Managerial Accounting
Prof. Dr. Varadraj Bapat
School of Management
Indian Institute of Technology, Bombay

Module - 10
Lecture - 24
Equivalent Production & Activity Based Costing

So, dear students we are discussing about job and process costing. In last few sessions you know now that, the job costing is typically used for relatively small quantity customer oriented output. So, in the last session we had seen how to make a cost sheet. So, we take 1 job go on adding all the costs incurred for that job and a separate cost sheet is required to be produced to get the cost of that job.

In process costing it is relatively simple because it is a massed production all goods are same they are not being made for the customer they are being made in identical goods in larger quantities. So, we make process accounts we charge the entire cost to that process account we divided by number of units to get the cost per unit. This is basics are clear to you next we see saw the concept of abnormal and normal loss. So, what happens is in many of the processes because of technical specifications input is not same as output. So, if you put in 100 units the output is 95 units.

So, it is inherent that 5 units are loss such loss is treated as normal loss can you give an example where such normal loss happens. In most of the machining processes, if you put in some raw material some of the material will be scrapped out and the output will be of lesser weight than what you put in. So, there will be some normal loss depending on what you are producing now when you put in 100 units. But, you get out 95 units you will charge the customers for the whole of the 100 units. That is why your total cost you will divide by 95 to get the cost per unit. Is it clear? That is why normal loss we charged to the customer suppose instead of 95 units I can produce only 92 units because of some mistakes made by the workers.

Now, this 3 units cannot be charged to the customer they have to be borne by the company. So, the total cost I still divide by 95 and I get cost per unit for 92 units I charged the customer and for the 3 units they are transferred to P and L account. That is why in process accounts we have to segregate the cost of abnormal loss and the cost of

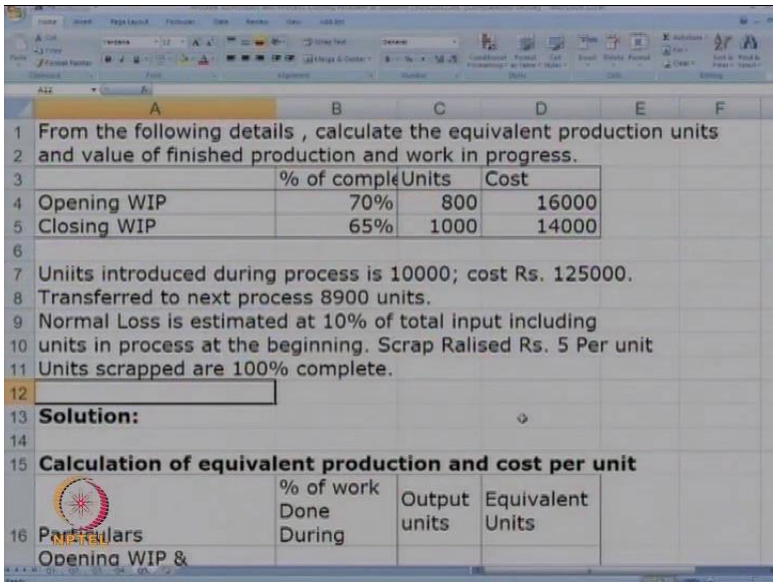
finished goods you are getting. So, abnormal loss it is a situation where actual loss is more than the normal loss sometimes reverse happens that I expect output of 95 actually I get output of 96. So, this 1 unit extra will be treated as a abnormal gain this is a gain to the company it need not be passed on to the customer. So, total cost is still divided by normal output which is 95. I get cost per unit and that cost per unit into 96 is charged to the customer 1 unit which I have gained will be credited to P and L account.

So, in the last session we had done 2 cases where in we are dealt with abnormal normal losses and abnormal gain. Now, there is 1 more issue involved in process costing that there may be some units which remain as a opening or closing stock at the level of each process. Now, you know that the total cost of the process let us say 100000 we are dividing it by 95 units because that is the output. But, instead of having full output of 95 we may have 3 units which are in process. So, neither they are raw material nor they are fully finished. So, I cannot treat them as 0 I cannot treat them as fully finished units also that is why I have to convert these units into equivalent units.

So I will look at these 3 units if I feel that they are 50 percent finished I will treat them as 1 point 5 units ready. So, my output will be 95 plus 1.5 further what may happen is these 3 units element wise may be fully or partly finished. For example, they may be fully finished as far as material concerned because generally material is putting at the beginning and then the conversion process starts. So, material wise they may be fully finished, but labor and overhead wise they may be only 50 percent finished. So, for material I take them as equivalent to 3, but for labor I take them as equivalent to 50 percent of 3. That is 1.5 this was a concept of equivalent production which we discussed towards end of the last session are you getting me.

So, now we will start with a case on that equivalent production and then we will go to operation costing a little bit discussion on operation costing. Now, let us look at the case on equivalent production.

(Refer Slide Time: 05:58)



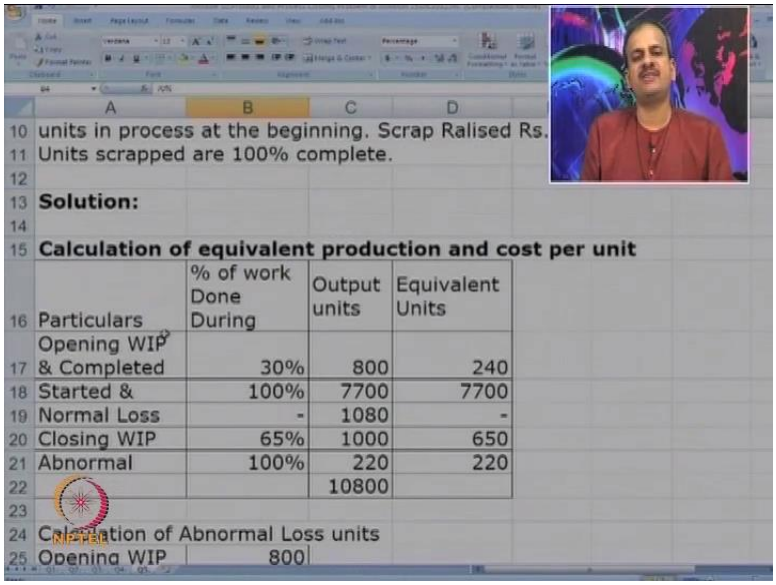
Now, here you can see that from the following data you are required to calculate the equivalent output and the value of finished goods and the work in progress is given. So, as far as the opening work in progress is concerned the percentage completion is 70 percent closing work in progress is 65 percent. The units are 8000 and the costs both are given I hope you are getting what is work in progress. So, this is the output which is not ready is partly finished at the end of the period.

So, you have both out opening and closing w I p now units introduced during the process are 10000 the cost is given 100000 25000 transfer to next process is only 8000 900. So, I have put in 10 I have sent out it 8000 900. The normal loss is estimated at 10 percent of the total input including units in the process at the beginning scrap is realized at 5 per unit and the units scrapped are also 100 percent complete. Now, we have to calculate the number of equivalent units and what is the cost of equivalent units, So, how you will you go about So, for each item like say material labor overheads. We have to look what is the number of units let us look at the calculation.

So, please make a chart like this with particulars percentage of work done and output units and the equivalent units. Now, first we start with opening work in progress it is already given that they were 70 percent complete. That means, in the last process itself last time itself 70 percent of the work was done not in the last process in the last period.

Say I am in the month of may then in the month of April 70 percent of these units were anywhere ready.

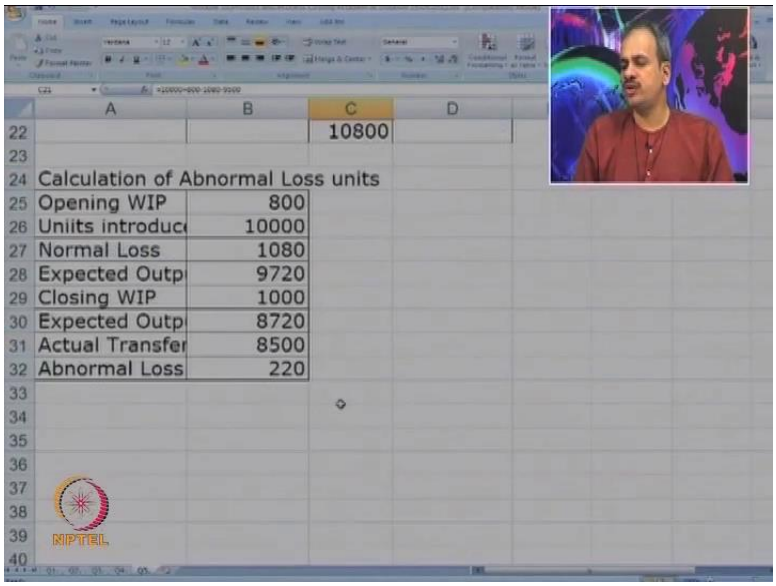
(Refer Slide Time: 08:11)



So, what I have done is I have only work 30 percent more that is why on opening work in progress and completed. I take the percentage work done as only 70 the number of units are given as 800. So, 800 into 30 70 is done 30 percent more was done in the current period; so 800 into 30. So, equivalent units are 240 getting. Now, new units which are started and completed we as yet do not know how much was completed. But, you know that the total output is 8000 900. So, of 8000 900 800 must have been from opening work in progress getting me.

