Surface Mining Technology
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Lecture – 14
Drilling Technology for Surface Blasting - IV

Let me welcome you to the 14th lecture of surface mining technology. This is the fourth and final lecture of the dueling technology for surface blasting. In this lecture, we will cover the cost analysis.

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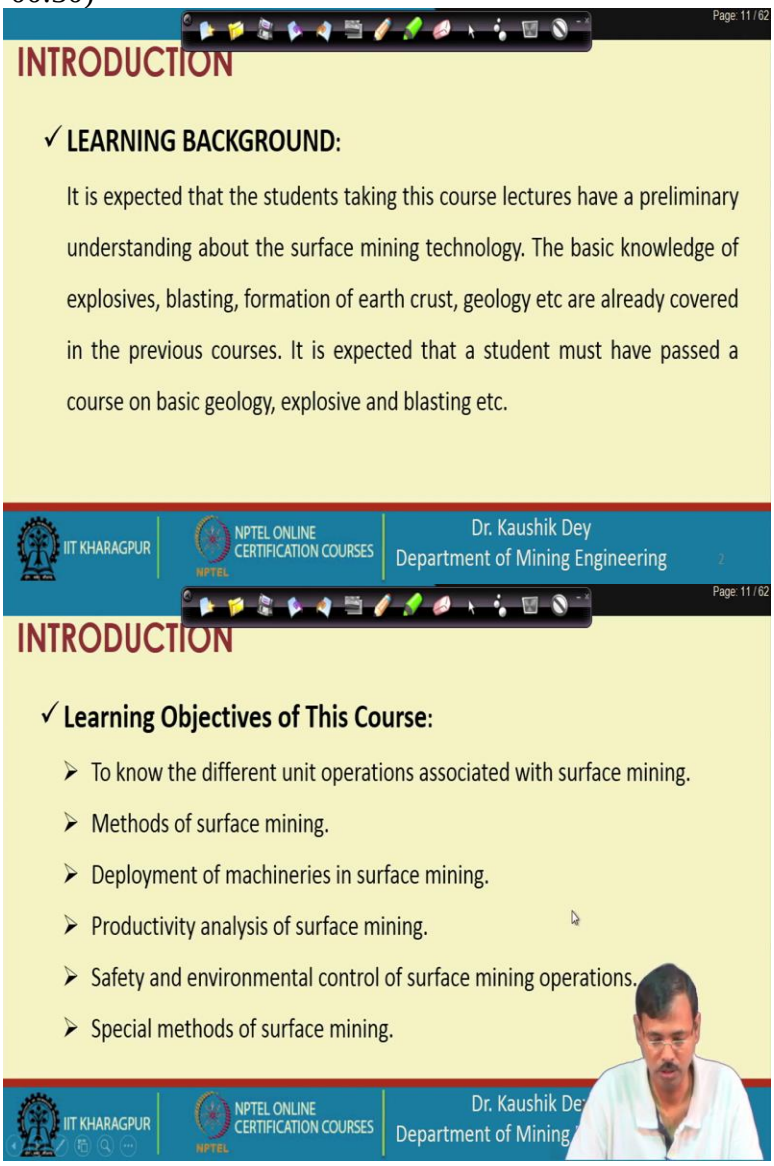

So, let us look into the learning background of the surface mining technology course. The learning objective of the surface mining technology course is this one. And there are the expected learning outcomes for the course.

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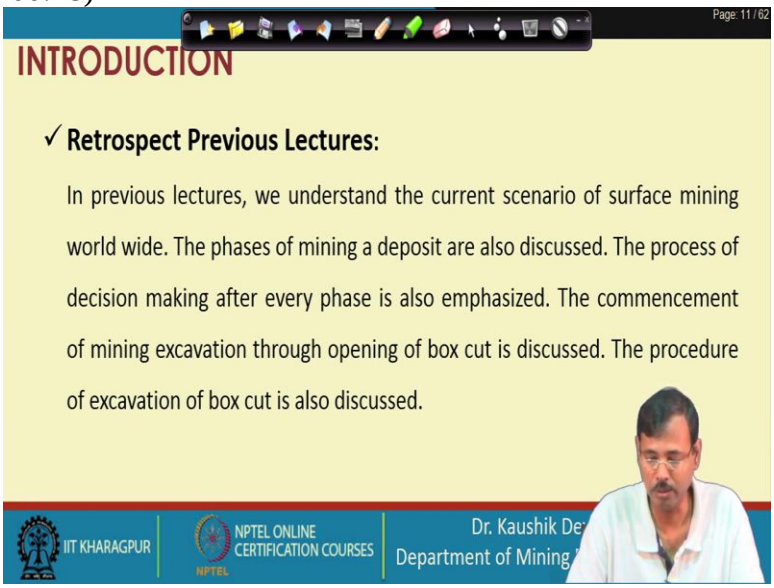

This is the retrospect of the previous lecture before dealing with whatever lectures are covered; this is discussed here. There is the mining status, phases of mining, and box cut opening. In drilling, we have almost completed all the lectures. We have seen the different types of drill machines, different types of drill bits, their applicability, merits, and demerits. And we have seen the durability of the rock, how we will select the machines with the rock.

And we have also discussed how to assess the performance of a drill machine, that is, the drillability of, the drilling rate of the drill machine, and penetration rate. So, how to calculate those things is also discussed. So, this is the previous lecture.

