Surface Mining Technology
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Lecture No. 08
Phases of Surface Mining - 3

Let me welcome you to the eighth lecture of Surface Mining Technology. This is the third lecture in the phases of surface mining. We are continuing the introduction to surface mining.

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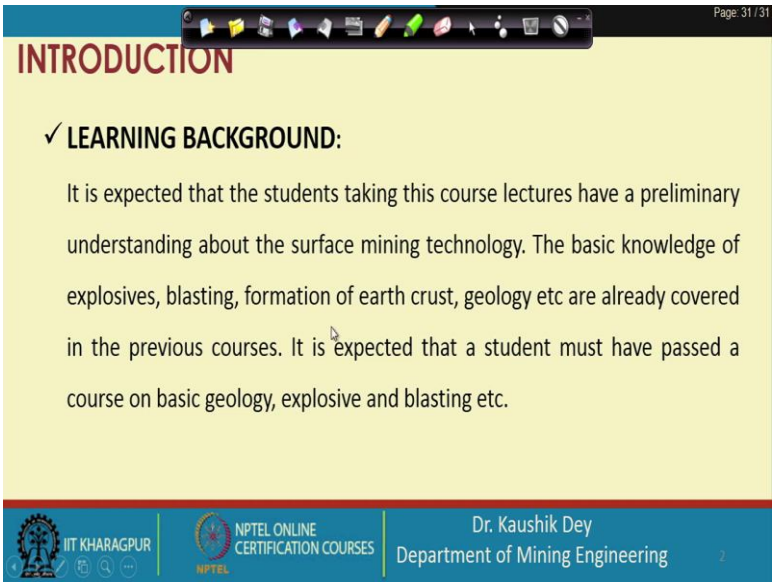

And as the requirement, let us give a glimpse of the learning background for the Surface Mining Technology.

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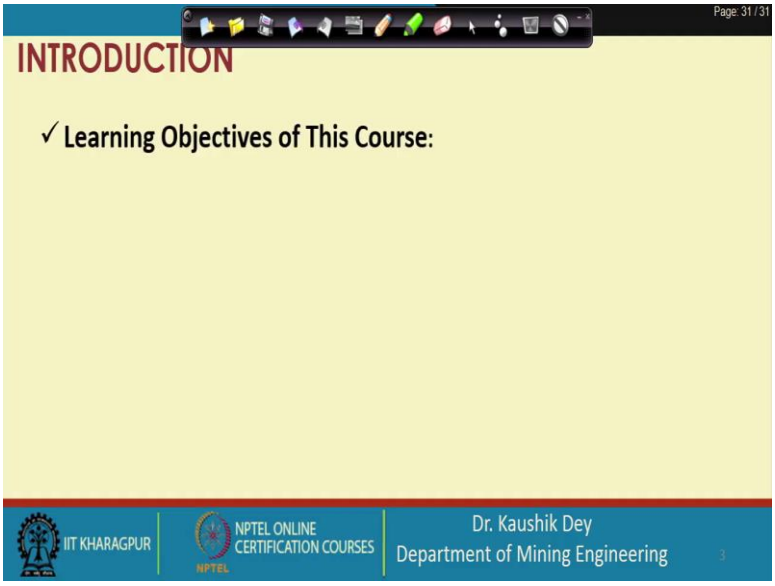

Then the learning objective of the course Surface Mining technology.

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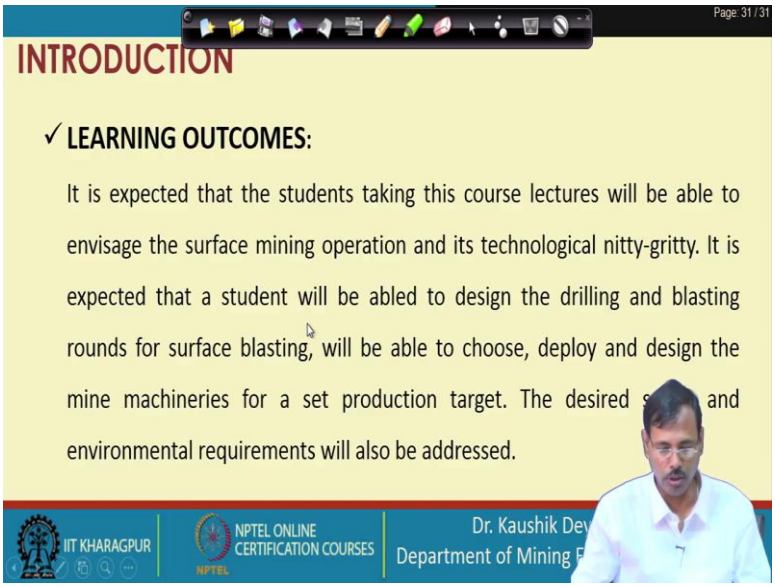

