Surface Mining Technology
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Lecture 35
Excavation with Surface Miner 5

Let me welcome you to the thirty-fifth lecture of Surface Mining Technology. This is the fifth and final lecture of excavation with surface miner. We will solve second tutorial here. So, in this tutorial we basically will go for cost analysis for the excavation with surface miner.

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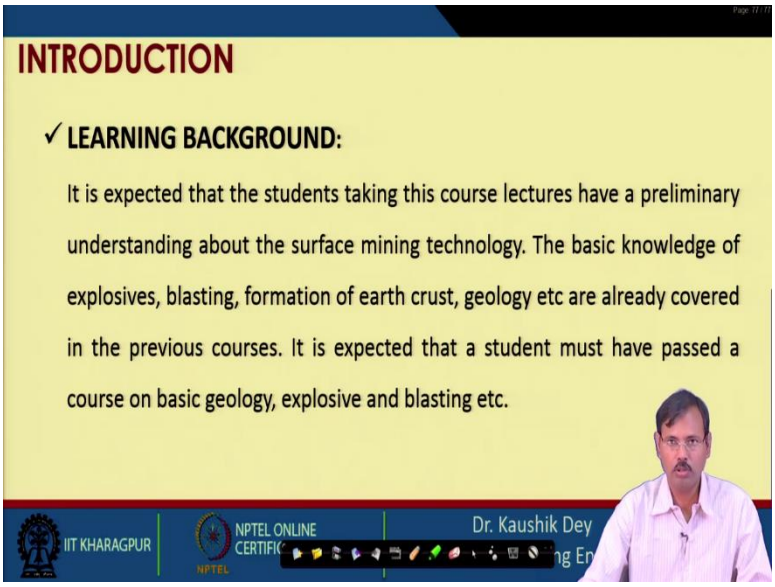

So, let us have one look into the learning background of surface mining technology course.

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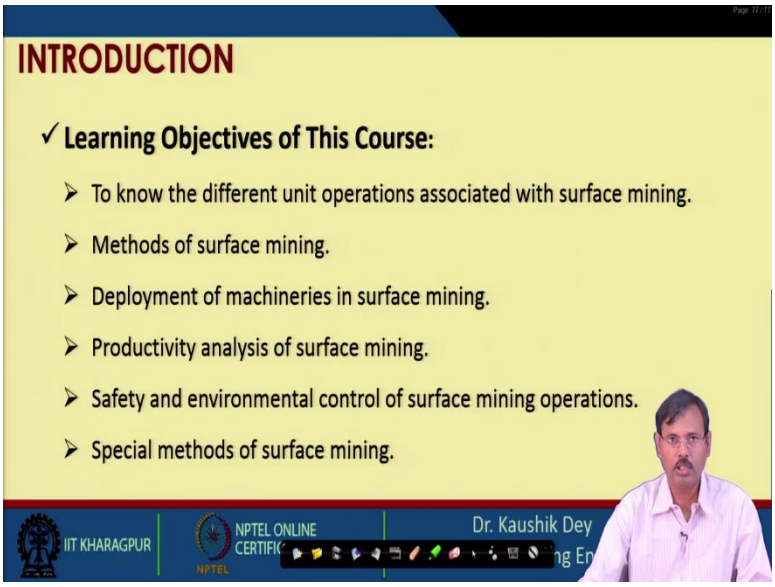

These are the learning objectives of the Surface Mining Technology course.

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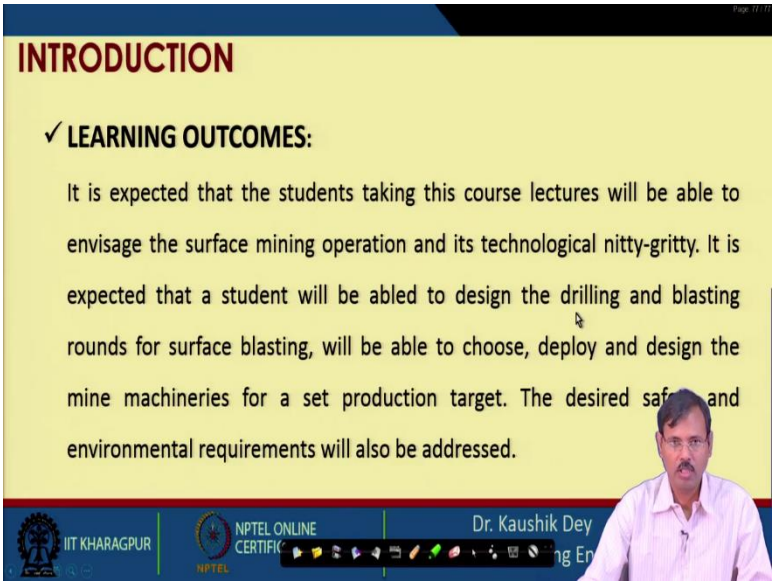

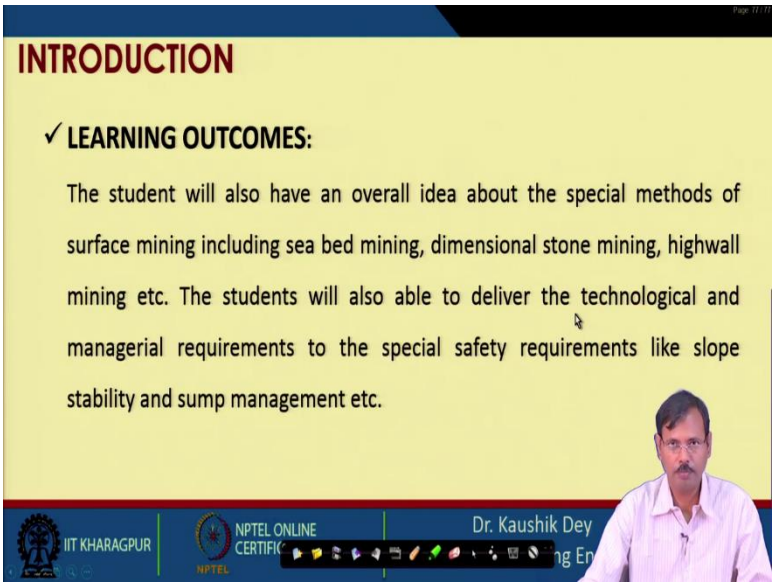

And these are the expected learning outcomes for Surface Mining Technology course.

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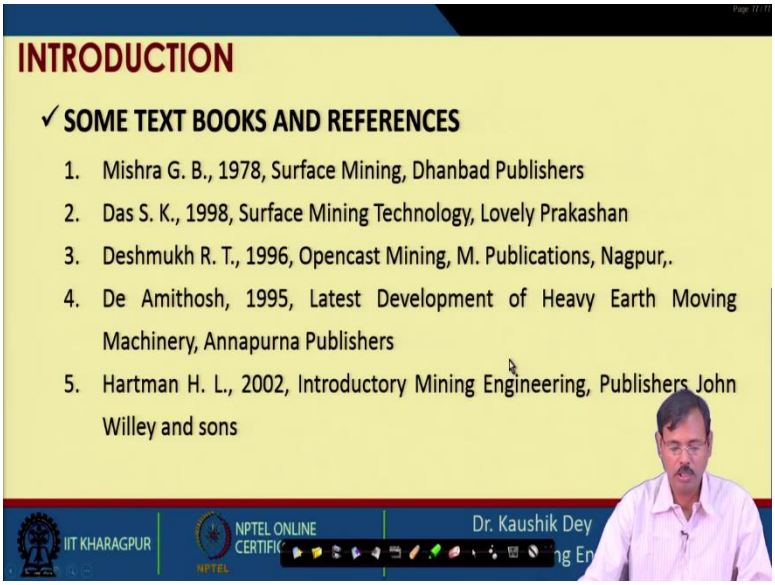

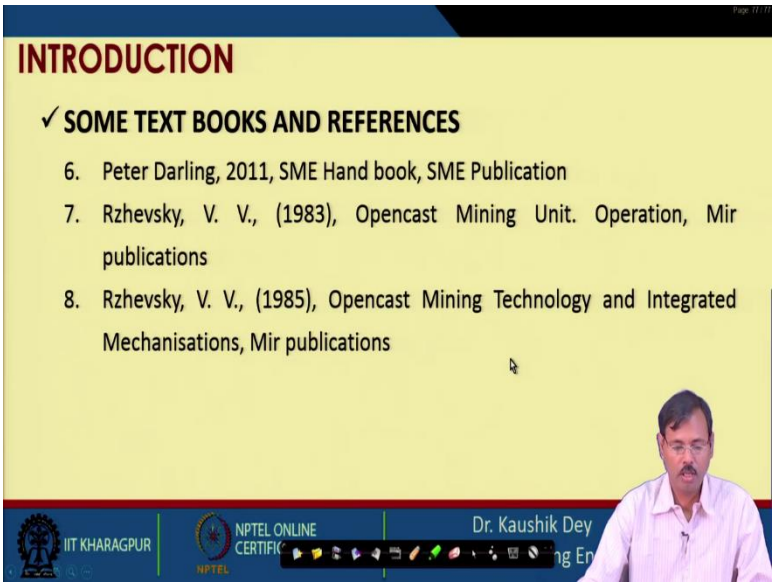

These are some of the texts and references available in the market.