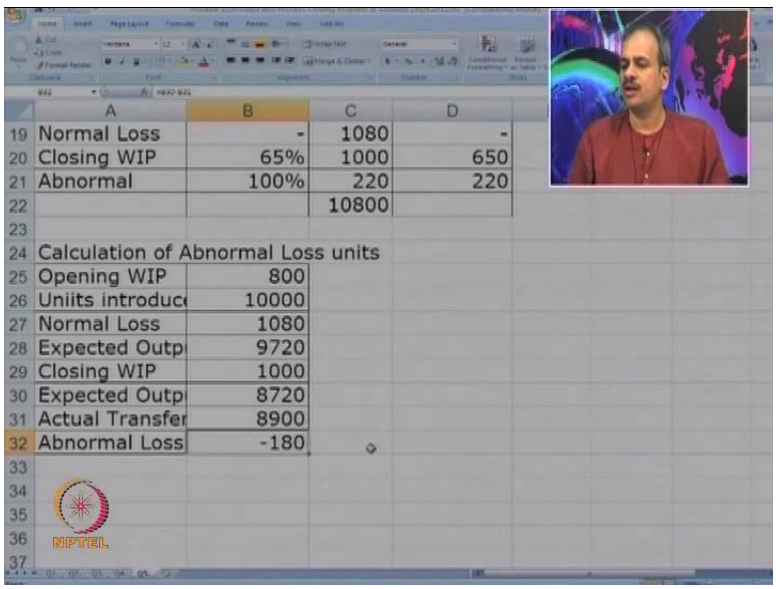
So, remaining might be started and completed let us also look at the normal loss normal loss. It is very clearly given that it is to be estimated at 10 percent of total input including units in process at the beginning. So the total input is 10000 units in the beginning is 800. So, 10000 plus 800 into 10 percent; so 10 percent of that that is 1 0 8 0 closing work in progress is given as 1000 it is also mentioned that it is 65 percent complete; so 1000 into 65 percent so I get 65. Now I will also have to calculate abnormal loss.

(Refer Slide Time: 09:50)



Now, abnormal loss units calculation you can see that opening work in progress was 800 units introduced is 10000. The normal loss is 10 800. So, expected output was 9 7 2 0 you are getting me, so 10000 plus 800 minus 1 0 8 0. So, if I would have fully finished that I should have expected output of 9 7 2 0 closing work in progress which is again given is 1000. So, out of 9 7 2 0 1000 units are incomplete. So, expected output after reducing work in progress become 8 7 2 0. So, 8 7 2 0 units must have been finished for transfer to next process, but actually transferred units are given to be only 8000 a 900 I am sorry here there is a small mistake.

(Refer Slide Time: 10:55)



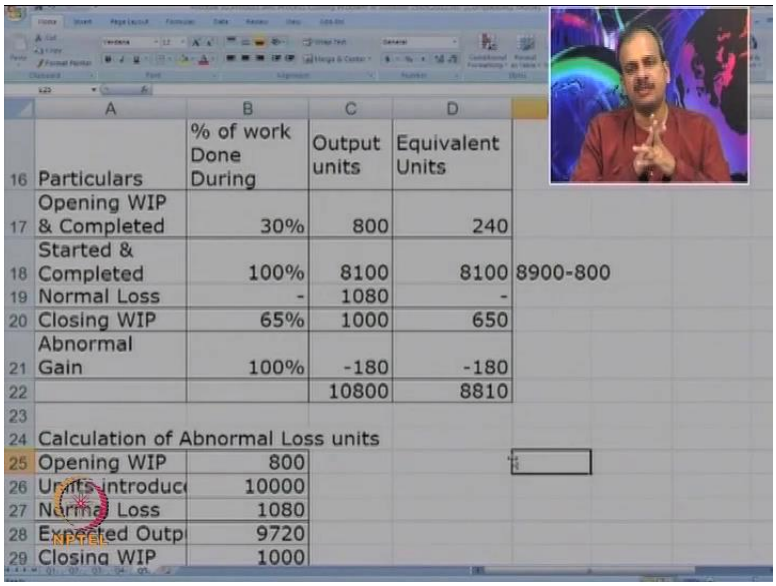
So, a 8000 900 units have been transferred. So, I get abnormal loss as minus 1 70. In other words there is no abnormal loss really speaking there is a abnormal gain. So, where I expect a output of 8 7 2 0 I have got a output of 8000 900. So, in other words there is a abnormal gain of 180. Now, let us go up here there is 1 mistake also with the units started and completed. You know that the total output is 8000 900 of that 800 is from opening w I p. So, remaining 8000 100 must be from the current output.

So, I will just show the calculation for the more clarity total output is 8 9 0 0 minus 800. So, the units which were newly put in and completed comes to 8 1 0 0 and there is a abnormal gain. And there is no abnormal loss as such and this abnormal gain we have just now calculated is to the tune of 1 8 0. Now, let us look at the output and percentages. So, of the total production 800 was the opening w I p we have worked only 30 percent on it.

So, equivalent units are 240 started and completed there are 8000 100 units which are all fresh raw material introduced fully completes. So, they are 100 percent. So, I get equivalent output as 8000 100 normal loss is 1 0 8 0 10 percent of input plus opening w I p a I will put dash. Because, no work can be taken as it even if it was given that units scrapped are 100 percent complete. We do not take in the equivalent output because they are to be charged to the customer.

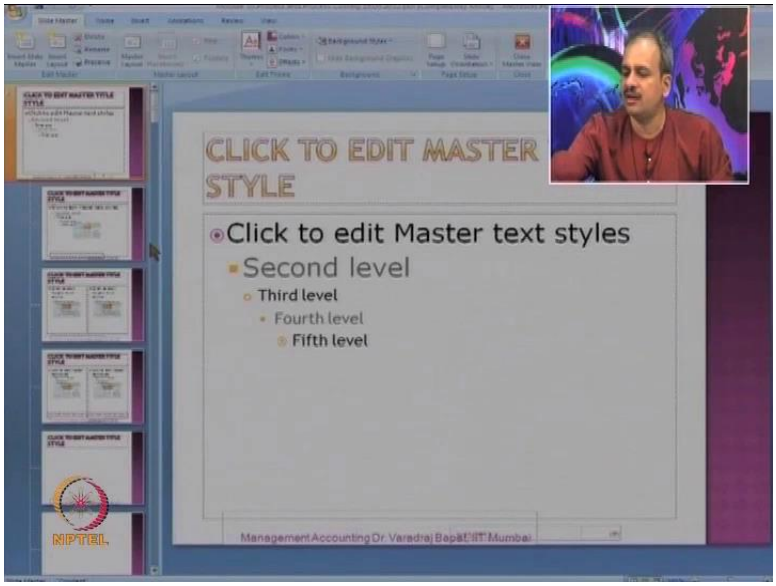
So, we have to be take it as nil only closing w I p is 1000, 65 percent complete. So, equivalent output is 650 and abnormal gain is 180. So, here we have shown the required calculation. So, 800 units opening plus 8 1 0 0 completed minus a loss of 1 8 0 0 minus 1000 minus abnormal gain. You will get a output of here I will make a small change because there is a abnormal gain now, there is no abnormal loss So, total output minus 180 that is 10000 800 is the total which I get are you getting me.

(Refer Slide Time: 14:03)



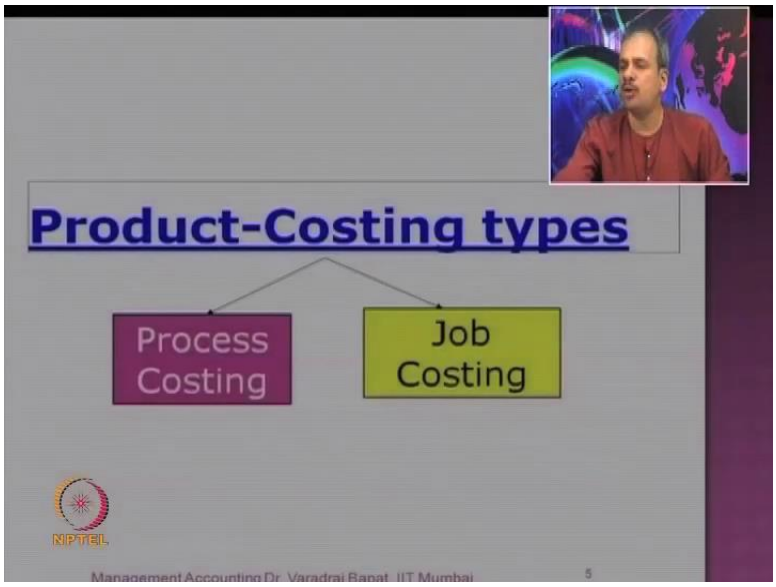
So, what is more important is I take a some of equivalent production which is 8 8 1 10 I will just take it here. This will be easier I think for you to understand to simply take abnormal gain as a negative figure because, there is no loss actually we have gained. So, total output is 10000 800, but equivalent output is 9 7. Now, I think it is more correct. So, equivalent output is 8 8 1 0 are you getting me. So, this is the concept of abnormal loss and gain which is now with equivalent production. So, partly finished goods are also we have accounted for. Now we will do 1 more case on this so that, there is more clarity in the next session.

(Refer Slide Time: 15:12)



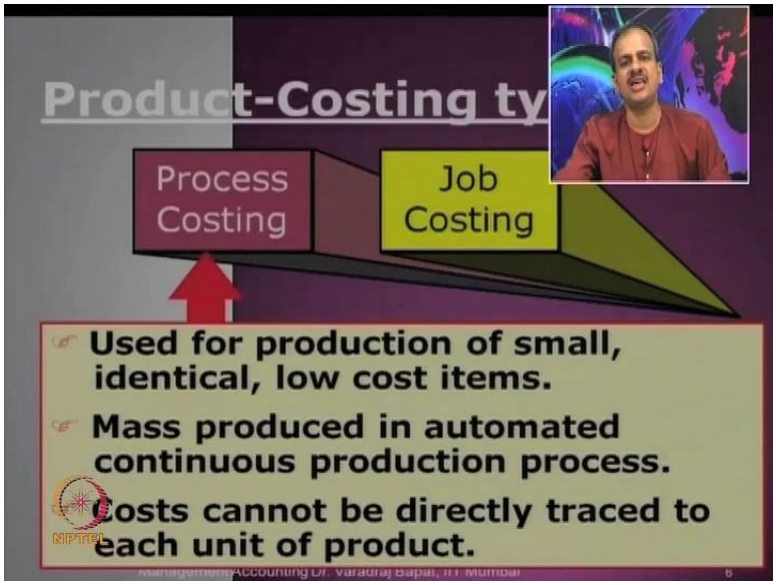
But, right now look at 1 more aspect about product.

