Work System Design
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Lecture – 14
Techniques of Work Study

Namaskar friends. Welcome to session 14 in our course on work system design. As you are aware that in the third week of our discussion we are focusing our attention on work study. So, the topic for discussion is work study and we have already seen the basic concept of work study. Also in the last session our focus primarily was to understand the concept of work content. Then we have seen.

The total work content is equal to the basic work content plus the excess work content or the excess time. The units were also specified as if you remember the man hours or the machine hours. So, basically we need to understand that what is the right amount of work that we must put in to complete or accomplish a given job at hand or to accomplish a given task? Our target in this course and work study or work system design is to design the work system.

In such a way that the worker feels comfortable while doing his job the system or the operation is productive. The company is also satisfied with the way the operations are being done. It leads to overall profitability for the organization and it leads to overall development of the society. Who is starting from the worker to the society the overall benefits have to be realized and how they can be realised.

It is only possible if as engineers we are able to design the work or design the system of accomplishing the work in such a way that it is comfortable. It is enjoyable. It is may be causing less fatigue. It is causing less may be injuries to the worker so before going for the design aspect of the work we must first try to see that what is the actual amount of work to be done and that we have understood in the previous session that what is the basic work content?

What is the definition? It is theoretical in nature we have seen that ideally the time required for doing a particular task is not the actual time span the difference is the excess time and why this

excess time creeps into the system is because of number of reasons. And in the previous class or previous discussion we have seen four important broad areas which lead to excess work content and these four are the issues related to the product design.

The problems related to the inefficient methods of manufacturing. The faults related to the management policies and the factors related to the man or the work force which is actually accomplishing the task. So, the four key words are the product, the process, the management and finally the man or the work man. So, these are the four important issues to be taken into account. So, we have seen among these four issues also what the various reasons for each one of these.

Which leads to excess time and we have tried to find out means and mechanism way and methods, tool and techniques which can help us to eliminate the excess time because of these four important factors. That was a very important topic. Now with that background with the back ground of understanding the productivity of the organization we will try to see that how to accomplish the task of improving the productivity?

How to accomplish the task of reducing the excess work content being added because of a number of reasons? And if you remember in the session number 10 in week second of productivity we have seen certain case studies. And in those case studies we have seen that if you change the design of the product your productivity improves in terms of the number of parts being used in the product. The number of assembly operations being used.

The weight of the product, the number of different types of parts going into the product, the metal fabrication time used. So when you change the product design your productivity increases. How that increases? Because we are able to eliminate the reasons leading to low productivity and some of the reasons we have already listed in the previous session like wrong product design, lack of standardization, inefficient methods of manufacturing.

So that is one, focus is on the product design. The second was we changed the process. In one case study we have seen the process change also leads to improve in the productivity. The employee moral we have taken the example of a particular company that giving certain

incentives to the employes they were able to improve the productivity of the organization. So we have seen all ready the cases where the changes in all these important factors the process.

The product, the people have led to an improvement in the productivity. And now in work study we have two important modules which help us to achieve our objective in a systematic scientific and logical manner. Now what are these two tools which is our target today? Technique of work study and we have already seen in our session 1 of this week that how a work study framework actually comes into action. We have seen two important areas which we need to focus on.

The first one is the method study and the second one is the work measurement. So, what do we try to do we have seen in the previous session there is a basic work content which has to be accomplished which is in term man hours or machine hours. We try to focus on the way we are doing the work. We are trying to identify what has to be accomplished? How is it being done? Who is responsible for doing it? Whether this is the only way of doing this work?

Can there be a better way of doing these works? So we try to find out the answers to all these questions and all these questions are very, very important. So once we list down these question we try to record all the facts related to that work that we are doing related to the sequence of activities that lead to the accomplishment of the work. We try to find out that how many people are involved what is the process or procedure they are following to accomplish the task.

So when we are able to record all these facts and then we critically try to analyze and try to figure out that whether this is the only option available with us cannot there we any other method of doing the same work? Can there be an alternative or a better method of doing the same job? That all discussion has been broadly put under one umbrella and that we call as method study. So method study usually is the technique.

For establishing scientifically one best method of doing a particular job or for particular task or a particular work. So our focus is always to look at ways which will help us to develop the best method. Now which method we will call the best method that also we must understand. Which method is best method? For example, I am delivering this lecture. May be for me this may be the

best method of delivering the lecture but independent reviewers.

