Network Analysis for Mines and Mineral Engineering
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Lecture - 11
Project due dates and earliest completion time examples

Hello, let may welcome to the NPTEL online certification course Network Analysis for Mines and Minerals Engineering. Its 11th lecture will be carried out today and the topic is Project due dates and earliest completion time examples.

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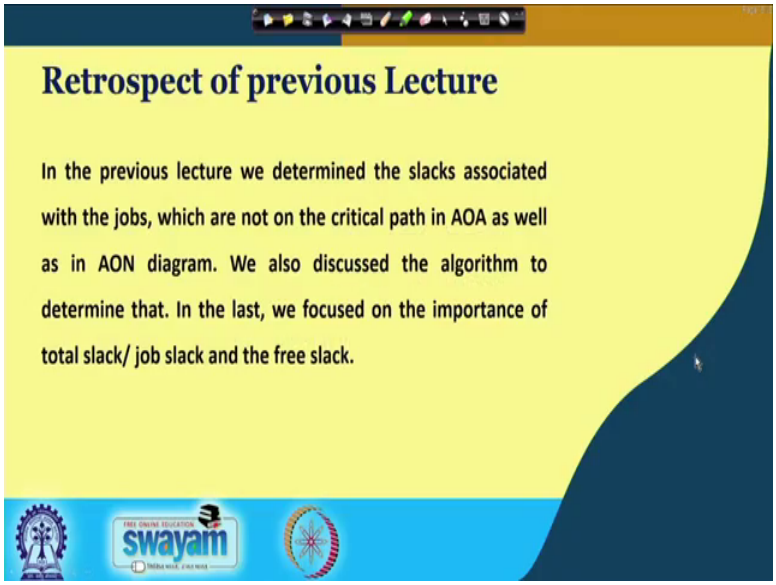

Basically just the way we carry out; first let us retrospect what we have covered so far. In the previous lecture we determined the slack associated to each job, we have seen that critical jobs are not having slacks other jobs may have some slacks. And, we understood that how this slacks will be determined using early start early finish late start late finish time. And, we have found that activity on arrow diagram and for activity on note diagram how this early start early finish late start late finished will be calculated and how the slacks will be determined. We have also found the slacks are of two types: total slack or slack and free slack. So, we have discussed the algorithm to determine those slacks also.

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And, in this lecture we will see if the project completion date is fixed for something then how that can be addressed in the network scheduling or the scheduling of a project.

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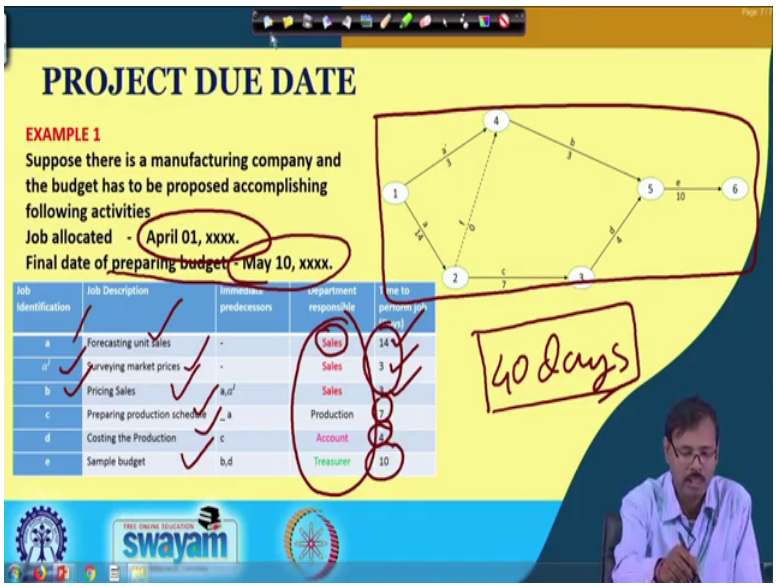

So, first let us carry out one example which we have already discussed to understand what is project due date. So, project due date say this example we have already covered a number of times where, the sample budget has to be prepared and for that the activities required are the forecasting of sale, market surveying, the market price, pricing of the sales, preparing the production schedule, costing the production and finally, the budget

preparation. So, basically to carry out this project which is having these activities which are distributed in different departments: sales department, production department, account department and treasure department.

And these are the days required normal duration for this completion of these activities. So, this is discussed n number of times in this course and this is the drawn network which is already discussed. So, say this project has to be carried out and suppose the meeting has been carried out in the department between these departments. And, it has been allocated on say April 1st of some 2018 or which may be the year. In April 1st this meeting has been carried out and the target date is fixed that the budget will be prepared by the 10th May of the following of that year of that particular year.