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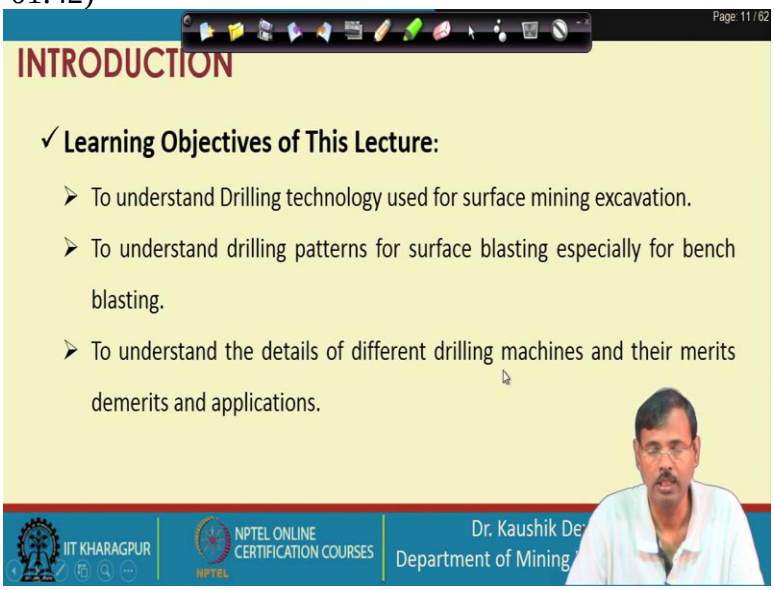

In this lecture, our objective is to go for a cost analysis of the drilling operation. This is the estimated analysis.

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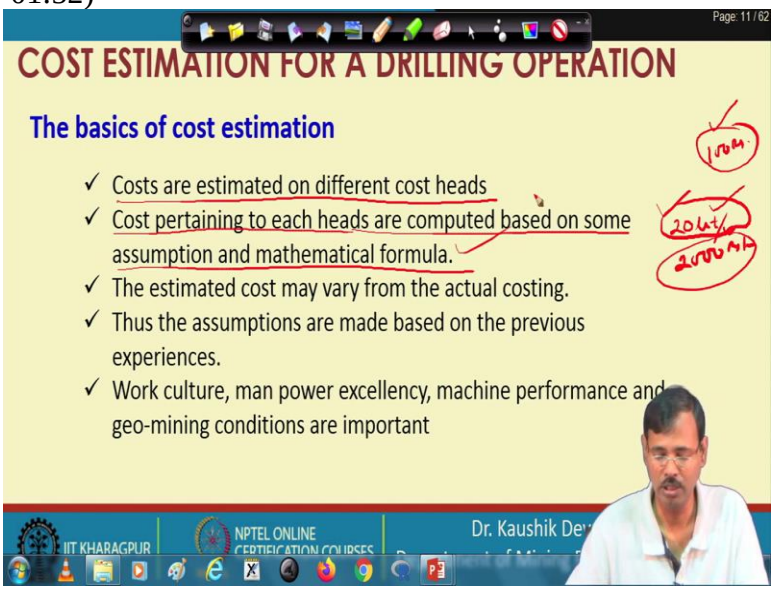

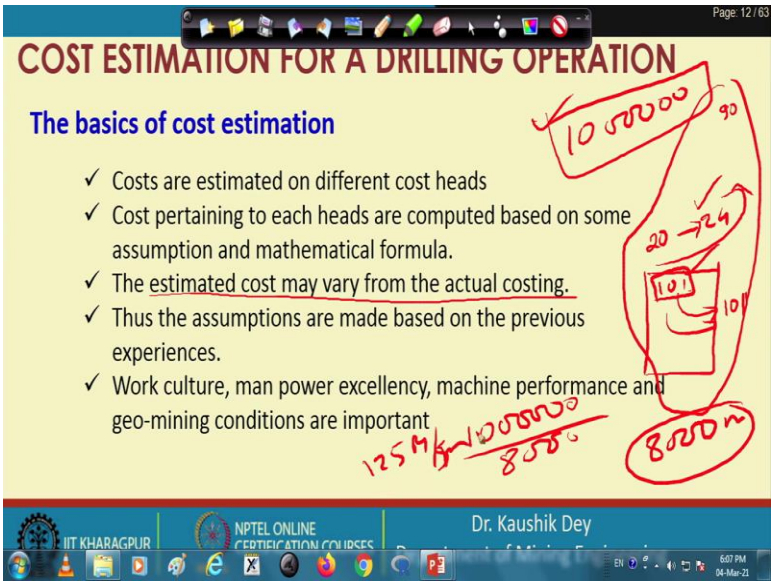

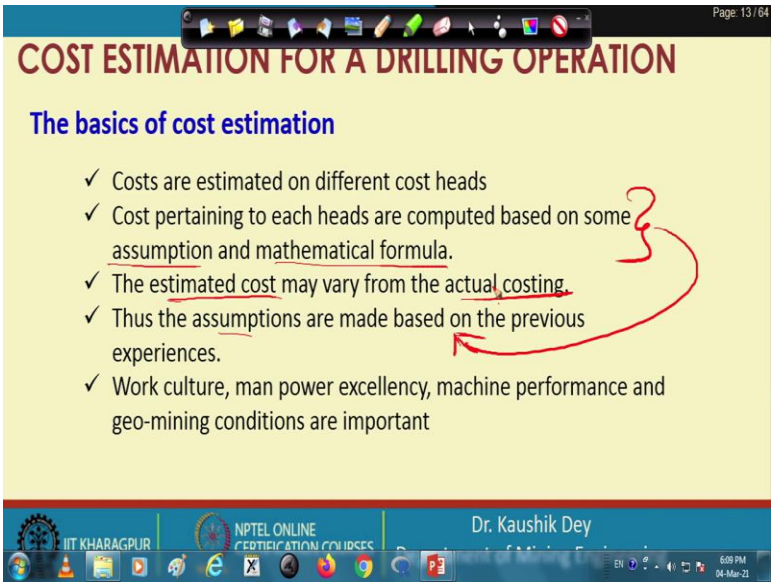

We will try to assess how the cost can be estimated, the actual costing when the mining is carried out at that time actual costing is taken in a different way. But this is cost estimation. Before you deploy the machine, you are estimating what could be the possible cost. So, there is n number of assumptions taken in that case. So, first, let us go into the basics of cost estimation.