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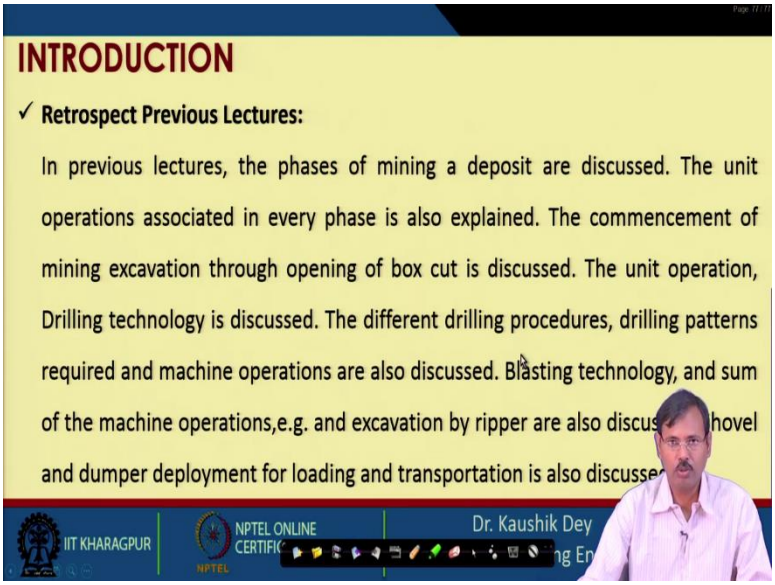

And let us look into the previous lectures what we have covered before this topic surface excavation with surface miner. We have covered the phases of mining a deposit, we have covered commencement of surface mining using box cut, we have covered the drilling technology, we have covered the blasting technology, we have covered blast free excavation technique that is the ripper and we have covered the excavation of fragmented rock mass either by blasting or by a ripper through a shovel or excavator.

We have gone through the different types of excavators and we have seen the transportation system, dumper transportation system and how the dumpers are working along with the shovel, how the shovel dumper combination can be carried out: that is discussed already. And we have started discussing the excavation with surface miner which is another blast free mining technology, continuous excavation technology and a very, very highly applicable technology for the current Surface Mining situation.

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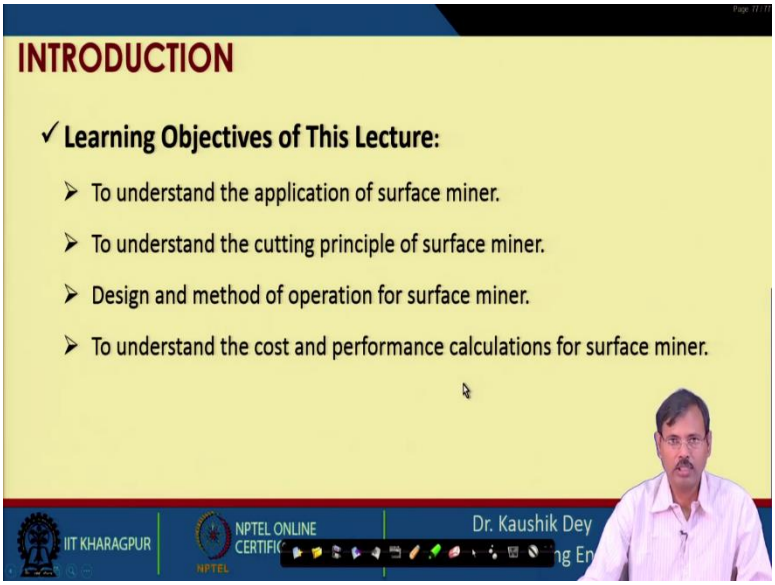

And in this lectures, we had the objectives to understand the application of surface miner to understand the cutting principle of surface miner, design and method of operation of surface miner, all these are discussed, we have carried out already one tutorial for the performance analysis of the surface miner, and in this tutorial, we will cover the cost calculation for the surface miner. So, this is one last class on the excavation with surface miner.

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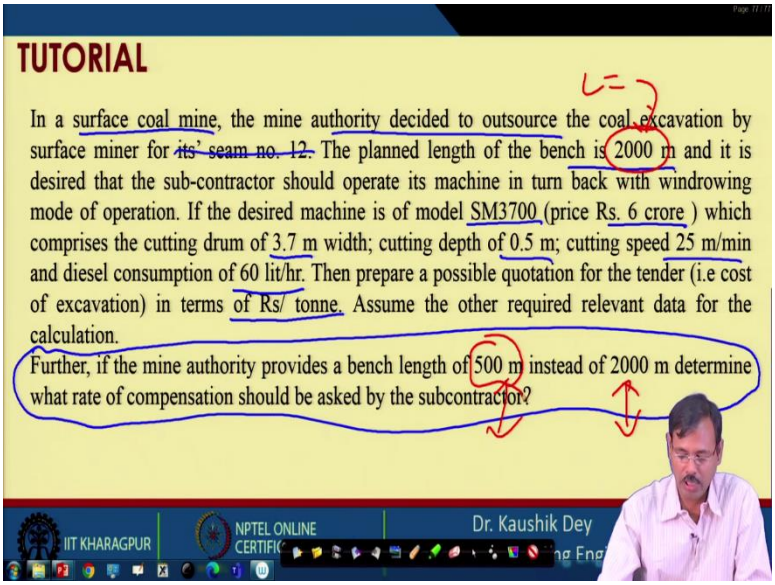

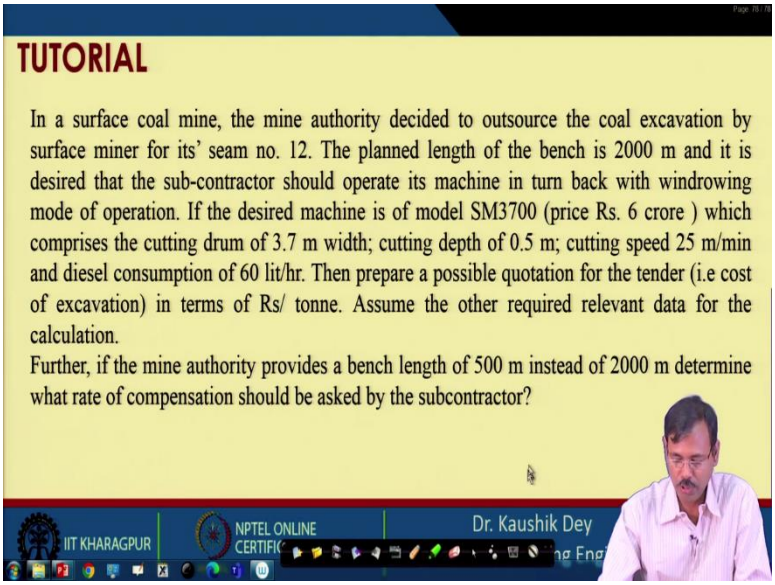

So, let us directly start with a problem. In this problem, we are having a coal mine, a surface coal mine. The mine authority decided to outsource the cold excavation by surface miner for its particular seam. So, the planned length of the bench is 2000 metres and now contractors are asked to go for bidding and it is considered that the desired machine is 3700 which is available at a price of 6 crores and it is comprising a cutting drum of 3.7 metre which can cut which can cut a depth of 0.5 metres.

