

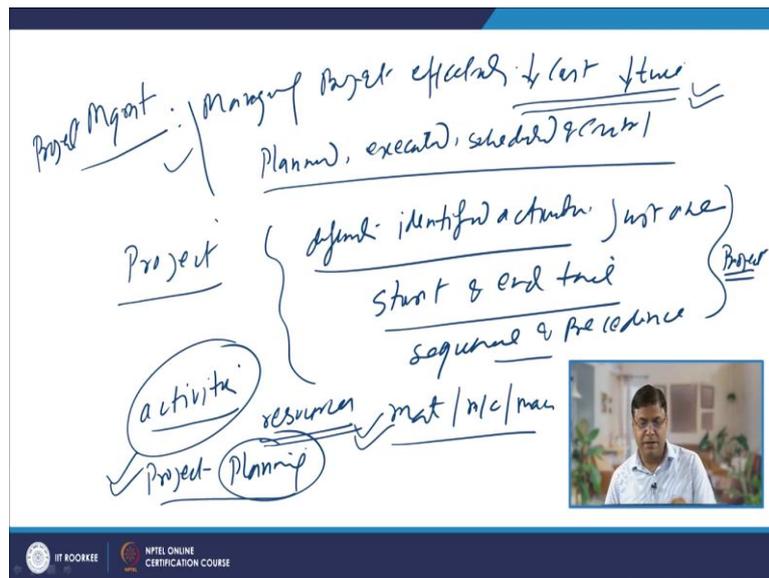
Principles of Industrial Engineering
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Lecture - 41

Project Management & Network Modelling: Introduction

Hello, I welcome you all in this presentation related with the subject Principles of Industrial Engineering and today we will be starting the new topic that is about the Network Modelling, which is used in Project Management. And understanding of the network modelling techniques like critical path method and the program evaluation and review techniques.

These help in the different stages of implement, successful implementation of the project. Starting from the planning, scheduling to the control, this network modelling is found to be extremely useful. So, we need to understand first, what the project management is and what the project is?

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So, you know as the managing the project, management project, management is all about the managing project effectively for successful completion at the minimum cost and minimum time. So, these are the two, you can see the performance parameters. So, how it should be done so that, it is effectively planned, executed, properly scheduled and controlled so that all activities are done systematically in the minimum possible time using the minimum possible resources.

So, as far, this is what we do under the project management, as far as the project is concerned, project is like the project has a definite identified activities which are done just once. So, the set of activities which are done just once with the definite start and end timing.

And these activities will be done in a particular sequence as well. So, means there will be some kind of the precedence relationship. The relationship between these activities.

So, a set of the activities which are done just once with the definite start and end timing and these activities are done in a specific sequence to complete the project. So, this is what constitutes to the project and when these activities, the various activities which are to be done having the definite start and end timing and the definite sequence in which these are to be done. When these are to be performed, these need resources. So, to perform these activities, whatever resources in form of the material, machines and the manpower is needed that has to be planned effectively so that the things can be made whenever these are needed for timely completion of the activities.

So, all the activities that are to be done for completion of the projects constitutes to the successful completion of the project. So, that is basically about the project planning, involving, arranging all the resources needed for smooth completion of all those activities whenever they need to be performed. So, that the things can be done at the minimum possible cost. So, that is about the project planning. Planning various resources so that these are available whenever they are needed for successful and smooth completion of the project.

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Project Scheduling: - activities to be performed
- sequence in which these will be performed
- Precedence relationship
→ Start / end time

Project < Gantt chart
Network model

The slide features handwritten notes in blue ink on a white background. The notes define 'Project Scheduling' as identifying activities to be performed, the sequence in which they will be performed, and their precedence relationships. It also mentions 'Start / end time'. Below the text, there is a simple network diagram with nodes labeled 'A', 'B', 'C', and 'D' connected by arrows. A small video inset shows a man speaking. At the bottom, there are logos for 'IIT ROORKEE' and 'NPTEL ONLINE CERTIFICATION COURSE'.

Another thing related with this itself as I have defined that in the project, the various activities are to be done with the definite start and end timing. So, it needs very systematic scheduling also. So, that is about the project scheduling where, whatever activities to be performed have been identified.