So, the available time is given is 40 days and these are the identified job has to be carried out for completing the project and for that 40 days are given. And, individual department heads that sells department head when he has forecasted the different time requirement or estimate the different type of requirement for these unit activity, this unit activity and this unit activity; he has found the normal direction for those jobs are required 14 days 3 days and 3 days.

So, he has found this is the time requirement; this is the time requirement for the production people. This is the time requirement for the account people and this is the time requirement for the treasure people to carry out the final budgeting work.

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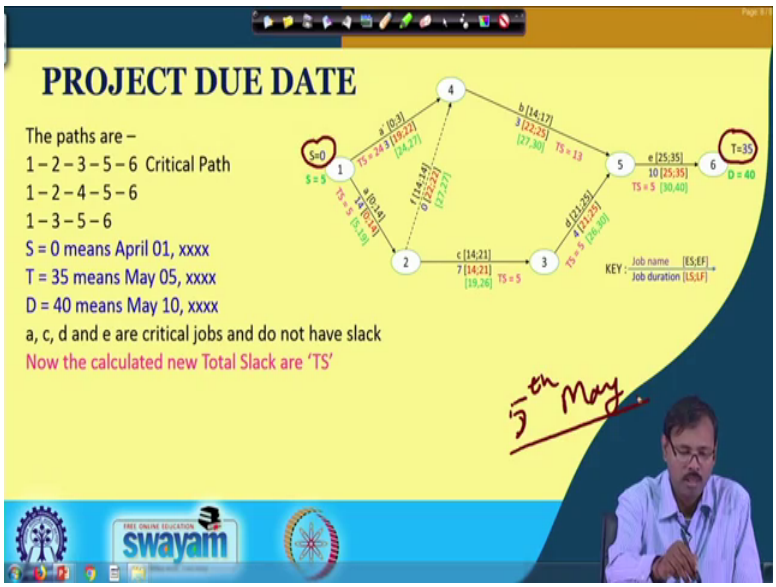

And, on doing these they have found the this will be the network, that means if they carry out this work on April 1st, if they start on the 1st April if they carry out this work starting with these activities they will complete this work on 35 days; that means, 5th May will be the completion date. So that means, by 5th May they would be ready with the prepared budget for this particular project.

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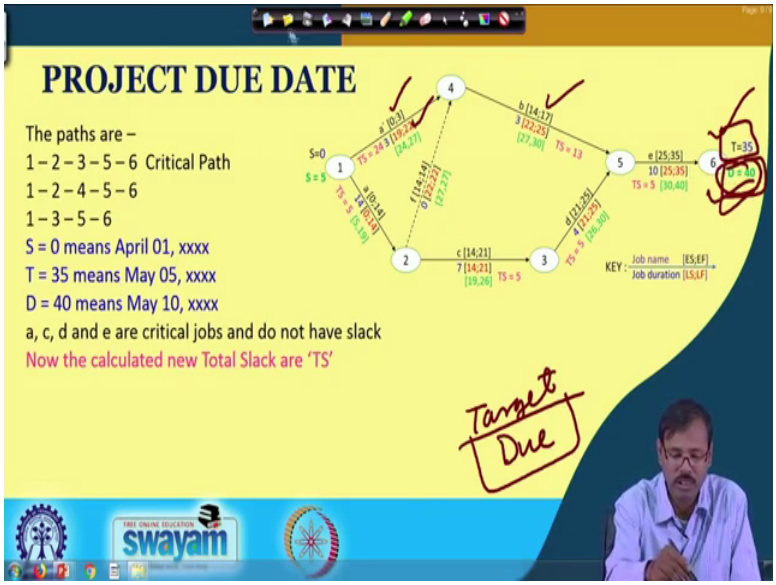

Now, the target date given is 10th May; that means, 40 days are allocated to them for the completion of the total project. That means, normal duration is 35 days and 45 days is the allocated period; that means, there are 5 days slack already slack given in the schedule. That means all the jobs are having 5 days slack in this case. So, this date is called target date or project due date; that means, the earliest possible time of completion of this project is the 5th May. That means, 35 days are required to complete this project from the starting date. And the target date is given which is already fixed by the way the project has to be completed.

In this particular example the target date is 40 days; that means, 5 days slacks are available reverse way also is possible. So that means, when we are finding this is the early start early finish time, this is the early start early finish time, this is the late start late finish time considering the 35 days is the completion period of the project. And while, we are considering the due date is 40 days; that means, 10th May is the due date; that means, available time is 40 days. If considering that is the completion time we

calculate the late start late finish time, which is shown here in a green color. In that case the late start late finish time will be considered like this and that is why you can recalculate your slacks for all the jobs.

