lecture 5 - Describing Categorical data (Continued...)
Lecture 6 - Describing numerical data
Lecture 7 - Describing numerical data (Continued...)
Lecture 8 - Exercises, Association between categorical variables
Lecture 9 - Association between categorical variables (Continued...)
Lecture 10 - Association between numerical variables
Lecture 11 - Association between numerical variables (Continued...)
Lecture 12 - Probability
Lecture 13 - Rules of Probability
Lecture 14 - Rules of Probability (Continued...)
Lecture 15 - Conditional Probability
Lecture 16 - Random variables
Lecture 17 - Random variables - concepts and exercises
Lecture 18 - Association between Random variables
Lecture 19 - Binomial Distribution
Lecture 20 - Normal distribution
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NPTEL Video Course - Mathematics - NOC: Groups: Motion, Symmetry and Puzzles

Subject Co-ordinator - Prof. Amit Kulshrestha

Co-ordinating Institute - IIT - Madras

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Lecture 1 - Permutation, symmetry and groups
Lecture 2 - Groups acting on a set/an object
Lecture 3 - More on group actions
Lecture 4 - Groups and parity
Lecture 5 - Parity and puzzles
Lecture 6 - Generators and relations
Lecture 7 - Cosets, quotients and homomorphisms
Lecture 8 - Cayley graphs of groups
Lecture 9 - Platonic solids
Lecture 10 - Symmetries of plane and wallpapers
Lecture 11 - Introduction to GAP
Lecture 12 - GAP through Rubik's cube
Lecture 13 - Representing abstract groups
Lecture 14 - A quick introduction to group representations
Lecture 15 - Rotations and quaternions
Lecture 16 - Rotational symmetries of platonic solids
Lecture 17 - Finite subgroups of SO(3)
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NPTEL Video Course - Mathematics - Discrete Mathematics

Subject Co-ordinator - Dr. Aditi Gangopadhyay, Dr. Sugata Gangopadhyay, Dr. Tanuja Srivastava

Co-ordinating Institute - IIT - Roorkee

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Lecture 1 - Introduction to the theory of sets
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 influence 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

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NPTEL Video Course - Mathematics - NOC: Mathematical Methods and its Applications

Subject Co-ordinator - Prof. P.N. Agarwal, S. K. Gupta

Co-ordinating Institute - IIT - Roorkee

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

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

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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
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Lecture 36 - Applications of Laplace transforms - I
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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
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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
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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
Lecture 7 - Fredholm integral equation with separable kernel
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
Lecture 11 - Fredholm integral equations with symmetric kernels
Lecture 12 - Fredholm integral equations with symmetric kernels
Lecture 13 - Fredholm integral equations with symmetric kernels
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
Lecture 22 - Classical Fredholm theory
Lecture 23 - Classical Fredholm theory
Lecture 24 - Method of successive approximations
Lecture 25 - Neumann series and resolvent kernels - I
Lecture 26 - Neumann series and resolvent kernels - II
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Lecture 44 - Euler equation
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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
NPTEL Video Course - Mathematics - NOC:Nonlinear Programming

Subject Co-ordinator - S. K. Gupta

Co-ordinating Institute - IIT - Roorkee

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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
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NPTEL Video Course - Mathematics - NOC: Numerical Methods

Subject Co-ordinator - Prof. Sanjeev Kumar, Prof. Ameeya Kumar Nayak
Co-ordinating Institute - IIT - Roorkee

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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 formulas)
Lecture 20 - Interpolation - Part V (Solving problems using Newton's Forward and Backward difference formulas)
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 formulas)
Lecture 26 - Numerical differentiation - Part II (Numerical differentiation based on Lagrange’s interpolation formulas)
Lecture 27 - Numerical differentiation - Part III (Numerical differentiation based on Divided difference formulas)
Lecture 28 - Numerical differentiation - Part IV (Maxima and minima of a tabulated function and differentiation formula)
Lecture 29 - Numerical differentiation - Part V (Differentiation based on finite difference operators)

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Lecture 30 - Numerical differentiation - Part VI (Method of undetermined coefficients and Derivatives with unequal intervals)
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)
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
Lecture 38 - Numerical Methods - II
Lecture 39 - R-K Methods for solving ODEs
Lecture 40 - Multi-step Method for solving ODEs
NPTEL Video Course - Mathematics - NOC: Numerical Linear Algebra