(Refer Slide Time: 15:15)

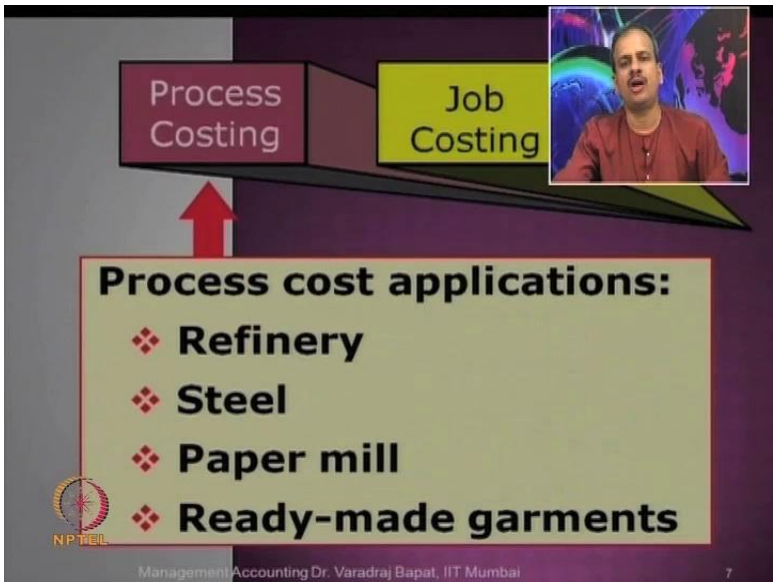


Costing.

(Refer Slide Time: 15:16)

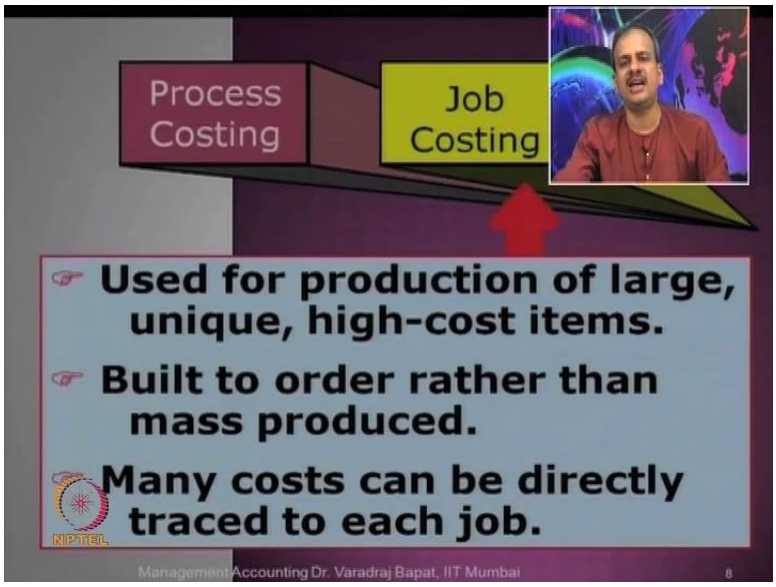


(Refer Slide Time: 15:17)



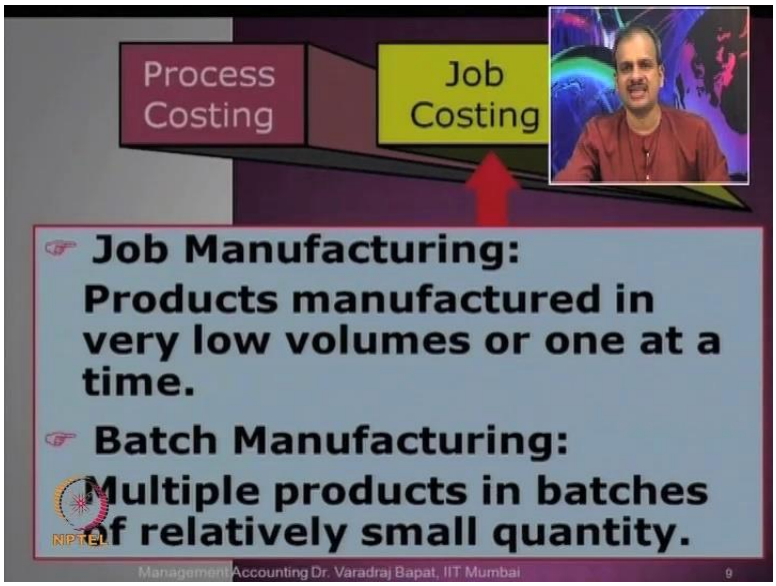
We have already dealt with process.

(Refer Slide Time: 15:18)

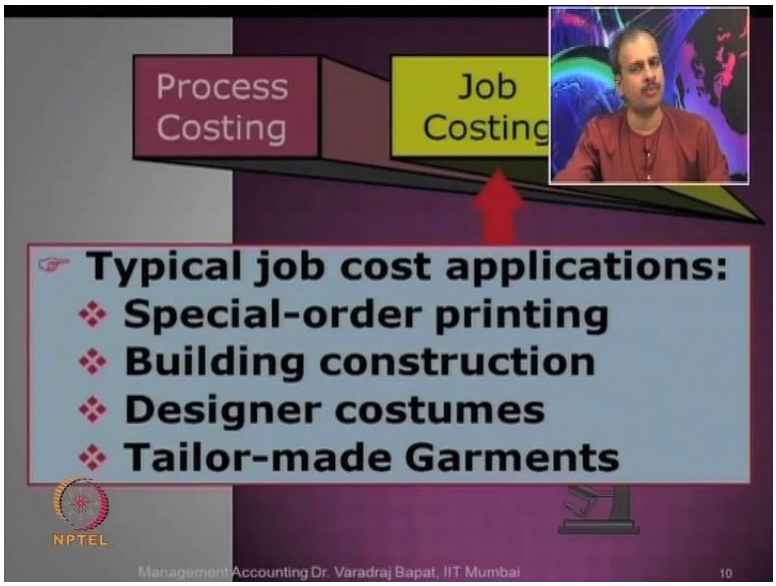


And job costing.

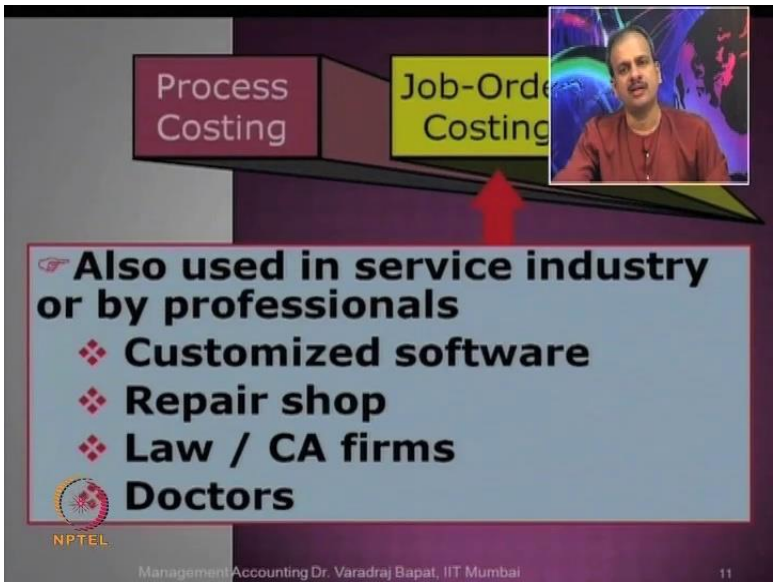
(Refer Slide Time: 15:19)



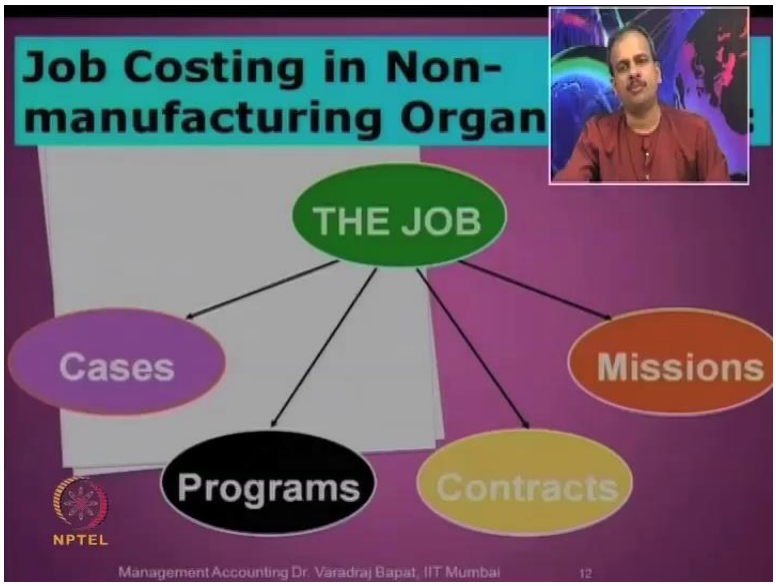
(Refer Slide Time: 15:19)