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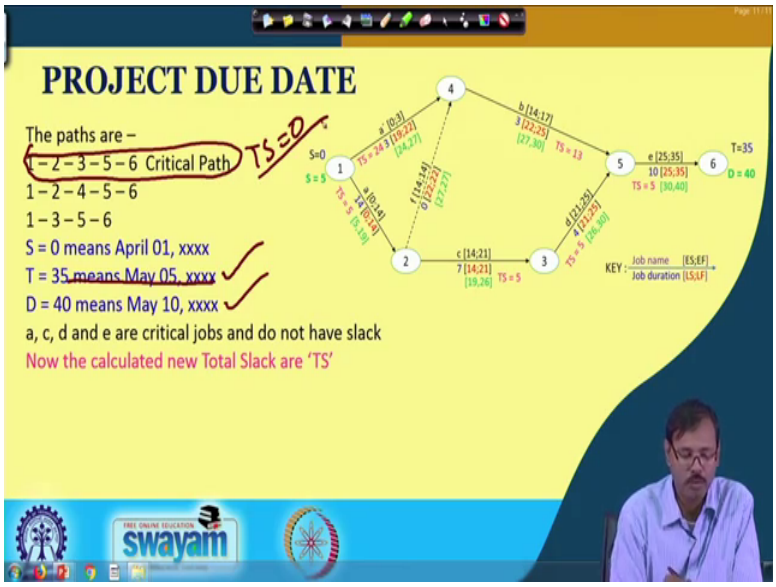

That means, when the desired completion date or the target date is given 10th May instead of 5th May is the normal completion time. Target date is given 10th May; that means, for 5 days extra is given. And, when the 5th May was the target finished date that time this jobs are critical having slack is equal to 0 in this case.

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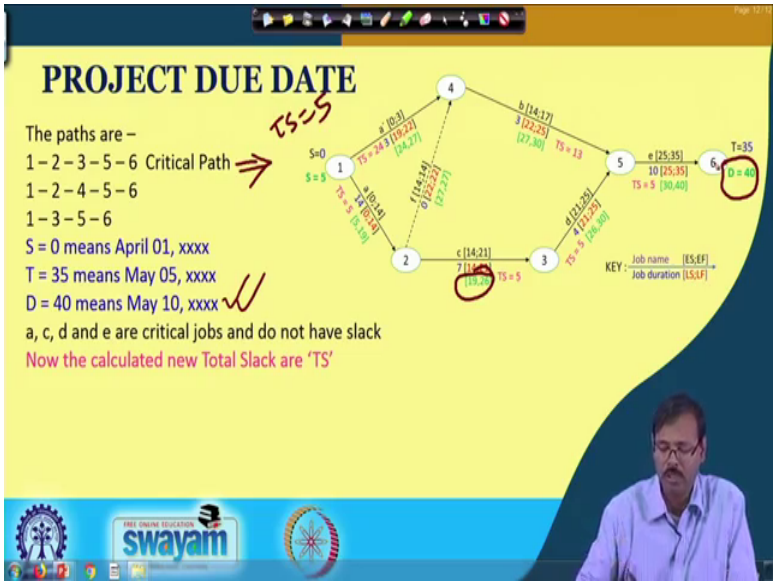

But, while we are considering while we are considering this one this jobs as this associated jobs are having some slack, but remember this slack will be the minimum one and that is equal to 5 days here. So, these calculations are carried out by from the late finish late start calculation and while that project completion date is considered the project due date. So, let us understand this in a little bit systematic manner.

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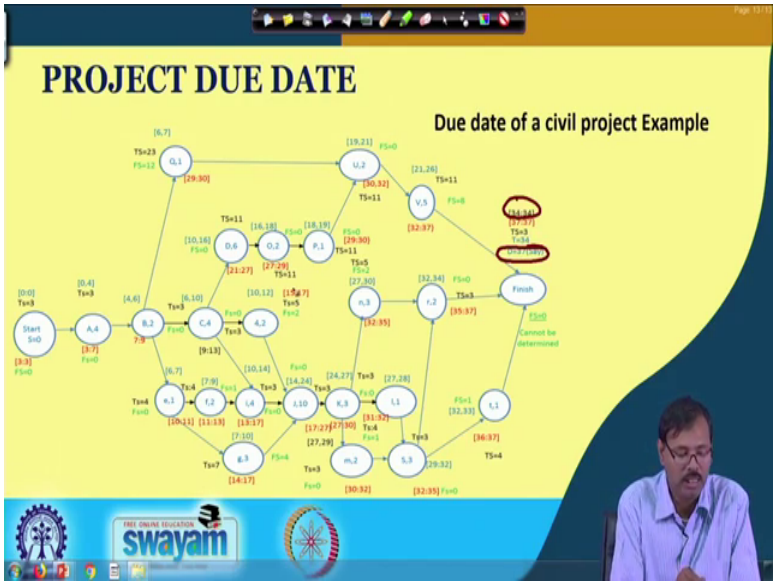

Say this example is also known to you; this is a very very big example where 34 days were considered to be the normal time. However, the due date was considered 37 days and considering that the total slacks and three slacks are calculated for each and every activity. So, this is very big network which was given to you in a number of times that we have shown how the early start early finish late start will be calculated for these jobs.

