Work System Design
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Lecture - 01
Introduction

Namashkar friends. Today we are going to start our discussion on a very important topic that is work system design. So I welcome all of you to this course and for those who have registered for the course I can assure you that if you go through the course in a religious manner, if you try to understand the basic concepts of the course you will even be able to apply these principles in your day-to-day life.

Even the small elements of work that we do daily will also get benefitted in terms of improved ways and methods of doing the work. Also we will be able to save time in our day-to-day routine if we follow the fundamental principles of doing work. So this subject more or less will be applicable not only from the shop floor point of view or from a service industry like hospital or restaurant point of view but it has a universal application.

It can be applied to our daily life also. For example, now I am recording this session. The principles of work system design are equally relevant in this scenario also. How they are relevant because I am an individual maybe I am an operator on a shop floor or in this particular studio I am a speaker, I am a teacher. Then, there is a system we have a system to help me with what I want to present.

Then, there is a recording device which is recording the whole discussion that we are doing, also there is a lighting arrangement, there are air conditioners which are keeping the room comfortable in a comfortable environment. So this is a complete system, a person is interacting with a system and both are leading to introduction of some work. In this case, it is a production of a video content for a particular course that in our case is work system design.

So current work that is being done is the recording of a lecture for the work system design, so that is the work being done, but how this is being done, I am doing some work so I must feel comfortable while doing my task. The system must facilitate my work, so therefore the

principles, guidelines, rules, regulations, theory are not only related to industry only but they are related to our daily life also and therefore you will enjoy the course.

It is less theoretical more practical oriented course and we will see that how we can use the principles of work system design in various spheres of industrial application. In various spheres of our day-to-day applications, in various spheres of service sector industry, so we will try to take certain examples wherever possible to apply the concepts of work system design into actual application.

So let us now try to see that what is the work system design.

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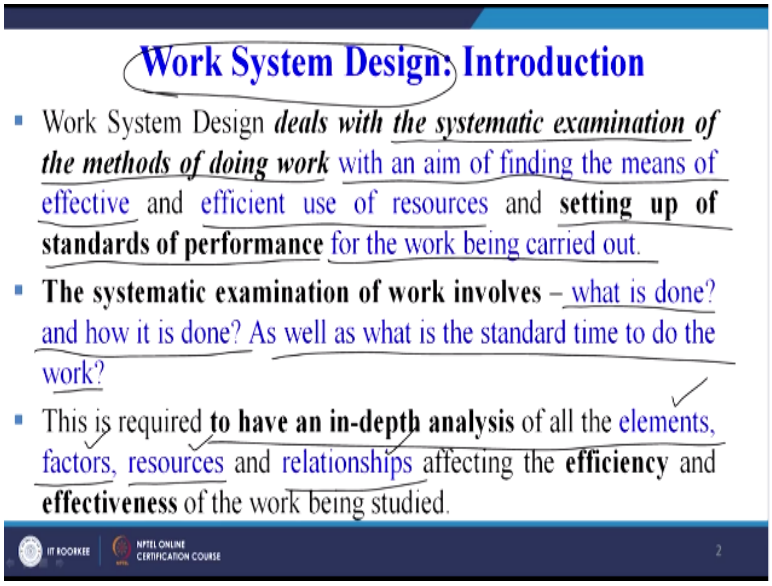

The work system design deals with the systematic examination you can see on your screen, the systematic examination so it is a scientific technique, it is not a philosophical technique, in this we will see, we will learn the different graphical tools, the different techniques which will help us to represent the current method of doing the job or the work and then what we need to do?

We need to find out, use our creative skills, use our mental faculties to find out the best ways of doing that work. So the current method maybe something which our forefathers have developed which maybe best till today but with the advent of technology, with the advent of assistive devices, we can certainly find out better methods of doing the work. So the work system design deals with the systematic examination of the methods of doing work.

Now why do we need to examine them? We need to examine them with an aim of finding the means of effective and efficient use of resources, so time is an important resource, our energy is an important resource so we must ensure effective and efficient use of resources and setting up of standards of performance for the work being carried out. So the standards of performance maybe in terms of time that is required to perform their task.