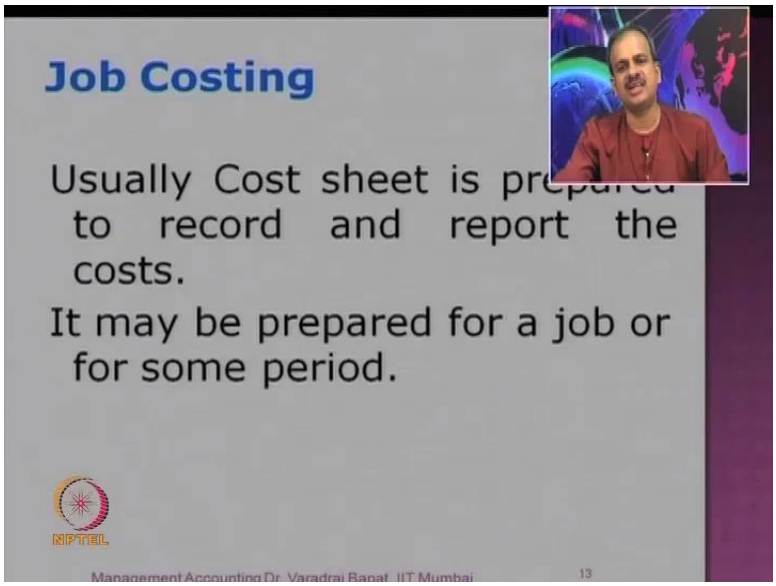
(Refer Slide Time: 15:20)



(Refer Slide Time: 15:20)

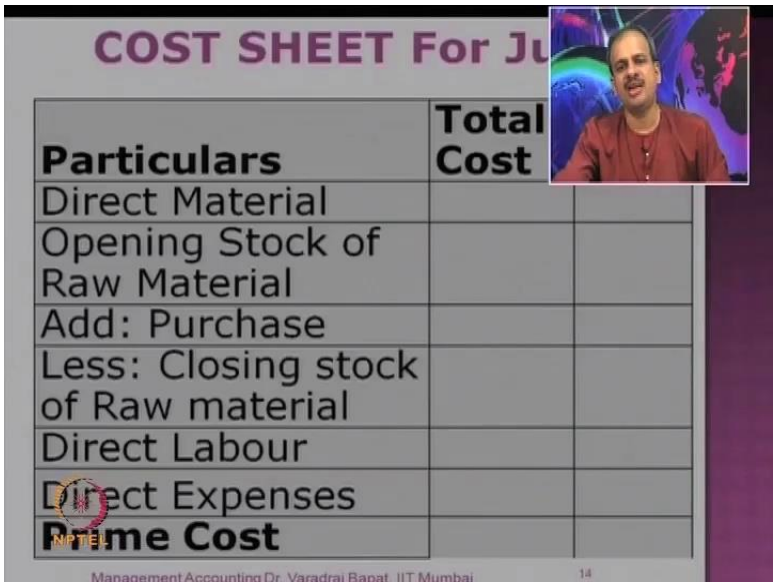


(Refer Slide Time: 15:20)

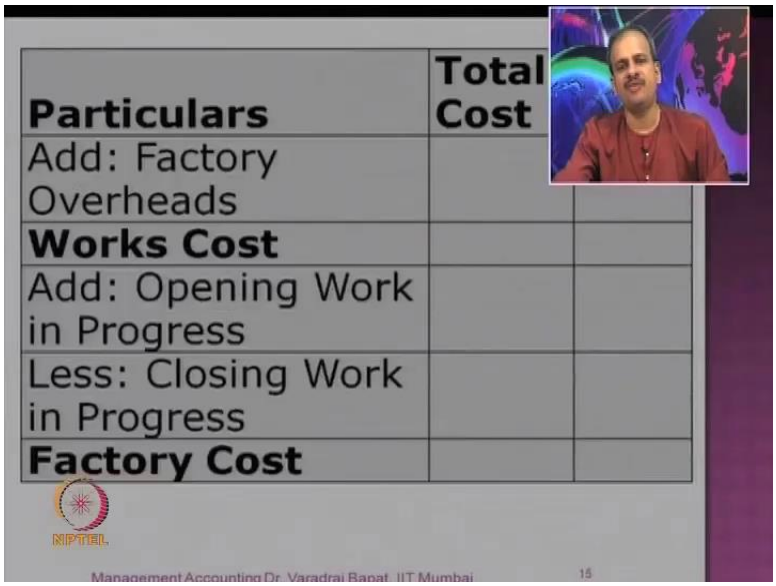


But, the similar fundamentals

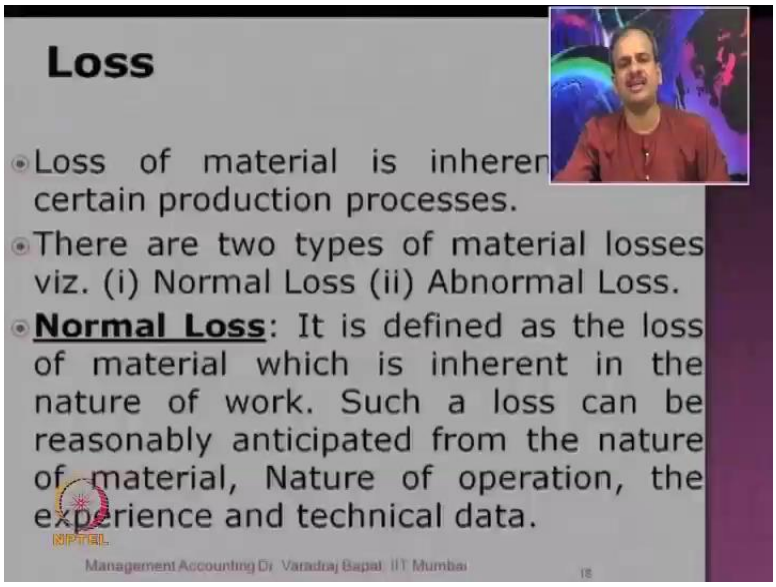
(Refer Slide Time: 15:21)



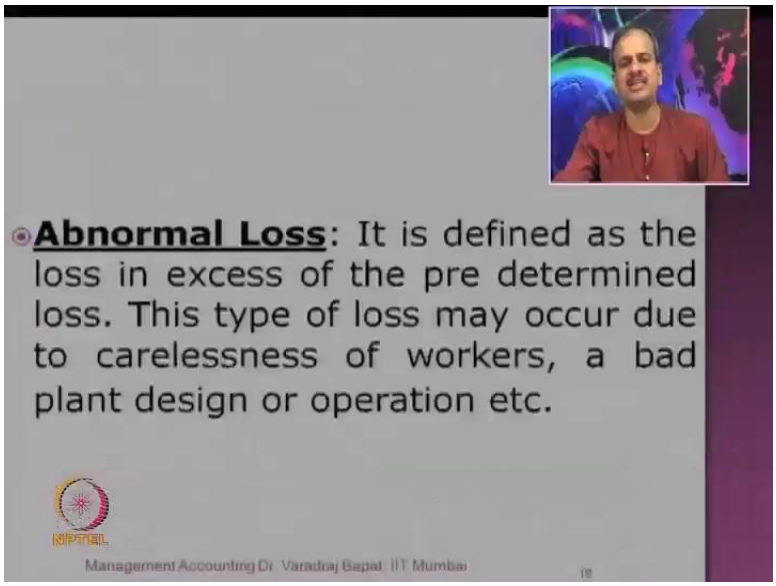
(Refer Slide Time: 15:21)



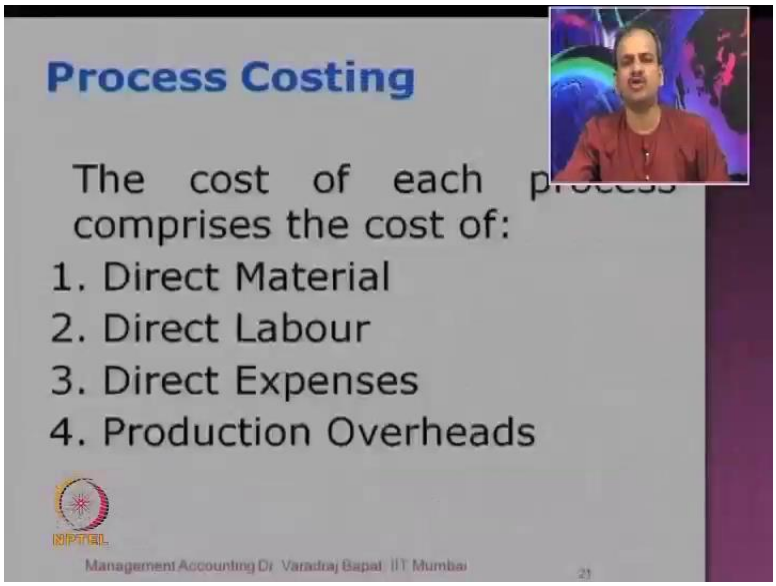
(Refer Slide Time: 15:22)



(Refer Slide Time: 15:22)

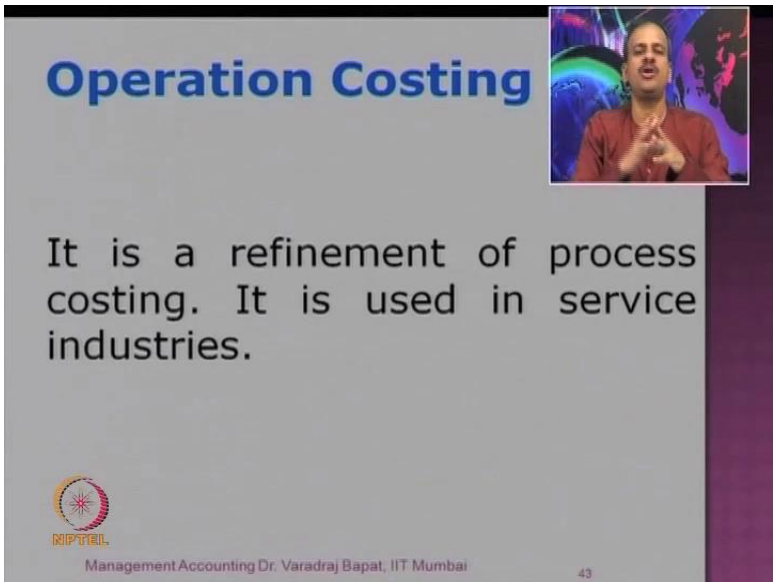


(Refer Slide Time: 15:23)



Can also use in service industry though most of our discussion was on production or manufacturing industries the similar concepts.

