Software Project Management
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Lecture - 42
Project Monitoring and Control (Contd.)

Good morning to all of you, now we will take up how to visualize the work schedules.

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We will see we can visualize the work schedules might be a different work charts such as the Gantt charts, slip chart, time line chart and then we will see how to monitor the costs.
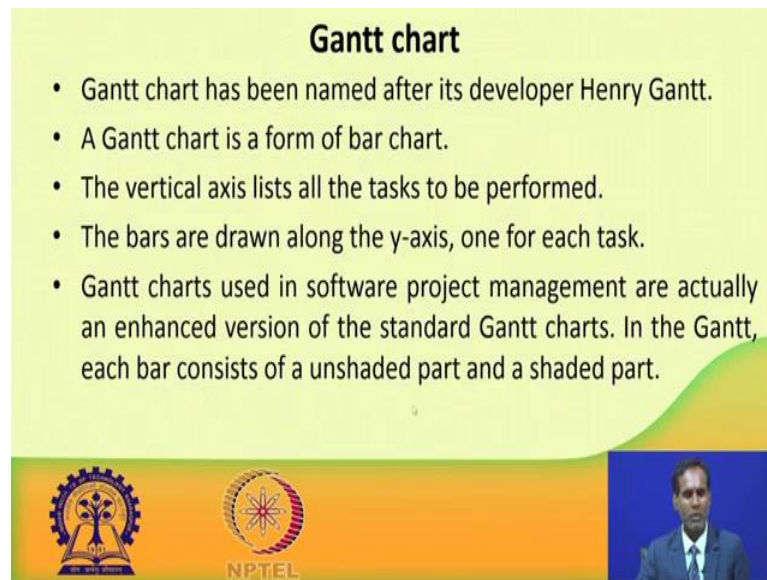
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Let us see how to be visualize the what progress of a project. So, we have seen last class how to collect the data about the progress of a project. So, after collecting the data about the progress of a project, the manager he needs some way of presenting that data to the greatest effect. So, there are some methods for presenting a picture of the project and its a future. So, some methods that provide a static picture such as a single snapshot for example, Gantt chart there are some other methods which tried to show how the project has progressed and changed through time that they represent the dynamic aspects of the system and example in the timeline charts. We will see first the Gantt chart then we will see slip line chart and then we will see the timeline charts.
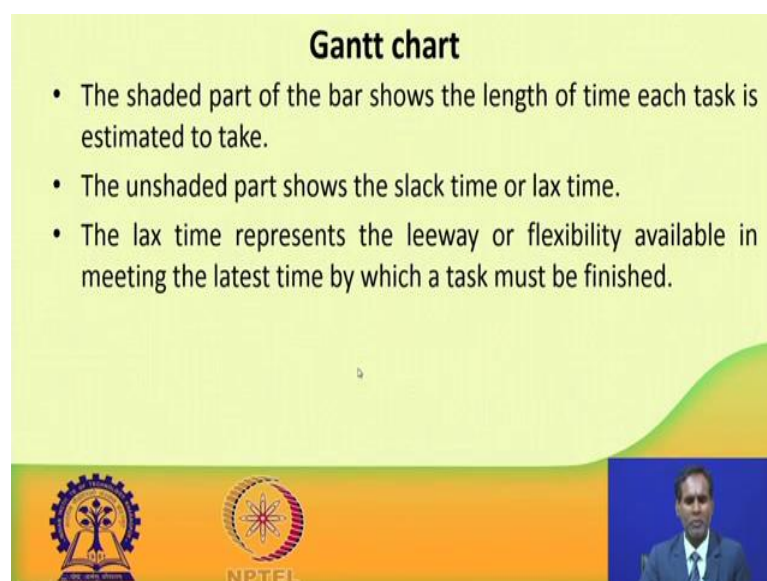
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Gantt chart has been named after its developer Henry Gantt, this Gantt chart is a form of bar chart that we have already seen earlier also in your matriculation or plus we must have seen about a what is a bar chart. So, a Gantt chart is a special form of bar chart. Here the vertical axis it lists the tasks to be performed, the bars are drawn along the y axis and the 1 bar for each task the Gantt charts are used in software project management, they are actually an enhanced version of the standard Gantt charts and in the Gantt chart as we have already seen that each bar consists of two parts one unshaded part and a shaded part we will see in the example.
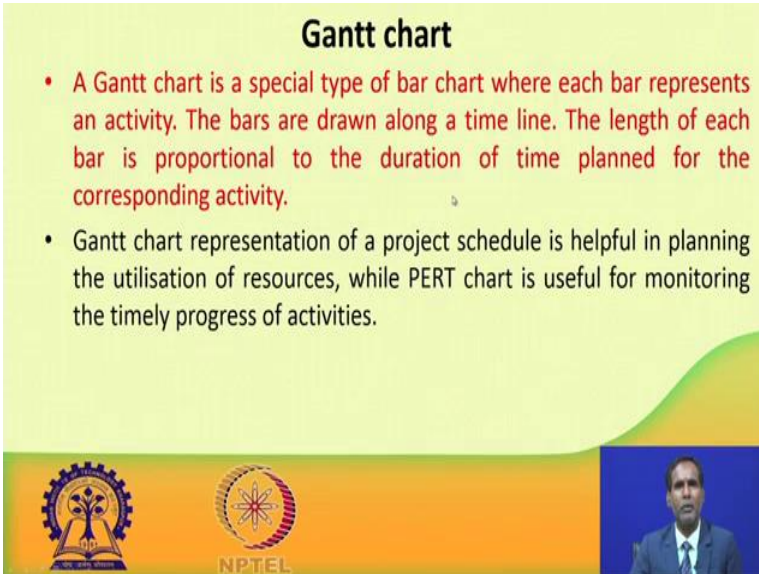
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Now, let us see what the shaded part represents and what the un shaded part represents. The shaded part of the bar shows length of the time each task is estimated to take. So, each task is estimated how much time it will take so, that time is represented at the shaded bar shaded part and the un-shaded part so, the slack time or the lax time.