Subject Co-ordinator - Prof. D. N Pandey, Prof. P. N. Agrawal

Co-ordinating Institute - IIT - Roorkee

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Matrix Operations and Types of Matrices
Lecture 2 - Determinant of a Matrix
Lecture 3 - Rank of a Matrix
Lecture 4 - Vector Space - I
Lecture 5 - Vector Space - II
Lecture 6 - Linear dependence and independence
Lecture 7 - Bases and Dimension - I
Lecture 8 - Bases and Dimension - II
Lecture 9 - Linear Transformation - I
Lecture 10 - Linear Transformation - II
Lecture 11 - Orthogonal Subspaces
Lecture 12 - Row Space, Column Space and Null Space
Lecture 13 - Eigen Values and Eigen Vectors - I
Lecture 14 - Eigen Values and Eigen Vectors - II
Lecture 15 - Diagonalizable Matrices
Lecture 16 - Orthogonal Sets
Lecture 17 - Gram Schmidt orthogonalization and orthogonal bases
Lecture 18 - Introduction to Matlab
Lecture 19 - Sign Integer Representation
Lecture 20 - Computer Representation of Numbers
Lecture 21 - Floating Point Representation
Lecture 22 - Round-off Error
Lecture 23 - Error Propagation in Computer Arithmetic
Lecture 24 - Addition and Multiplication of Floating Point Numbers
Lecture 25 - Conditioning and Condition Numbers - I
Lecture 26 - Conditioning and Condition Numbers - II
Lecture 27 - Stability of Numerical Algorithms - I
Lecture 28 - Stability of Numerical Algorithms - II
Lecture 29 - Vector Norms - I

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Lecture 30 - Vector Norms - II
Lecture 31 - Matrix Norms - I
Lecture 32 - Matrix Norms - II
Lecture 33 - Convergent Matrices - I
Lecture 34 - Convergent Matrices - II
Lecture 35 - Stability of non linear system
Lecture 36 - Condition number of a matrix
Lecture 37 - Sensitivity Analysis - I
Lecture 38 - Sensitivity Analysis - II
Lecture 39 - Residual Theorem
Lecture 40 - Nearness to Singularity
Lecture 41 - Estimation of the Condition Number
Lecture 42 - Singular value decomposition of a matrix - I
Lecture 43 - Singular value decomposition of a matrix - II
Lecture 44 - Orthonormal Projections
Lecture 45 - Algebraic and geometric properties of SVD
Lecture 46 - SVD and their applications
Lecture 47 - Perturbation theorem for singular values
Lecture 48 - Outer product expansion of a matrix
Lecture 49 - Least square solutions - I
Lecture 50 - Least square solutions - II
Lecture 51 - Householder matrices
Lecture 52 - Householder matrices and their applications
Lecture 53 - Householder QR factorization - I
Lecture 54 - Householder QR factorization - II
Lecture 55 - Basic theorems on eigenvalues and QR method
Lecture 56 - Power Method
Lecture 57 - Rate of Convergence of Power Method
Lecture 58 - Applications of Power Method with Shift
Lecture 59 - Jacobi Method - I
Lecture 60 - Jacobi Method - II
NPTEL Video Lecture Topic List - Created by LinuXpert Systems, Chennai

NPTEL Video Course - Mathematics - NOC: Numerical Methods - Finite Difference Approach

Subject Co-ordinator - Prof. Ameeya Kumar Nayak
Co-ordinating Institute - IIT - Roorkee
Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Numerical solutions
Lecture 2 - Numerical Solution of ODE
Lecture 3 - Numerical solution of PDE
Lecture 4 - Finite difference approximation
Lecture 5 - Polynomial fitting and one-sided approximation
Lecture 6 - Solution of parabolic equation
Lecture 7 - Implicit and C-N scheme for solving 1D parabolic equation
Lecture 8 - Stability analysis of Explicit scheme for solving parabolic equation
Lecture 9 - Stability of Crank-Nicoloson's scheme
Lecture 10 - Approximation of derivative boundary conditions
Lecture 11 - Solution of two-dimensional parabolic equation
Lecture 12 - Solution of 2D parabolic equation using ADI scheme
Lecture 13 - Solution of Elliptic Equation
Lecture 14 - Solution of Elliptic equation using SOR method
Lecture 15 - Solution of Elliptic equation using ADI scheme
Lecture 16 - Solution of Hyperbolic equation
Lecture 17 - Stability analysis for Hyperbolic equations
Lecture 18 - Characteristics of PDE
Lecture 19 - Lax-Wendroff's method
Lecture 20 - Wendroff's method
NPTEL Video Course - Mathematics - NOC: Multivariable Calculus