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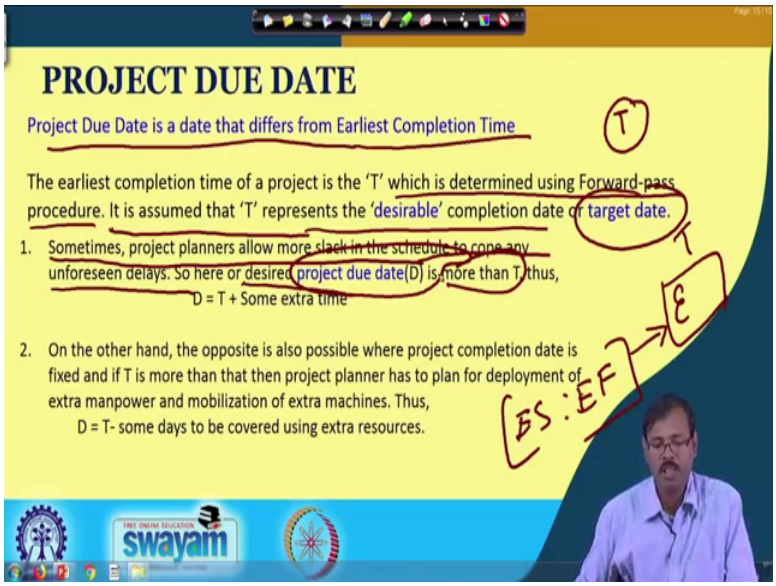

So, let us see the logic of the project due date. Project due date is the date that differs from our earliest completion time; that means, the normal completion time or which is considered as the earliest completion time which is which we are denoting by T; if the completion date is considered default from that that is called project due date.

So, project due date is basically determined by the forward pass procedure; forward pass procedure means in forward pass procedure we calculate early start and early finish time. So, early start and early finish time which is calculated by the forward pass procedure. And, the maximum value which we have received at the finishing point in this that is considered as the early finish time completion time of the project. And, that is considered as the time of the possible time earliest possible time of the completion of the project.

So, if the assumed earliest possible completion time represents the desirable completion date then that is called target date. So, that is why we denote the earliest completion time as T because, it is considered as to be target date. But, often our project planners allow some more slack because, of unforeseen incidents may differ the completion of the project or to cope any unforeseen delays the due date is in general kept more than the T.

That means, suppose you are constructing a house then there may be some unforeseen rain may delay the construction. So, for consider some of that unforeseen delays what is carried out, it is carried out some delay maybe inserted into this. Same thing is carried out for the railway scheduling etcetera where the average speed is calculated, but

between some station some additional delays is allotted to cope the any delay carried out earlier into the train schedule to that consider that delay time into this.

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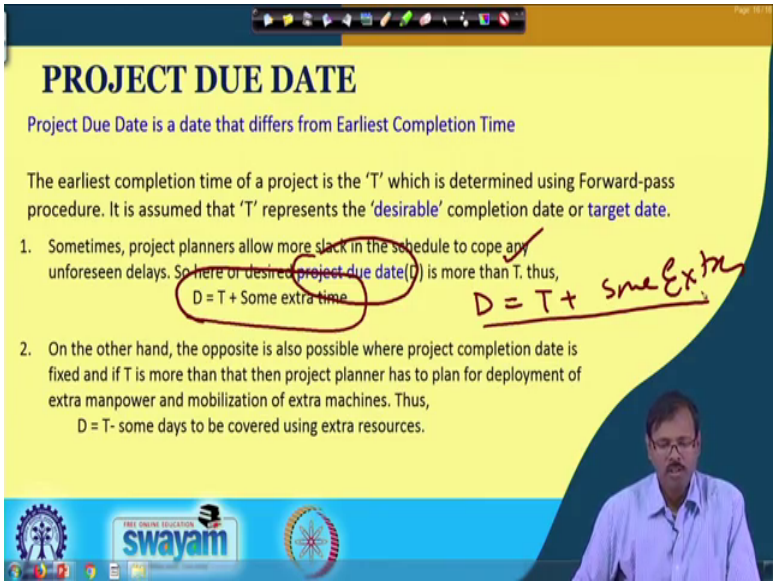

So, this project due date is basically in most of the cases generally it is kept more than the T, where to allow the completion of the project within the schedule time. And, that is why D is in general represented T plus some extra time. On the other hand it may be possible that the project due date is fixed and T is more than that project, then project planner has to think to deploy additional resources like extra manpower, extra machines; so, that the due date can be addressed.

So, in this case due date is some days to be covered up using T minus some days to be covered up using external resources. In fact, often you will find out say suppose some hydroelectric project. So, it is planned that hydroelectric project will be comments from x date.