The basics of cost estimation mean costs are estimated based on the different cost heads. And costs pertaining to each head are also computed based on some assumptions and mathematical formulas. One small example is that one cost head in calculating operating costs is fuel consumption. So, suppose a drill machine is consuming 20-liter fuel, and if it is consuming 20-liter fuel per hour, 20 liter HST per hour.

And the diesel price says 100 rupees per liter; then, hourly diesel consumption is 2000 rupees per hour. Say, the assumption; this is we are assuming depending on the engine power depending on, on the manufacturer guidelines, we are getting this one. This is the market price and this assumption; assumptions are considered when computing this one. But the mathematical formula is if the diesel consumption is this one, price is this one; this is the cost.

This is the mathematical formula that is considered here. See, this is a very simple example; there are many others there like depreciation, all these things mathematical capital cost, mathematical formula there. So, in this lecture, we are basically estimating based on this. The estimated cost may vary from the actual costing, how this varies, and how you are coming to that now.

Say, suppose, while you are getting out dealing with the same machine in which you are estimating the 20 liters will be expected one. Suppose the operator controlling that machine also operating that machine runs the machine at a higher feed, higher thrust. Then what is happening? The consumption may be increased from 20 liters to 24 liters. So, it varies in that aspect?

And it may go to 18 liters, depending on how an operator is working. So, this full load, half load, all these things are coming in those conditions. And in that case, you will get the actual cost that what is the consumption of the fuel, and what is the price. Maybe that time the price is 90 rupees, so, what will be the price? So, based on that, you are getting the actual costing. So, the estimated cost is continuously varying from the actual cost.

And when the mine is under operation, all these machines, etc. These cost components are booked in different cost heads. So, say suppose your drill machine is placed at a cost head of 101. So, whatever decision is given to that machine is booked under this cost head of 101. Similarly, if the drill bit, one drill bit is issued to that machine and the drill bit to price is said 10,000 rupees, that also booked in the cost head of 101.

So, all the costs related to this particular drill machine are booked in the cost head of 101. So, after one month, you have found the price or maybe one financial year, the cost in this 101 maybe say ten lakhs rupees or maybe 10, 10 to the power 5, 10 to the power 6, 1 million rupees. So, this is the cost pertaining to that particular machine, during one financial year. Now, you find out what is the, in one year how much dealing is carried out by that particular machine?

You have found out the total dealing carried out by that machine is 8000 meters. So, this is the total drilling carried out, and this is the total cost. So, now, we are finding out rupees per meter, divided by 8000. So, that is 125 rupees per meter is the, per meter is the actual cost you have found in that particular machine. So, this is for the actual costing case, but we are basically considering different assumptions and mathematical formulas for calculating this for the estimated one.

This assumption and mathematical formula you are using are close to this actual costing if you consider your previous experience. So, if you have previous experience working with a similar machine or a similar type of machine, same model of machine, you will find out what the assumptions are. So, the assumption that 20 liters per hour of fuel is right or not; you will come if you have previous experience with that assumption will be very close to the realistic one.

So, the difference between the estimated and actual costs will not be significant. So, that is why previous experience in this estimation holds goods, and that always wishes that estimator estimations will be made based on the previous experiences.

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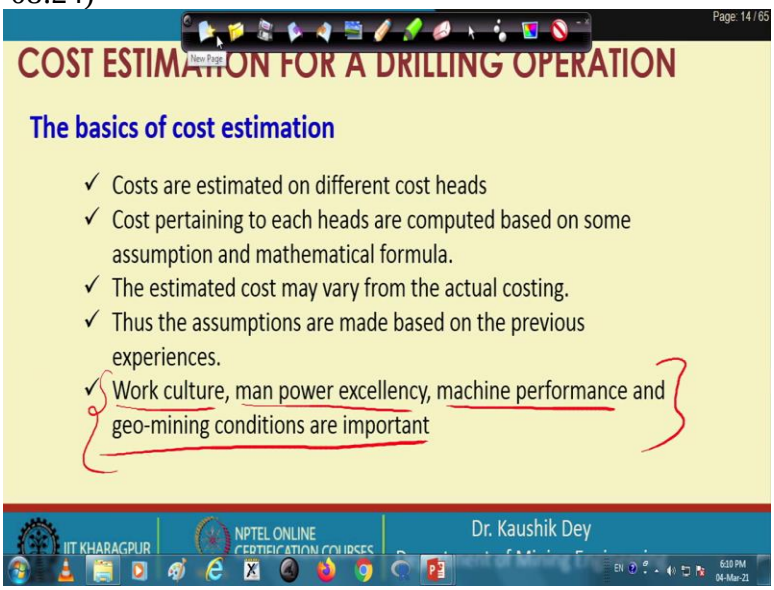

And apart from that, work culture, manpower, equivalency, atmospheric conditions, machine performance, and geo mining conditions are important in these conditions; those have a significant impact on the different assumptions. So, if the situation is like that, say, twice the rainy season is going on in South India. So, wear and tear is the jamming of the drill rod, or all these problems occurring in those minds.

Because the stickiness of the material occurs frequently, that is basically reducing the availability and utilization of the machine. So, suppose you are considering in one place the 4000 hours of the hour available or 4000 utilized hours are available for a particular machine. In that case, that may not behold true for that particular region or another region. So, those things are essential and should be considered the critical parameter.

Say, working culture in the government sector gives the lower performance than the private sector that is always found in the Indian mining condition. So, those things must be considered while the estimations are made.