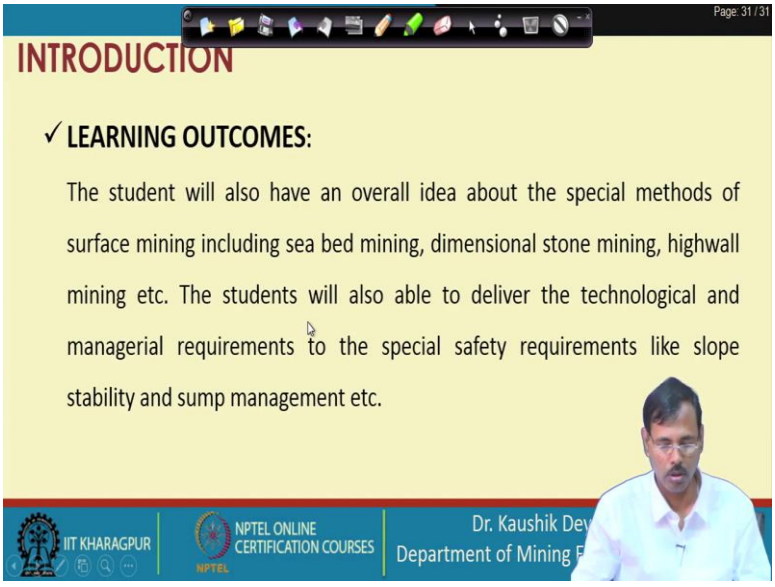

And this is the learning outcomes we are expecting from the participants who are undergoing to this Surface Mining Technology course.

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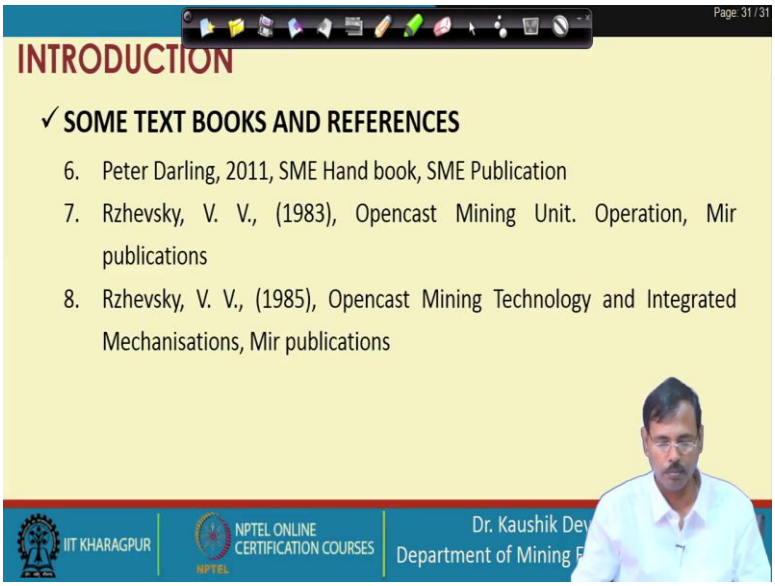

And these are the reference and textbooks.