So we need to examine the current method of doing the work in order to ensure efficient and effective use of our resources as well as we need to find out that what must be the standard time required for performing the task using the best method of doing the work or the task. The systematic examination of work involves what is done, we need to ask this question and how it is done, the method of doing the work as well as what is the standard time to do the work.

So we need to find out the answers to these questions and these are not the only questions for which we need to find out the answer, we need to find out the answers like what else can be a better method of doing the job, who else can perform the job in a better manner, so there can be a large area or large list of or long list of questions which we must put while we are analyzing the work or the questions to which we must try to find out the answers regarding the work that is being done.

And if we are able to creatively analyze the work, we will definitely be able to find out a better method of doing the work. Now this is required why do we need to understand the concept of work system design, we need to understand this because to have an in-depth analysis of all the elements, factors, resources and the relationships among the various elements affecting the efficiency and effectiveness of the work being studied.

Now these are the 4 important key words that we will be using quite often that is what are the various elements of the work system, the factors affecting the performance of the work system, the resources required to perform the work as well as the interrelationship among all these 3 parameters. So all these things we need to take into account why? Because we need to ensure the effectiveness and efficiency of the work being carried out.

Now suppose I have to record this session which is going to be a 30 minutes' session precisely and I take maybe complete day to record this 30 minutes of recording or to record

this 30 minutes of discussion I may not be very, very efficient and effective, so maybe I am using may be 8 hours of the studio time for recording a 30 minutes' video may be I may not be one among the favorites among the recording people or people who are responsible for doing their recording.

But if suppose I have to record a 30 minutes' video and I am able to do it with all cuts and stoppages in between or with all kinds of factors beyond the control of the speaker as well as the recording team, if I am able to do it in 35 minutes I will say oh I have efficiently utilized my time, I was effective, I was able to deliver the content that I have planned for 30 minutes during the specified time only.

So therefore it is important that the elements like in this particular process the elements may be the air conditioning system, the lighting system, the recording equipment, the loud speaking equipment, so all equipment, the person, they must interact the relationship must be such that the time is utilized properly, the work is done in the most efficient and effective manner, so that is the basic purpose of understanding the work system design.

Now we will try to learn the various parameters, the various techniques that will help us to improve the effectiveness and efficiency of the work being done.

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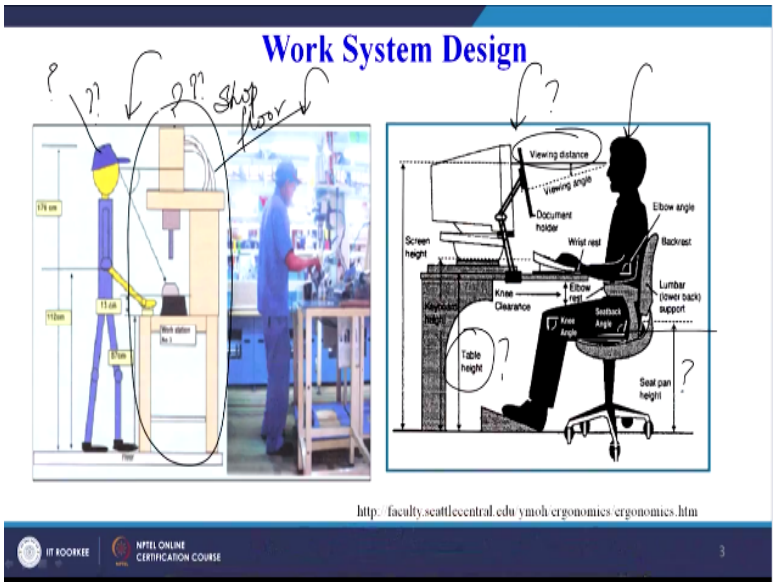

And here you can see, this is one schematic of a person who is standing and performing his task. This is actual representation of a person performing a task, how to design, what must be taken into account in context of the person who is performing the task, what must be taken

into account in context of the machine which is being operated by the person. So there will be some parameters which will affect the machine.

There will be some parameters which will affect the person. Similarly, in this case also this is an example of a shop floor where a person is performing maybe assembly operation. So here we can see a person who is performing, this is another work system in which the person is doing a work on the computer, so this is again an example of a work system and you can see there are so many elements to this work system.