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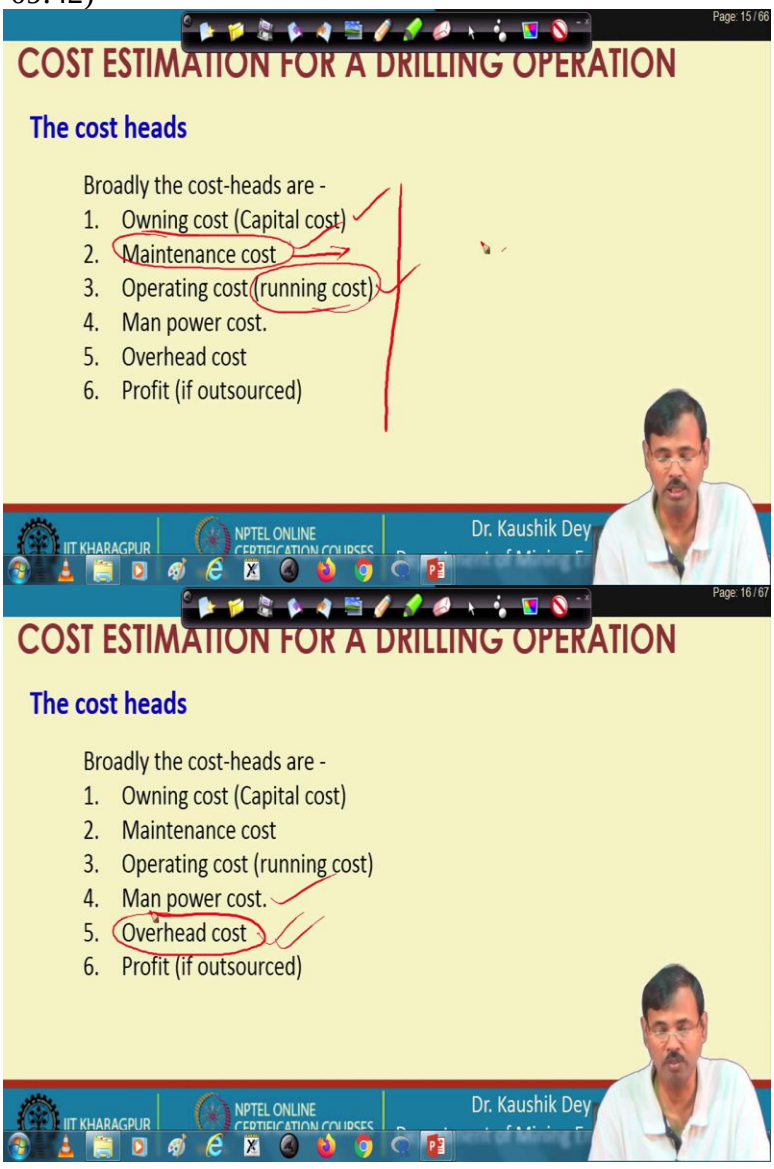

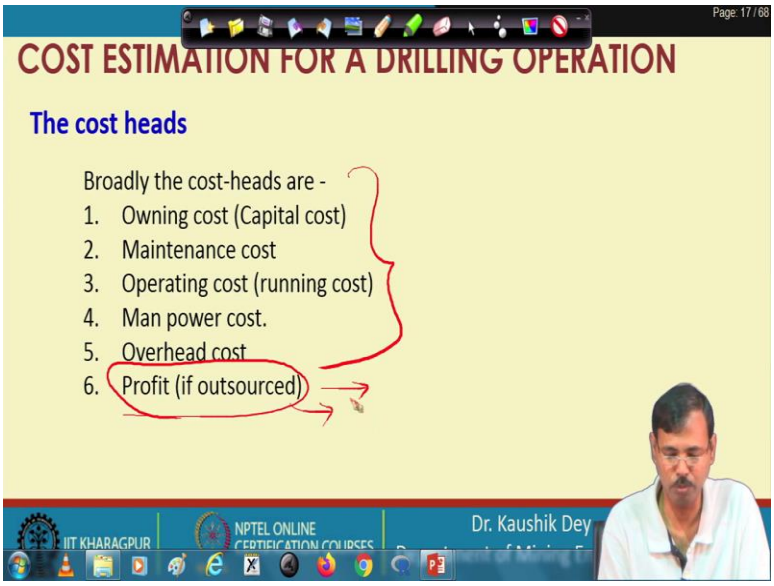

Now, let us look into the different cost heads we are interested in. There may be n number of other ways, but this is one type of distribution of cost head. There may be different types of also. Say, suppose we are distributing the cost head like one owning cost. Owning cost means what are and what cost the owner incurs for holding that particular machine. That means purchasing that machine, maintaining that machine's depreciation, and paying interest for that machine; these are considered the owning cost.

Maintenance cost is the cost required for the significant maintenance of this machine, say regular oil changes, then that hourly basis maintenance is considered in this maintenance cost. Operating cost is the cost, because of the running of the machine, that is the power cost, there may be some important spare there, which are very heavily consumed. So, those are also considered the operating costs.

Like, say, tire of the trucks, tire of the trucks, the cost pertaining to the tire of the trucks is not considered part of the maintenance cost. Still, it is considered the running cost similarly, if you think the filter, air filter of a, of an engine that is coming into the maintenance cost, but not in the operating cost. So, these are some of the default boundaries you may have with the spares.

But this is only for the estimation case, as we have discussed if the actual mining is going on, in that case, you need not consider this one because whether the air filter is issued or the lubricant is issued, or the tires are issued, all are booked in the same cost code. So, directly you can get the actual of what is the actual cost going on there. So, operating costs are those are the main costs.

Manpower cost is the. Manpower, you are directly recruited for that particular machine. So, that is considered as the manpower cost. Overhead costs are the associated other costs for maintaining an office, recreation, etc. Because, unless and until you are considering a portion of that cost in your operative, operative costing, costing system, those costs cannot be booked anywhere.

And if you are going for an estimation of this cost for outsourcing the job, you have to add a profit part for the outsourcing company. Because he has to earn some profit from this, this profit cost is not there, if you are going for costing for your own company. But if it is going for the other company, you also have to consider the profit as part of that.