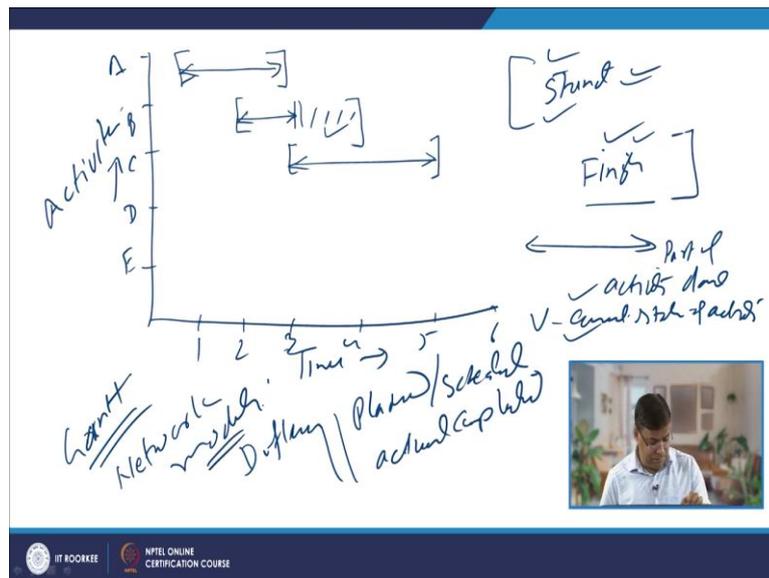
Now, we need to see what will be the sequence in which these will be performed. And to identify the sequence, we need to see if there are certain activities we should be done first before others can be taken up or means there, if there is any precedence, precedence relationship between the activities.

So, identification of the activities, the sequencing which these will be performed along with the consideration of the precedence relationship like the certain activities can be done only if others are completed before. Like if, there, if the activity D is to be done, then it may be required that before that C, A and B are also performed. So, say, activities are indicated in this manner, say activity A, activity B, activity C. So, for doing the activity D, it is necessary that B A; C, B and A all are completed.

So, for doing the D here, the precedence requirement is that A, B and C all are completed. Likewise, C can be taken up only when the A and B are completed. So, these are predecessor activities until the D will be the successor activity for the activity C. So, and when this is done, we get the definite, means in the project scheduling, we get the definite start when a particular activity will be started or when it will be ending. So, start time and the end time will also be identified when the project scheduling is done.

So, there are certain techniques which have been used for effective management of the project or so that the things are, the different activities required for completion of the project are done in time manner or within the stipulated period for the project. So, there are certain techniques for managing the project like the Gantt chart was one. And then Network Modelling is the another approach.

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But the Gantt chart has many disadvantages or many limitations. In one hand we have the, means in the x axis we show the time. It may be like hours, weeks, months, etc. On the other hand, y axis has the activities which are to be done. So, activity A, B, C, D, E, etc. 5 activities are to be done. So, when particular activity will be started and when it is expected to end say, activity will we started say time unit of 1, 2, 3, 4, 5, 6 like this. So, activity will be started, it will be shown like this, a bracket, start of the activity and say it continuous to the 3 ton units so, this is how it is shown.

Arrow will be indicating that it has been completed. Say, activity B started after the second time period and it continuous to the 4th time period like this and say, arrow is indicated only up to a particular gap which indicates this is the portion of the activity which has been done and it is a still to be done. Then, say C activity, say started after 3rd week and continuous to the 5th week. So, if it is shown in this manner, which will indicates that the entire C activity has been completed and this is the incomplete activity B portion.

So, this is how it shows and if so, the sign like this indicates the square bracket here showing the start of the activity sign of this kind and while the finish activity is indicated by this kind of sign. And when there is arrow like this, it indicates the part of the activity done and when V sign is used, V sign indicates the current status of activity in the entire project period. So, it indicates the current status, when it start, when it will end or if there is difference with regard to the planed or the schedule activity and actually completed activity.

So, it shows the actual progress with respect to the planned one, when it started, when it ended and what is the current status of the activities. So, these are the things related with the

Gantt chart. But it does not show the precedence relationship or the kind of the variability which will exist related with the completion of the various activities and what is the estimated, what is the probability to complete the entire project. So, those things can be effectively answered through the network modelling approach.