I have already discussed what is a slack time or float time or a free time in the last class, the un-shaded part represents the slack time or the lax time the what is the lax time we can say that? The lax time represents or the slack time this slack time or the lax time represents from the leeway or the flexibility that is available in the in meeting the latest time by which a task must be finished. So, here some free time is available you can little bit delay the task so that, it will be what it can be finished before it can be completed before its target time.
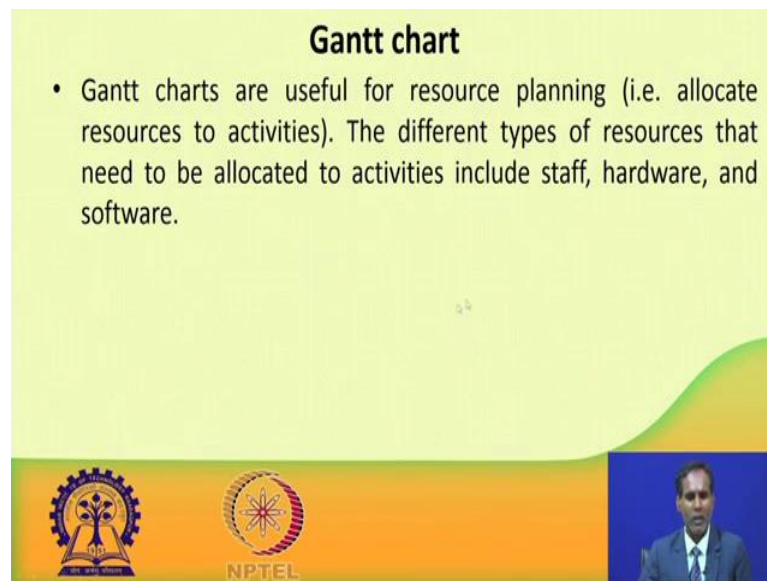
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A Gantt chart is a special type of bar chart that we have already discussed, where each bar represents an activity and the bars normally they are drawn along a timeline. The length of each bar is proportional to the duration of the time that is planned or expected for the corresponding activity. The Gantt chart representation of a project schedule is helpful how let us see how Gantt chart is helpful. The Gantt chart representation of a project schedule is helpful in planning the utilization of the resources, how we can plan the utilization of the resources for that you can use a Gantt chart.

So, but those who have I think you have already seen CPM PERT earlier. So, while PERT chart is useful for monitoring the timely progress of the activity. If you will compare between Gantt chart and PERT chart you can see that Gantt chart is helpful in planning the utilization of resource while PERT chart is very much useful in monitoring the what timely progress of the different activities.

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Gantt charts are also useful for resource planning how to allocate the resources to the activities based on what. So, these Gantt charts are very much useful for resource planning that is how to or during allocation of resources to activities. The different types of report resources you know that need to be allocated to various activities, you have already discussed in last class they can be the resources could be staffs, could be hardware, could be software, could be other equipments, could be what space even could be time these are various what resources.

How the different types of resources that can be allocated the different types of resource resources that need to be allocated to activities such as staff, hardware and software these allocation can easily be represented using Gantt charts.