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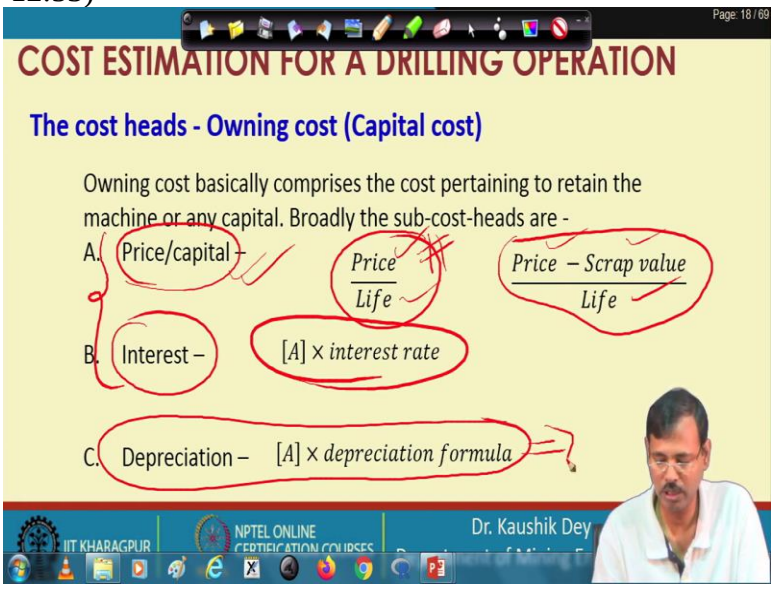

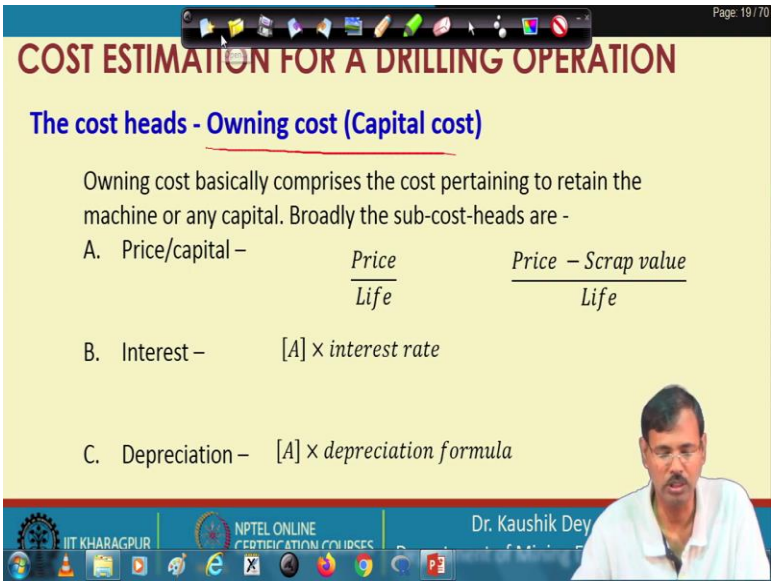

Now, let us the subheadings of this every cost. So, owner cost, owning cost is first the capital cost, say you can consider the formula like this price by life, or price minus scrap value my life or there are other any number of the different economic formula is available, for all these calculations. So, you can opt for any of such calculations. This is the simplest one, the simplest and easiest one.

You can opt for this, you can opt for this, but there is n number of other formulas available given by the different economist; you can apply any such procedure for the estimation. But your owning cost must have a component of capital considerations here. Similarly, if you are procuring that machine using a bank loan, you have to consider an interesting part, an interesting part of the bank loan. And in that case, we have to consider the interest component as part of the owning cost.

And depreciation, as you understand that the machine values are gradually depleted. And one must have to keep some money to replace the machine. So, those are considered as a part of the depreciation. And this part is very, very important, and you have to consider this part as a part of this owning cost. But it is; these are all for the estimation part. And in this estimation part, under the serving head of owning cost, you have to consider all these different cost components.

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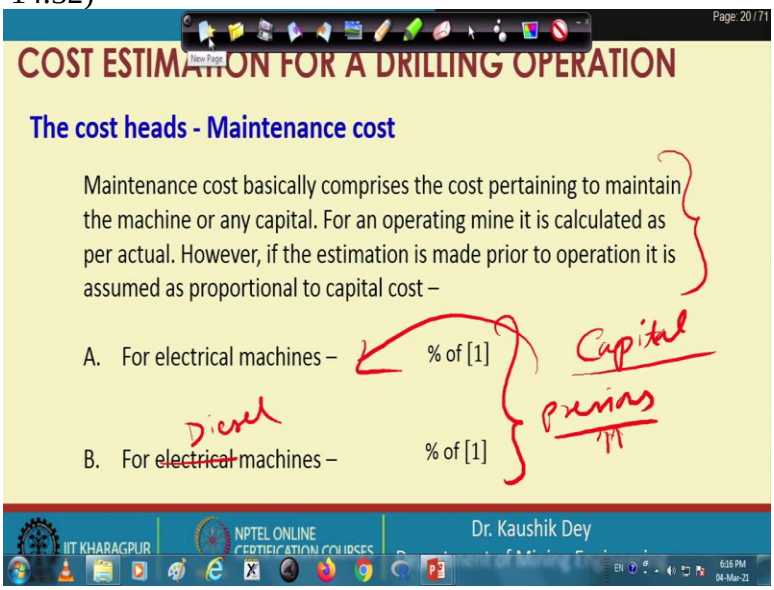

Next is the maintenance cost, as we have already discussed. If the machine is under operation, you can have the direct maintenance cost from that part. But if you do not have that, you have to estimate this maintenance cost. In general, maintenance cost is expected or estimated as a part of the capital cost. Because, as the capital price of the machine is if high obviously, price of its spare is also high.

So, if your maintenance cost means you are considering the price of the spare. So, that is why you have to consider the price of the price as a component of the maintenance cost in case of estimation. As a rule of thumb, often that 10 percent is considered for the electrical machine, 20 percent is considered for the diesel operated machine, and for the diesel-operated machines, generally considered.

But I always believed that previous experience, the previous experience should be considered because a number of things depend on the work culture, the excellence of the operating crews, the excellence of the maintenance crews, all these are dictating on this, and that is why previous experience is much much better to be adopted in this case. There is the maintenance cost-related issues.