Subject Co-ordinator - Dr. Sanjeev Kumar, S. K. Gupta

Co-ordinating Institute - IIT - Roorkee

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Functions of several variables
Lecture 2 - Limits for multivariable functions - I
Lecture 3 - Limits for multivariable functions - II
Lecture 4 - Continuity of multivariable functions
Lecture 5 - Partial Derivatives - I
Lecture 6 - Partial Derivatives - II
Lecture 7 - Differentiability - I
Lecture 8 - Differentiability - II
Lecture 9 - Chain rule - I
Lecture 10 - Chain rule - II
Lecture 11 - Change of variables
Lecture 12 - Euler's theorem for homogeneous functions
Lecture 13 - Tangent planes and Normal lines
Lecture 14 - Extreme values - I
Lecture 15 - Extreme values - II
Lecture 16 - Lagrange multipliers
Lecture 17 - Taylor's theorem
Lecture 18 - Error approximation
Lecture 19 - Polar-curves
Lecture 20 - Multiple Integrals
Lecture 21 - Change Of Order Of Integration
Lecture 22 - Change of Variables in Multiple Integral
Lecture 23 - Introduction to Gamma Function
Lecture 24 - Introduction to Beta Function
Lecture 25 - Properties of Beta and Gamma Functions - I
Lecture 26 - Properties of Beta and Gamma Functions - II
Lecture 27 - Dirichlet's Integral
Lecture 28 - Applications of Multiple Integrals
Lecture 29 - Vector Differentiation

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Lecture 30 - Gradient of a Scalar Field and Directional Derivative
Lecture 31 - Normal Vector and Potential field
Lecture 32 - Gradient (Identities), Divergence and Curl (Identities)
Lecture 33 - Some Identities on Divergence and Curl
Lecture 34 - Line Integral (I)
Lecture 35 - Applications of Line Integrals
Lecture 36 - Green's Theorem
Lecture 37 - Surface Area
Lecture 38 - Surface Integral
Lecture 39 - Divergence Theorem of Gauss
Lecture 40 - Stoke's Theorem
Lecture 1 - Introduction to differential equations - I
Lecture 2 - Introduction to differential equations - II
Lecture 3 - Existence and uniqueness of solutions of differential equations - I
Lecture 4 - Existence and uniqueness of solutions of differential equations - II
Lecture 5 - Existence and uniqueness of solutions of differential equations - III
Lecture 6 - Existence and uniqueness of solutions of a system of differential equations
Lecture 7 - Linear System
Lecture 8 - Properties of Homogeneous Systems
Lecture 9 - Solution of Homogeneous Linear System with Constant Coefficients - I
Lecture 10 - Solution of Homogeneous Linear System with Constant Coefficients - II
Lecture 11 - Solution of Homogeneous Linear System with Constant Coefficients - III
Lecture 12 - Solution of Non-Homogeneous Linear System with Constant Coefficients
Lecture 13 - Power Series
Lecture 14 - Uniform Convergence of Power Series
Lecture 15 - Power Series Solution of Second Order Homogeneous Equations
Lecture 16 - Regular singular points - I
Lecture 17 - Regular singular points - II
Lecture 18 - Regular singular points - III
Lecture 19 - Regular singular points - IV
Lecture 20 - Regular singular points - V
Lecture 21 - Critical points
Lecture 22 - Stability of Linear Systems - I
Lecture 23 - Stability of Linear Systems - II
Lecture 24 - Stability of Linear Systems - III
Lecture 25 - Critical Points and Paths of Non-linear Systems
Lecture 26 - Boundary value problems for second order differential equations
Lecture 27 - Self - adjoint Forms
Lecture 28 - Sturm - Liouville problem and its properties
Lecture 29 - Sturm - Liouville problem and its applications
Lecture 30 - Green's function and its applications - I
Lecture 31 - Green's function and its applications - II
Lecture 32 - Origins and Classification of First Order PDE
Lecture 33 - Initial Value Problem for Quasi-linear First Order Equations
Lecture 34 - Existence and Uniqueness of Solutions
Lecture 35 - Surfaces orthogonal to a given system of surfaces
Lecture 36 - Nonlinear PDE of first order
Lecture 37 - Cauchy method of characteristics - I
Lecture 38 - Cauchy method of characteristics - II
Lecture 39 - Compatible systems of first order equations
Lecture 40 - Charpit's method - I
Lecture 41 - Charpit's method - II
Lecture 42 - Second Order PDE with Variable Coefficients
Lecture 43 - Classification and Canonical Form of Second Order PDE - I
Lecture 44 - Classification and Canonical Form of Second Order PDE - II
Lecture 45 - Classification and Characteristic Curves of Second Order PDEs
Lecture 46 - Review of Integral Transforms - I
Lecture 47 - Review of Integral Transforms - II
Lecture 48 - Review of Integral Transforms - III
Lecture 49 - Review of Integral Transforms - III
Lecture 50 - Laplace Equation - I
Lecture 51 - Laplace Equation - II
Lecture 52 - Laplace and Poisson Equations
Lecture 53 - One dimensional wave equation and its solution - I
Lecture 54 - One dimensional wave equation and its solution - II
Lecture 55 - One dimensional wave equation and its solution - III
Lecture 56 - Two dimensional wave equation and its solution - I
Lecture 57 - Solution of non-homogeneous wave equation
Lecture 58 - Solution of homogeneous diffusion equation - I
Lecture 59 - Solution of homogeneous diffusion equation - II
Lecture 60 - Duhamel's principle
NPTEL Video Course - Mathematics - NOC: Matrix Analysis with Applications