So, now you see the depth is given in metre directly not in centimetres. So, you have to consider that in your production formula. Cutting speed is given 25 metre per minute, diesel consumption is given as 60 litre per hour and that subcontractor has to give the tender pricing this. Further, the problem is extended, which I will not solve at this place. But, it is the duty of the participants to do it back to their home.

Suppose the mine authority is failed to provide the promised length of 2 kilometre, bench length: a pit bench length of 2 kilometre. If instead they are providing the length of 500 metres then what is the loss to the contractor for the same and how much compensation a contractor will ask from the mine authority for the same. So, that calculation needs to be carried out.

So, it is a simple one, firstly the calculation will be made, considering the L is equal to 2000. So, whatever price is coming the calculation can be made using 500 also. Then find out the differences between these two, whatever is the difference that is the compensation will be asked from the mine authority because of their inability to provide the desired length.

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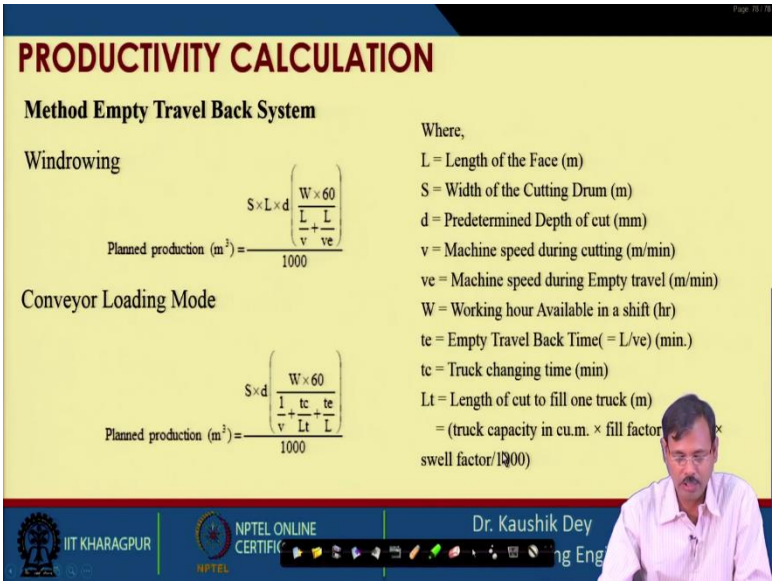

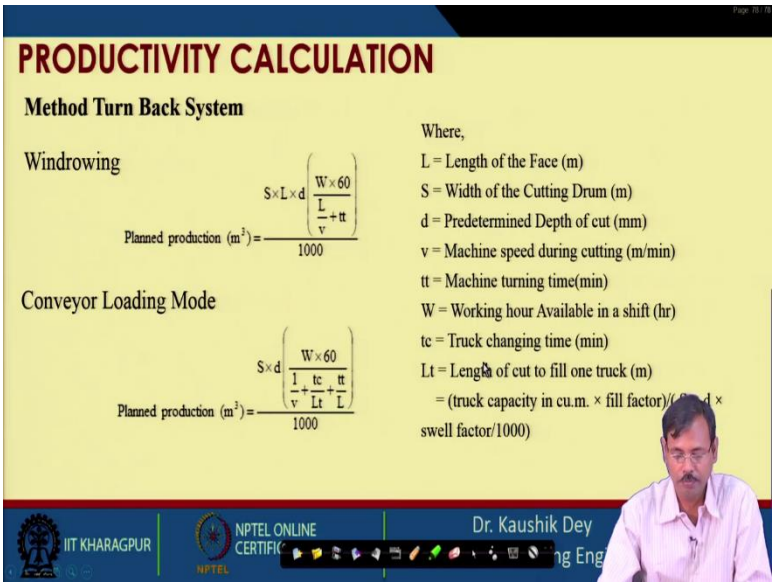

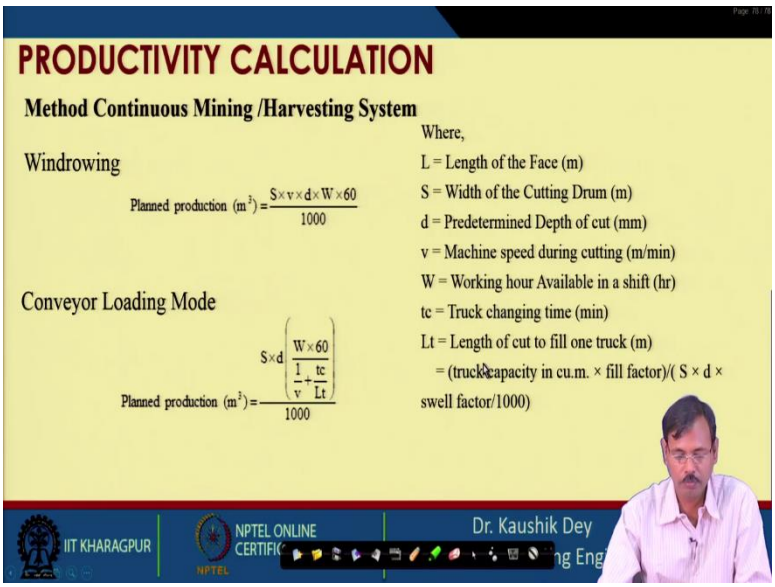

So, again once again look into this formula this are already given.

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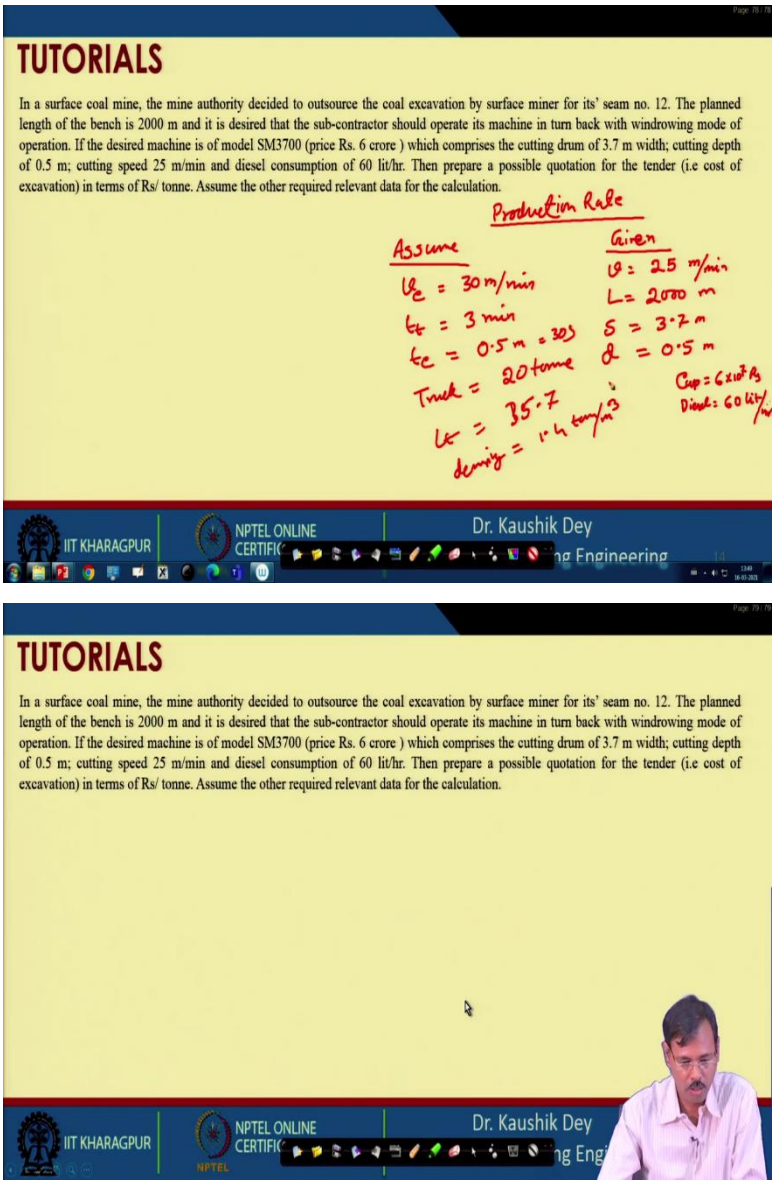

Now, I just reduce the size of this so, that I can solve at this place. So, you have to find out the production rate and a number of data needs to be assumed is given in the data, v is given 25 metre per minute. The L is given 2000 metres. The S is given 3.7 metre, cutting depth d is given 2.5 metres and few data is given pertaining to cost that price capital cost is 6 x 10^7 rupees and diesel price is given 60 rupees per litre and sorry it is not diesel price it is digital consumption given as 60 litres per hour.