Learners can always come up with certain suggestions. Sir, you can do it better if you follow this method. If you follow this technique your lecture can become further important or further may be enjoyable for the learners. So, that is may be the independent reviewers point of view which can give me feedback and help me to further improve the lecture content delivery part. Similarly, for any work that is being accomplished there can be a better method of doing the job.

For shop floor operations what can be the criteria for finding out what is the best method which one is the better method of doing the job. There can be criteria on which the current and proposed method can be compared. The criteria can easily, all of you can maybe clearly list down the criteria for comparing the two different method of doing the job, easily you can list down. One is whether the work is safe for the workers or not?

May be the current method may be leading to injuries or frequent injuries to the workers. You can say that one of the criteria has to be the safety for the worker. So, we must change the method so that it is safer for the workers, first criteria. Second criteria can be the comfort of the worker. Third criteria can be the time required to perform the task. The fourth criteria can be the effort required to perform the task.

Then the efficiency with which the work is being done, the effectiveness with which the work is being done. So you can list down the criteria based on which you can compare the old method or the current method with the new or a proposed method of doing the work. So in method study our target primarily is to develop newer, better, efficient and effective method of doing the work. One we are able to standardizing the method of doing the work.

Then we start looking for the time required to do the work using the standard method which has been devised. And that is the second broad area which is one of the important techniques of work study which we call as the work measurement. So in work measurement there are standard procedures, standard techniques, standard equipment which are used to record or standardize the time required for performing the task using the one best method of doing the work.

So standard process will be used the procedure which has been outlined which has been specified after the method study is used to perform the work and standard time is calculated for performing the task. You know some of you may be wondering and this is an important question sometime in the viva voce examination also that why do we need to find the standard time what is the need for finding out the standard time.

When the procedure is known, you train your workers and tell them that you have to follow this procedure and do this task. What is the need of finding out the standard time? So the need for the standard time is because we need to fix the accountability and responsibility. We need to assign the work to our workers based on the standard time for doing a particular task. For example, a person has the job of making holes in the steel plates using the standard drilling operation.

Now you can yourself say that how many holes he can make in a day. You can yourself try to figure out. Now scientifically we have to assign work to him that how many holes or how many number of holes is expected from him in a given shift of 8 hours' duration. How we will find that? We have to calculate the time required for making one hole and for that standard procedure has to be followed.

We have to find out the standard time required for making one hole using a procedure and that procedure falls under our study of work measurement. So work measurement will teach us that what has to be the standard sequence of steps? What are the calculations required to find out the standard time for making a hole? So once you have calculated that standard time scientifically using all the allowances and all other that we are going to study.

When we focus our attention on work measurement we find out one standard time for making a hole for given set of conditions. You know set of conditions can be thickness of the plat, the material of the plate, the diameter of the hole, the cutting speed to be employed, the feed rat to be employed. Under given set of conditions now we have found out a standard time required for making a hole. Now, we know suppose it comes out to be 2 minutes.

The work is on the shopfloor in the shift for 8 hours' duration. 8 hours multiplied by 60 minutes it is 480 minutes. Now, he is in the factory for 480 minutes he can make one hole using the standard procedure in 2 minutes, very easily we can say that 480 minutes divided by 2 minutes he must be able to make 240 holes in a day if he follows the standard operating procedure. But okay we can give certain additional allowances.

Some lunch break or tea break or certain tool change requirements may be there. So, we may not like to assign 240 holes in a day but certainly we can multiply it with a factor and try to assign the work to him. Now, we know x worker who is spending 8 hours in a day can make this many number of holes this is first information usefulness of work measurement. Second is now we know the worker is making this many number of holes.

How much salary must be paid to him what are the skill sets required for this worker? Can he follow the standard procedure? Can he use his physical and mental faculties to accomplish this task? So it will help us, it will guide us in the selection of the worker also. It will guide us in the fixation of the wages also. It will help us in all our production planning and control activity. It will help us in the material management policy also.

Because we know this many number of holes will be make. How many numbers of plates can be serviced or can be machined on this machine by able bodied, mentally alert worker. So, we are able to take a lot of management related decisions if we have calculated using a standard procedure, the standard time required for accomplishing a task. So both these important techniques that is the method study.