So this is one variable that what must be the height of the chair on which the person is sitting, what must be the table height which must be taken into account, what must be the viewing distance which is ideal for a person who is working on a computer system. So we need to find answers to all these questions and what will help us the theory behind the work system design, the principles which lead to the work system design will help us, will guide us, will give us lot of information which will help us to design such type of work system.

So here 2 examples are given one is from a shop floor, this one can be from an office where a person is performing a task on a computer. Now how to design this work systems, there are different elements of the work system, then there is interaction among the various elements of the work system. Now how this has to be taken into account is an important thing which we will try to learn which we will try to discuss during this course.

So we will see that how the course will be organized so how it is organized which is given on your screen.

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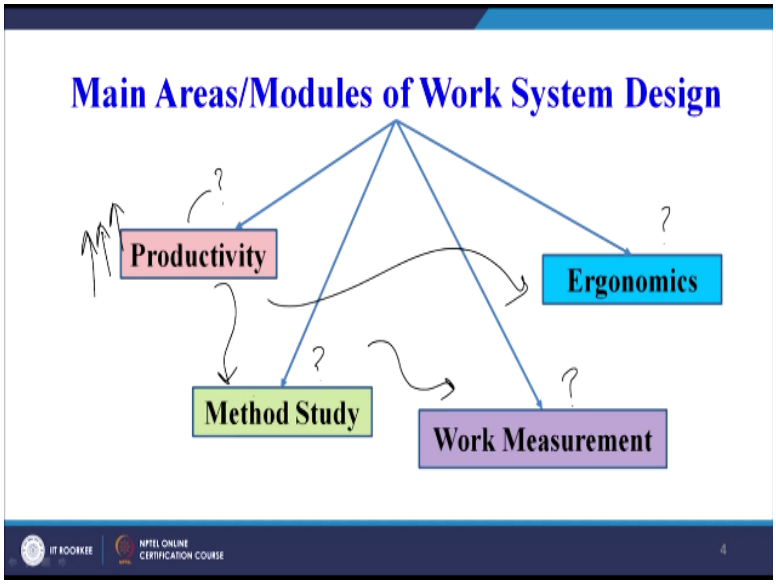

You can see, we will first try to see the concept of productivity. Then, we will try to see work method study followed by work measurement and then ergonomics. Why I am putting the question mark because most of you may be having the basic information about these terms or about these definitions of these particular words but then in this course we will try to go beyond the definitions.

We will try to go to the next level of understanding that is the application of method study for solving certain problems. In today's session, I will try to give you very few examples just to introduce the concept of work system design and these 4 major modules that we are going to cover. So in productivity we will try to see what are the causes of low productivity, how we can measure the productivity, how we can improve the productivity.

So productivity will be an important topic why because in order to improve our productivity we need to do the method study, we need to do the work measurement, we need to do the ergonomic study of the work system because we want to improve the productivity of our organization. So when we have to improve the productivity, we need to follow method study, we need to conduct work measurement as well as we need to design the system in such a way that the person feels comfortable.

He does not have a feeling of fatigue or he does not feel tired when he is performing his task, he feels safe while performing his or her task. So we need to understand the safety aspects, we need to understand in general the ergonomic aspects of doing the work and therefore these

4 modules will guide us, will orient our thinking in the direction of finding new and new, better and better and even the best methods of doing the work.

So each one of us is involved in one or the other kind of work whereas always there is an improvement, certainly there is a scope for improvement in the type of work we are involved in so how we can improve our efficiency, how we can be more effective, how we can be more productive that we can always find out using the basic concepts of work system design, so let us see each one of these modules one by one.