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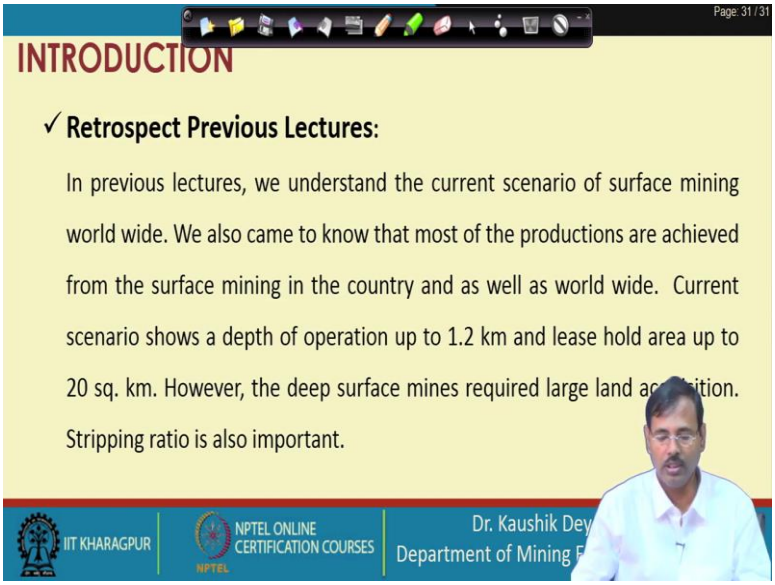

Now let us retrospect the previous lectures. In the previous lecture, we have covered the phases of mining up to the mining phase end. We have already discussed the exploration phase we have carried out geophysical prospecting. We have carried out then the geological prospecting. And after that, we go for the geological exploration in which we take the core drilling to take out the core. We analyse the grade of the deposit at a different position.

Then, by getting those grades of the deposit at different positions, we distribute the grade in-situ with some mathematical techniques. And then, from there, we have come out with the positioning of the deposit inside the rock mass. And for identifying this one we go for block modelling system. After this deposit is established through this block modelling and grade distribution system is, the mining people understand the distribution of that deposit inside the rock mass. They first do the feasibility analysis of the deposit.

So, they come out with the decision that economically, the mining of this deposit is acceptable, and this is the capital requirement, this is the money flow, this is the profit if the mining is carried out in this deposit. And when the financial appraisal of the mining is accepted by the management accepted by the financing authority, then the detailed technical report is made for carrying out mining in the detailed technical report the different phases of mines how the mining will be carried out, from where it will start.

Then how the mining will be extended, what machines will be deployed, how they will be phased out, how the mining position will be changed from time to time all these are in detailed notate detailed planned and accordingly it is designed. Then the actual mining is when the detailed project report is met then the deployment of the machines carries out the

actual mining. Then the mining is carried out as per the detailed project report is mentioned. And gradually, the mining is carried out until the ore's last tonnage is excavated.

So, this is discussed in the previous lectures the previous lecture, we have seen the different mining missionaries. For those who are possible to use in a mining system it is not required that the all the machines are required at a time or in any mining you will see all those machines. But as per your design, some of the machines will be available in some mining sector.

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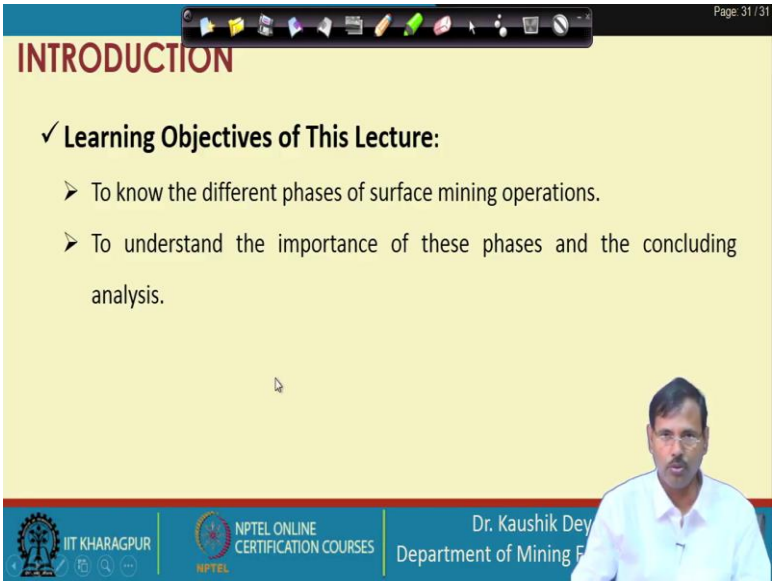

So, this lecture's objective is to discuss the post-mining. How we will carry out the closing of the mines and the different mining systems. That means we have already seen the different missionaries, but we are not these machines used these machines are not possible to combine with each other. So, some combinations of machines are used in some mine some other combinations are used in some other mine.