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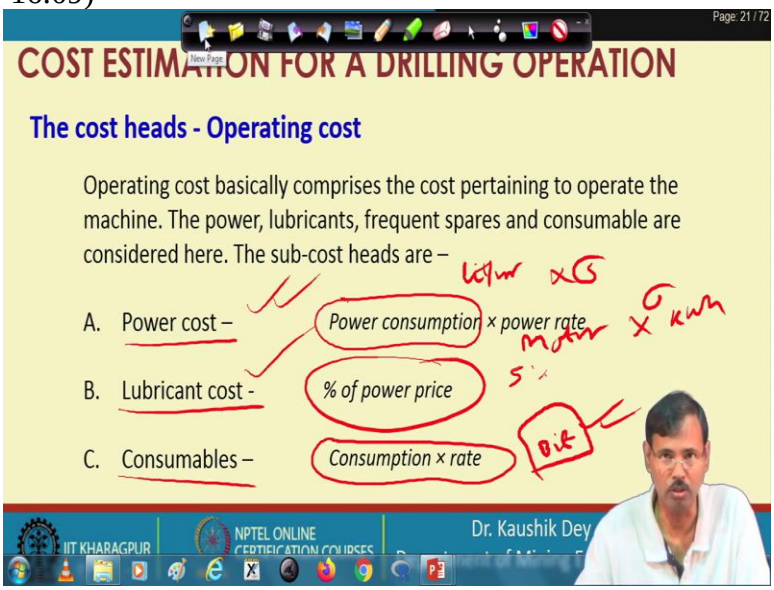

Then the operating cost, basically you can have subheading power cost, lubricant cost, consumables. So, we have already discussed the power cost as diesel is the liter per hour consumption. Then, the price of the diesel, if it is electrical, then the motor size, motors, and the rate of a kilowatt-hour. So, that has to be incorporated as the power cost; lubricant cost is considered a percentage of power cost.

Generally, it is considered 5 percent of the fuel cost or something like that. These are basically lubricants, which means greasing, other mobile oils, etc. These are considered the lubricant cost; lubrication of the different movable parts is considered here. And consumables are the essential consumables that are frequently used; those are not considered in the maintenance part. That means, for drill machines, say drill bit. A drill bit is a regular consumable material that is regarded as the consumable and placed in the operating cost in this case. So, this is very very important this main other consumable should be considered at this place.

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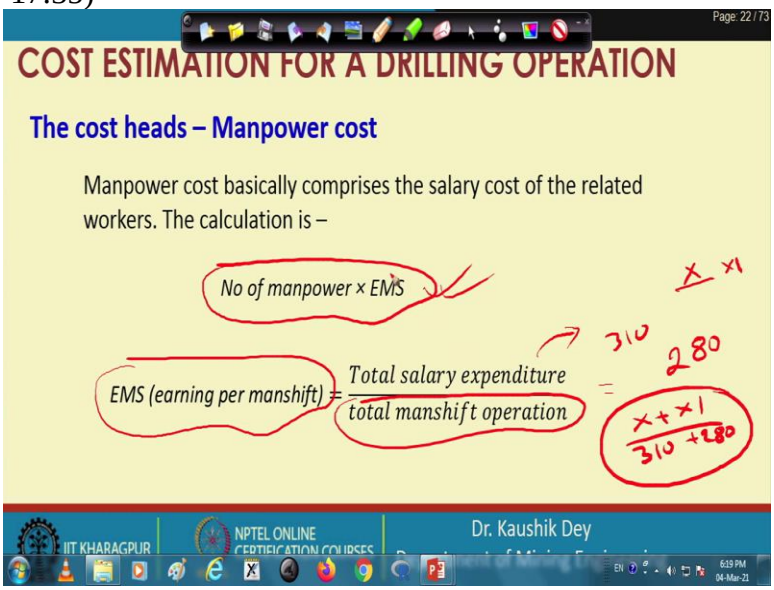

If it is considered the manpower cost, manpower cost, the number of manpower multiplied by the EMS is the easiest way to conditions the manpower cost. And what is the EMS? EMS is the earning per man shift; basically, the total salary ahead of the company divided by the total man shift operation is considered the average salary per shift operation.

That means it may be possible a person who is the direct recruitment of that company is working say 310 shift in a particular mine. And the total salary he has drawn is, say, x. So, he has a 310 shift, with x salary. Another person who works has taken some leave, etc. 280 shift he has operated, and his salary is x1. So, the EMS is x plus x1 divided by 310 plus 280. So, this is the average salary of x and y person. So, this is the similar way we calculate the EMS from a particular mine.

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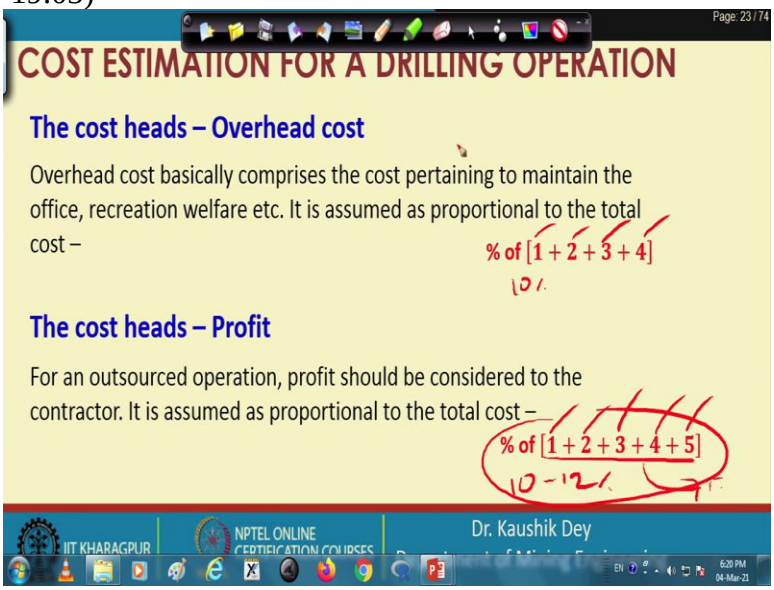

Then again, we have discussed overhead cost and profit are considered as a percentage of the total cost, which is there. So, generally, the overhead cost is considered 10 percent. And this is also considered as 10 to 12 percent of the profit. So, it is an addition of up to 1 to 4, which means owning costs, maintenance cost, operating costs, and manpower cost. Here it holds cost, maintenance cost, operating cost, manpower cost, and overhead costs. So, this is the total of that one. So, this is why, and up to this, this is 1 to 5, this is the total cost, and you are adding a percentage of profit to the total cost.