So, this is given and we have to assume a number of other data. So, for production related data let us assume what we have assumed previously say v_e is 30 metre per minute and we have to assume the turning time 3 minute. We have assumed the truck exchange time is 0.5

minutes that is 30 seconds and we have assumed the truck capacity 20 tonne. So, your Lt will be calculated as 35.7, density also assume in situ density of coal also as a 1.4 tonne per metre cube. So, let us assume all these things.

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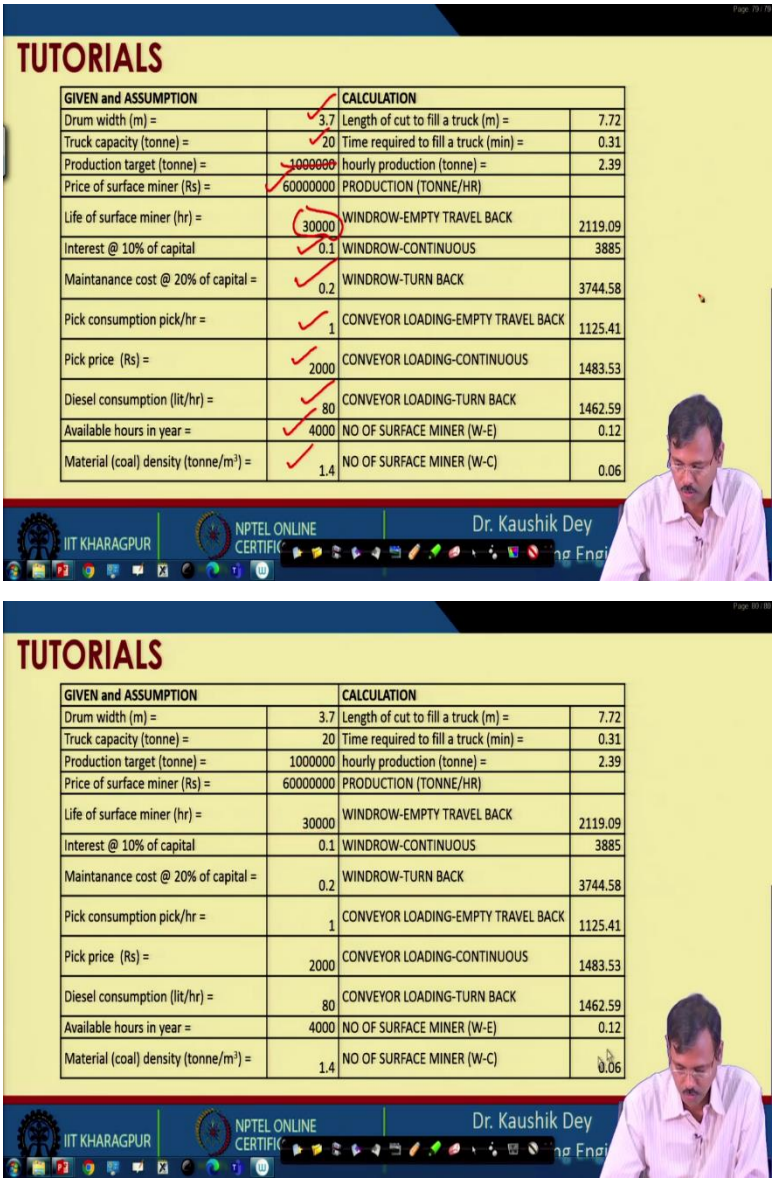

And utilising this, utilising this we can have calculations. So, our assumptions, this is a given assumption we are saying, truck capacity, this is not required for this, this is the price of the machine. This is the life we have assumed. This is the interest. This is the maintenance cost assumptions, big consumption we have assumed, pick price we have assumed, diesel consumption we are assumed, sorry that 60 litre has to be changed to 80 litre, here we have taken 80 litre, availability we have assumed 4000, material density we have assumed 1.4.

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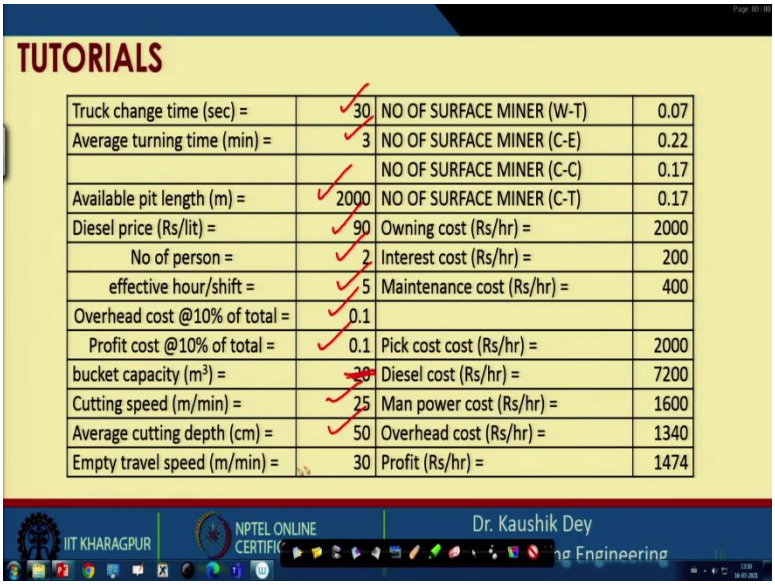

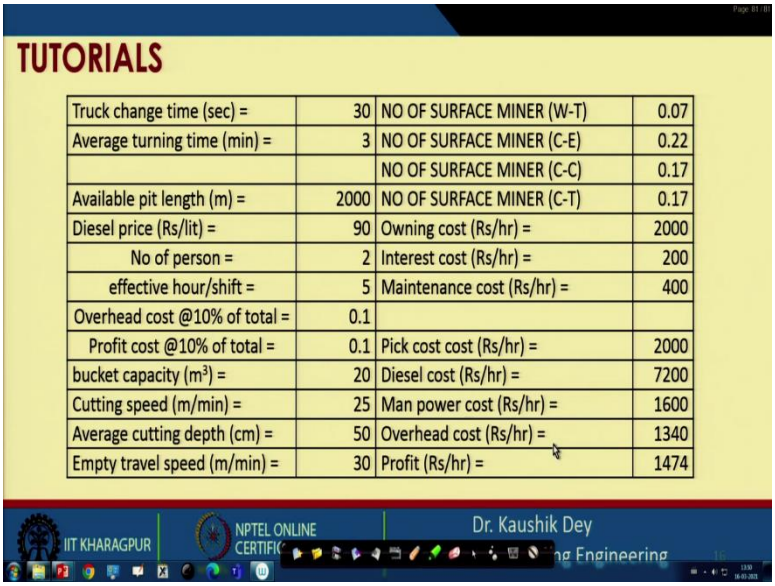

And we have also assumed our truck change time, turning time, pit length, diesel price, number of persons, effective hour in a shift, overhead cost 10 percent, profit 10 percent. Then, these are not required. This is cutting speed, this is average cutting depth, this is empty travel speed.