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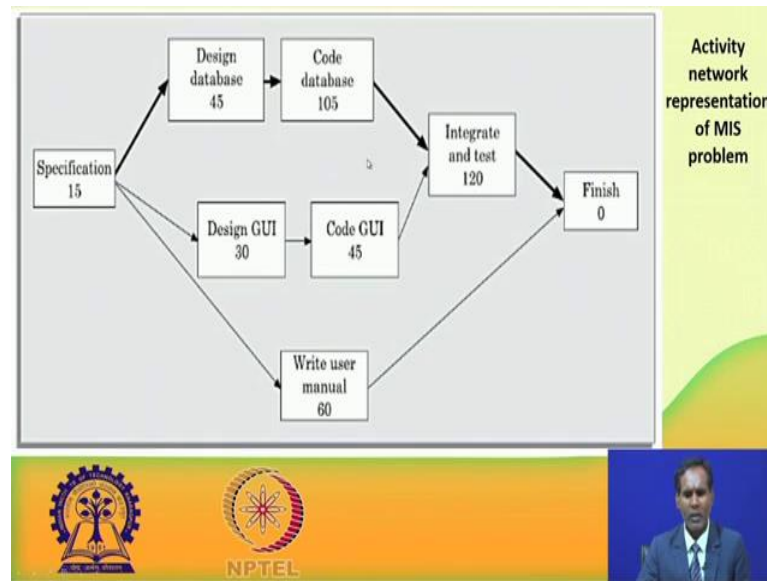
So, normally the Gantt charts you can easily construct if from the activity network or from the precedence network. So, first step is that you construct the activity network or the precedence network then from that activity network or the precedence network you can easily consider you can easily construct the Gantt chart.

So, this is a sample what activity network for a MIS problem where the various activities and their expected times they will take to what for their the these activities how much time they are expected to take that is also written like requirement specification will takes 15 days, designing database will take 45 days, designing GUI will take 30 days and then writing manual will take 30 days then what code database will take 105 days coding GUI part will take 45 days integrate and testing will take 120 days and then complete.

So, you can say that in this activity network the dependencies are also shown like before coding design of database should be there, before coding GUI design of GUI must be completed and before integration and system test this coding of database and GUI should be completed. So, in this way if a given activity network ok. If in this way if an activity network is given you can easily construct the Gantt chart you see.
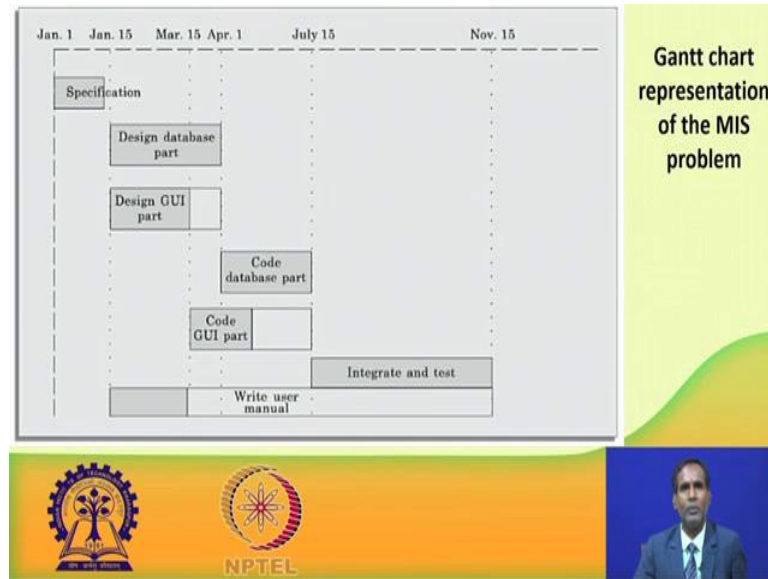
So, now you see you see first we will be we have already seen what is the first? First one is the specification, requirement specification that will take 15 days. So, accordingly we have seen that, we have started with specification and suppose the starting date is January 15. So, it will take how many days we have already seen it will take 15 days. So, up to January 15 it will continue then as we know that only after specification is completed we can start 3 activities parallely what are they? Design database, design GUI and write user manual.

So, you see now after January 15. So, from January 15; that means, 15 days after the specification January specification is started in January 15 January 1st it will take 15 days, then 3 activities can be started what parallely designing database, design GUI and write user manual see all those 3 activities have been started parallely from January 15 and you have to show the timings.