So, we will discuss these combinations of machines in this lecture. So, first, we will discuss the post-closing operations. Then we will see the mining systems.

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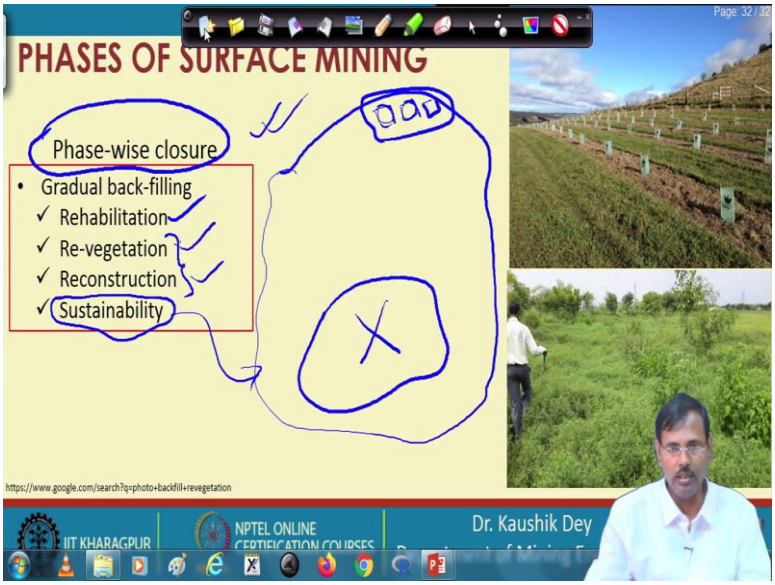

So, these are the generalised phases exploration phases mining phases we have discussed. Then the phase-wise closure of the mine. So, phase-wise closure means we have to close the mine. There are some important aspects, or some inner thought is required here. What is that in inner thought? The inner thought is that currently mining is going on at this place, or you can say this is the area.

Let us go for it; we are having some township here at this position. And we have carried out mining at this position. So, all these workers or the people either they are directly working here or indirectly opening some shop et cetera at this position and they are having their livelihood related to this mine. So, whenever we are withdrawing a mine or closing your mine, we have to think of their rehabilitation.

Before the mining, the place was maybe having some flourished or maybe some abundant area or sometimes there is a township, or sometimes there is the agriculture field. So, when we have completed the mining, we cannot leave a big hole in that area and remain the area like this. So either we have to go for revegetation or reconstruction. So, all these are required to be carried out at this place.

And finally which is the requirement is the sustainability of the same. That means we have to develop an ecosystem in this area to be self-sustained, that will not create any environmental hazard, that will not create any safety hazard, and that will be fruitful to the society. So, that is the essential requirement and when a mine has to be closed, one mining company need to have some inner thought related to this.

It is not that you always have to fill back the mine, but some constructive thinking, some new thinking, and some inner thought thinking is required. This will give the sustainable closing of the area, which means it is technically sustainable, economically sustainable, and environmentally sustainable. So, that is essentially required while you are thinking of closing a mine.