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Network Modelling

CPM - Critical Path Method

PERT - Program Evaluation and Review Technique

Project planning, Scheduling, redirecting resources

Inter relationship between various activities of project

Control

Reducing project duration

Project Cost

Delays

Control of project activities for timely completion

reducing cost

resource needs

So, in the network modelling that is found to be very useful in answering the number of questions. Network Modelling. There are two techniques related with this, one is the critical path method commonly known as CPM, Critical Path Method. And another is PERT, the Program Evaluation and Review Technique. So, these are the two techniques which are found to be extremely useful. And these help a lot in project planning, effective scheduling and redirecting resources and control. So, that the entire project can be completed well in time.

So, as far as the advantages is concerned it is of this network modelling approach, it shows the inter relationship between various activities of the project, activities of the project to be done. Means, which what are the activities to be done first and what are the activities which need to be done later. It helps in reducing the project duration. Say, if earlier it was taking 6 months then, through the network modelling approach, it may be done in 4 months or 5 months.

And that in turn also helps in reducing the project cost. Reducing the project delays. So, these are some of the benefits and if some uncontrolled situation arises, wherein there is a possibility for delay, then it helps in effective control of the project activities for timely completion.

And how it is realised? In between if it is realised, that the certain activities have been delayed and the entire project is expected to get delayed, then it can help in proper control of the project through redirecting the additional resources needed to crash the time required for forming the certain activities on the, which are necessary for timely completion of the project.

So, redirecting the resources for timely completion of the project, reducing the delays, reducing the project cost, reducing the project duration, showing the inter relationship between the various activities, what are the various resources which will be needed and above all, effective project planning, scheduling, redirecting resources and control of the project is facilitated through the effective project modelling.

And that is why, since it is very systematic in terms of showing various activities to be done, when they will be done, and if there is any deviation from the planned activities, then redirecting the additional resources.

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Handwritten notes on a whiteboard:

- Hardly of Complex Project
- CPM/PERT
- Applicati.
- Big/Complex project where no of contributors are large in no.
- Missile
- Highways
- Buildings

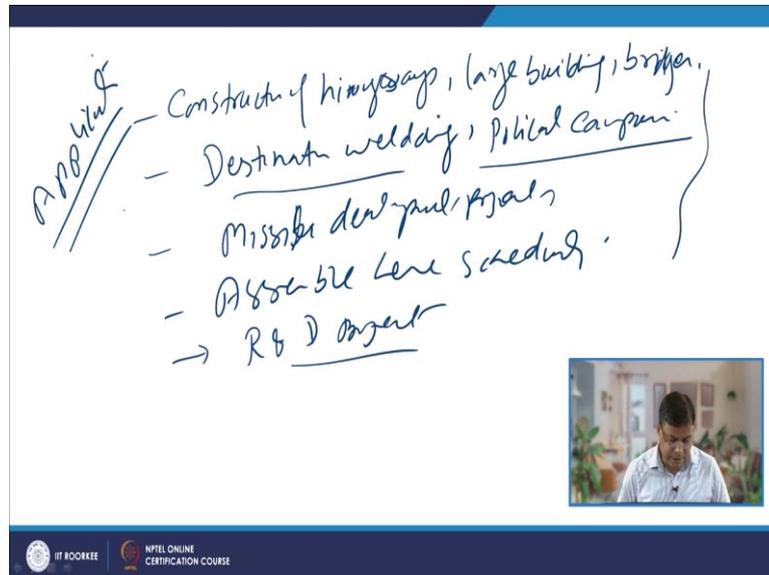
A small video inset shows a man speaking.

So, because of these unique features, it is able to, means these approaches are able to handle, handling of the complex projects becomes very easy. Handling of the complex projects through the CPM and the PERT techniques becomes comparatively easier as compared to the simple other approaches like the Gantt chart. And that is why, these are being extensively used. Means the application areas of these techniques are many, especially in case of the big and the complex projects wherein, the number of the contributors are very large in number.

Like, say, a big missiles are to be developed, missile development, development of the highways and development of the huge buildings. So, wherein the many contractors and the

many contributors will be playing a big role in successful and timely completion of such kind of the things which will be done uniquely. In those cases, the CPM and PERT techniques are found to be extremely useful.

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Few examples of these are like Construction of highways, large buildings, large bridges and then say, so this is all about the construction like say, uniquely complex things like destination weddings, then political campaign organization, organization of the political campaign, then the missile development projects and the many the assembly line scheduling and many R and D projects which are complex in nature, variety of the activities need to be done.