And the work measurements are important for any management. And most of the time I have seen, I have noticed when the students go for industrial training the learners some of the learners may be students as well so when the students go for industrial training the companies do assign them work related to the method and time study. They are asked to improvise the procedures being followed.

Sometimes they are told to find out the time required for certain standard operations being

carried out in the organization. So both these topics that is the method study and the time study are important not only from the theoretical or academic point of view. But they are really important from the practical and application point of view also. So, we will try to study in our course both these techniques.

The tools that are followed to accomplish the method study the various graphical aids that we can use to solve the issue related to method study. Also we will try to learn using some simple mathematical problems how we can calculate the standard time and what is the utility of the standard time for various organizations. So I think today I have taken a bit longer. I must not say bit I have taken too long to introduce the concept of method study and time study.

But quickly now we will try to understand the basic definition of the two important aspect and then we will bind up our discussion in this session number 14. Now, already I have explained that work study basically is made up of the method study and the work measurement. Method study is also called as the motion study.

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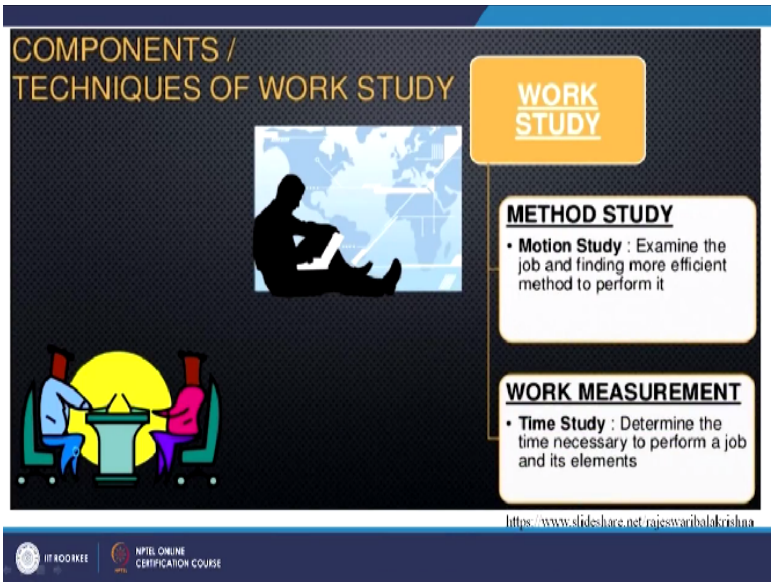

And it examines the job and finding more efficient method to perform. I have already told we need to look at the one best method of performing the task. In work measurement which is also called as time study it determines the time necessary to perform a job and its elements. Many a time we will divide the complete job into the various work elements and for each element we

will find out the time may be using a stop watch time study.

And then we will add up time may be using a stop watch time study and then we will add up the times to calculate the overall time required to complete the work. So, basically focus is on these two broad areas method study or motion study or work measurement or time study. Now these are the two important techniques method study and work measurement.

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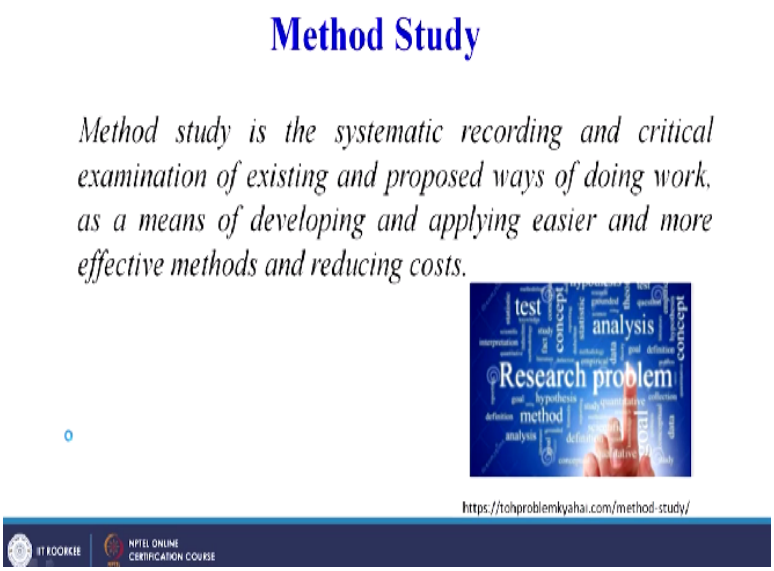

Now what is method study? The definition is given on the screen. Method study is the systematic recording. We will see what are the various steps involved, broad steps involved and critical examination of what? What we need to critically examine? The existing and the proposed so existing means the current way like I am delivering a lecture this is the existing or the current way of lecturing. And what can be the proposed way?