(Refer Slide Time: 15:32)



Can be also used in service industries where in we call it as a operation costing. So, you know that process costing is for mass produced goods which are identical in nature. Same way, on large scale services the costing method used is known as operation costing can you name some industries where, it is a large scale identical service. Say railways say railways all the passengers are being carried. And they are being provide d same type of service there may be classes like you may have a sleeper class third ac second ac first actually.

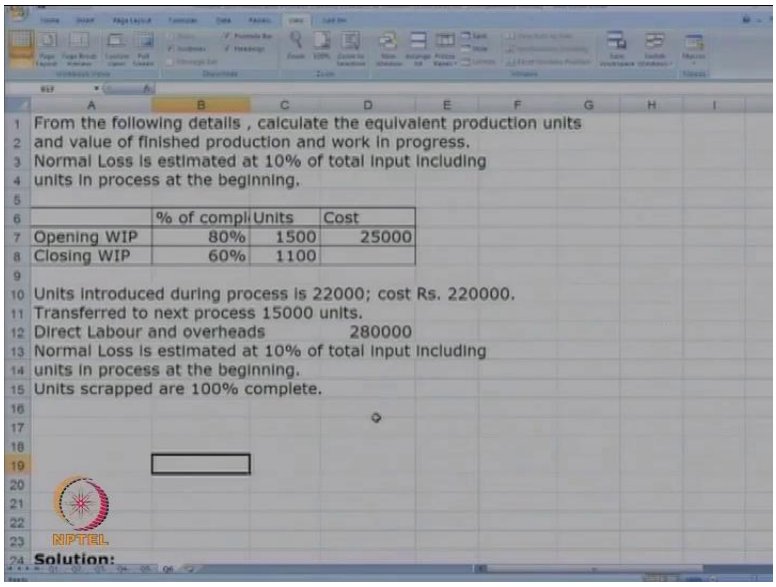
So, on, but within the sleeper class all the customers are same that is why there is no need to make a separate calculation for each customer. Just like process costing we can take the total cost divided by the number of customer same way for the carriage of goods the unit is on number of kg's carried. There is no need for a separate calculation for each k g are you getting. So in case of passenger as well as goods transferred you can use operation costing any other industry. You can think of it is a mass scale large scale service like electricity like telephone.

So, for each unit of electricity you can get the total cost of electricity distribution divided by number of unit distributed. You will get cost per unit this is the way the operation costing can be used as against this for professional and specialized services. We are already dealt with we used job costing can you give 1 or 2 examples in case of a doctor or a chartered accountant. Or for customized software these are specific services or

professional services. So, here you cannot take total cost and divided by number of customers because each customer is unique in nature. You have to make a separate job cost sheet for the customer. So, for such services job costing is appropriate, but for a mass scale and large scale services we used costing method known as operation costing.

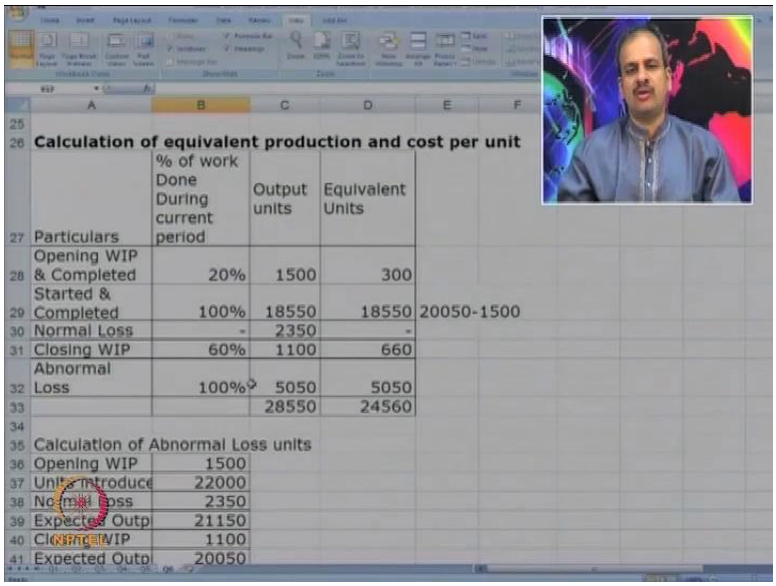
So, let us do 1 more on the concept of equivalent production as we are already discussed what happens is in process accounts the calculation of cost per unit is essentially based on total cost upon number of units So, we do not get data on per unit liking job costing. So, we are taking the total cost per period and averaging it out to know the cost per unit now whenever the units are partly complete. You cannot add a fully complete unit to partly complete unit. Hence, partly completed needs to be converted into equivalent number of fully units that is where we will do 1 more.

(Refer Slide Time: 18:57)



Some of the following details value of and w I p the normal loss including the units percentage units including of the total unit has given. And the cost is 25000 units include during the process cost that is 10 rupees per unit the normal loss is estimated at the unit costs are 100 percent complete. So, now we have to calculate the number of equivalent units and also the cost per unit closing stock, normal loss abnormal, loss opening cost, and sheet normal loss.

(Refer Slide Time: 20:26)



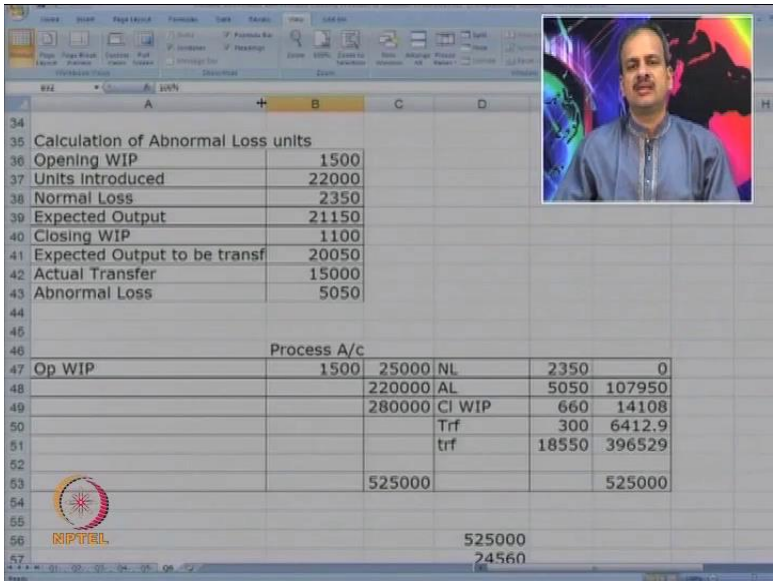
So, 2 3 5 0 expected output will be 23000 500 minus 2 3 5 0. Which comes to 5050 is abnormal loss equivalent production for the same percentage completion opening which are complete total number of units are 1500. We know that, total output expected of are the units are concerned entered to be completed closing stock abnormal units are that cost is charged to the customer we do not take consideration. So, you can see the equivalent production. So, let us go for actual cost calculation for your clarity it was given about next cost given is add the number of units its clear to you.

First you have a lot of you know that 80 percent beginning then there 20000 0 50 which are tin the nature of remaining newly units are normal loss are closing stocks. Now, we apply the percentages you can go back and check for picture we are seeing that cost is charged to the customer. So, actual cost, so you can see that the cost calculation in process account opening work in progress that is retained in 25000. So, here I will add the number of units 20000 units this is our direct material cost. Am I correct? Next is given that 28000 that is already accounted here. I had told that its very good picture want to see in the work in a world being completed and transferred are newly units.

Entered to be completed closing stock and abnormal units are 5 5 0 of is closing stock and closing stock, go back and check 60 percent work. Now, we apply the 50 percent, 80 closing stock was 50 and normal was we take as 100 percent ask to the customer. In case

of normal loss for each of them it is clear and let us go for I have tried to make small process accounts it.

(Refer Slide Time: 24:18)



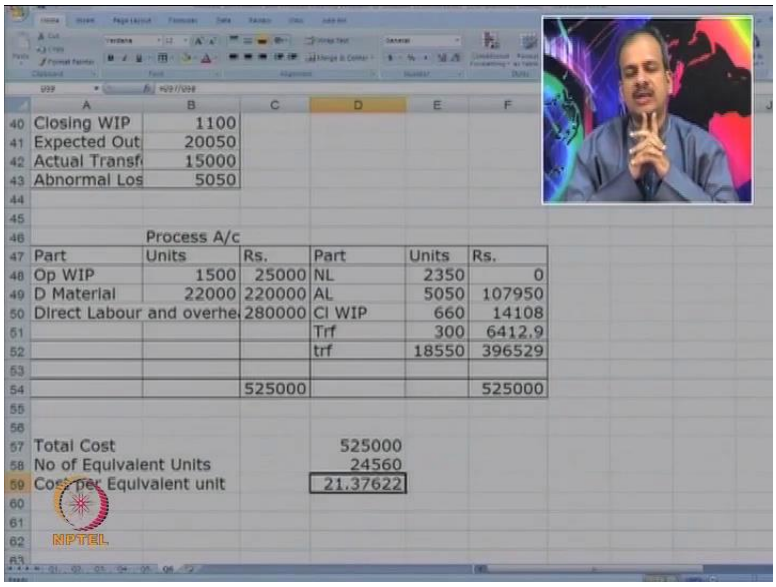
Was given about that 1500 unit that has been retained makes the cost has been introduced 22000 units the cost is 2 2 0 2. Direct labor and overhead cost are 28000. So, that is already accounted here right. Now, let us go to credit side I will add the 22000 unit the cost is 2 2 0. This is our direct material cost am I correct next is it is given that direct labor and overhead cost are 28000. So, that already accounted here right.