Subject Co-ordinator - Dr. Sanjeev Kumar, S. K. Gupta
Co-ordinating Institute - IIT - Roorkee

Sub-Titles - Available / Unavailable  |  MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Elementary row operations
Lecture 2 - Echelon form of a matrix
Lecture 3 - Rank of a matrix
Lecture 4 - System of Linear Equations - I
Lecture 5 - System of Linear Equations - II
Lecture 6 - Introduction to Vector Spaces
Lecture 7 - Subspaces
Lecture 8 - Basis and Dimension
Lecture 9 - Linear Transformations
Lecture 10 - Rank and Nullity
Lecture 11 - Inverse of a Linear Transformation
Lecture 12 - Matrix Associated with a LT
Lecture 13 - Eigenvalues and Eigenvectors
Lecture 14 - Cayley-Hamilton Theorem and Minimal Polynomial
Lecture 15 - Diagonalization
Lecture 16 - Special Matrices
Lecture 17 - More on Special Matrices and Gerschgorin Theorem
Lecture 18 - Inner Product Spaces
Lecture 19 - Vector and Matrix Norms
Lecture 20 - Gram Schmidt Process
Lecture 21 - Normal Matrices
Lecture 22 - Positive Definite Matrices
Lecture 23 - Positive Definite and Quadratic Forms
Lecture 24 - Gram Matrix and Minimization of Quadratic Forms
Lecture 25 - Generalized Eigenvectors and Jordan Canonical Form
Lecture 26 - Evaluation of Matrix Functions
Lecture 27 - Least Square Approximation
Lecture 28 - Singular Value Decomposition
Lecture 29 - Pseudo-Inverse and SVD

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Lecture 30 - Introduction to Ill-Conditioned Systems
Lecture 31 - Regularization of Ill-Conditioned Systems
Lecture 32 - Linear Systems
Lecture 33 - Linear Systems
Lecture 34 - Non-Stationary Iterative Methods
Lecture 35 - Non-Stationary Iterative Methods
Lecture 36 - Krylov Subspace Iterative Methods (Conjugate Gradient Method)
Lecture 37 - Krylov Subspace Iterative Methods (CG and Pre-Conditioning)
Lecture 38 - Introduction to Positive Matrices
Lecture 39 - Positive Matrices, Positive Eigenpair, Perron Root and vector, Example
Lecture 40 - Polar Decomposition

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NPTEL Video Lecture Topic List - Created by LinuXpert Systems, Chennai

NPTEL Video Course - Mathematics - NOC:Mathematical Modelling: Analysis and Applications