So, design database will take 45 days, design GUI will take 30 days and writing man user manual to 60 days see. Design part should take how much days its take 45 days so; that means, January 15 to what may be what February 15 and then you will take that up to what you can say April 1 or so, then design the GUI part tool should take how many days it should take what 30 days. So, here its I think January 15 to what see it is taking up to March 15.
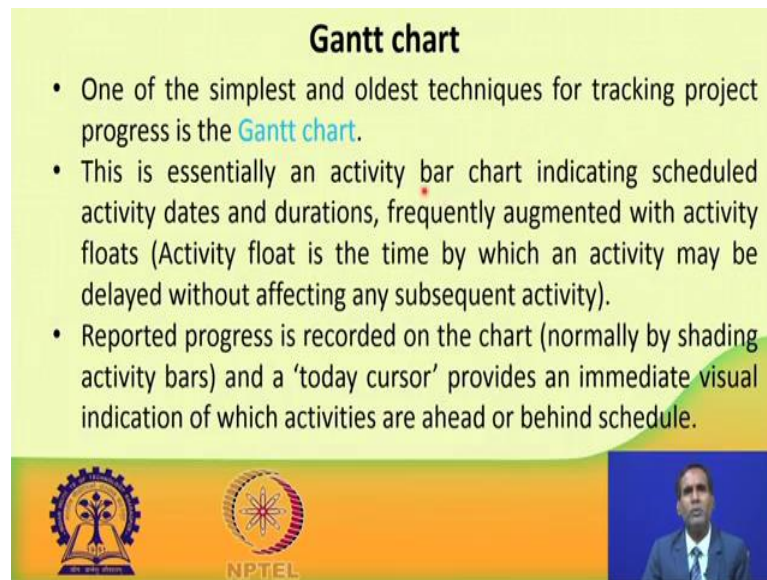
So, I think this what days are little bit wrong you can correct accordingly. So, this should take from January 15 it should take how many 45 days. So, count what is January 15 to 45 days accordingly please write down this one might be a small mistake here. So, similarly designing the GUI part it takes 30 days so; that means, the January 15 to, it will take what maybe February 15 or so. So, accordingly please change the date here and then what you see this will take how many days writing user manual it will take 60 days may be January 15 to what march 15 or so, see exactly what the 60 days and accordingly you can proceed.

So, then after this you can after this designing database, you can do the coding the database it will take 115 105 days. So, coding will starts from this see after this 105 days coding can only start and then coding GUI part can start coding GUI part it can start after what after these design GUI part is over. So, here design GUI part is over from here. So, then you can start the coding in GUI part and finally, you can do the integration and testing after this what code database and code GUI part is over. So, code database is over only it takes maximum days 105 days. So, even if your code GUI part it takes less than 45 days, but it has to wait because integration and test is testing, but can start only after this code data base part is there.

So, you can see this is the slack time or the flex time because this time is free. So, if sufficient resource is not available, then you can little bit delay the code GUI part in order to consume this free time part. And you see write user manual takes 60 days, but here see this the here this much time is what free time is there and if sufficient user is staffs are not there resources not there you can also delay what this write user manual so, that it can be it will not affect the end date, it will project can be finished in its appropriate target date. So, this is how from this activity network we are able to construct the Gantt chart for this MIS problem.

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Now, as we have already told you that Gantt chart is one of the simplest and oldest techniques for tracking the project program progress. This is essentially an activity bar chart which indicates the scheduled activity dates and the durations. The frequently augmented with activity floats I have already shown you how you can represent the floats these un-shaded parts are the float or times or the slack times. We have already I have only told you float that is float or activity float is the time by which an activity may be delayed without affecting any subsequent activity.

So, the reported progress is recorded on the chart normally by shading the activity bars ok. The progress is represented by this bars or the shaded bars and un-shaded part is this what slack time or the what free time. So, the reported progress is recorded on the chart normally by shading the activity bars and today cursor provides an immediate visual indication of which activities are ahead and which activities are behind the schedule. So, this is how you can prepare the Gantt chart.

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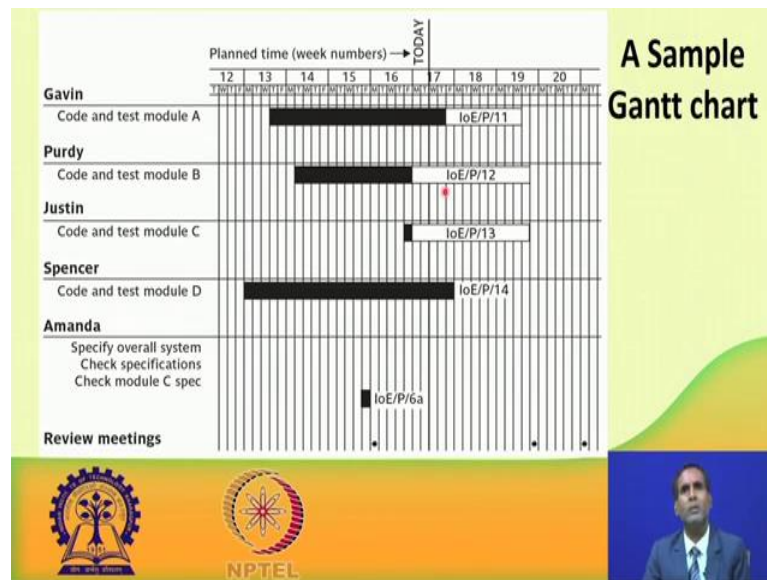
Another example also has been shown here. So, here these are the what different activities, we have taken coding and testing this is another a plan. This is another example coding and testing for module A coding and testing for module B and like code and test module C, code and test module B etcetera and these axis x axis we have taken the weeks where week 12, week 13 week 14 etcetera then the days of those weeks and this shaded parts said that code and test module A takes a this much period and this unshaded part is the free time.