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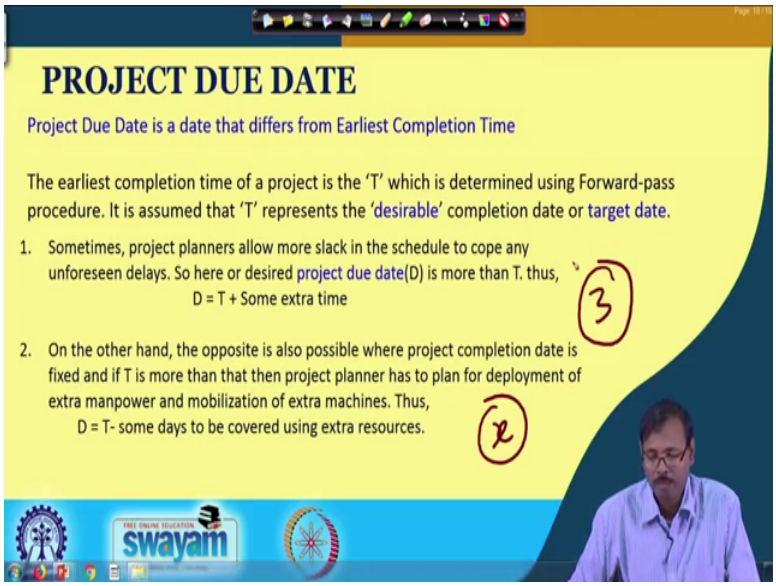

But after working of 2 years 3 years when the x date that is very close that time it is find it will be it may be found that the project is running late by 3 months or something like that. So, that 3 months has to be adjusted by deploying more additional powers on the remaining jobs so, that the company may address the fixed desired date of commencement of the project.

The reason is that when the financial calculations are made, it is considered the faster investment period, where the projects are being projects are being constructed. After that it will run the project will run and that gives the return so, that this investment will be pay back.

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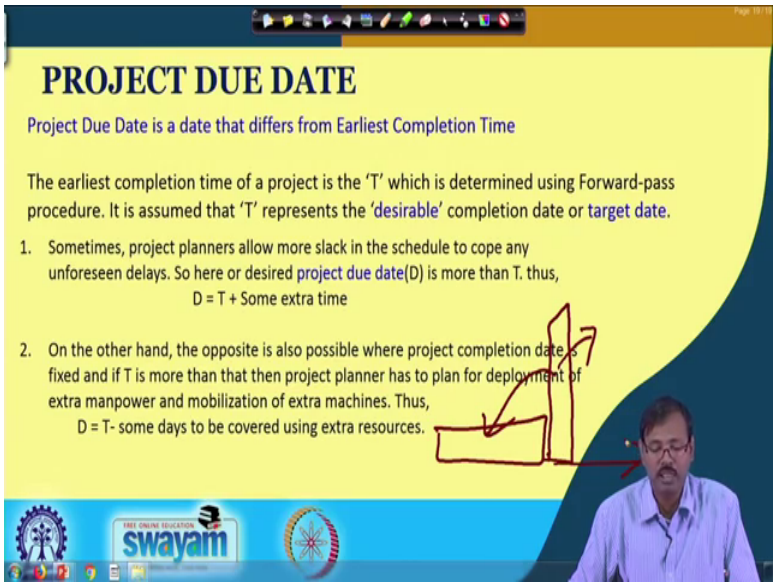

Now, if this is deferring, this is deferring then the interest part of the investment amount is gradually increasing and that is why the payback period will become more. And, it may also found that project the complete project may not see the profit in its lifetime.

So, that is why timely completion of the project is very very important and that is why the due dates must be adjust; I can give you one small example. So, suppose hydropower project is being considered to be constructed with say 2000 crore rupees or something maybe like that or maybe say 500 million US dollar.

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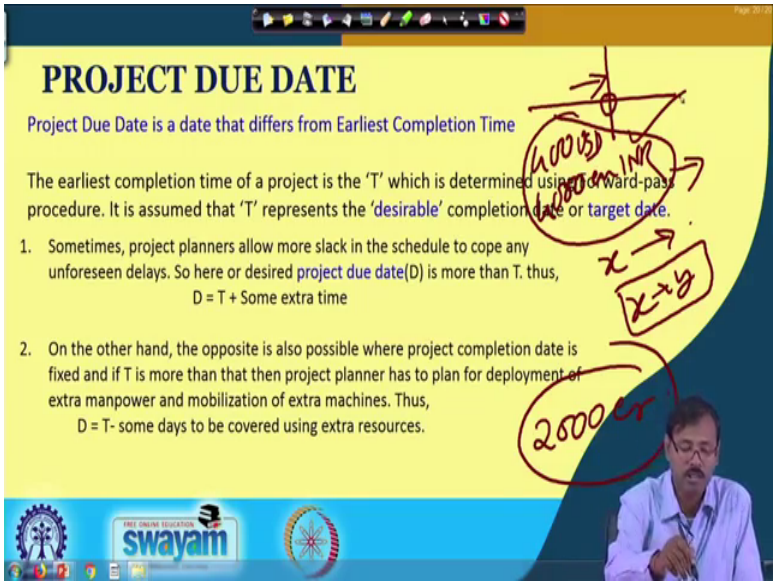