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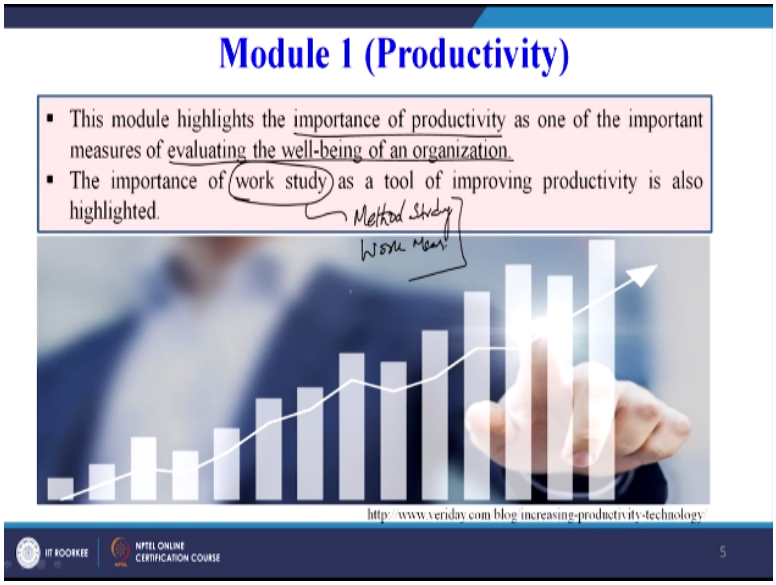

So in productivity, this module will highlight the importance of productivity as one of the important measures of evaluating the well-being of an organization. So if the organization is productive, it is skillfully converting the inputs into the outputs and the outputs are giving good revenue for the organization, the economic health of the organization will be good. So the importance of productivity as a measure of evaluating the well-being of an organization we will try to understand.

And the importance of work study as a tool of improving productivity will also be highlighted. Now we need to study the work or as we have seen in today's session only we need to scientifically examine the work in order to improve the work in terms of effectiveness and efficiency and therefore we will establish the importance of method study. So here 2 terms have already come into picture.

The method study and the work measurement already we have seen these 2 terms. So the importance of these 2 terms as a tool for improving the productivity will also be highlighted.

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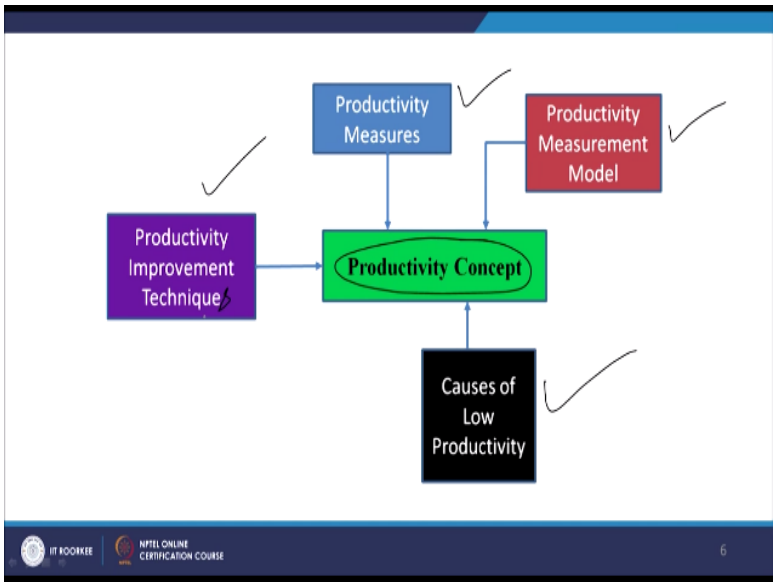

Now in our quest to understand the concept of productivity, we will see the causes of low productivity, the productivity measurement model, the productivity measures, what are the measures of productivity and productivity improvement techniques. So in order to understand the concept we will develop our discussion based on these 4 or 5 important parameters that are the 4 or 5 important directions which are listed here.

So causes of low productivity, productivity improvement techniques, productivity measurement models and productivity measures. Now once we understand that the productivity is an important parameter for each and every organization and there are certain causes for low productivity and there are certain suggestions already established based on the data available for various companies which can help the companies to improve the productivity.

We will try to understand the tools and techniques that can help to improve the productivity and one of the most important techniques is the method study. Now what is method study?