May be based on the feedback of the learners there can be a better method of delivering the lecture. So, the proposed ways of doing work so what is the work? The delivery of the lecture that is an example as a means of developing and applying easier, more effective methods and reducing costs. So, three objectives of method study are also listed in this definition. First one is as I have already told the proposed method must be easier.

It must be more effective and it must reduce the cost. So now from this simple definition we can

see that there is a current method of doing the work using the critical examination, using our creativity we have to find out alternative methods of doing the same work. What is the criteria for comparison? The criteria is the proposed method or the selected method out of the proposed alternatives must be easier, must be effective, must be efficient, must be productive as well.

As can be done in less time or another thing can be the most important that is the cost effective method. Basically we have try, we have to find out the better ways of doing the work using the tools of method study this is one definition. Then the techniques of method study aim essentially to do the following three things.

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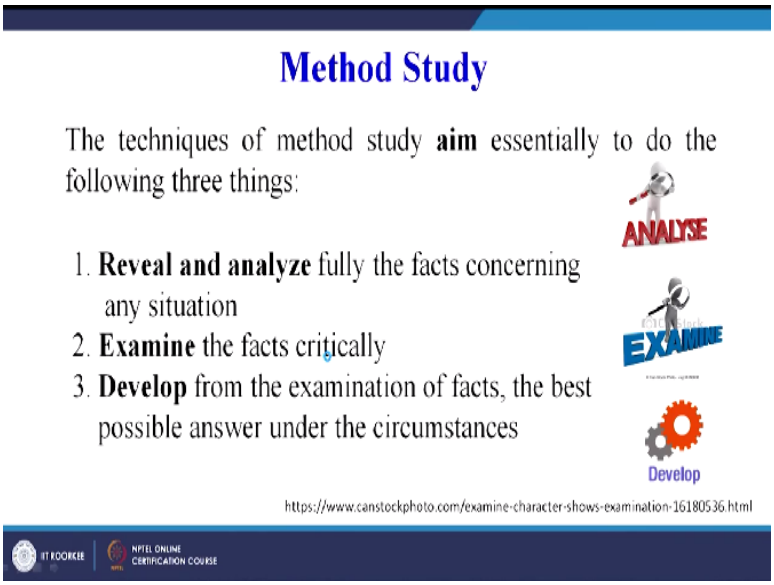

Whatever definition has suggested now we have to implement the definition we have to now put it into practice, put it into use, put it into action. Now when we want to put that definition into action what do we need to do? We need to reveal and analyze fully the facts concerning the situation. Or we can say the current method. Our focus has to be on the current method of doing the job. Reveal and analyze fully the facts concerning any situation.

Examine the facts I have already told critically. Try to see why this method is being followed? Why this sequence is being followed? Why this person is only doing the job? Why three persons are required to do the job? Ask as many questions as possible related to the current method of doing the job. Find out the answers and then critically examine where you need to put your

effort? How improvement can be incorporated.

Then once you have reveled and analysed everything you have examined the facts properly, critically you have examined the facts then develop from the examination of the facts, what? The best possible answer under the circumstances and that best possible answer will be the best method of doing the work or the job or the task. So three or four important words are there reveal and analyze, examine and finally develop.

This is just one example to highlight where method study can help us and this is an investment casting or loss to wax method.

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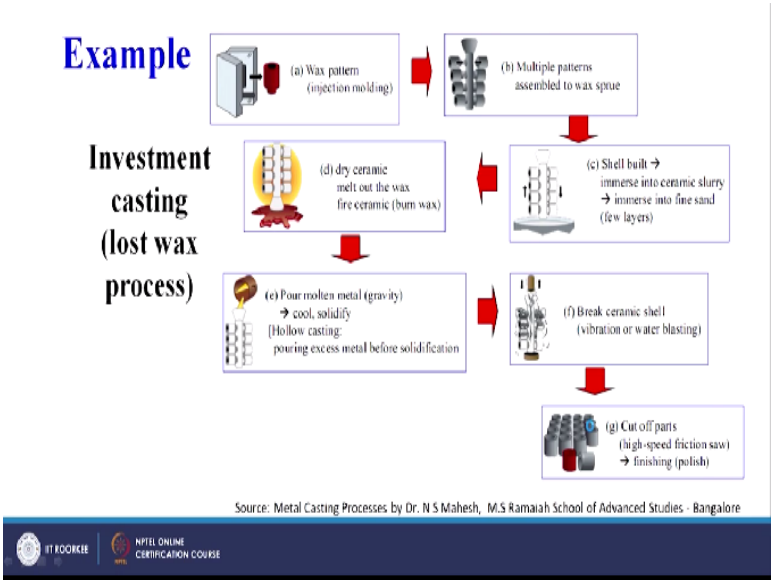