So, if you are considering that is the cost and that has to be the return has to be obtained from date x on ward on some price basis. So, that at x plus y time the payback could be covered. But suppose that x time x date at x date the project is not complete then by that time probably say 400 US million 400 million US dollar is invested or maybe 4000 crore INR is invested. But, project is not complete the money is not being paying back, but this investment amount is having interest and probably this interest part the interest are in crore rupees or maybe in few thousand dollars per day interest.

So, that interest are becoming more in those cases and that is why the timely completion of the projects are very very important. So, that is why the when the network is being scheduled due dates are giving their importance in those cases.

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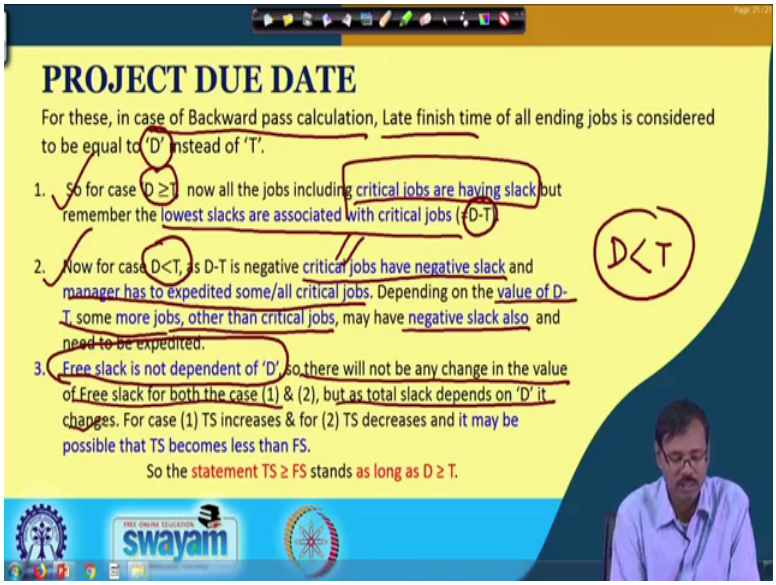

So, in case of backward pass calculation, if we are having the fixed due date we calculate late finish time for all ending jobs not considering T is the ending time instead of that we calculate D is the ending time. And, you know we are having the considerations that D may be greater than equal to T in those case, critical jobs are having some slack. And, but the lowest slacks are always associated with the critical jobs critical jobs. And, other jobs are having more slack than that and that is always equal to D minus T.

In case of D less than T in that case critical jobs have the negative slack and manager has to expedite some or all critical jobs because that is essentially required, but that may be possible other jobs which are not critical may not have any effect on that. So, in the case

of D late than a T in those cases the critical jobs are important and utmost care, utmost importance, utmost supervision must be given on to the critical job for their earliest completion.

Depending on the value of D minus T some more jobs other than critical jobs may become critical. Say suppose another job which had only say 1 day or 1 month slack was there, but the project is delayed now by 2 months or something like that. And, due date is less than that due date is more than that in that case that job may also become critical and may need some additional requirement of man, material and machines. So, some others jobs apart from the critical jobs may become critical if D is less than T in those particular condition and may have negative slack also. So, if the negative slack is there; that means, that need additional manpower additional material additional machine requirement or other requirements.

Free slack is not dependent on D. So, there will not be any change in the value of free slack in both cases of 1 and 2, but total slacks depends on D so, it changes. So, this is very very important free slacks are interdependent between the jobs. So, that is why free slacks are not changing with the change with the due dates, but that total slacks are changing.

Because, it is the change in the jobs completion time of the same job only. So, if the total slack increases and for 2 case second case for D is greater than T case total slack increases and D is less than T case the total slack decreases. And, it may be possible that total slack became late than the free slack, but free slack will remain unchanged.

So, total slack this is the only condition. If you can remember our earlier lecture where we have calculated total slack and free slack and that time we discussed that general in general that total slacks or more than the free slacks. But, this is the case well where we are considering the backward pass not in consideration with the earliest possible time of closing the project, but in consideration with the project due date.

In those cases totals slack may became less than the free slack in that project network, but you remember free slack is not affected with the due date whichever it is. So, the statement stands only total slack greater than equal to free slack only when D is greater than equal to T.