Now, let us go to credit side I will add the headings for more clarity. So, this is particulars these are the units and these are rupees or the amount same thing. On the other side I hope everyone is getting the picture clear. So, now we have seen the cost side total cost is coming to I have taken the sum of these 3 items the cost consists of opening w I p. That is the semi finished units as they were there in the beginning plus direct material was added plus labor and overheads was added. So, if you take the sum of all these the total cost comes to 525000.

Now, before going to credit side we need to calculate the cost per unit which is our main requirement for calculating the cost of finished goods. So, the total cost is 5 2 5 0 0 0 here you should keep in mind that you are going to divide it by number of equivalent units and not number of total units. Number of total units may be more, but we are looking at number of equivalent units you can see this chart of equivalent production.

So I will make a small change before we go ahead because what has happened is 300 were the opening units which were entered the completed units as you know are 20500 minus 1 5 0 0. This was the expected completion actual completion is less because of abnormal loss and that abnormal loss of 5 5 0 0 is accounted for down. So, total cost is 5 2 0 0 0 we divide it by equivalent output which is 24500. So, I get cost per equivalent unit. So, 525000 500 divided by number of equivalent units.

(Refer Slide Time: 27:47)



We will get 21.37 everyone is getting. Now, let us go to the credit side on credit side first item we have taken is normal loss. We will go to the chart you know that out of the units some units are bound to be lost and that percentage was given at 10 percent. So, we have already calculated this I will write in full for more clarity this is normal loss 2 3 5 0. Normal loss in not charged anywhere because, it is to be charged to the customer so we take its value as 0.

Then, we have abnormal loss we know that abnormal loss was calculated at 5 0 5 0 it is 100 percent completion. So, equivalent units are also 5 0 5 0 multiplied by the rate I get 7 9 50 the rate used is 21.37. Then closing work in progress in case of closing work in progress there are 1100 units, but there are only 60 percent complete. So, we will take it as 6 6 0.

So closing work in progress taken as 660 equivalent units charged at the rate 21. So, we get 14000 this is the stock of work in progress in hand and the end of the period. Now, I

have written 2 transfers. Why 2 transfers? Because, 1 300 if you go up you will realize that, this 300 was the opening unit transferred got it plus units which were newly introduced and transferred. So, total units if you take sum now you'll find that there is some difference why is this difference can you tell me is it correct or there is some mistake.

There is a mistake so that, you clearly understand what is happening if you find a difference you will realize that 3 4 1 0 is a difference. Now, from where is this coming because units which are newly introduced and transferred have been slightly overstated actual units transfer. If you know the production of the process was 15000 of that 1500 units were from the opening stock. So, how much units are transferred 15000 minus 1 5 0 0.

So I will need to correct here I hope everyone is getting right is it correct because 15000 units have come out of that 1500 units are these units. So, units which are completed and transferred should be 13500 right now, normal loss is anyway lost. So, there is no need to account closing w I p comes to 1 1 0 0 as it was given and abnormal loss also we have already calculated. Now we will see the rate of change are you getting me I was just seeing whether you are able to locate the difference. I hope now the things are clear we will just go back.

So normal loss 20 3 50 at 0 abnormal loss 5 0 5 0 at 13500 closing w I p 6 16 at 17 at 26 rupees it comes to 17000 760 transferred units 300. And another transfer units are not 18000 500, but they are 13 5 5 0 are you getting what is happening. So out of 1000 500 units in the beginning 92000 were newly added. So, we have 23000 500 units of this the normal loss abnormal loss closing stock these 2 transfers means this is transfer from opening w I p for more clarity. And this is so in full if you see this is the output newly introduced and transferred.

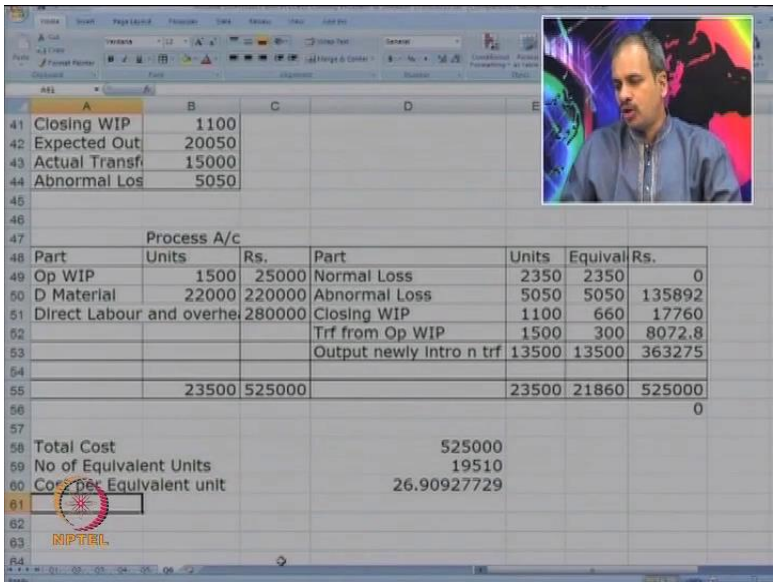
So, total of 15000 is now categorized into 2 categories now take a look at the calculation of the normal abnormal units to see that all units are properly accounted. So, our opening stock was 15000 units introduced was 22000 normal losses. So, if you take a sum here you have 22 3500 units of that 2 3 5 0 were lost were to be lost. So, get expected output or normal output of 21 5 5 0 of that 1 1 0 is the closing stock. So you have 20000 500 of

this 50000 was transferred and 5 0 5 0 remains as a abnormal loss. So, everything is accounted now.

Now, we will try to look at the equivalent units we have got abnormal loss which is 2 3 5 0 accounted as nil abnormal loss 5 0 0 100 percent complete. And we are accounting it at 26 rupees closing stock its 1100 units, but we are looking at equivalent units which are 660 transfers from opening w I p. So, what has happened is, opening units are being introduced and transferred. So, we have accounted it at 300 only then output which is newly put in and transferred 13500 it comes to 360 3 7 50, now look at the different.

So you will realize that now these two sums are exactly matching are you getting what is being done. So, I hope now you have fully understood exactly how this accounting is done. Why is this difference?

(Refer Slide Time: 35:31)



So,1 6 4 0 actually, this difference because these units are equivalent units where as these units are actual units. So, there is bound to be some difference if you want to ensure that there is no difference I will just add 1 more column. So that, you do not feel that we are doing something which is not correct. So, abnormal loss there is no question of equivalent units. So, a normal loss abnormal loss also we will account for all the units in case of closing w I p number of units are 1100. Here, it is opening w I p units transferred are 1500 and 13 500 are the actual units which are newly introduced and transferred.

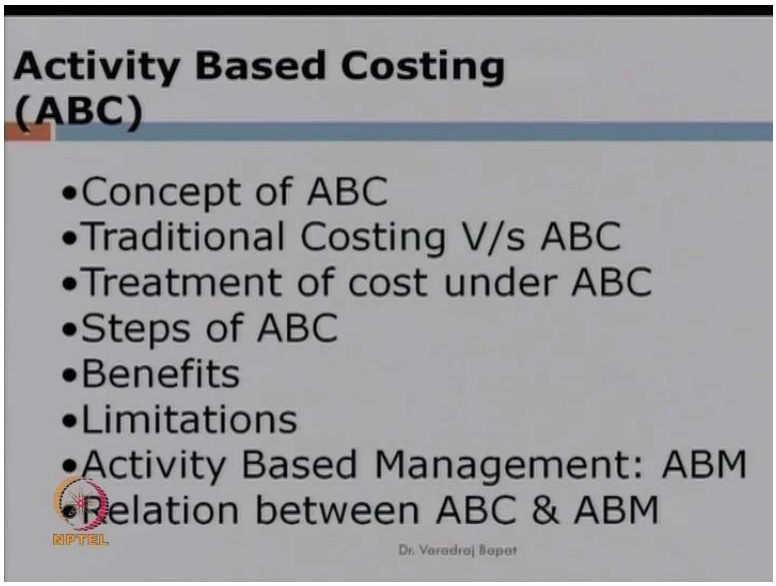
So, we get a sum of 23000 500 these are the actual units where as these are the equivalent units are you getting me or is there any doubt. Now, if we add 1 more column for units then we are looking at equivalent units on this side also. But, actually on this side there is no need to go for equivalent units. So, we can delete it you can just be sure that actual units column is tallying and the accounting is done based on the equivalent minutes. So, we will remove this difference I hope now the things are clear to you.

Now, here is how we understand that how using the concept of equivalent production we are doing the accounting. Now, let us try to go into new area if process costing is more or less clear to you we will go for the next module. This next module is on a very interesting theme that is known as activity based costing to very clearly understand activity based costing. You will have to slightly go back and remember the traditional way of doing the costing because activity based costing is giving an alternative to the traditional cost accounting system. So, in traditional cost accounting system if you remember we followed some steps: step number 1 was allocation.

So, total costs were divided into direct and indirect direct costs were directly charged indirect costs were charged were to taken as a common tool. Next step was apportionment here the indirect cost were apportioned to cost centers. Third step was reapportionment. So, service cost centers costs were charged to production cost centers fourth step was absorption here indirect costs which are collected at cost centers were charged to products. And then we did under or over absorption.