So the various steps are listed here. May be this may be more relevant to mechanical engineering students or learners from mechanical engineering or production engineering background. But very quickly we can see that for making investment casing product there are number of steps, sequence of steps has to be followed. So there first a wax pattern is made then multiple patterns are put. Then a shell is deposited on to the wax pattern.

So shell is built immersed into the ceramic slurry, immersed into fine sand so we make our sand mould air. After the shell is built we dry the ceramic shell and melt the wax out of the shell and then we melt the metal and pour this metal into the ceramic shell, pour the molten metal by

gravity. Then we break the shell and take out the metal parts. Now this is just one example of the investment casting process. So, you can see how many steps are there.

First a wax pattern is made. The second is multiple patterns are stagged together then may be this third step we make a slurry coating on top of the shells, on top of the patterns. Then the fourth one is we dry it and squeeze out after melting the wax. Then the fifth one is we pore the metal. Sixth one is we break the ceramic shell and the seventh one is we cut out the metallic parts which have now solidified. Seven steps are there.

There is specific sequence that is followed to make the product. Now from method study point of view what is our target? Our target will be to see that if we can club two or three processes we can eliminate any process. We can change the design of the product in such a way that some of the processes here or the sequence can be eliminated. We can try to see, can be use some newer technology? A new method which can squeeze these 7 steps into 5 steps?

Can there be a new machine which can help us to significantly reduce the time required for making the casting using the investment casting procedure. So, we are not trying to understand the concept of investment casting here. We are trying to understand that there is process which has 7 steps. How we can work using the method study in order to improve the current method of doing the job. Now coming on to work measurement.

Just I have taken one example that what will be our focus in method study? In work measurement (()) (26:41) it is the application of techniques again there will be number of techniques that we will learn designed to establish the time. So the main focus is to establish the time for a qualified worker. So important word is qualified for a qualified worker to carry out a specified job which is also important not any job or may be not a job as per his way of doing.

The work has to be done as per the standard way of performing the task at a defined level of performance. So level of performance also we will try to see today in the last slide to basically each and every word here has a very, very important meaning. So what is work measurement? It is an application of techniques which has been designed to establish the time required for a

qualified worker to carry out the specified task at a defined level of performance.

So very, very important definition so I have already explained the concept of work measurement along with the importance of work measurement or the standard time in various decision making processes of the management. Now work measurement refers to the estimations of (()) (28:02) standard time that is I have already highlighted standard time, estimation of standard time. That is the time allowed for completing the job using the given method.

So whatever method, standard method is already identified, already developed for that method how much time will be required or for doing the job using that method how much time will be required that is called as the standard time. This is the time taken by an average experienced worker for job with provisions for delays beyond the workers control. So, we take into account the various allowances because there are definitely going to be certain delays.

Which are beyond the workers control so for that we account for that delay in terms of certain allowances that we give to the normal time of working and then we calculate the standard time. The business environment has become fiercely competitive and companies has been pushed to limits for achieving the all times high standard of efficiency and effectiveness. So, the companies are now focusing for achieving the all times high standards of efficiency and effectiveness.

So, they do not even want to waste a single productive minute of any worker in the organization. So they want to make use of each and every minute, each and every hour that the worker spends on the shop floor. So, the importance of work measurement cannot be neglected in today's scenario especially the business environment being so fiercely competitive. So, the time while the activities are being done can be determined by using different types of equipment.

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Work Measurement

- The time while the activity is being done can be determined by using different types of equipment.
- A brief knowledge about these equipment is necessary to further proceed to the calculation of job time.