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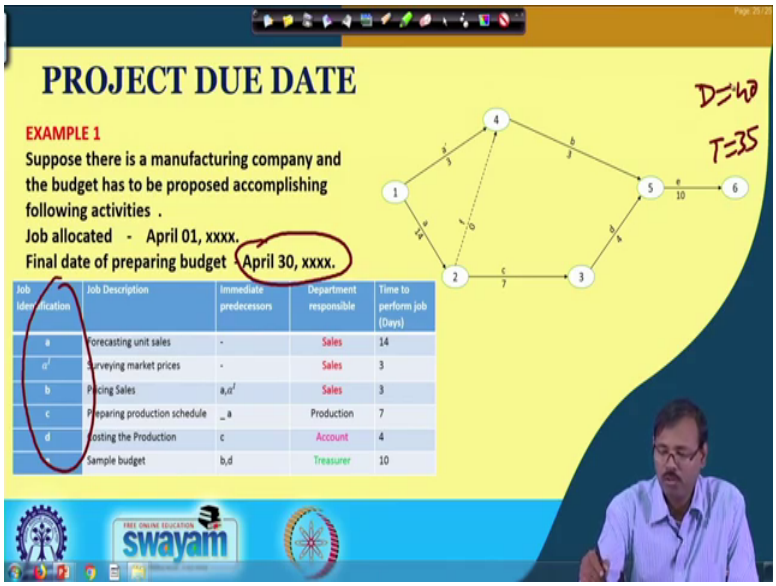

So now, let us consider the project due date one for the additional time another is for the late time. So, additional time we have already discussed in our earlier example, where we have seen that 5 day extra is given and that is why project are all the critical jobs are having 5 days total slack and other jobs are having some 5 days additional slack to their already existing slacks.

So, that is the case which we have discussed in the earlier. Now, let us see on the same project instead of having the completion date of 10th May, if we are having completion date of 30 April. That means, earlier we are having T is equal to 35 and D was 40.

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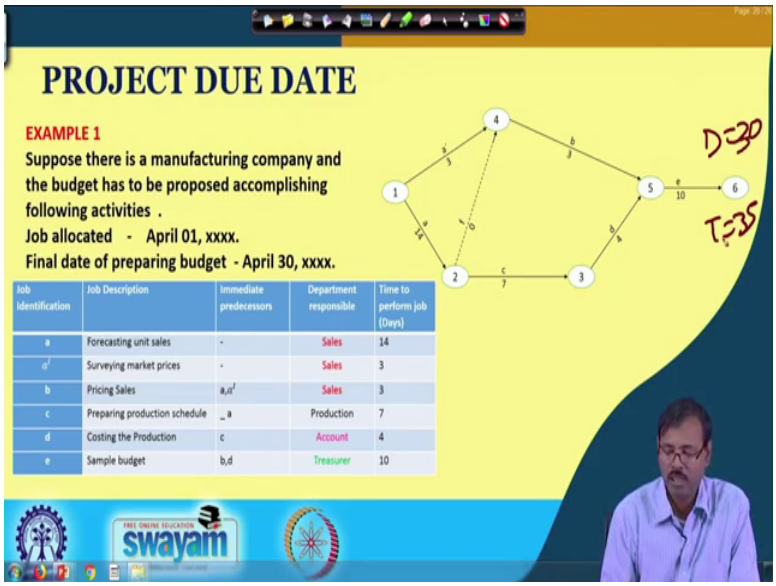

Now, instead of D was 40 now, we are having D is equal to 30 where, T is still 35, then how we can complete this one. And, let us see the network how we can address this.

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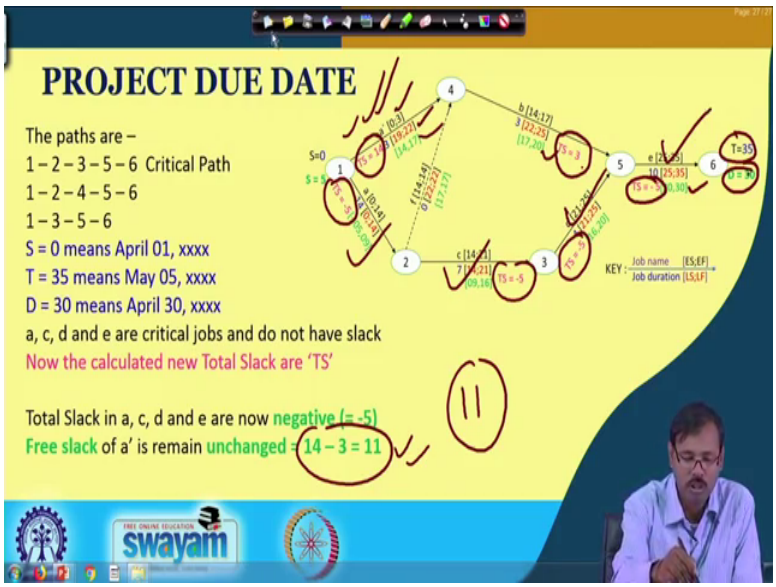

So now, we have calculated our early start early finish early start early finish late start late finish considering T is equal to 35 and considering D is equal to 30; this is our late start late finish times. Now, if you look into the total slack in this condition you can see the total slack for job e which is a critical job is now minus 5 days and all the critical jobs the total slacks are become minus 5 days.