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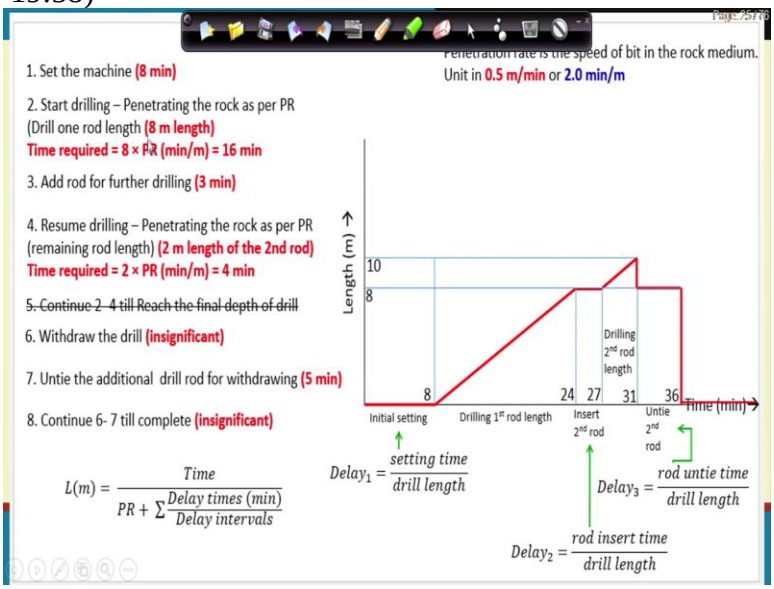

So, this is what we have discussed now; in this case, we are not considering the with, with rod is turning red. So, that is not considered here. So, this is the total consideration for a 10-meter drill hole. We have found that 36 minutes is required to deal with this one.

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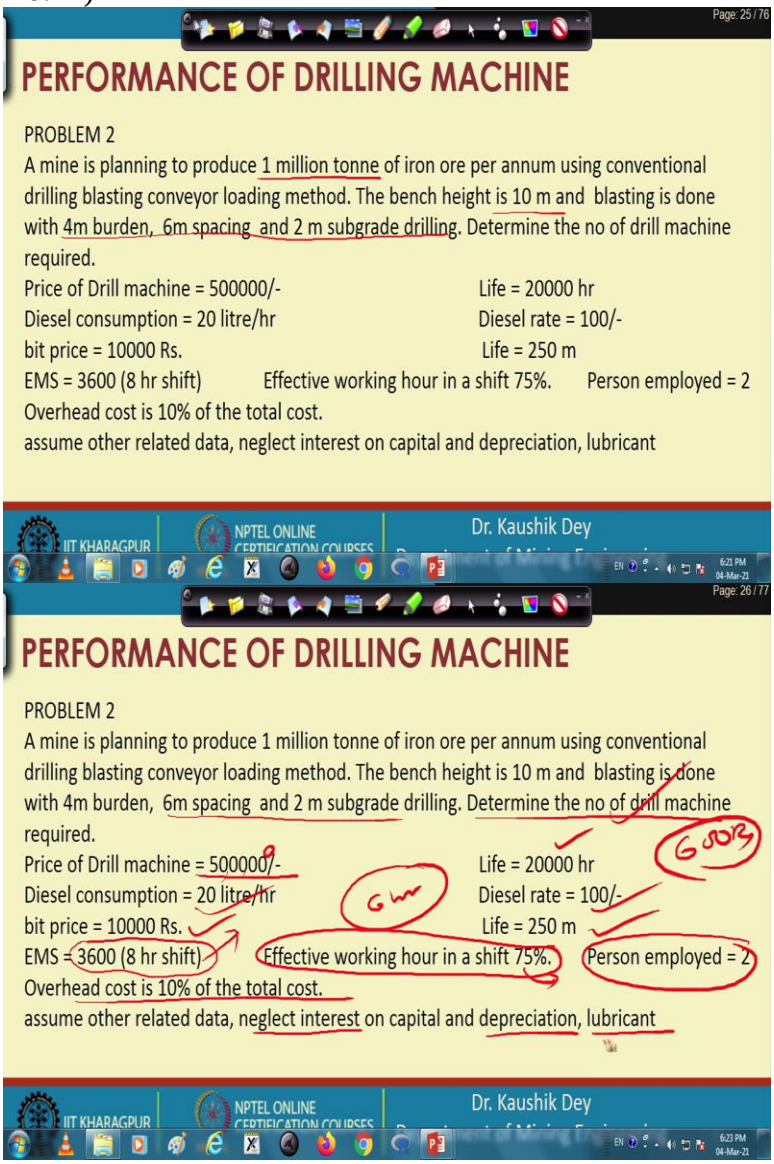