If we are on today at this point; that means, at 17th weeks we can say that in module A is ahead of the schedule also you can see that in today this is the 17th week and we have also done some extra; that means, code and test module D is also ahead of the planned schedule, but if you look at the other two activities code and test module B and C you see this is the today's date this one is the today's date.

So; that means, we are behind the planned schedule, we are lagging behind the planned schedule for this code and test model B and C. So, accordingly you have to take remedials what action how you can what meet the time maybe by hiring more what manpower or so. So, you should try to meet the what a target line, this is how you can prepare a sample Gantt chart.

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This already I have explained ok.

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Now, let us see the other type of what the chart that is called a slip chart. A slip chart is a very similar alternative which are favoured by some project managers its a similar alternative to Gantt chart. And so here these as you can see that is a very similar alternative this these are favoured by some project managers who believe that it provides a more striking visual indication of those activities that are not progressing to schedule. So, this slip chart it can provide you a more striking visual indication for those activities

which are not progressing as for the schedule, that is you can see that the more the slip line bend you can say that greater the variation from the plan, let us take a small example say.

Like this similar to your Gantt chart, but you see here if this is today you see some what you are connecting and these what activity the progress of different activities through somewhat lines. So, more it is bend; that means, more there is a variation from the schedule, had it been straight line then we are what moving as per the schedule as per the plan. If there are more bendings if the slip line is more bended; that means, is more variation more deviation from the what the planned schedule which should not there. So, you should take remedial action to overcome this problem.

That is what we are saying here that this chart it will provides a more striking visual indication of those activities that are not progressing to the schedule and more the slip line bend just like this is the slip line, if it is more bend it indicates that the greater the variation from the plan and hence you have to take remedial action. So, additional slip lines also they can be added at intervals and as they build of the project manager will get an idea as whether the project is improving; that means, the subsequent slip lines bend less or not.

So, here you have put one, then after take the remedial actions afterr two weeks another again you draw the what slip line C whether this is becoming more straight or not. See if more straight means we are meeting the target lines we are as far the schedule more bending means it is more deviation from the schedule.

So, periodically after every 1 week 2 week draw the what slip lines and observe whether you are moving into the planned schedule or not. If you are not moving towards the planned schedule you are if you are deviating then take remedial action such as a higher more man power etcetera so, that you can meet the target dates and you can move as far the schedule ok. So, a very jagged slip line it indicates a need for rescheduling if the slip line is very much jagged, then it indicates that there is a need for re scheduling the activities.

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Next one is the timeline chart. So, let us see one of the drawback of this Gantt chart and slip chat. So, one drawback is that they do not show clearly the slippage of the project completion date through the life of the project. So, these two diagrams we have discussed Gantt chart and slip chart, they do not show the slippage of the project completion date through the life of the project. So, analysing and understanding the trends the project so far allows us to predict the future progress of the project. If we will there should be some mechanism for analysing and understanding the trends in the project. So, far happen and this will allow us to predict what will happen in future. It will help in predicting the future progress of the project.

For example, suppose if a project is behind the schedule because so, far productivity has not been as high as I assumed at the planning stage, then it is likely that the scheduled completion date also it will be pushed back even further unless action is taken to compensate for or improve the productivity. The timeline chart is a method its a technique for recording and displaying the way in which targets have been changed throughout the duration of the project I have already told that Gantt chart is a static figure it represents the static aspect of the project, but timeline chart it represents the dynamic aspects how the progress is moving with respect to the time.

So, its a it represents the dynamic aspect. The timeline chart is a method of recording and displaying the way in which the targets have changed during what the development of the project.