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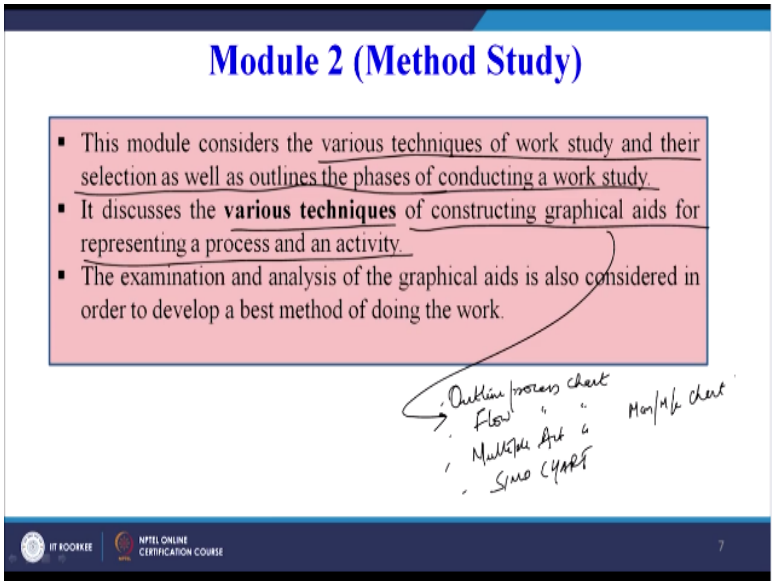

So in method study we will consider the various techniques of work study and their selection as well as we will try to outline the phases of conducting a work study. So the various step-by-step procedure to conduct a work study that we will try to understand. The various techniques of constructing graphical aids for representing a process and an activity. Now there are different graphical tools that are used in method study such as the outline process chart.

You can have a flow process chart, you can have a multiple activity chart, you can have a Simo chart depending upon the level of analysis that we are going to undertake. So there can be another one which can be man machine chart. So you have different graphical tools and we will learn about each and every graphical tool with the help of an example that this type of tool can be used or this particular graphical tool can be used for solving this type of problem.

So we will try to see that how a process can be represented and today only we will see one such example. The examination and analysis of the graphical tools is also considered in order to develop a best method of doing the work, so what is our target. Now suppose there is a work material or there is a raw material, which is entering an industry and then it is traversing a particular path before being converted into the final product.

Now we can make, we can depict this whole sequence of operations in one chart and then we can try to understand that what can be done in order to improvise this work being doing or in order to improvise this particular segment or this particular we can say shop floor of the work being done. So maybe we can try to do the re-layout or we may try to re-layout the machines

or equipment that are being used and we may try to find out that the new layout is giving us better efficiency and effectiveness.

So we will try to take one example. There are other graphical tools also, I have not written all of them maybe string diagram is another important tool, which has just come to my mind related to the layout design. So when we are trying to redesign the layout string diagram helps us in a much better manner. So we can see that different recording techniques will be followed.

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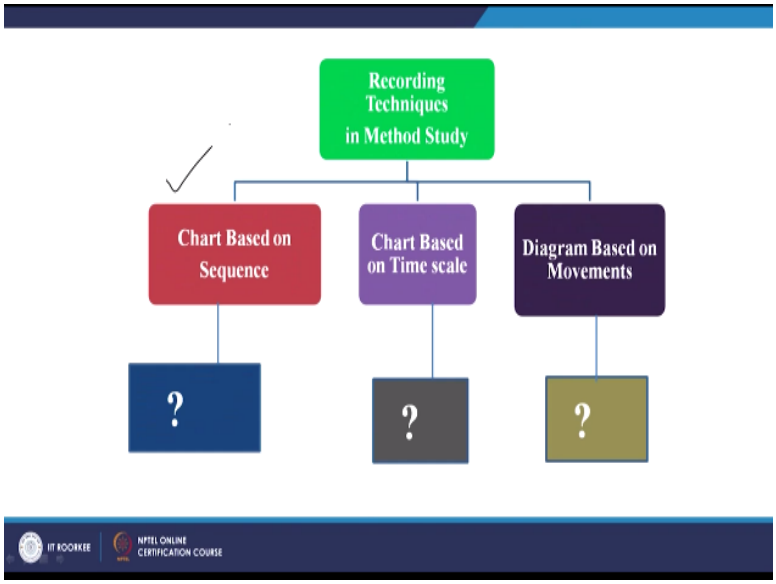

So here we can see we will be trying to discuss the charts based on sequence. I have already told a raw material entering and then moving through the shop floor before being converted into a final product. This sequence has to be followed, so there are certain charts which are based on the sequence, charts are based on the time scale that there will be a time scale and then the different activities being done by the left hand, different activities being done by the right hand.