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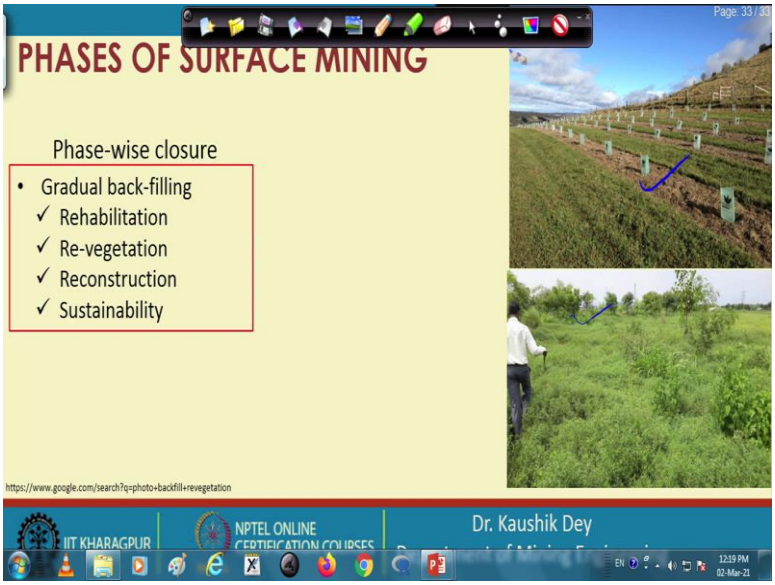

So, this is very, very important and phase wise closing of the mine must be carried out you can see this is the two photographs we are showing here, this is a beautiful vegetation is created here. This is how the dump area is being maintained is managed using the different plantation system.

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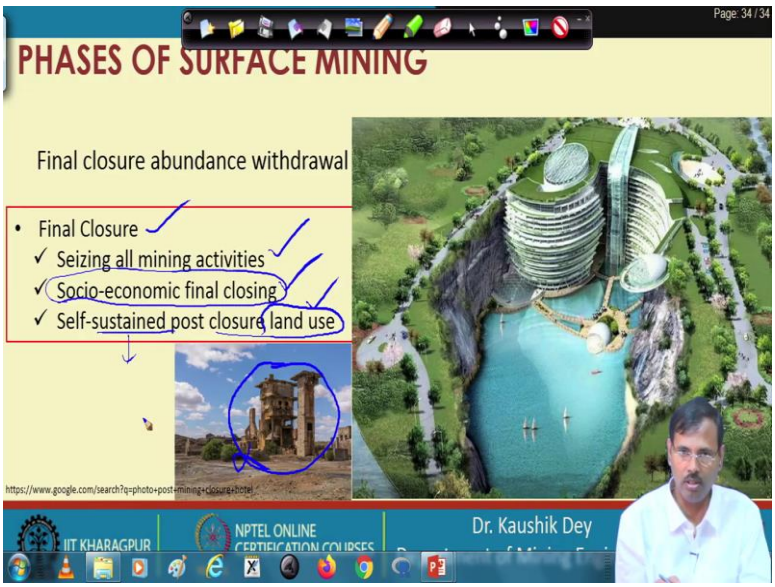

And finally, the closing has to be carried out. Conclusion This final closing means we have to seize all the socioeconomic mining activity the final closing has to be carried out. And self-sustained pushed closure land use has to be met. So, this part that we are discussing is very, very important. That final closing means we are withdrawing everything related to mining operations. We cannot leave a structure like this.

This is probably a plant structure, but we cannot leave a structure like this. So, we have to demolish the structure because it will pose a danger to this. In the final closing we have to demolish this structure we have to withdraw each and every structures, machines and whatever is there related to mining that has to be withdrawn first. So, that is the ceasing of all mining activities.

And withdrawing of all the mining-related equipments and structures must be there. It is not that if you have a housing colony, you have to demolish that one. If the housing colony is in good condition that can be handed over to the local administration for further future use that can be an option. But those who are dangerous structures that have to be demolished must be withdrawn.

Then the final socioeconomic closing is very important, which I have discussed in the last slide. The local people we have uplifted their lifestyle we have given some job opportunities some other employments are there. And that socioeconomic closing means we have to give some source of sustainability to this community. So, mining can be withdrawn, which is a positive way.

Say suppose there is a village during the mining this is uplift their lifestyle is uplifted they are now habituated with the televisions they are now habituated into smartphones that much economic and social growth to the society has to be maintained in the post-mining also. And that is why in the post-mining land should be used in a positive way in some sustainable growth way so that after the mining, a less similar lifestyle can be maintained.

And that is why self-sustained post-closure land use is also very important for the sustainability of the whole thing. So, I have already mentioned that sustainability means it is technically sustainable. Technically sustainable means if you are looking at this picture or maybe in this picture, this will not pose any danger, it will not fall down, it will not create any safety hazard, so that is a technical closing.