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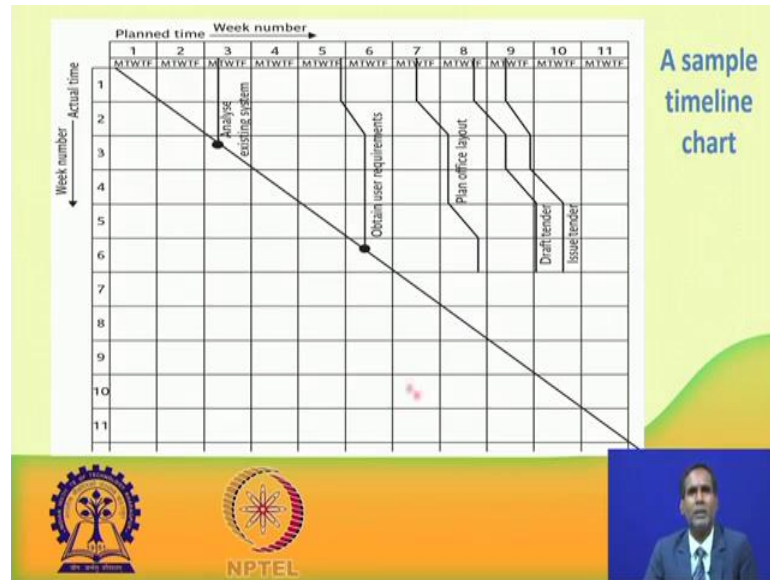
Will take a simple example. See this is a what sample timeline chart we are here we have taken the wig in this y axis we have taken the week numbers and here in the down if you will see the actual time, it will go downward this represent the actual time and in x axis also we are taking the what plan time in week number in y axis we are taking the actual time in terms of the week numbers and in x axis you are taking the plan time also in terms of the week number. So, these are say there are 11 weeks here and here there are also 11 weeks and we see how we are progressing how the project is progressing this can be visualized from this graph let us see what is saying.

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This figure given in the previous slide that is the timeline chart, it is show the sample timeline chart at the end of the 6th week you see at the end of the 6th week. It is a 4-5 it is the 6th week suppose we want to see this is the progress at the end of the 6th week we want to know what is the progress that is shown here and the plan time which plotted along the horizontal axis and the elapsed time along down the vertical axis. So, here x axis is planned a time y axis this actual time. The timeline and the lines mean meandering down the chart is represent the scheduled activity completion date.

So, the this line these are meandering the lines meandering down the chart represent the scheduled activity completion dates. So, this it is meandering, so, they represents the completion dates. So, at the start of the project if you will see the analyse existing system is scheduled to be completed by the Tuesday of week 3. So, this is this what analyse the existing system, it is expected to be completed in the 3rd week on the Tuesday and then at the start of the project as I have already told you the analysing every system with scheduled to be completed by the Tuesday week 3 and obtain user requirements by Thursday of week 5, it was initially planned that week 5 this activity should be finished by what thursday of week 5 and then these issue tender etcetera by Tuesday of week 9 issue tender where is the issue tender? This is about issue tender it was initially planned to be completed in week 9 maybe Tuesday ok.

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But the at the end of first week the project manager review the progress review the target dates and leaves them as they are that is the lines are therefore, drawn vertically downwards from the target dates to the end of week 1 on the actual time axis. So, what we have seen? At the end of 1 week you see it at the end of the 1st week at the end of 1st week see lines are just straight forward it was what see this is the 1st week actual one this 1st week, just straight forward we expected that every activity will meet their dead line then what happened?

At the end of the week 2 then the project manager he could have observed that obtained user requirements will not be completed until Tuesday of week 6. So, this obtained user requirements you can see that after this first week he has just seen that this obtain user requirements it is getting delayed, it cannot be finished this it will take some more days might be what week 6 it will take one more week. So, that is why it said that at the end of week 2 he decides that he felt that obtained a user requirements cannot be completed until what Tuesday of week 6 and hence he therefore, extends that activity line diagonally to reflect this.

So, that is why what has done up to 1st week see it is straight then he found that it cannot be finished by Tuesday of 6. So, that is why it has bended the he has what made bent the line up to what this the 6th week Tuesday and then again now it is what moving straight forward ok. And similarly what other activities also they are expected to be delayed and

accordingly he had made them as bended after this 2nd week. So, he has bended all these lines for other activities ok.

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So, then by the Tuesday of week 3 analyse the existing system is completed. So, by the use of 3 see 3 this one is finished. So, they have made a circle in order to mark that the activity is completed and then at this what time at the end of at the by the Tuesday of week 3 analyse the existing system is completed and the project manager puts a blob on the diagonal life timeline in order to indicate that this has already completed. Then at the end up week 3 decides to keep the existing targets he has tried to meet the existing targets and at the end of week 4 he adds another three days to draft tender and issue tender.

So, then he has seen that. So, again at the end of week 3 he has seen that this thing are not able to be finished the target dates again they will be delayed, see again after this again it is dealing to this. So, whenever he expressed that there will be further delay again he will bend the line and every after every week you will see the progress if it is delaying, then you will accordingly bend the line. Then what note that by the end of week 6, two activities have been completed and this 3 are still unpinning not completed. So, this is week 3, first activity is completed then at the end of week 6 he has seen that this is also completed, but you see this is originally it was supposed to be finished in 5th week.

But since it is expected that it cannot be finished in a week 5 the line has been bended and it is expected that it will be over in 6th week maybe by Tuesday. So, accordingly this has been bended. So, at the end of 6th week the project manager again he reviews the progress and he has observed that two activities first two activities are being finished and still three are not finished. So, in after every week again he will what review the progress and if again it is expected that these activities will be delayed accordingly he will bend the lines and when it will completed again he will mark a what dark circle in order to indicate that those activities have been finished.