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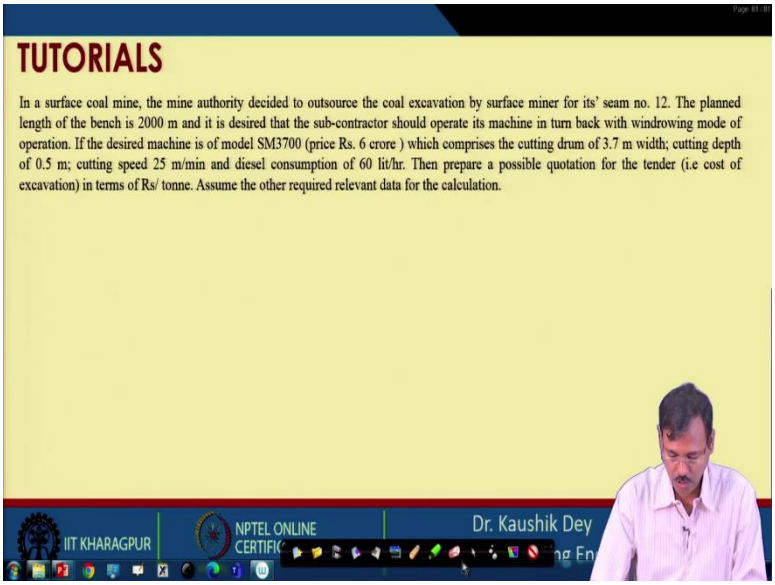

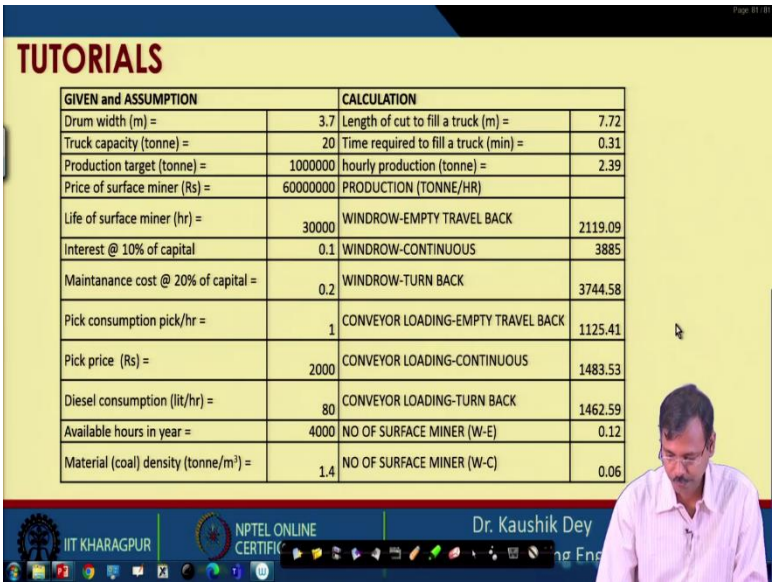

So, these are the assumptions. Now, based on these assumptions first what we did? First, we have calculated the production. So, we have found the length to cut to fill a truck actually, there is some problem with this. So, let us, probably it is a little bit mistakes occurred here. So, the procedure will be given same.

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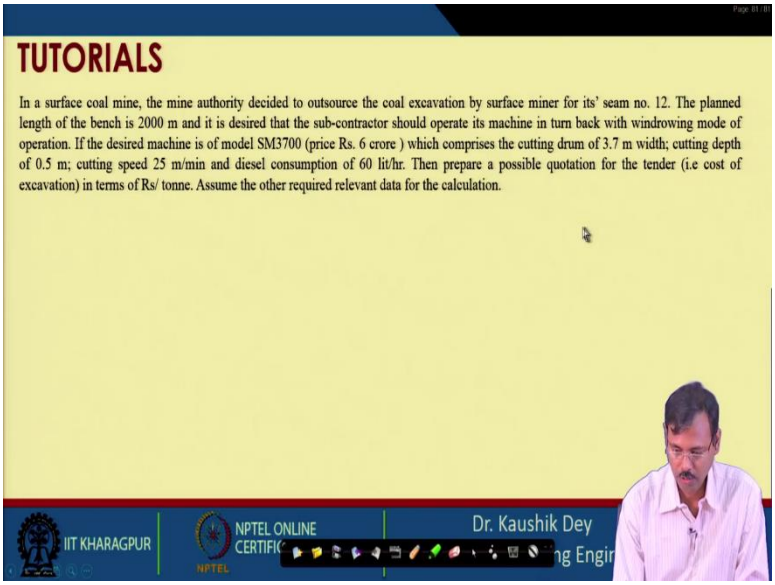

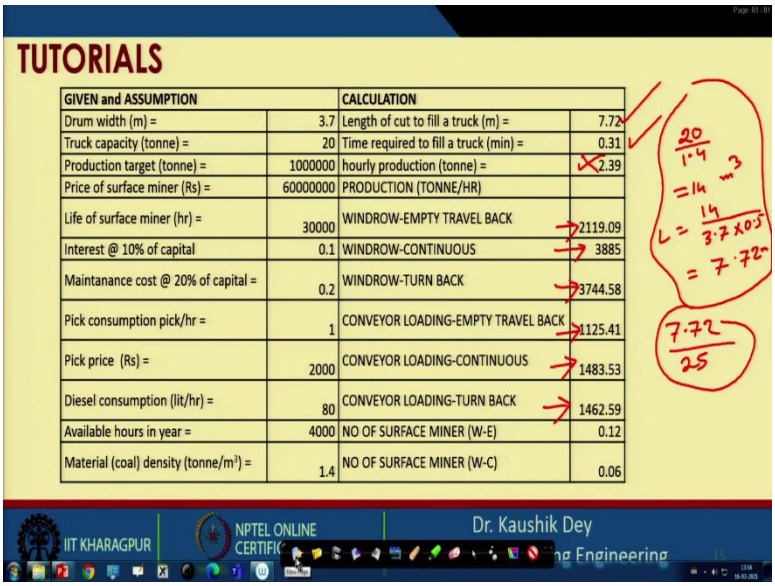

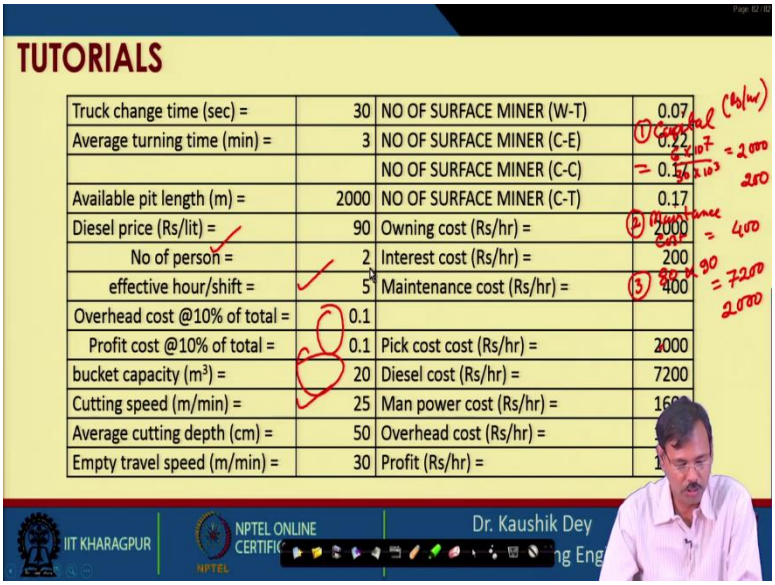

TUTORIALS

Truck change time (sec) =	30	NO OF SURFACE MINER (W-T)	0.07
Average turning time (min) =	3	NO OF SURFACE MINER (C-E)	0.22
		NO OF SURFACE MINER (C-C)	0.17
Available pit length (m) =	2000	NO OF SURFACE MINER (C-T)	0.17
Diesel price (Rs/lit) =	90	Owning cost (Rs/hr) =	2000
No of person =	2	Interest cost (Rs/hr) =	200
effective hour/shift =	5	Maintenance cost (Rs/hr) =	400
Overhead cost @10% of total =	0.1		
Profit cost @10% of total =	0.1	Pick cost cost (Rs/hr) =	2000
bucket capacity (m^3) =	20	Diesel cost (Rs/hr) =	7200
Cutting speed (m/min) =	25	Man power cost (Rs/hr) =	1600
Average cutting depth (cm) =	50	Overhead cost (Rs/hr) =	1340
Empty travel speed (m/min) =	30	Profit (Rs/hr) =	1474

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TUTORIALS

GIVEN and ASSUMPTION		CALCULATION	
Drum width (m) =	3.7	Length of cut to fill a truck (m) =	7.72
Truck capacity (tonne) =	20	Time required to fill a truck (min) =	0.31
Production target (tonne) =	1000000	hourly production (tonne) =	2.39
Price of surface miner (Rs) =	60000000	PRODUCTION (TONNE/HR)	
Life of surface miner (hr) =	30000	WINDROW-EMPTY TRAVEL BACK	2119.09
Interest @ 10% of capital	0.1	WINDROW-CONTINUOUS	3885
Maintanance cost @ 20% of capital =	0.2	WINDROW-TURN BACK	3744.58
Pick consumption pick/hr =	1	CONVEYOR LOADING-EMPTY TRAVEL BACK	1125.41
Pick price (Rs) =	2000	CONVEYOR LOADING-CONTINUOUS	1483.53
Diesel consumption (lit/hr) =	80	CONVEYOR LOADING-TURN BACK	1462.59
Available hours in year =	4000	NO OF SURFACE MINER (W-E)	0.12
Material (coal) density (tonne/m^3) =	1.4	NO OF SURFACE MINER (W-C)	0.06

So, our length truck capacity is this , oh sorry sorry, this is actually carried out, our cutting drum width is changed. So, that is why truck capacity. So, the truck capacity is 20 tonne, material density is 1.4. So, it is coming around 14 point something metre cube. Now, for achieving this metre cube, our length required is 14 divided by 3.7 into 0.5. So, that is why this is coming close to 7 metre.