So we can use different types of equipment one of them can be stop watch. A brief knowledge about these equipment is necessary to proceed further for the calculation of the job time. So, there are various types of equipment that are used for conducting a scientific work management study now what are these we can see such time study equipment. Quickly we will see stop watch.

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Work Measurement

Time Study Equipment:

- Stop watch
- A study board
- Time study forms
- The motion picture camera
- Electrical and mechanical time recorders
- Electronic data collector and computer



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Already I have highlighted, a study board, time study forms are there. Motion picture camera, electrical and mechanical time recorders, electronic data collector and computer which is very, very relevant in today's scenario.

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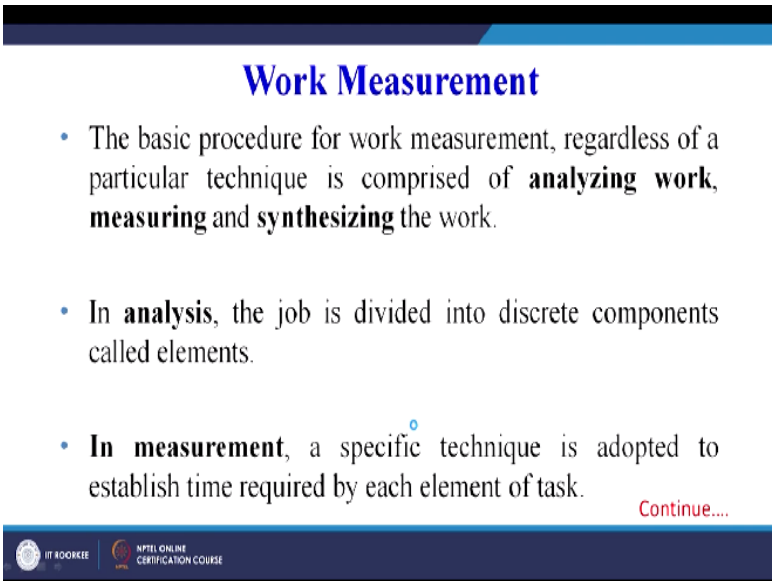

Now what is the basic procedure? Just quickly we will have 2, 3 slides on work measurement. The basic procedure for work measurement regardless of a particular technique is comprised of analyzing work, measuring and synthesizing the work. The important point is that any technique we may use because three of them I can name just now. One of them can be a stop watch time study then there can be approach of work sampling.

Then we can predetermine motion time systems like MTM system. So we have different techniques for conducting a work measurement analysis or work measurement study in any organization. But that standard approach or stand process will remain same in that first what we have to do? We have to analyze the work which has to be timed for which the standard time has to be set then we have to measure.

We have to record the data sometime using data we can take the data required for doing the job from standard books. Many times we may use a stop watch time study tool to record the data. So the second point is any approach we are using for calculating the standard time first one is analyzing the work. Second one is finding out the time for each individual element and then synthesizing then combining the various work elements.

Adding the allowances and finding out the standard time. In analysis the job is divided in discreet components called elements. For example, suppose we want to make a hole in a steel

plate. We can easily divide this total hole making operation into 5 to 6 element. What can these elements fix the job on the work bench or the work table then switching on the machine, bringing the head down so these are the elements.

And for each element, we can do the calculation using the stop watch we can find out the time. We can measure the time for each and every work element. So, in measurement a specific technique is adopted to establish to establish the time required by each element of task. So, I have taken an example of a stop watch. So first we select the operation which we need to time so may be it is a whole making operation.

We divided the complete job into various work elements that is at the analyzing the work stage. Secondly for each element we need to find out time in our example we have used stop watch in some other example we may use the standard data which is already available we take the data from the book make a table for each element get the date. For each element we know the time required and then we can add up the time for each element.

That is coming under the synthesis stage. Finally, elemental time are synthesized and added together with appropriate allowances to construct the standard time to complete the task.