And in between we have a time scale, so there will be charts that are based on time scale. Now what are these charts? The question mark depicts that there are certain charts which are based on sequence, based on time scale, based on the movement, so we will try to learn all these charts. So whenever we draw a chart there are 2 things, first is the current method, so whatever method is being followed we try to focus on that method.

And then try to see that the work has been depicted or the method has been depicted or the various stages of work have been depicted properly. So there is a current representation of the method being followed. Then, we try to use creative skills to find out that what are the areas of improvement or what are the operations which can be combined together, what are the operations which can be completely eliminated.

So all those things have to be taken into account and then we try to find out the alternatives maybe 3 or 4 and then we try to depict those alternatives again with the help of the same chart and then compare the current method and the alternatives and then we will be able to find out the one best method which is having less number of operations which is consuming suppose less time, less manpower is involved.

So sometimes even the operations become less, the effort also becomes less, the system becomes more responsible becomes more efficient and as well as more effective. So we will try to see that in this particular current method these are the scope for improvement and if we have these alternatives we can easily find out a better method of doing the work. So we will use the charts based on the application.

Or depending upon the type of work being done, depending upon the type of analysis that we want to perform we will select a particular graphical tool or a recording technique and then use it for finding out the best method of doing the work.

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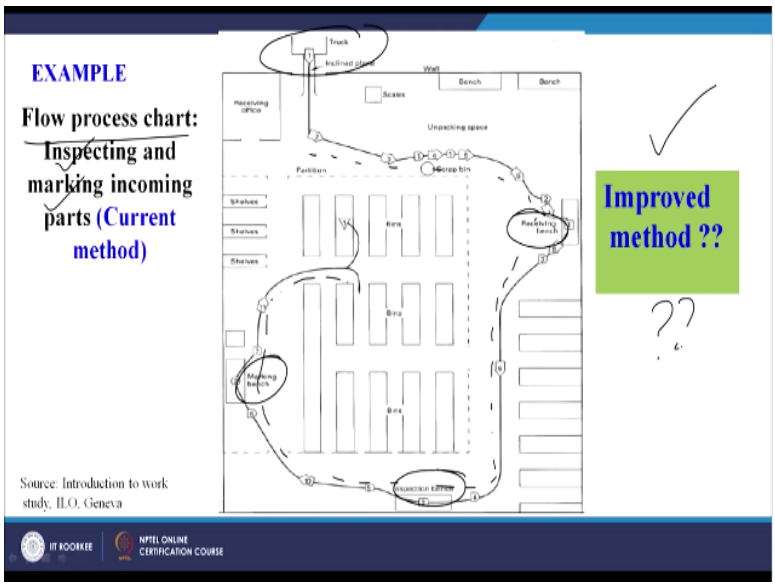

Now here you can see, this is one method of doing a work, it is a flow process chart of inspecting and marking the incoming parts. So here there is a truck from where the material is coming and this is the path being followed by the material before being stored in the bins, so there is a receiving bench here, there is a marking bench here and there is an inspection bench here, so inspection and marking are the 2 important works being done.

So the material is coming, it is coming to the receiving bench, it is inspected, then it is marked and then it is stored, so this is the one flow of flow process chart depicting the movement of the material on the shop floor before being stored. Now what can be the improved method that we will try to understand, trying to improve this particular work being done on the shop floor that this will be one introductory part that such type of problems we will solve during our course.

Then, the third module is the work measurement. Why do we need to do work measurement, we need to find out that how much we can produce, what is our capability in terms of the labour? in terms of the machines? in terms of the overall system? and to establish the expectations. Now suppose I have to assign work to 10 different workers, how I will assign the work?