So, at the end of 6th week the manager observes that the first two activities are finished and other activities are still they are not completed, they will take some more time to be completed. So, periodically he will review the progress of these activities and then if they are not moving as per the plan or the schedule, then he will be in bend the lines as and when required. So, this is how this timeline chart it represents the dynamic aspects. Dynamically the lines are just what keeping unbending as it is expected that this will take more time the lines are being bended.

So, it represents the dynamic aspects how the project is progressing it represents the dynamic aspects. So, gantt chart represents the static aspect whereas, the timeline chart it represents the dynamic progress of the project. So, now, we have observed that by the end of week 6, two activities have been completed and the three activities are still unfinished. Up to this point he has revised the target dates on the three occasions and the project as a whole is running seven days late.

It will see on a as a whole the project is running almost to 7 days late it was it should be finished in 9th week, but it is moving towards what a 10th week. So, almost 7 days the whole project is delayed the timeline chart is ok.

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So, this we have seen the timeline chart is very much useful both during the execution of a project as well as the part of the post implementation review. Analysis of the timeline chart and the reasons for the changes they can indicate the failures in the estimation process or other errors that might be avoided with that knowledge ok.

So, if you will analyse the timeline chart analysis of the timeline chart and the reasons for the changes why you have made the changes they can indicate the failures in the estimation process, they can or the other errors that might be there and with that knowledge these what errors or failures they can be avoided or these changes also changes in the timelines etcetera they can be avoided in future. These errors also can be avoided in future by using by analysing the timeline chart.
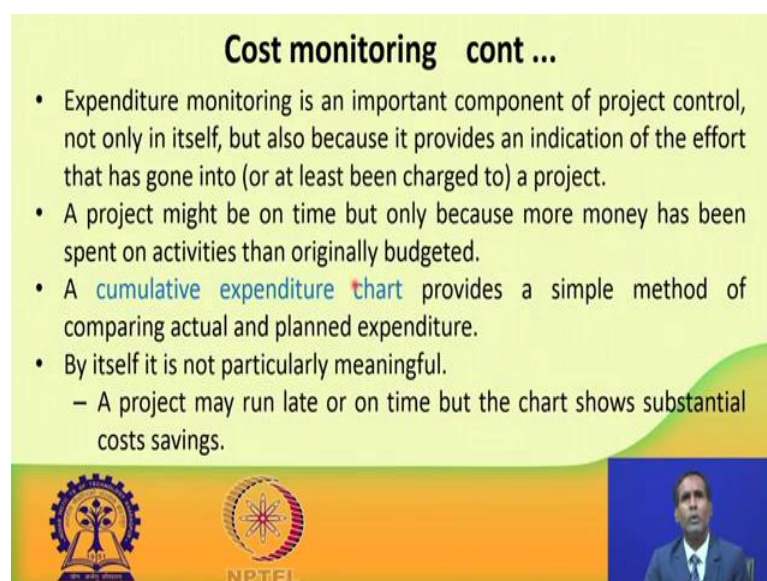
We will quickly say about the cost monitoring. A project could be late because of the staff originally committed, they have not been deployed at the right time. And so, in this case the project will be behind the time, but under budget it will be behind time, but still it is under budget. A project could be on time, but only because additional resources have been added ok. A project can be completed on time, but only when we will hire additional resources of course, this will be over budget you have to spend some more money. So, that is why you have to need to monitor both the achievements whether you are completing in time or not and the cost that we are spending.

So, expenditure monitoring is an important component of project control, it not only in itself, but also because it provides an indication of the effort that has gone into or at least that has been charged to a project. A project might be on time, but only because more money has been spent on the activity that originally budgeted. So, we have originally expected this much money will be spent, but since you have what moving late, you might have to add more manpower and hence you have to what spend more money.

So, in that case the project might be on time, but on the cost of what are the cost of additional what money. A cumulative expenditure chart you can draw which will be provide a simple method of comparing the actual cost or the actual expenditure and the planned expenditure by itself it is not particularly meaningful, but a project made on late or on time, but the chart shows the substantial cost savings.