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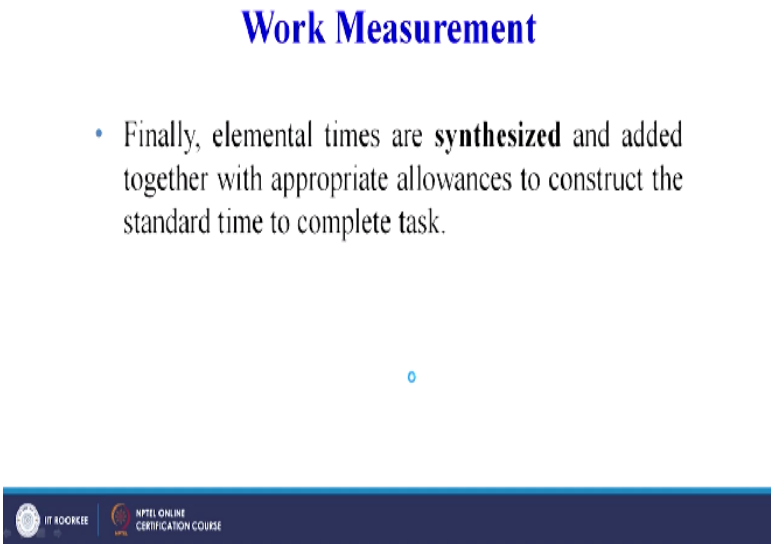

So this is a standard approach analyzing the work, measuring and finally synthesizing, adding

with allowances and specifying or standardizing the time required for completing a particular task. Now, this is the last part that one word has come in today's definition of work measurement that at a defined level of performance. So that is very, very important and we can see that what are the various common performance measure.

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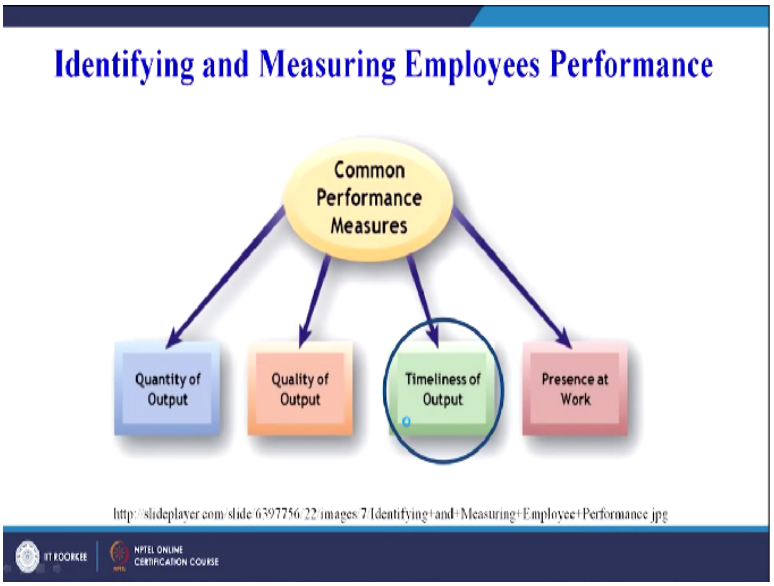

Quantity of output maybe as I have already told when we specify the work to the worker or when we allocate the work to the worker we have to do it in line with the standard time required for producing a unit out then we can multiply the number of parts that we expect from the worker. So that is first thing is the quantity of output expected from the worker can be one performance measure.

May be if we are expecting 200 parts from a worker in an 8 hours shift if he is producing more than 200 we will say his quantity is better then what is expected. But the quality also is very, very important if he is producing more but poor quality we can say that his performance measure cannot be taken as excellent. Although he has produced the quantity more then what was expected but many of the parts produced by him are defective.

So all these has to be taken together so quantity of output can be one performance measure, quality of output can be other performance measure, timeliness of output can be other performance measure. Timeliness of output that is more importantly related to the work

measurement because now we have set the standard time for a worker to perform the task. So timeliness of output is very, very important.

And then may be from the human resource point of view the presence work can be the other common performance measure. So we will see that when the worker is doing the task he is producing the right quantity, in right quality at right time. So these we can say can be the performance measures for any worker. Then there is an important concept of rating which we will try to understand when we will discuss the topic of work measurement in detail.

In our subsequent lectures may be our module on work measurement will be discussed may be in a week or 2-week time. During that discussion we will definitely understand the concept of performance rating. Today, I have just tried to, may be highlight the importance of performance measurement of the employes. Why? Because the worker has --we have seen some of you may be having a doubt that what we are doing?

We are specifying the time required for the worker to complete the task. What if he is not producing the right quality? So common performance measure is that he must produce the right quantity, right quality at right time then only we can say that he has accomplished the task for the organization. So, today I will conclude now we have already discussed two important techniques of work study.

The method study and the work measurement and these two techniques we are going to discuss in much more detail in our subsequent weeks. Thank you.