I must have a scientific background that each person will be able to perform this much amount of work or each person will be able to produce 200 components in an 8-hour shift. From where do I get these numbers, the 200 components in an 8-hour shift, so this we will be able to find out using the concept of work measurement. We will be able to scientifically establish a standard time for performing a particular task.

So work measurement will help us to assess our capabilities. Now suppose we find out that experience, skillful worker will be able to produce 5 parts in one hour and then he will be in the industry for 8 hours. So if suppose he produces 40 parts in a day or in a 8-hour shift we can very easily assess the overall capability in terms of machines and manpower that we possess or that we have.

So we can use the work measurement for assessing the capability, we can use the work measurement for establishing our expectations.

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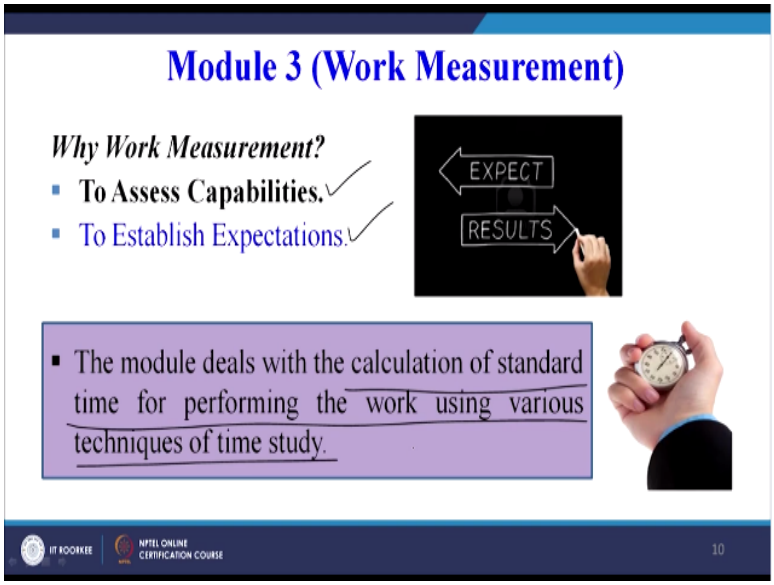

So this module deals with the calculation of standard time for performing the work using the techniques of time study. So we will see different techniques of time study. This is what is related to the allowances which help us to (()) (24:16) of the standard time.

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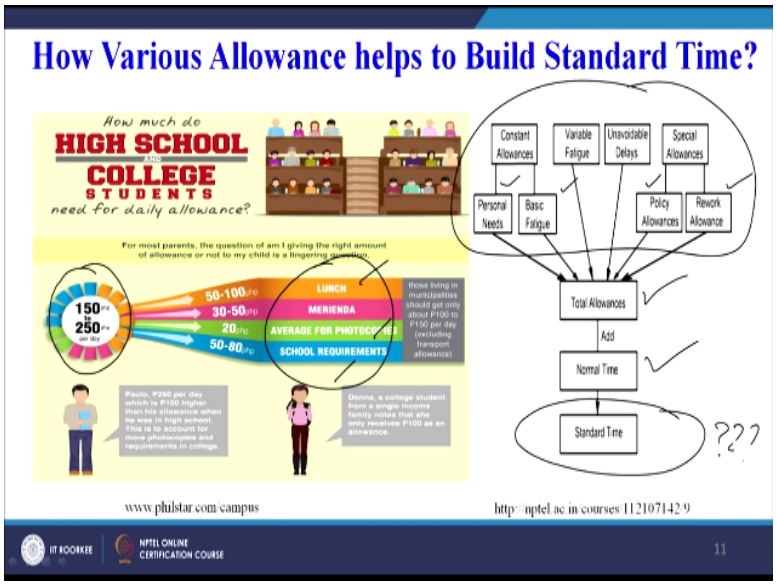

Our target is to find out the standard time which is a question mark, how to calculate that so for that we require normal time, we require the allowances and these are the various types of allowances that are given to a worker for calculation of the standard time. So these allowances we will try to understand that what are special allowances such as policy allowance, rework allowance, personal needs allowance, basic fatigue allowance.