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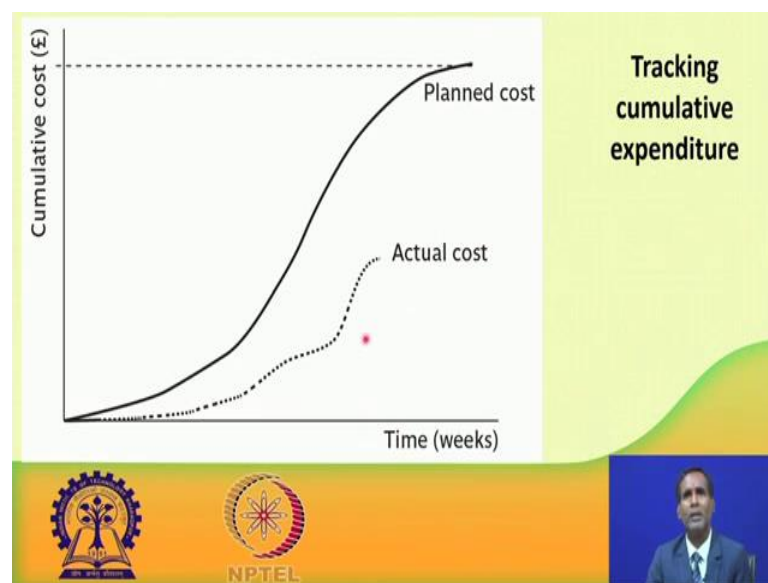
So, what is the substantial cost savings that the chart can show this a sample example of the what the cumulative expenditure chart. So, here in the x axis you are taking the time weeks and y axis we have taken the cumulative cost, you can see the actual cost was estimated sorry the planned cost was estimated to be what this, but the actual cost is moving like this. So, this shows the comparison between the what actual cost and planned cost you can track the cumulative expenditure by looking at this expenditure and by looking at this graph and accordingly you can take remedial action.

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We need to take account of the current status of the project activities. First we should take account of the current status of the project activity, before attempting to interpret the meaning of the recorded expenditure the cost charts they become much more useful if we add the projected future cost ok. So, these costs that have been developed there can become much more useful if we can add the projected future cost which are calculated by adding the estimated cost of the uncompleted work to the cost which have already incurred.

Where a computer based planning tool is used, revision of cost schedules is generally provided automatically if you are using tools software for what these what the cost schedule the revision of cost schedule is generally provided automatically once the actual expenditure has been recorded.

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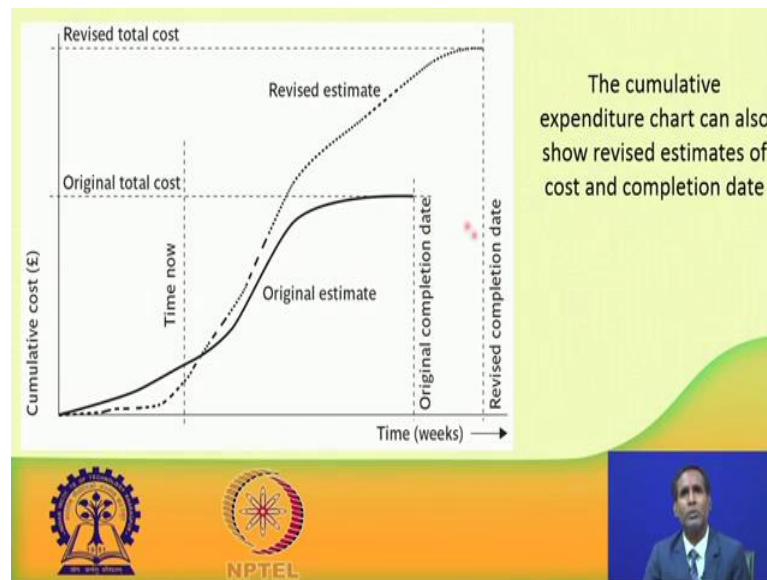
So, there is another diagram you shows this what the cumulative expenditure, here we are taking the time in weeks and here the cumulative cost. You can see that the cumulative expenditure chart it can also show what is the revive what are the revised estimates of the cost and on the completion dates. So, this was the original estimate and then since the progressive the during the progress of the project, you might add more manpower or some additional cost.

So, now the cost is being changed. So, this is the this diagram this line show the dotted line show the revised estimate, you can compare this what original cost estimate versus the revised estimate similarly this was the what original completion date and since you are lagging behind and this is the revised completion date, as the progress as the project progresses you can draw the revised completion date the you can find out the revised completion date.

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You can see that this figure illustrates the additional information available once the revised cost schedule is included. In this case it is you can see that the project is behind schedule and over budget. Please see the project is what the time original completion with time, but it is revised completion t. That means the project is behind the schedule. Similarly the original cost was this and revised cost is this; that means, say you are spending it is expected that more money has to be spent. So, in this case it is very much apparent that the project is behind the schedule and over the budget.

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So, we have discussed the various ways to visualize the progress of a project by using Gantt charts, slip charts and timeline charts we have also presented the fundamental concept basic concepts of cost monitoring. How can use cumulative cost chart to expect or to visualize the progress of the project with respect to time and the cost.

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2. R. Mall, *Fundamentals of Software Engineering*, Fifth Edition, PHI Learning Pvt. Ltd., 2018.

These are the references.

Thank you very much.