Environmental closing means it will not generate any pollutants. It is not generating any adverse effect on the local environment. And finally, the economic one means the economic sustainability should be there. So, that it is self-sustained, whatever the output is coming or income is going on, the expenditures from that income can be maintained. So, that is the economic sustainability of the post-closure land use.

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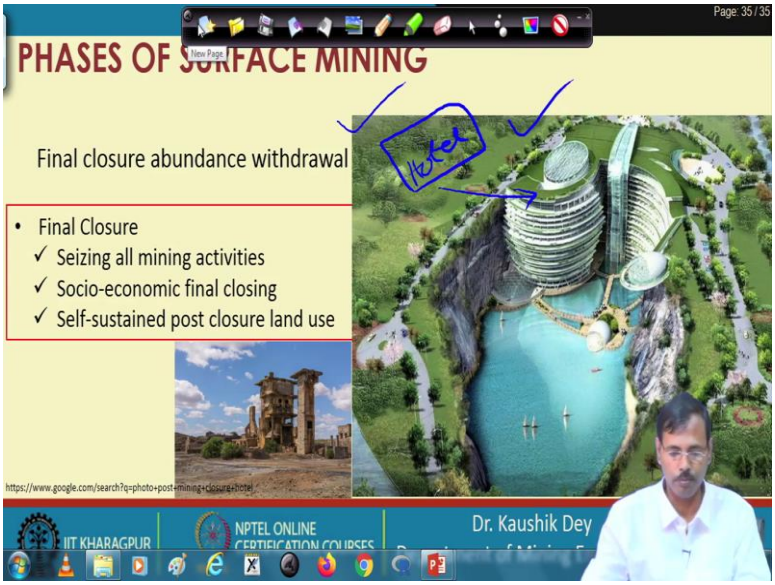

This is a very good example of post-closure land use. This is a proposed hotel mining is converted to a hotel. Post mining, the hotel is created at this position. And with the recreation, it is a self-sustained post-closure example of self-sustained post-closure mine use.

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These are the different final closing or abundance meant of the mine you can see in this picture the mining is converted into a water resource. This is a mine you can see in 1979 this is the situation of the mine. In 2000 the mine is properly maintained with the slope and acts as a water reservoir. So, this is acting as a water reservoir here. This is converted to a beautiful spot tourist spot converted to a beautiful tourist spot.

You can see these are the overburden dumps how the dump area is vegetated and recreated. So, it is acting as a very good recreation centre here. So, these are the different examples of the closing of the mines different utilise sense are possible with different mining. In fact, in India, some of the Tata Steel mines are also converted to a plantation park for that with economic plantations. Those things are converted beautifully for mining post-mining land use.

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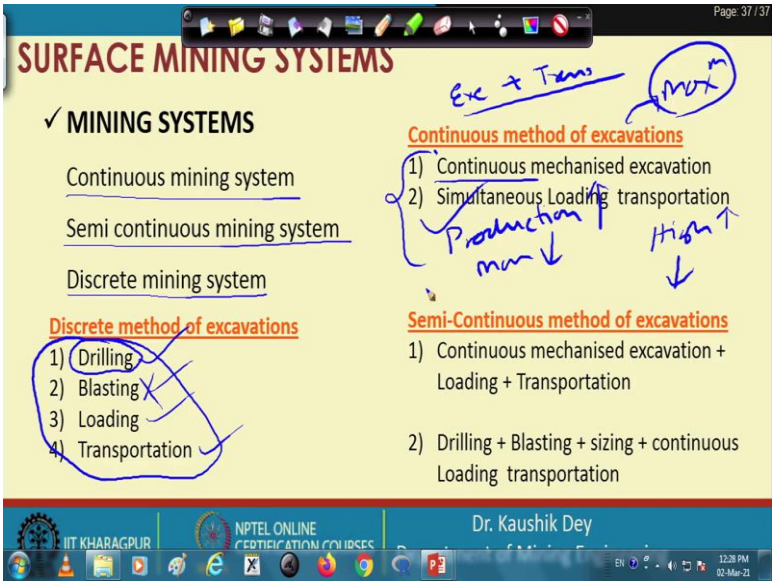

Now let us look into the mining system. Surface mining system is broadly classified into three groups continuous mining system, semi-continuous mining system, and decreased discrete mining system. So, a continuous mining system is basically a mining system where continuous excavation and transportation are carried out.