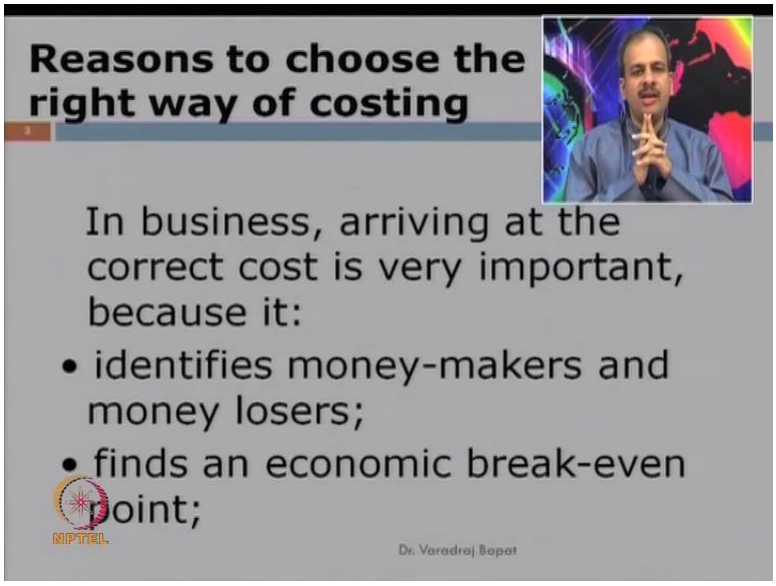
So, you will see that all the costs are first collected at cost center level and all the indirect costs especially direct cost are charged to products. Indirect costs are first collected at cost center and through cost center they are charged to products in activity based costing; we try to identify cost drivers. So, that based on the activity or based on the function they serve the cost can be charged directly to the products. Now let us see actually what is being done and we also try to solve some cases on the same. So, here we are starting with our next module on activity based costing.

(Refer Slide Time: 39:46)



This presentation includes these things we will first start with concept of ABC. Then we will compare the traditional with the activity based costing. We will look at the treatment of cost under ABC steps the benefits and limitations of ABC. We will also discuss about activity based management and its relationship with activity based costing.

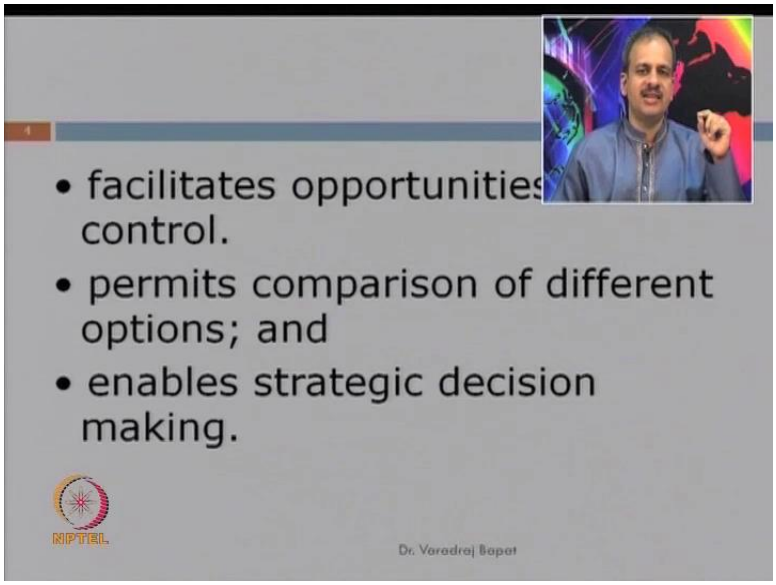
(Refer Slide Time: 40:14)



Now you all know that is very important that we arrive at a correct cost whether it is product, whether it is process, whether it is a project. Where it is very important that

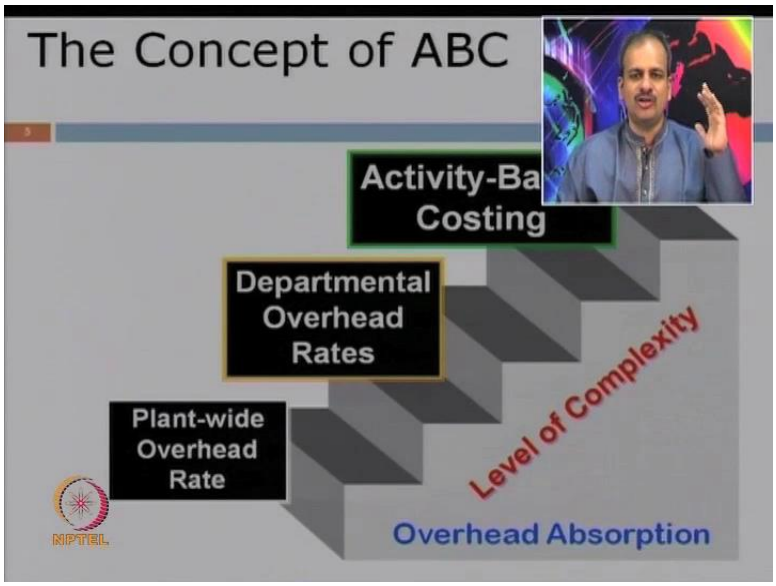
company knows what is the cost it is incurring for the same, because we can identify money makers and money losers. We can find an economic breakeven.

(Refer Slide Time: 40:36)



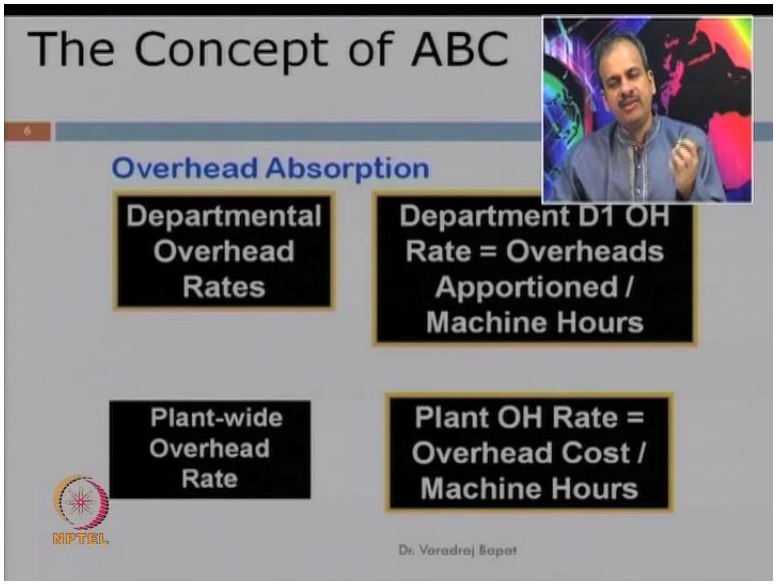
Then it facilitates the opportunities for cost control it permits the comparison of different options and it enables strategic decisions. So, strategic decisions like company may want to automate a process it may want to outsource. So, various types of decisions can be taken based on the cost information.

(Refer Slide Time: 41:03)



Now as I just now discussed that there is a problem with overhead absorption because direct cost can be charged directly, but indirect costs do not have a direct linkage to product. So, we will have to root it through something for that various methods are used the most simplistic method is plant wise overhead rate slightly more sophisticated. And giving more details is departmental overhead rates and even more advanced form is activity based costing earlier. We have discussed department wise overhead rates. Today we are going to go into deeper activity based costing plant wise rates anywhere; too simple normally no company uses the method of plant wise overheads.

(Refer Slide Time: 41:57)



Now, let us try to understand exactly what it is I hope you remember what absorption is. So, in absorption essentially we have some cost and we are trying to charge it to products very simpler way is get the total cost for the plant and get a plant wise rate. So, as you can see here plant overhead rate is the plant overhead cost divided by machine hours. So, if you have the factory let us say you have got 10 types of overhead costs which may include rent. It may include security plant managers salary indirect material helpers wages and so on.

All this overhead costs are simply added and an appropriate base is chosen I have assumed machine hour is a good base. So, the total cost for plant is collected and it is simply divided by machine hours. So, we get machine hour rate. So, whatever product

passes through the plant or produced in a plant based on the machine hours consumed for that product will go on charging that product.

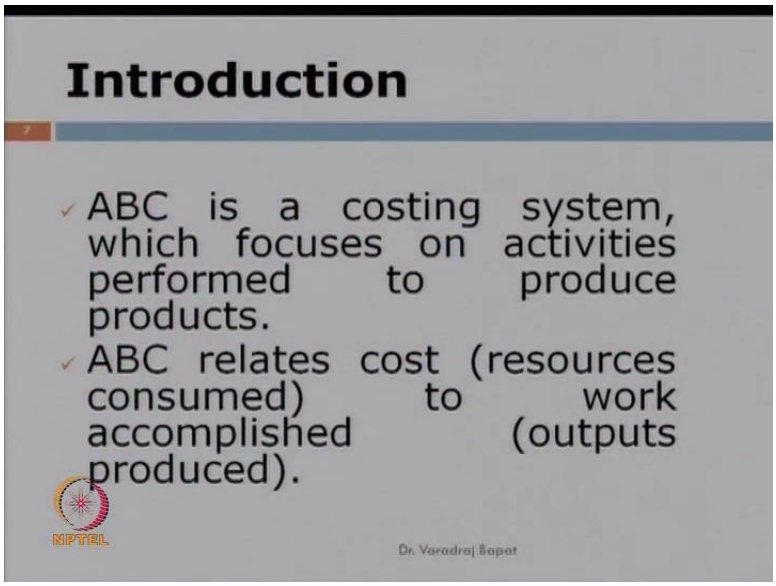
Now, this is too simplistic method it does not categorize the plant into cost centers or the departments. So, we do not have any way to control the cost at each department secondly certain departments may have more costs. Some other departments may have less costs, but we have 1 common rate we are charging all only on that rate if departmental overhead rates system there is more sophistication. So, if we have total rent we cannot charge it to the product, but we can apportion it to the departments.

So, the total plant rent is first apportioned to the departments total plant manager salary is apportioned to the department based on time maybe rent is apportioned. Based on the area used we may have a storage cost or maintenance cost they may be charged to the departments as for the services they consume. So, we get the total overhead cost for the department and then divided by machine hours in that department. So, we get departmental overhead rate. So, here you can see department d 1 overhead rate.