So, 7.72 metre is coming the length of cut required to fill a truck. So, the time required to fill a truck is now 7.72 divided by cutting speed is 25. So, whatever is coming that is the time required for cutting the, filling a truck that is 0.31 minute. In every 0.31 minute you are able to fill the truck if you are going for conveyor loading. So, the production tonne per hour you have to calculate.

Not this one for different methods use the formula and all the desired component which we have assumed for that windrow empty travel mode, it is coming this one windrowing continuous mode. This one windrowing turnback mode, this one conveyor loading empty travel back mode, conveyor loading continuous mode and conveyor loading turn back mode, these are the options achieved.

So, considering this we have to find out, these are the production target, how many number of machines are required considering 1 million tonne is found here. But our requirement is that we need to find out the costing. So, we have to consider different cost components as it is known our first component is capital cost. So, as we assumed capital cost is the capital by life. So, this is 6 into 10 to power 7 divided by 30 into 10 to power 3.

So, the capital cost is coming something, so this is 10 to power 3, so this is 2 into 10 to power 3. So, that is 2000 rupees per hour. So, all are in rupees per hour and we are considering interest is 10 percent of the capital cost. So, you are considering interest is 200 rupees as it is given here maintenance cost is 20 percent of the capital cost. So, maintenance cost these are the assumptions we have made, so, that is 400 rupees per hour.

So, this is multiplying. Then we are considering diesel consumption. So, that is a little bit deviation from the problem. So, we have considered 80 litre here. So, diesel consumption is 80, we have considered the diesel price is 90 rupees. So, 7200 is the diesel consumption per hour. We have considered the pick consumption also. So, we have considered pick consumption and power hour is 1 and pick price is rupees 2000.

So, pick consumption is 2000 rupees per hour and we have considered the manpower is 2, let us look into the considerations. So, number of number of person is 2, we have forgot to write that or MS is given. So, I think manpower cost is 2 and MS is 4000 and we have considered operating shift is 5. So, operating shift is 5, so, that is it 1600 rupees I think is there any deviation from that let me check, 1600 rupees.

So, that is so, this is the manpower cost. This is manpower, this is diesel and our fifth component is pick is this is pick consumption which considered here. So, this is pick consumption, this is manpower and then we are having a subtotal. So, let us add it. So, it is coming, 00. So, this is the hourly cost and we are adding to this 10 percent that means 1300 to the overhead. So, 1340, this is 40, this is 7, this is 4, this is 1, then 10 percent profit, so, 1474. So, it is coming 4 1 2 6 1. So, this is coming close to this.

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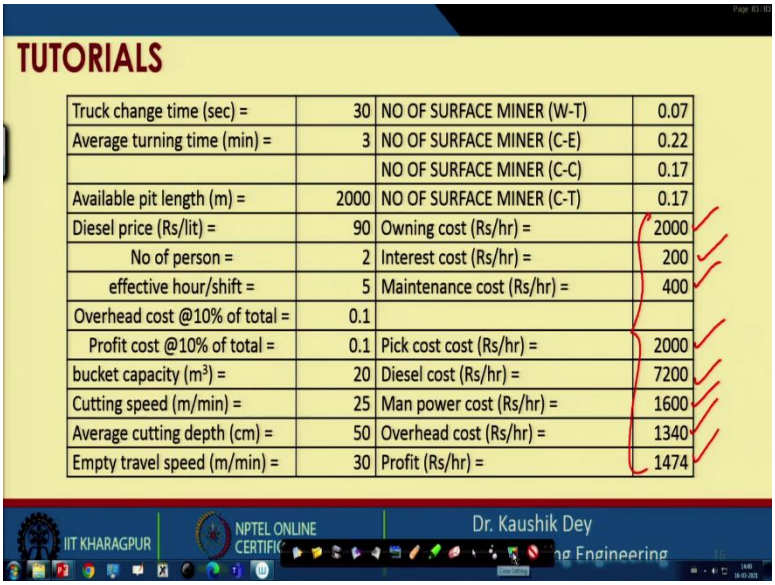

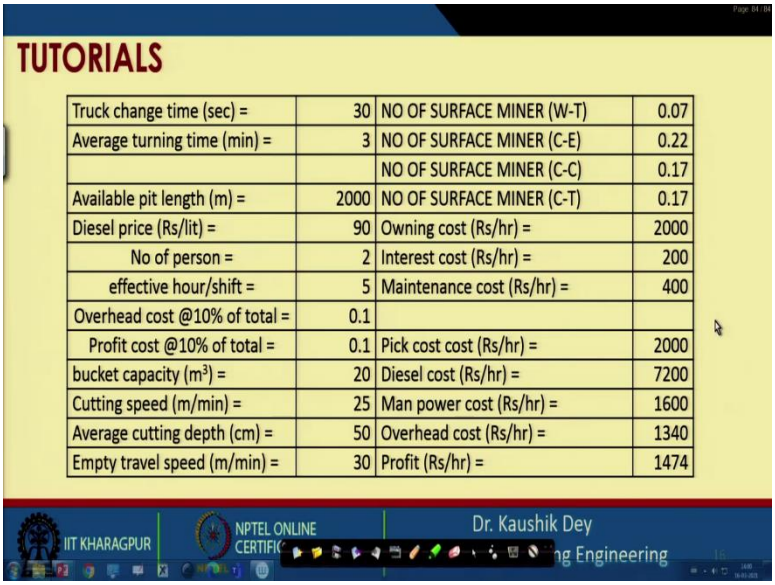

So, in considering with that we are finding that owning cost is 2000 rupees interest, maintenance cost, pick cost rupees 2000, diesel cost this one, manpower costs this, overhead profit. So, altogether the total cost is coming close by adding up all this and this is the total cost. Now, we have seen our production.

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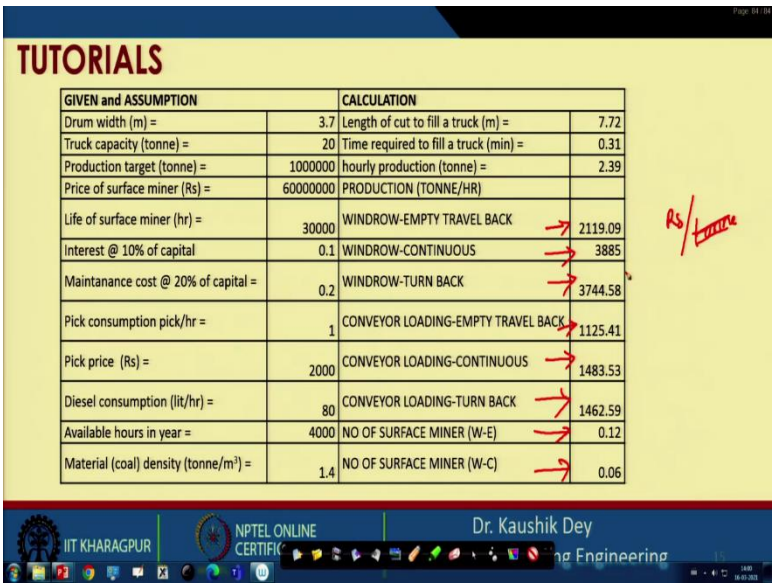