So, that means the material excavation and material flow is continuous in this system. So, the mechanisation is made here so that continuous mining can be carried out. The benefit of continuous mining is that the production rate will be very high. You will obtain a very high production rate, and your productivity is also very high because your manpower requirement is less.

So, this continuous mining system is always very, very productive, highly productive, and a man at the low manpower requirements. But it also demands a very high investment as the capital costs. So, the initial capital requirement is high but the operating cost is less. So, the production rate is high, which is why it gives the maximum profit. So, whatever you will find out those deep mines et cetera, they in general opt for the continuous mining system so that the increased production rate will fetch them the low operating cost.

So, that is why that is a benefit to them, and they go for the continuous mining system. If you are looking at the discrete mining system, we go for different unit operations separately. So, you can carry out drilling separately, blasting separately, loading separately, transportation separately. These things are not dependent to each other. So, stoppage in one does not hamper the performance of another one. So, that is why all these are independent and can be made very easily.

This is the benefit of the discrete system but as different unit operations are carried out differently, that is why its production rate is less, and it is a product, manpower requirement is high. But in this case, the stoppage as it is a continuous process. Stoppage of one is basically hampering the operation of another also. So, that is the disadvantage in the continuous system.

So, to take the advantage and disadvantage advantage the in-between system is made that is called a semi-continuous system. Where either we have a continuous excavation system and discrete loading transportation system or we have a discrete excavation system then continuous loading and transportation system. So, these are the two options available in this case. So, it is basically a compromising between the continuous and discrete systems. So, that the advantage of both can be maintained.

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Now you can see the possible continuous mining system we have. We have a possible mining system excavation system. The bucket wheel excavator is very commonly used as the continuous mining system. We have a continuous transportation system that is the conveyor et cetera can be used as the continuous transportation system.

This is you can see a video of the continuous mining system. So, in this video, you can see this continuous excavation is carried out. And in continuous excavation, the material is transported into the conveyor. From this conveyor the material is dumped to the conveyor safety well conveyor which is placed here. And the safety well conveyor is basically taking the material.

So, excavation is carried out continuously at this place the material is taken out. And the material is dumped into the conveyor continuously. So, excavation is continuous transportation system is continuous. So, that is why this system can be considered as the continuous mining system. And you easily understand that the moment if this bucket will stop the continuous excavation will stop means you will not find any transportation of the material.

Because the material will also stop at this position so, you will not find transportation. So, the stopping of the excavation will also stop the transportation. So, that is the drawback of the continuous mining system. And that is why this is the continuous mining system should have a continuous excavation and should have a continuous transportation system.

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Now let us see the semi-continuous mining system. In a semi-continuous mining system, we can have a continuous excavation system. And along with that, we can have discrete loading and transportation system. So, you can see in this case a continuous miner, a surface miner is excavating the rock continuously. But this miner is dumping the material on a dumper. So, the dumper is a discrete transportation system.

So, that dumper is taking out the material in a discrete way. Similarly, the bucket wheel excavator can also dump onto the dumper. So, this is a continuous example of continuous mechanised excavation but a discrete material transport system. Alternately, we can have an alternate system here in which we can continuously transport the material using a conveyor or slightly transport system.

But in that case, we have a discrete drilling blasting excavation system. And that is then the continuous transportation is carried out. So, you can see what the example is there. The material is blasted at this position. Then the blasted material is taken by the shovel drilling, and blasting is carried out. You can see this is the drilling carried out blasting carried out. So, after drilling and blasting whatever material is there, that is taken by an excavator.

And the excavator is dumping the material on a mobile crusher. So, the sizing is carried out using this mobile Crusher. And this mobile Crusher is fragmenting the rock or sizing the rock in a smaller size. All this continuous transport system we are using is mainly conveyor or slurry transportation system. So, this transportation system demands the sized material smaller size material.