So, overhead apportioned upon machine hour, so like that if you have say 4 departments d 1 d 2 d 3 d 4 for each department there will be a rate and any product passing through d. 1 will be charged with the for those hours in d 1 then if it goes to d 2 it will be charged for d 2. It will then goes to d 3 it will be charged for d 3 and if it goes out it will not be charged for d 4.

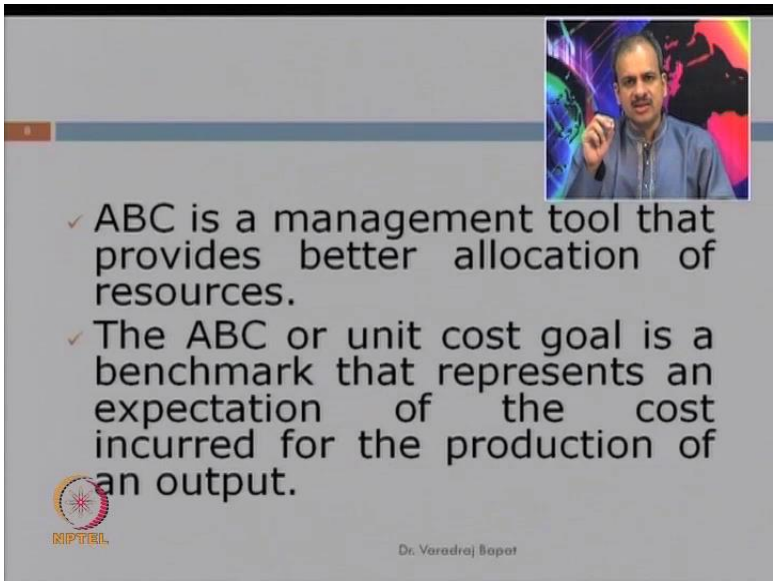
In plant wise rate 1 lump sum rate was there in departmental rates we have rate for each department. So, departmental rates slightly an improvement over plant wise rate, but still it is not giving enough details. Because, all costs have to be rooted through departments in activity based costing an attempt is made to identify the cost drivers. So, that cost can be directly charged to the product now let us see how that will be done.

(Refer Slide Time: 45:26)



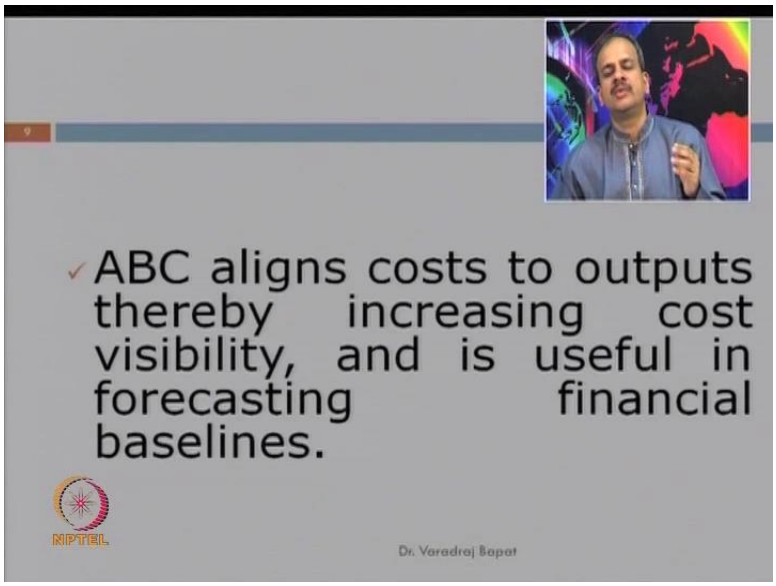
So ABC is a costing system which focuses on activities performed to produce the products it relates the cost to work accomplished. So, costs are the resources consumed they are consumed for some work. So, we try to see that this cost is for what and try to directly link it to the product through cost drivers.

(Refer Slide Time: 45:52)



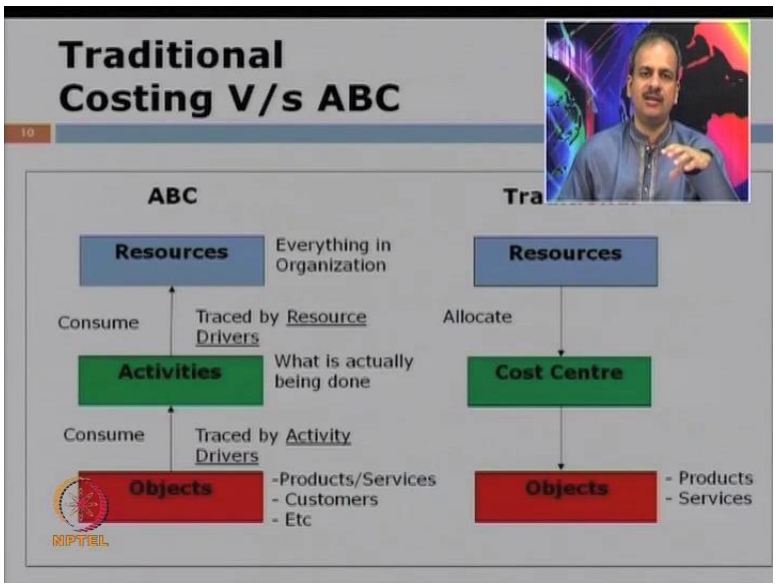
Now, it is a tool which enables to management for better allocation of resources ABC or cost unit goal is a benchmark that represents an expectation of cost incurred.

(Refer Slide Time: 46:08)



It aligns the cost output. So, cost visibility increases. So, we know that this cost is for this particular thing and it is useful for forecasting financial baselines also.

(Refer Slide Time: 46:26)

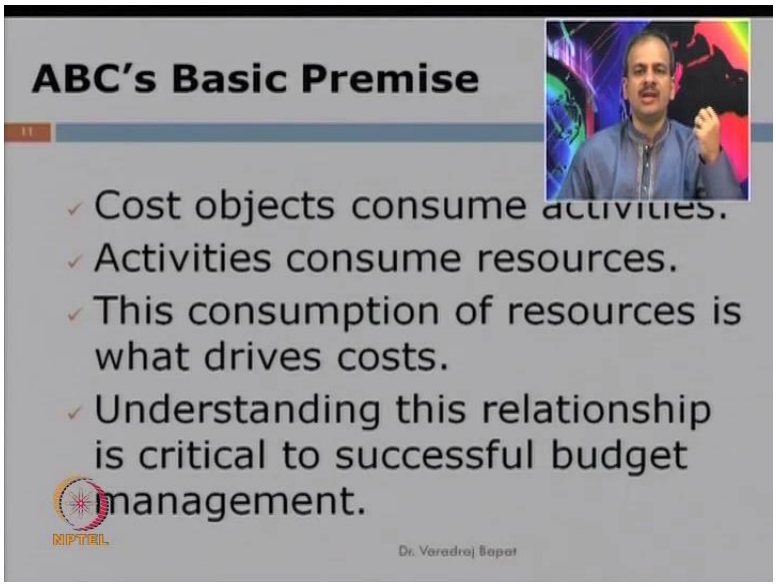


Now, again let us look at how we move from a traditional system to ABC in traditional system. All the overhead costs are apportion allocated apportioned to cost centers through cost centers they go to objects. That is cost units or the products in ABC the total resources are consumed which are consumed and traced by the cost drivers. So,

resources are linked to the activity that for what the resource is being then and through activity drivers they are charged to objects that is product services customers and so on.

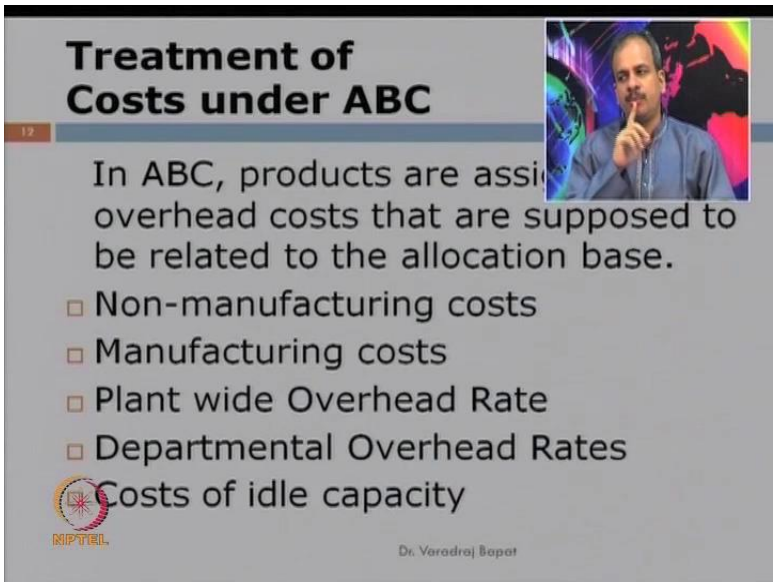
So, we have two sets of cost drivers 1 are the resource drivers where we know we try to link resources to activity, and then your activity drivers which try to link activities to objects. So, this is more sophisticated system then traditional costing it requires more details.

(Refer Slide Time: 47:38)



So, basic premises are that cost objects consumed activities and activities consumed resources. So, this consumption of resources is what drives the cost because no resource will come for free. So, we have to pray for the resource. So, we have to incur some costs. Now, if we try to understand this relationship it will be very good because we can link then the cost better to the products.

(Refer Slide Time: 48:10)



Now, ABC the products are assigned to overhead costs that are supposed to be related to the allocation base. So, various costs like non manufacturing costs manufacturing costs plant wise rates these are all used in ABC. So, we will stop for this session. So, today what we have discussed is first we started with the concept of equivalent production which we had already done in the last session. But, today we have done a case on it then we have gone into understanding of ABC. In next session we will do some cases and practical sums on ABC, then I think it would be more clear to you.

Thank you so much.