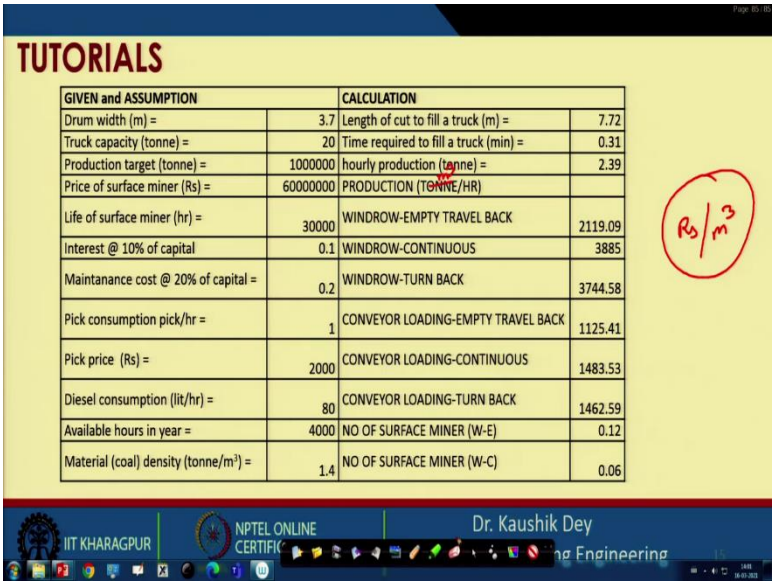

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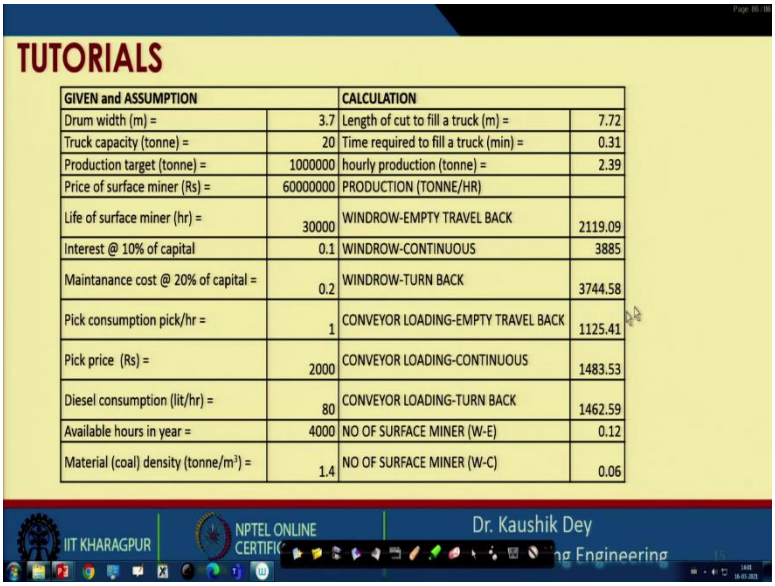
Pick consumption pick/hr =	1	CONVEYOR LOADING-EMPTY TRAVEL BACK	1125.41
Pick price (Rs) =	2000	CONVEYOR LOADING-CONTINUOUS	1483.53
Diesel consumption (lit/hr) =	80	CONVEYOR LOADING-TURN BACK	1462.59
Available hours in year =	4000	NO OF SURFACE MINER (W-E)	0.12
Material (coal) density (tonne/m^3) =	1.4	NO OF SURFACE MINER (W-C)	0.06



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Production from each method is shown here, production per hour. So, as these are available with this if you are divided your rupees by this production you will get the mining cost in rupees per sorry you, you have not considered this in tonne, this is actually in metre cube, in rupees per metre cube. This is not in tonne, this is in metre cube. So, it will be considered in rupees per metre cube.

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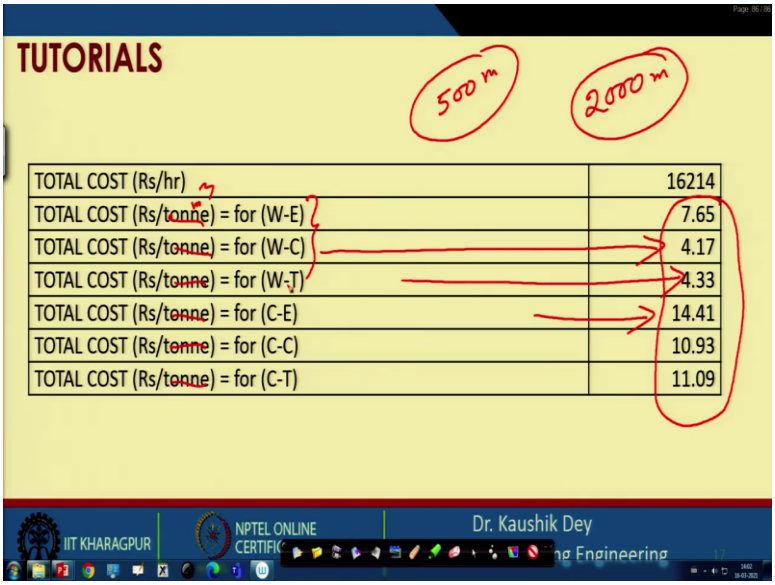