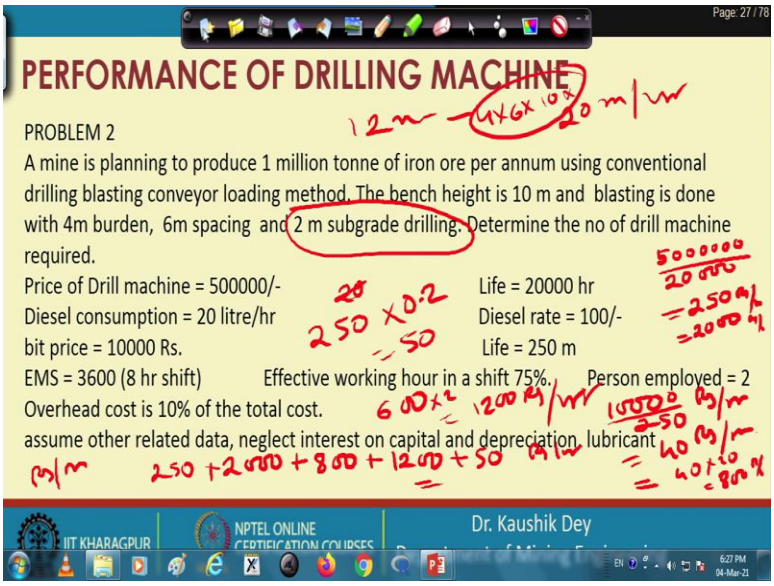

So, let us consider all these things and solve one costing problem. Suppose we have to go for 1 million tonnes of iron ore using drilling blasting. Bench height is 10 meters, 4 meters, 4 meters, 10 meters, 4 meters, 6 meters, and 2 meters; these are the burden spacing and sub drilling. And we have to determine the number of drill machines required and find out the cost. So, this number of drill machines required we have already calculated.

Now, for costing, let us consider the same problem, the price of the drill machine is 50 lakh, sorry one 0 is missing I think. So, this is 50 lakh; life is considered 20,000 hours. Diesel price, a diesel condensate is regarded as 20 liters per hour, diesel rate is 100 rupees per liter. Bit price is considered at 10,000 rupees, bit life is considered at as 250-meter, 250 meters drilling. Earning per man shift is considered as 3600 hours for an 8-hour shift.

And it is considered that the practical working hour, that means in an 8 hours shift only 75 percent of that are utilized for drilling. So, that means actual drilling is carried out for 6 hours only. So, it is 80 by 8, 75 percent of 8 hours is 6 hours. So, you can consider the EMS that is the 3600 rupees is spent for a 6-hour operation. So, that means hourly 600 rupees is spent.

And you need to have two people to operate a drill machine. So, these are given, and also it is given overhead cost should be considered 10 percent. So, what are we considered? We have neglected the interest part on capital and the depreciation part in the owning cost. We have not considered the lubricant part also in this calculation. And using this, we have started our calculation. So, let us start calculating here.

So, let us consider owning cost is only the price by life. So, the price is 50 lakhs; the life is 20,000. So, owning cost is 250 rupees per hour. So, this is rupees; this is an hour. Then diesel consumption per hour is 20 liter. So, diesel consumption is 20, 100 rupees, 2000 rupees per hour. We have to consider the maintenance, say considered 20 percent is the maintenance cost. So, the maintenance cost is 250 into 250 in terms of 0.2. So, 50 rupees is the maintenance cost.

We have neglected lubricant; we have to consider the bit. Bit price let us think, later it is given 10,000 rupees, bit life is 250 rupees. So, this is, you see 250 meters. So, it is now expressed in rupees per meter; how many rupees per meter? So, that means it is 40 rupees per meter. And in 1 hour, you can drill, say 20 meters. That we have already got from our previous exercise, 20 meters per hour is the drilling rate.

So, you can have, if you are expressing it in rupees per hour, then it is 40 into 20 that means 800 rupees per hour, that is the drill bit cost. Now, your final one, EMS, we have already got that 600 rupees per hour are the EMS. So, it is 600 into 2, that is 1200 rupees per hour is the earning per man shift. So, if you are adding it up in 1 hour, you are adding 250 plus 2000 plus 800 plus 1200 plus 50.

If I miss something, you may add it from your side. So, this is the rupees per hour, and you have 20 meters in one hour. So, if you are dividing this by 20, you will get rupees per meter. And if you are trying to convert it, you can convert it to tonnage also; then, you have to consider the sub drilling part. This is drilled, so the drilling cost is there, not the yield. So, that has to be converted appropriately.

So, 12-meter drilling is you have to consider this 12-meter drilling is yielding say, whatever it is four into six into ten into specific gravity, whatever this is, this is that is the tonnage. So, you have to consider that in this calculation. So, we have already considered this in our calculations.

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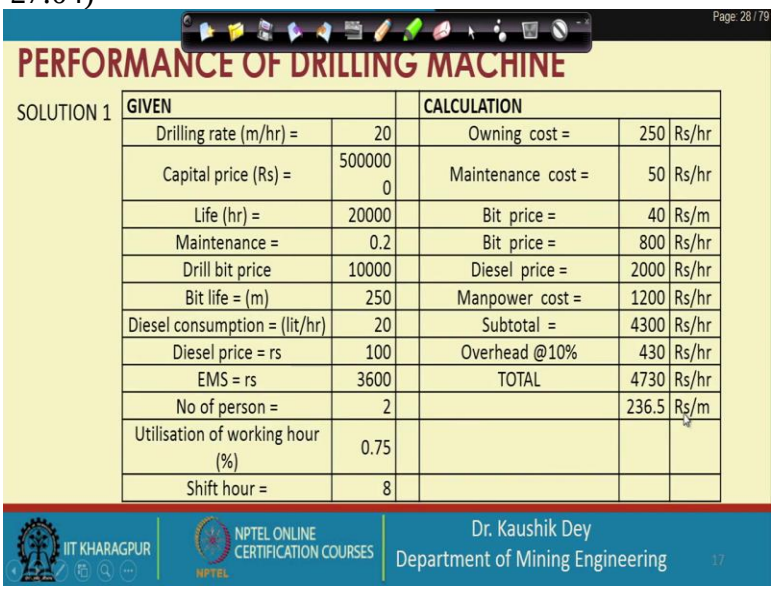

As you can see, this is coming to 236 rupees per meter or 4730 rupees per hour, with all these considerations. So, this is the one way of cost estimation; there is n number of other ways also. You can consider those things; this is the easiest way of cost estimation, so that is given to you. So, this is the end of the drilling part. Thank you.