So, this is how, these are the various applications where the network modelling can be applied effectively. These may have 1000s of the activities which are to be done by very large number of the contributors? So, each one will be given up a specific task which will be done in time bound manner by each contributor in order to complete the activities in the stipulated period of the project.

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Methodology

- Monitoring the program
- Reduction of resources
- List/identify each & every activity to be done for project
- Develop network/diagram the activity with sequence in which they are to be done
- Estimate of time needed for completion of each activity
- Analyse the network estimate of time to do of project critical activity

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So, as far as the general methodology, specific methodology for CPM and PERT may be different but the general methodology for network modelling is like this where, listing or you can say identification. Whatever activities are to be done are analysed extensively and each and every activity which is very specific in nature need to be performed for successful completion of the project is identified. So, identification or listing of the each and every activity to be done for completion of the project.

So, this is one, first the describing the details of the each and every activity to be done. Then here, developing the network or you can say diagramming the activities with sequence in which these are to be performed, in which these are to be done. That is the second step. And then (develop) and have an estimate, either very specific and unique value or the rough estimate about estimate of the time needed for completion of each activity. So, this is another estimation of the time for each activity developing the network or developing the diagrams showing the sequence of activities in which these are to be done.

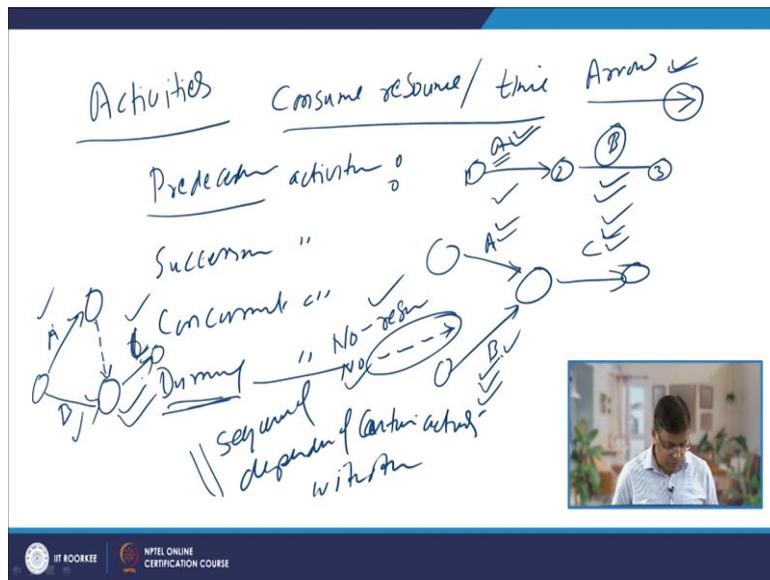
And identification of the various activities that are needed for completion of the project. And then develop analysing. Analysing the network. When the network is analysed, it shows the estimate of the time, estimate of the time to do a project. What are the critical activities? Means activities which cannot be delayed if they are delayed, then the entire project will be delayed. So, it gives the estimate of the time required to completion of the project and identification of the critical activities which must be given enough attention.

So, those are not delayed and if those are delayed then, the entire project will be delayed. And if the project period is to be reduced then what are the activities those need to be crashed by

putting in the additional resources so that the time required for those critical activities can be reduced. And thereafter, the monitor, the progress. Monitoring the progress and wherever required as per the need, redirecting the resources. So, that the project can be completed well in time.

So, as I have said, for doing a project, we need to do a definite set of the activities just once and these activities will be having a definite start and end period. And these are done in a specific sequence.

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So, it is important to see that the way by these activities are done they are different types of the activities which are, there are different names which are given to the various activities in a network modelling.

So, better understanding, for better understanding of these activities, we will see what are the various activities. These activities, mostly consume resources means, they need time, man, material, etc. They consume resources and they need time to complete so this is one thing. Now, depending upon the sequence where these, when these activities are done, we can say these are like predecessor activity, successors activity, then there is a concurrent activity and the dummy activity. These are 4 types of the activities.

So, predecessor activities are those activities which must be done before others can be taken up. Say, if we have a sequence of the two activities, say A and B, 1, 2, 3. These are the nodes. So, activities are basically represented by arrow where at one hand it will have the arrow

indicating the direction in which the activity, basically this is the symbol of showing the activity.