So this is just one example the depiction high school and college student this is how much money the parents feel must be given to the students for their day-to-day expenditure that is

for lunch and then average for photocopies, school requirement, so all these is just one allowance which are given to the students. So here we are talking about the allowances which must be given to the worker.

Now suppose if I am given complete booking for the studio for 8 hours, it may not be possible for me to record 16 sessions of half an hour each why because there are limitations of speaking continuously, there are limitations of human body, there are limitations of different types, I may need to take some rest, sometimes I may like to have a cup of tea or I may like to drink a glass of water so there are these allowances which must be given to me.

So if I have the recording time available or the whole studio booked for me for 8 hours, I may never be able to record 16 sessions of half an hour each. So therefore whatever are the allowances those will be used to calculate that what is the standard time for recording a lecture of 30-minutes duration, so that way if 30 minutes of actual content is being delivered, the standard time may come out to 35 minutes or 40 minutes or 45 minutes.

So we will try to learn how to calculate the standard time and finally the 4th module will deal with ergonomics.

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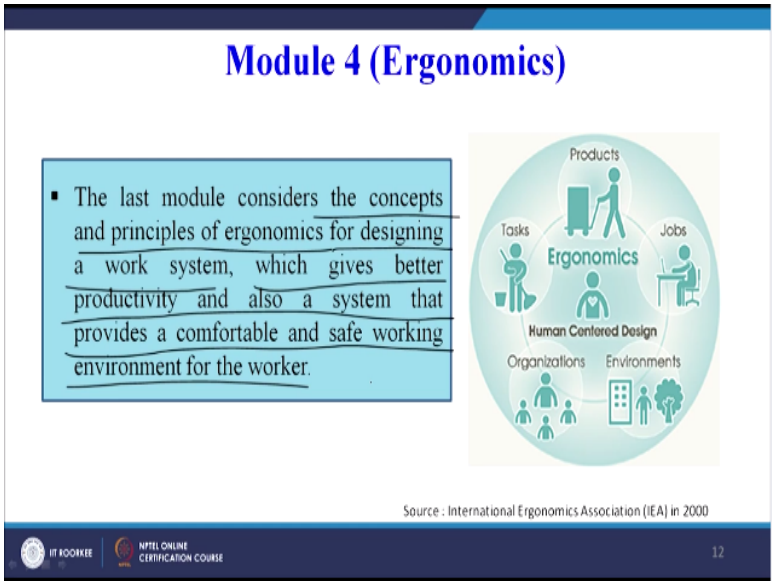

So the last module considers the concepts and principles of ergonomics for designing our system which gives better productivity and also system that provides a comfortable and safe working environment for the worker. So there are few things, few terms which are very, very

important. That is the comfortable and safe working environment, moreover the concepts and principles of ergonomics for designing of work system.

So if you remember in the very beginning today we have seen a professional who is working on a computer system. Now that is the work system that needs to be designed. We need to fix up the distance between the eyes to the computer screen, we need to fix up the height of the chair on which the person is going to sit, we need to fix the height of that table, we need to fix the height of the table in which the keyboard will be placed, we need to decide where the mouse must be placed.

So whether it must be at elbow height or it must be at a slightly higher height than the elbow, so what must be the angle of the thighs when the person is sitting, what must be the angle between the thigh and the leg when the person is sitting, whether the person's feet must be on floor or they must be at an angle. So all these parameters, all these values have to be found out by the work system designer in order to make the work system comfortable, safe for the worker who is performing the task.

Now this is related to one particular example only where a person is sitting in an office and working on a computer. Now you can yourself imagine the worker working on a shop floor where he is doing a heavy work where physical effort is required. So how we can design the work system in such a way that the worker feels safe, he feels comfortable, he does not have a feeling of fatigue, he does not get tired too easily and he enjoys performing his work.

So we need to ensure as engineers and managers that we provide such type of a system to a worker that he enjoys performing his work. So with this we conclude the introductory session for our course on work system design and subsequently we will try to cover all the 4 modules in as much detail as possible during the course and the focus will be on application based learning with the help of certain examples.

So that the things become ingrained in our thought process and wherever some work is being done immediately a thought must cross our minds that can there be a better method of doing this work. Thank you.