So, that is carried out by a crushing system spear, and mobile Crusher discharges the material onto the conveyor system. Then the conveyor system is gradually transferring this one. So, this is another example of that one where the mobile Crusher is basically this the mobile Crusher is basically transporting the material to the conveyor. So, this is the semi-continuous system.

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SURFACE MINING SYSTEMS

SURFACE MINING SYSTEMS

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So, this is one example of this one. Let us watch this video. You can see a continuous surface miner is cutting the material, and it is dumping onto the truck. So, the truck is being loaded with the boom conveyor boom attached with the surface miner. And you see the next dumper is standing in the side. So, whenever this excavation is complete, this excavation of this is a limestone query.

This excavation of this will complete the second dumper will come, and that will replace this dumper. So, you can see the first dumper is filled, and the next dumper is coming. See, this next dumper has come. So, now surface miners will start loading onto this dumper. So, the surface miner starts its excavation and dumps the material onto the dumper, so the continuous excavation is going on here. And the discrete transportation system is made.

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In the other case, you can have an excavation. This is where discrete excavation can have a blasting and carry out the blasting. This is the video of a big blast. So, you can blast the after dealing you can blast.

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And then so you can see this is the mobile Crusher this is an animated video. So, this mobile Crusher is moving. And this is the mobile transport conveyor. This is the safety wheel, will conveyor. So, this mobile transport conveyor is the excavator. So, these three are moving simultaneously. So, this is the excavator which is excavating the material dumping it onto the mobile cluster.

So, when the material is dumped onto the mobile Crusher, the mobile trucks are sized it. Then dump it into the conveyor you see the excavator is has taken it out. Dump the material in the mobile Crusher, and then the mobile Crusher sends the sized material to the conveyor. Then conveyor continuously transports the material through the mobile transport conveyor and shiftable belt conveyor.

So, this is the animated video showing the semi-continuous excavation scheme of the mining system.

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And finally, the discrete system in the discrete system, you can see that you have to carry out drilling blasting separately. In this picture, one by one, these are showing this is the drilling. In drilling, you are basically creating the hole increase it so that you can place the explosive inside the rock mass. And as you have placed the explosive inside the rock mass when the explosive is loaded that is fragmenting the rock.

So, this is the blasting carried out in blasting you are fragmenting the rock. The rocks are fragmented in a smaller size. So, this is the here the rocks are fragmented in a smaller size. So, after blasting small fragmented rock, smaller sized fragmented rocks are piled at this

position. Then we sent our excavator so that this fragmented rock can be taken into the bucket of the excavator and that will dump it onto the dumper.

And there will be a series of dumpers that will basically take this material to our destination, either the crusher plant or the railway siding. So, this is a common discrete mining system that is used.

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SURFACE MINING SYSTEMS
https://www.youtube.com/watch?v=ynHrocLKk9c
Now Let's Dig!
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So, let us see the video of the mining system. You can see this is the drill machines. This is the excavator. So, drill machines have already drilled in that area. And this has to be blasted in this area. So, this complete area is drilled by this drilling machine. So, this is the blasting carried out. So, after drilling, explosives are placed, the blasting is carried out. And see, after the blasting is carried out, we send our excavator.

So, now the excavator is taking out the material you see in the backside, we have also deployed a dozer. So, fragmented rock pieces can be gathered to make a heap of rock. And the excavator can have a better filling up the bucket if the rock is placed in a heap. So, it is it has filled this bucket. Now see your dumper has come. So, the excavator is now dumping the material in the pan of the dumper.

So, this is discrete loading and transportation system. You can see another dumper standing in the site so that after filling up this dumper, the dumper can be placed to take the next load. So, this is the final load is given to the dumper. So, that dumper has moved out the new dumper has come at displacing again. So, this is the loading and discrete mining system you can see in this slide.

So, these are the details of the mining system continuous mining system semi-continuous mining system and the discrete mining system. This is how the mining is carried out: the different combinations of machines that details are discussed in this place. So, this is the end of the phases of the mining systems phases of surface mining and the mining systems. Thank you.