Subject Co-ordinator - Prof. Ameeya Kumar Nayak

Co-ordinating Institute - IIT - Roorkee

Sub-Titles - Available / Unavailable  |  MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Mathematical Modeling
Lecture 2 - Discrete Time Linear Models in Population Dynamics - I
Lecture 3 - Discrete Time Linear Models in Population Dynamics - II
Lecture 4 - Discrete Time Linear Age Structured Models
Lecture 5 - Numerical Methods to Compute Eigen Values
Lecture 6 - Discrete Time Non-Linear Models in Population Dynamics - II
Lecture 7 - Analysis on Logistic Difference Equation
Lecture 8 - Classifications of Bifurcation
Lecture 9 - Discrete Time Non-Linear Models in Population Dynamics - II
Lecture 10 - Discrete Time Prey - Predator Model
Lecture 11 - Introduction to Continuous Time Models
Lecture 12 - Solution of First Order First Degree Differential Equations
Lecture 13 - Continuous Time Models in Population Dynamics - I
Lecture 14 - Continuous Time Models in Population Dynamics - II
Lecture 15 - Stability and Linearization of System of Ordinary Differential Equations
Lecture 16 - Continuous Time Single Species Models
Lecture 17 - Qualitative Solution of Differential Equations - Phase Diagrams - I
Lecture 18 - Qualitative Solution of Differential Equations - Phase Diagrams - II
Lecture 19 - Continuous Time Lotka - Volterra Competition Model
Lecture 20 - Continuous Time Prey - Predator Model

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Lecture 30 - Lyapunov Stability - II
Lecture 31 - Introduction to Control Systems - I
Lecture 32 - Introduction to Control Systems - II
Lecture 33 - Controllability of Autonomous Systems
Lecture 34 - Controllability of Non-autonomous Systems
Lecture 35 - Observability - I
Lecture 36 - Observability - II
Lecture 37 - Results on Controllability and Observability
Lecture 38 - Companion Form
Lecture 39 - Feedback Control - I
Lecture 40 - Feedback Control - II
Lecture 41 - Feedback Control - III
Lecture 42 - Feedback Control - IV
Lecture 43 - State Observer
Lecture 44 - Stabilizability
Lecture 45 - Introduction to Discrete Systems - I
Lecture 46 - Introduction to Discrete Systems - II
Lecture 47 - Lyapunov Stability Theory - I
Lecture 48 - Lyapunov Stability Theory - II
Lecture 49 - Lyapunov Stability Theory - III
Lecture 50 - Optimal Control - I
Lecture 51 - Optimal Control - II
Lecture 52 - Optimal Control - III
Lecture 53 - Optimal Control - IV
Lecture 54 - Optimal Control for Discrete Systems - I
Lecture 55 - Optimal Control for Discrete Systems - II
Lecture 56 - Controllability of Discrete Systems
Lecture 57 - Observability of Discrete Systems
Lecture 58 - Stability for Discrete Systems
Lecture 59 - Relation between Continuous and Discrete Systems - I
Lecture 60 - Relation between Continuous and Discrete Systems - II
NPTEL Video Course - Mathematics - NOC: Advanced Engineering Mathematics

Subject Co-ordinator - Prof. P.N. Agarwal

Co-ordinating Institute - IIT - Roorkee

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

| Lecture 1 | Analytic Function |
| Lecture 2 | Cauchy-Riemann Equations |
| Lecture 3 | Harmonic Functions, Harmonic Conjugates and Milne's Method |
| Lecture 4 | Applications to the Problems of Potential Flow - I |
| Lecture 5 | Applications to the Problems of Potential Flow - II |
| Lecture 6 | Complex Integration |
| Lecture 7 | Cauchy's Theorem - I |
| Lecture 8 | Cauchy's Theorem - II |
| Lecture 9 | Cauchy's Integral Formula for the Derivatives of Analytic Function |
| Lecture 10 | Morera's Theorem, Liouville's Theorem and Fundamental Theorem of Algebra |
| Lecture 11 | Winding Number and Maximum Modulus Principle |
| Lecture 12 | Sequences and Series |
| Lecture 13 | Uniform Convergence of Series |
| Lecture 14 | Power Series |
| Lecture 15 | Taylor Series |
| Lecture 16 | Laurent Series |
| Lecture 17 | Zeros and Singularities of an Analytic Function |
| Lecture 18 | Residue at a Singularity |
| Lecture 19 | Residue Theorem |
| Lecture 20 | Meromorphic Functions |
| Lecture 21 | Evaluation of real integrals using residues - I |
| Lecture 22 | Evaluation of real integrals using residues - II |
| Lecture 23 | Evaluation of real integrals using residues - III |
| Lecture 24 | Evaluation of real integrals using residues - IV |
| Lecture 25 | Evaluation of real integrals using residues - V |
| Lecture 26 | Bilinear Transformations |
| Lecture 27 | Cross Ratio |
| Lecture 28 | Conformal Mapping - I |
| Lecture 29 | Conformal Mapping - II |