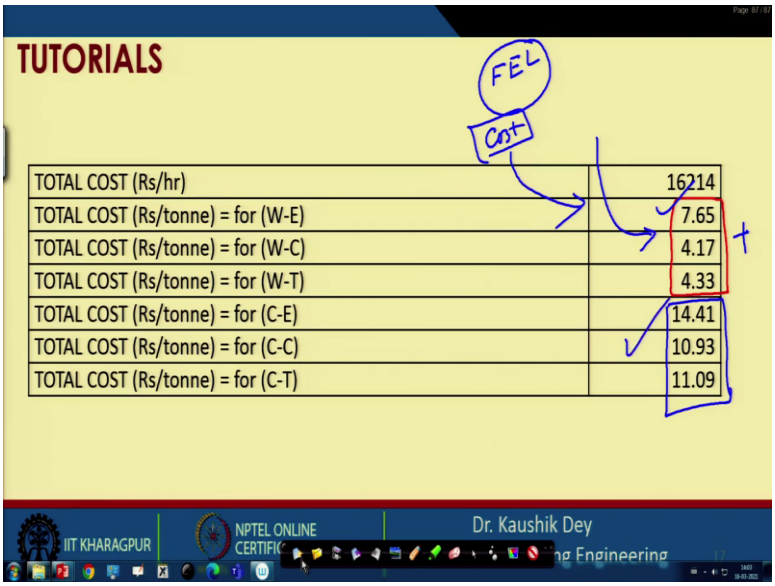

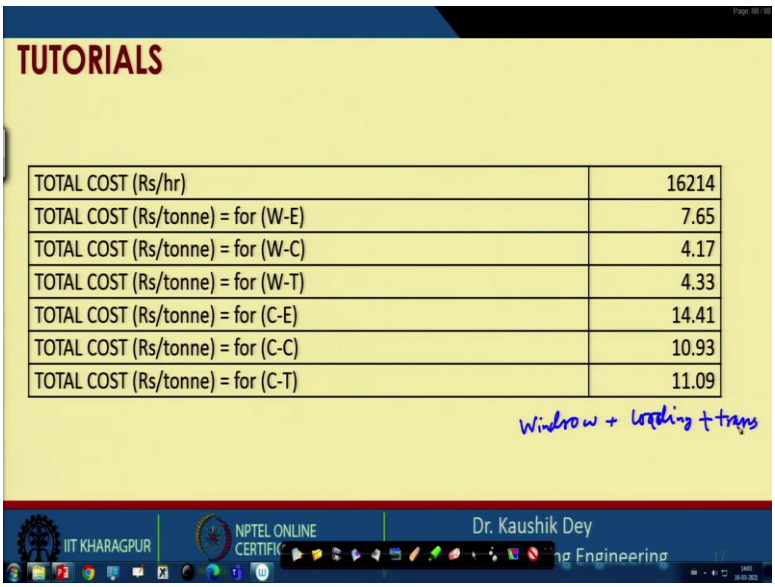

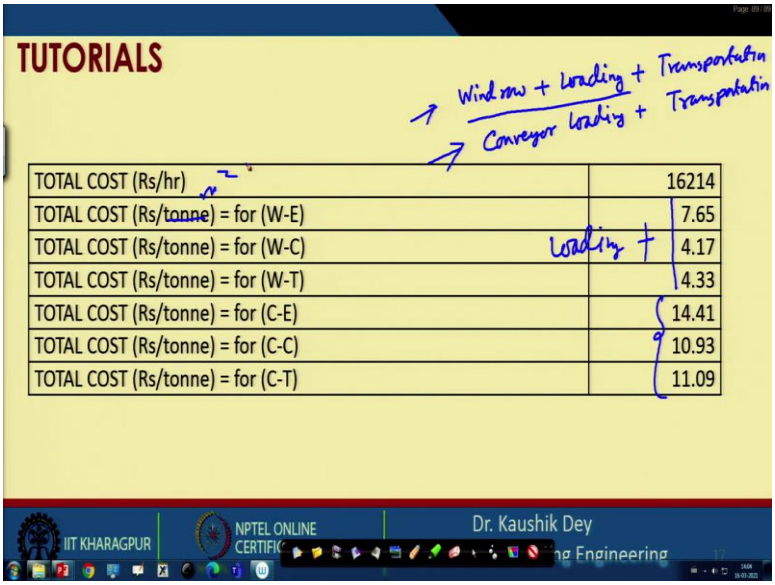

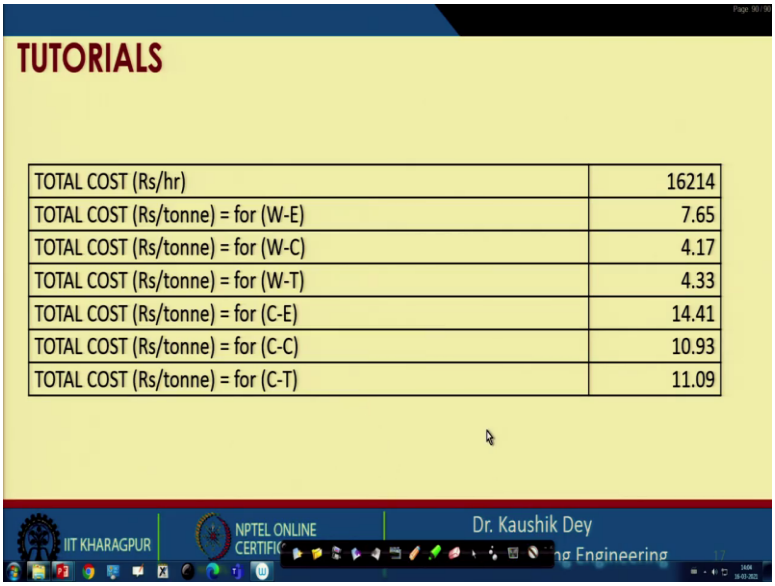

So, in doing so, you will find this is the rupees per metre cube. So, make the corrections here. So, these are the values obtained and it can be seen the minimum cost is windrowing continuous mode, windrowing turnback mode and maximum is obviously continuous empty travel back mode, this is for 2000 metre pit length. So, the things will be altered if you do the practice for 500 metre you can check whatever will be the change in the cost.

Obviously, it will not change in these 2, because these are not depended on the length but it will change for the others. Now, in this case, this part is important but though one can see that this part is significantly lower than this part. But, this part is essentially having the next component that is the FEL loading system. This FEL loading system has to be considered what is the cost coming for this?

What is the cost coming for this? That has to be added along with this to compare between this one and this one. So, whenever a subcontractor has to calculate its costing, either he has to consider windrow plus loading plus transportation. Let me write once again. Windrowing plus loading plus transportation, all he has to consider conveyor loading plus transportation.

So, if the transportation cost is same for this one, so, basically windrowing plus loading and you have to compare between the windrowing and loading and with the conveyor loading. So, that is why this part plus the loading must be considered to compare this with this system. So, this is the essential requirement. I leave that 500-metre calculation part at your end. There maybe some printing mistakes, consider these are as metre cube. The same thing is there for the previous one also that has to be considered here.

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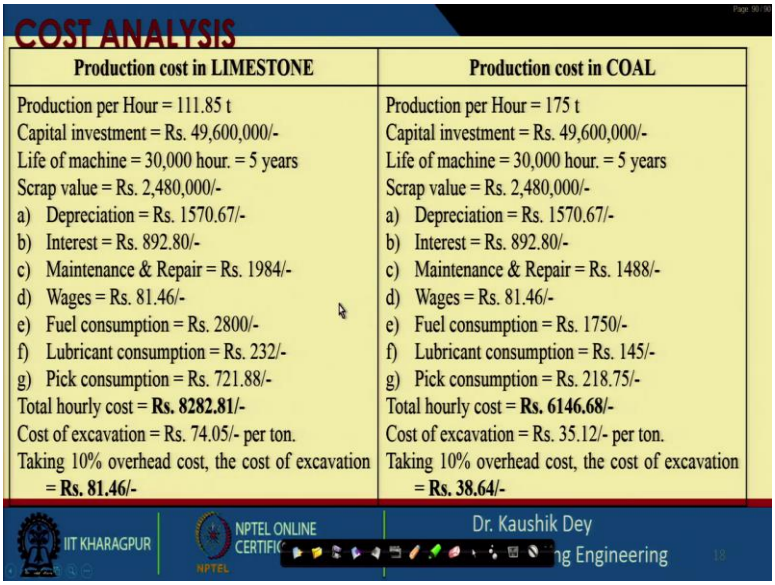

Now, let us look into one some similar calculations, this is for a limestone comparison of the cost calculation for the limestone and coal.

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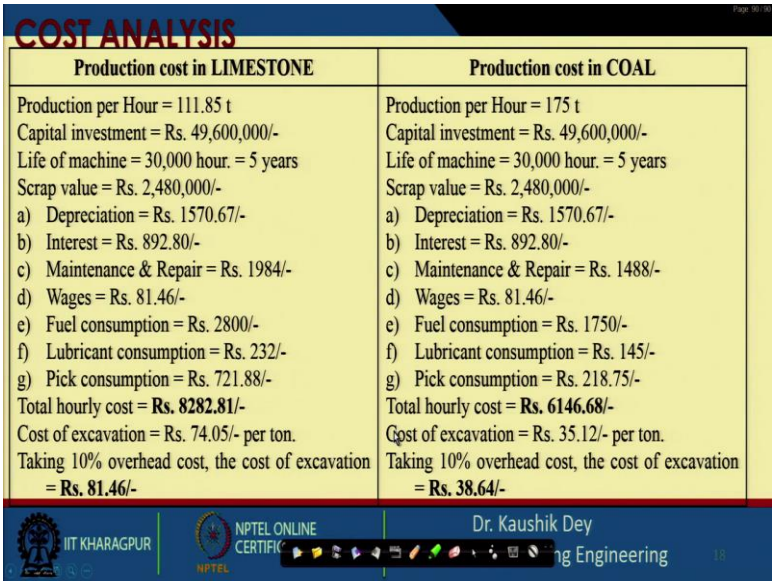

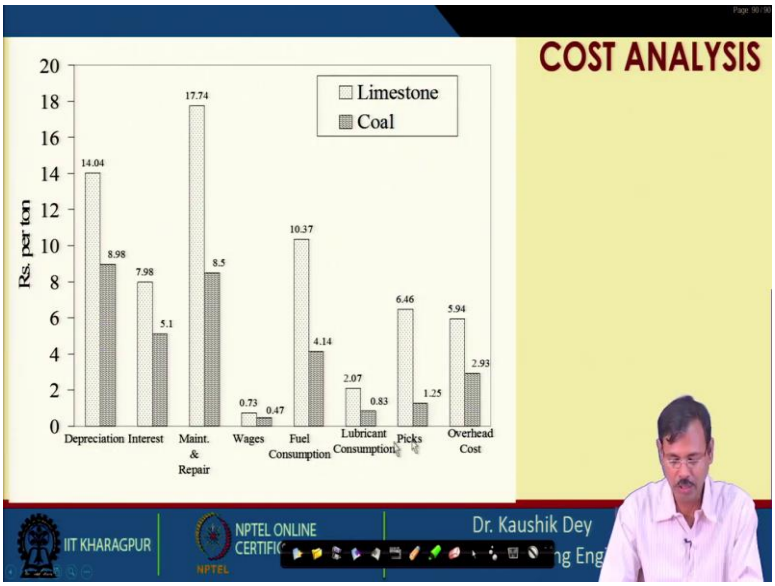

And these are the different components. And you can see the cost is coming around 74 rupees per tonne, here we can see multiplied at the density to make a tonne and here it is 35 rupees per tonne is coming for the coal and these are the different components lubricant, picks all these are considered here. And I hope with this we are concluding with the excavation with surface miner. This chapter, we are concluding here and it is expected that more and more tutorial will be practised as home assignment at your end. Thank you.