And if we consider the activity A and B, then activity A will be the predecessor activity for activity B. B can be taken up only on completion of the A. Likewise, B will be the successor activity for the A. On completion of the A, B can be taken up. So, B is the successor and A is the predecessor here. When we have a situation of the different type wherein like the two activities which can be done in parallel, like activity A and B are not having any kind of the precedence relationship.

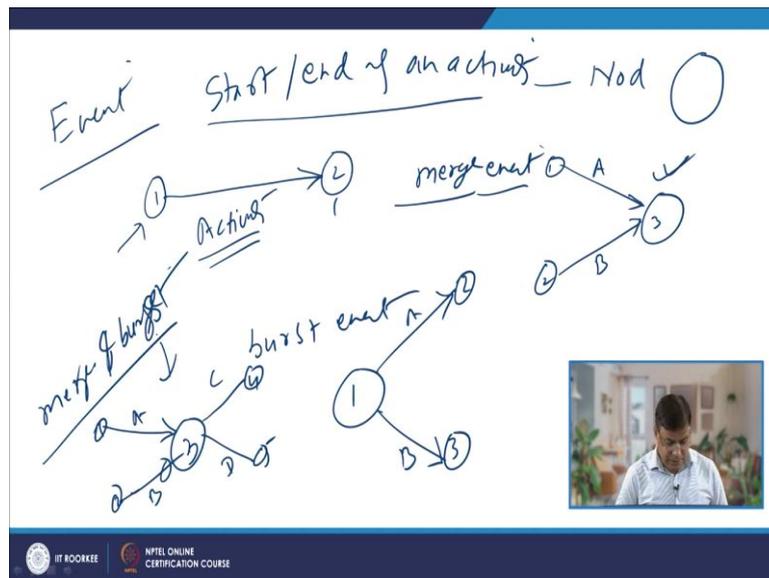
In that case, the activity A and B, both can be started at the same time. And these need not to follow each other one after another. So, concurrently both can be taken up and thereafter, say third activity C can be started. So, if we see, for starting the C activity, A and B both are the predecessor activity. While for A and B, C is the successor activity. A and B here are the concurrent activity. Sometimes, we have another situation where just to show the sequence or dependence of certain activities with other activities, dummy activities are used.

Dummy activities basically these are the no resource use activities, no time. So, 0 time, 0 resource is required for these activities. These primarily use to show the particular kind of the dependency of certain activities on other activities and it is represented by a dotted arrow line.

So, dotted arrow line is used for the dummy activity. It does not consume any resource, it does not consume any time. So, to show this, say, there is one typical diagram like say, A and B activity and then we have C activity. So, if the situation here for activity C is that, the C can although A and B are the concurrent activities or parallel activities.

But see if it is, we have to see that C can be taken up only after completion of the A. Then to show this relationship, we will be drawing one dotted line like this. So, this shows that this is the dummy activity and it will be showing the dependency on the C on A and B both. So, to show the dependency of the certain activities on completion of other activities, we use the dummy activity. It does not consume any time or any resource. So, that was about the dummy activities.

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Similarly, we have the Event. Event means it shows the start or the end of an activity, this is in the, and this start and end of an activity is indicated by indicates the event. And it is shown by a node. This is basically a circular, a circle. So, when an activity starts, we have one event and when it ends another event. And both can be shown with the help of certain alphabets or numbers like 1 or 2 or A and B. And arrow here shows the activity and 1 and 2 are showing the events, start or end of the activity.

There are certain types of the events where like merge event. In case of the merge event, two activities will be ending or starting at the same time. So, here, so the two activities will be ending at the same time. So, this is the merge event. Like, 1, 2, 3 so, activity A and B, completion of both the activity is indicated by the node 3 that is the merge event. And then to we have the burst event.

Burst event shows the like the two or more activities are having the same starting points. So, here 1, 2, 3 activity A and B. So, here this is how we represent the burst event and merge and burst event both are shown like this where at one event the two activities are merging, here A and B so 1, 2, 3, 4 and 5. So, activity A and B are merging at 3 and the bursting is taking place at event 3 for activity C and D.

So, here it combines both merge and the burst events. Now, I will summarise this presentation. In this presentation, basically I have talked about the introduction related aspects of the project management like what are the techniques of the project management and what is the network modelling, what are the techniques of the network modelling and

what are the advantages and applications of the network modelling. Thank you for your attention.