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NPTEL Video Course - Mathematics - Advanced Matrix Theory and Linear Algebra for Engineers

Subject Co-ordinator - Prof. Vittal Rao

Co-ordinating Institute - IISc - Bangalore

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Prologue - Part 1
Lecture 2 - Prologue - Part 2
Lecture 3 - Prologue - Part 3
Lecture 4 - Linear Systems - Part 1
Lecture 5 - Linear Systems - Part 2
Lecture 6 - Linear Systems - Part 3
Lecture 7 - Linear Systems - Part 4
Lecture 8 - Vector Spaces - Part 1
Lecture 9 - Vector Spaces - Part 2
Lecture 10 - Linear Independence and Subspaces - Part 1
Lecture 11 - Linear Independence and Subspaces - Part 2
Lecture 12 - Linear Independence and Subspaces - Part 3
Lecture 13 - Linear Independence and Subspaces - Part 4
Lecture 14 - Basis - Part 1
Lecture 15 - Basis - Part 2
Lecture 16 - Basis - Part 3
Lecture 17 - Linear Transformations - Part 1
Lecture 18 - Linear Transformations - Part 2
Lecture 19 - Linear Transformations - Part 3
Lecture 20 - Linear Transformations - Part 4
Lecture 21 - Linear Transformations - Part 5
Lecture 22 - Inner Product and Orthogonality - Part 1
Lecture 23 - Inner Product and Orthogonality - Part 2
Lecture 24 - Inner Product and Orthogonality - Part 3
Lecture 25 - Inner Product and Orthogonality - Part 4
Lecture 26 - Inner Product and Orthogonality - Part 5
Lecture 27 - Inner Product and Orthogonality - Part 6
Lecture 28 - Diagonalization - Part 1
Lecture 29 - Diagonalization - Part 2

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Lecture 30 - Stability Equilibrium Points
Lecture 31 - Stability Equilibrium Points (Continued - I)
Lecture 32 - Stability Equilibrium Points (Continued - II)
Lecture 33 - Second Order Linear Equations (Continued - III)
Lecture 34 - Lyapunov Function
Lecture 35 - Lyapunov Function (Continued...)
Lecture 36 - Periodic Orbits and Poincare Bendixon Theory
Lecture 37 - Periodic Orbits and Poincare Bendixon Theory (Continued...)
Lecture 38 - Linear Second Order Equations
Lecture 39 - General Second Order Equations
Lecture 40 - General Second Order Equations (Continued...)
NPTEL Video Course - Mathematics - NOC: Linear Algebra

Subject Co-ordinator - Prof. Dilip P. Patil
Co-ordinating Institute - IISc - Bangalore

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

Lecture 1 - Introduction to Algebraic Structures - Rings and Fields
Lecture 2 - Definition of Vector Spaces
Lecture 3 - Examples of Vector Spaces
Lecture 4 - Definition of subspaces
Lecture 5 - Examples of subspaces
Lecture 6 - Examples of subspaces (Continued...)
Lecture 7 - Sum of subspaces
Lecture 8 - System of linear equations
Lecture 9 - Gauss elimination
Lecture 10 - Generating system, linear independence and bases
Lecture 11 - Examples of a basis of a vector space
Lecture 12 - Review of univariate polynomials
Lecture 13 - Examples of univariate polynomials and rational functions
Lecture 14 - More examples of a basis of vector spaces
Lecture 15 - Vector spaces with finite generating system
Lecture 16 - Steinitz exchange theorem and examples
Lecture 17 - Examples of finite dimensional vector spaces
Lecture 18 - Dimension formula and its examples
Lecture 19 - Existence of a basis
Lecture 20 - Existence of a basis (Continued...)
Lecture 21 - Existence of a basis (Continued...)
Lecture 22 - Introduction to Linear Maps
Lecture 23 - Examples of Linear Maps
Lecture 24 - Linear Maps and Bases
Lecture 25 - Pigeonhole principle in Linear Algebra
Lecture 26 - Interpolation and the rank theorem
Lecture 27 - Examples
Lecture 28 - Direct sums of vector spaces
Lecture 29 - Projections

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