And, the total slack in the other non-critical jobs it was earlier 8 days now, it is reduced to 3 days. It was earlier 19 days now it is reduced to 14 days. But, if you see the free slack for this job still it is 11 days; 14 minus 3 early earlier 11 which we have calculated still it is 11 days for this case.

So, now you can easily understood though it is not the free slack is becoming late than less than the total slack still this condition is not here. But, the total slack is becoming a reduced for all the jobs, critical jobs all these critical jobs are affected and demands their attention of the supervisors for the additional resources that is very very important for these jobs. Now, if you look into the details of this job; so, this job a the department was sales, in the job c the department was production, job d the department was account and job e the department was treasurer.

Now, if you see this one then on this calculation as the supervisor of the sales department or the head of the sales department; he has to drive more more manpower more manpower in this job more manpower in this job than this these jobs which are also under his control. But, the production manpower is only having this one this is for the accounts and this is for the treasurer.

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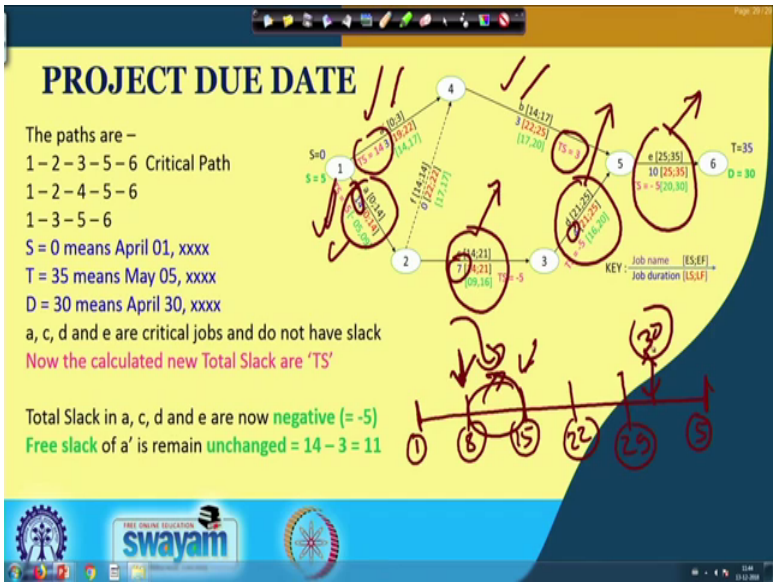

So now, he has to find out some additional resources for carrying out this job less of 5 days. This is production managers responsibility to carry out it in less than 4 days. This is the sorry this is the accounts person, this is the production manager has to decide how to

reduce the job length of this one. And, this is the sales managers requirement he has to carry it out in a lesser time than 14 days and for that he may drive some manpower from this one at this one to this which are already under him and they are having some slacks already available with them. So, that is why this managerial decisions are important and unless and until all the backward parts are every time modified with the progress achieved in the forward past.

That means, this is a 35 days schedule, this is a 35 days schedule and say let me divide it in 5 parts. So, there are 5 weeks ok. So, this is April 1 8 15 22 29 and May 5 ok. So, now on these dates every week if the progress star if the progress star reviewed and it has been found that it is not up to the mark, then the additional manpower will be diverted or changed or the resources has to be changed in different way.

So, that before the arriving to the next review point that delayed has to be reduced as much as possible to address this on the specified date or due date whichever it is fixed said; now our due date is not at now at this position on the 30th. So, to reduce that to be completed within this 30 April whatever the manpower has to be recruited or the resource has to be added to the system.

So, this review progressive review has to be carried out properly to take the additional manpower and deploy those manpowers resources in each and activities each and every activities carrying out after that date so, that the due date can be addressed. So, after the making the forward pass the backward pass are always has to be modified each and every review so, that those decisions can be made where the additional resources has to be carried out. So, basically this is the importance basically this is the importance of the project scheduling and that has to be carried out that has to be carried out on time to time basis.

So, generally the objective of this lecture was to give you the understanding about the importance of the project due date. And, this project due date is now I believe you are able to understood. And, this time to time review of any project which is made in a network basis; the progress in the forward pass to be achieved actually achieved progress has to be compared then the reap drawing of the or reap devising of the network has to be made. So, that the additional time requirement or the additional research requirement

has to be adjusted. So, this is the importance of the project due date. This is all for this lecture.

Thank you.