Work System Design
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Lecture – 44
Computation of Standard Time - II

Namaskar friends, welcome to the session 44 of our course on work system design and we are currently in the 9th week of our discussion and the topic that we are discussing is work measurement and we are trying to calculate the standard time for doing a task or for performing a work using different situations or using different types of data. Now, different industries may have different types of data available with them.

But each and every industry would definitely love will definitely like to have some standards of time with which they can allocate the work to their workers, they can plan their production, they can plan their materials procurement, they can plan their finances, so this time standards usually can be used for a large number of applications and we have already covered all these application areas in which we have seen that why, what is the importance of setting a time standard for performing a particular task.

And in the previous sessions if you remember, in the last session we have seen few simple problems of calculating the standard time, so basically if you revise you can have an idea that what is required. Now, what is required primarily is that some time data or the observed time data has to be available for the various elements involved in performing the work, so some time data has to be there.

Then we need to rate the worker and there is the standard pace or standard rate at which a worker must perform the task and if you remember, I have already explained the example that each one of us can do this simple exercise of rating or understanding the concept of rating that 4 of us or 4 of the friends can get together and ask each one of us to walk a defined distance of maybe say 15 metres or 20 metres.

And we can use our watch only to see how many seconds are taken, so we will easily see that there is a difference, some of us may be walking at a faster pace, the others may be walking at a slower pace, so we will tell that without any motivation that you have to come first, it is a competition, it is not a competition, it is just a lesser walk for 15 metres, so we will see that there is a time distance or time difference which will help us to understand the importance of performance rating.

Same concept is there in industry also, where there are different types of worker, each one of them may be assigned the same task but they will be performing the task in different time domains or in different time durations why because each one of us have a different set of may be methodology that we use for performing the same task and in method study, we have already standardised, we have found out one best way in which the workers have to perform the task.

So, we have standardised the methodology in the method study, now for that methodology we want the workers to perform the task, now suppose, all 10 workers or all 15 workers are given a standard operating procedure that you have to work using this standard procedure only, they will perform the task as per the standard procedure but still there will be a difference in the time that each worker is taking to perform that task using the standard procedure.

Therefore, the job of a time study analyst becomes very, very important, he has to first train himself that what is the standard rate of working, what is a standard pace of working and based on that he has to put the standard rating, which is usually taken as 100 in most of the cases and then rate the worker accordingly. The worker may be working at a faster pace; the worker may be working at a slower pace than the standard pace.

And accordingly he has to adjust the rating, so when he will give the rating that rating will be multiplied now with the time which has directly been observed using a stopwatch. So, when you multiply we observed time and the concept of rating, which I have already tried to summarise today, we have already discussed this think I am just revising, so once we know the rating, suppose the rating is given as 120, the standard rating is 100.

So, what we will do; we will multiply the observed time suppose, it is 1 minute, so we will multiply the observed time for a particular element and the observed time is also many a times taken as an average of the 10 readings or 20 readings or 50 reading, so the average observed time we will multiply with the performance rating and we will get a normal or a basic time, at this time, then we will add certain allowances.

Now, what are the allowances; allowances also are very, very clear to all of you, we have different types of allowances, which are given to the workers, so there can be relaxation allowance, delay allowance, fatigue allowance, policy allowance, so we have different types of allowances which we have already covered and in different books, you will find tables given that what is the generic value for a delay allowance.

What is the general value which must be given for the policy allowance? so, policy allowance, special allowance, the rework is a special type of allowance, so within special allowances, we have further policy allowance and a rework allowance, so in personal allowance, we have different types of allowance given for washing of hands or for we can say going to the lavatory, so different types of allowances are given.

So, basically if we see that there are 3 important things that have to be taken into account, when we are calculating or computing the standard 10. First one is the observed time, second one is the performance rating and third thing is the allowances, so if we know about these 3 things, we can easily compute the standard time required for performing the tasks. Now, some of you may be wondering that why this thing has been revised again.

Because as I am made to understand that these lectures will also be available as standalone lectures on YouTube, so a learner or a person who is listening to this lecture only may also get an idea that how the standard time is calculated and what are the important constituents which are; they are which will add up or will be multiplied to calculate the standard time because all of a sudden if somebody listens to this lecture.

And see the word allowances, he must know that what is the importance of allowances in calculation of the standard time, so the first few minutes I have spent on the overall summary of how to calculate the standard time, so to summarise in single sentence, we require the direct observation to get the average observed time, we need to multiply it with the performance rating to get the basic or the normal time.

We need to account for the allowances and we need to add these allowances to the normal time in order to calculate the standard time, so now we will try to see some of the examples may be 3 examples and 4th example I will leave for you to do the calculations. So, let us see our example number 1, as you know our target is we; sorry, as you know our target is to calculate the standard time.

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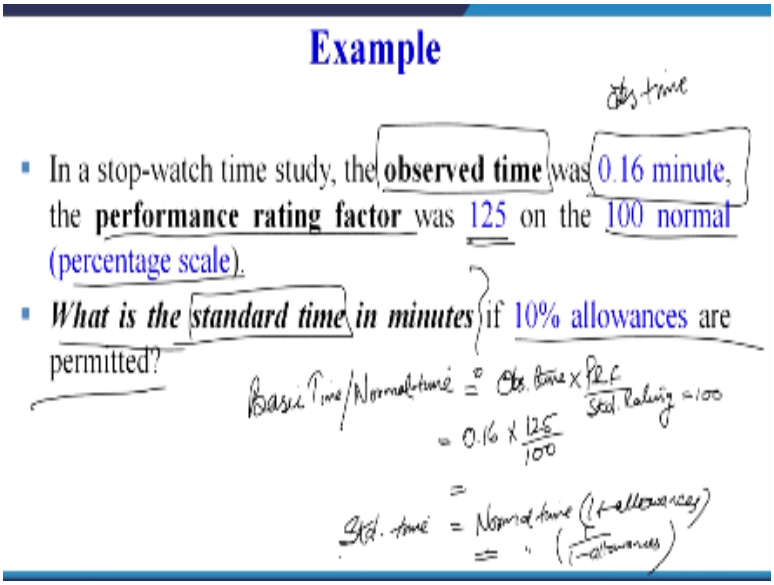

For today, we have taken 3 examples, so let us see the example number 1; in example number 1, our target is to calculate the standard time because we are asking what is the standard time in minutes, this is our question, 10% allowances are permitted, so this is one information, so in a stopwatch time study, what is the stopwatch, what are the different types of stopwatches, what is the different types of time study equipment already, we have covered in our previous sessions.

So, in a stopwatch time study, the observed time directly it is given was 0.16 minute, so already we have the information about the observed time is already known, the performance rating factor

is also given, 125 on the 100 normal percentage scale, so 100 is the standard performance rating, so how they can very easily calculate let us try to calculate the things here, what we need to do; we need to 1st find out the basic time or we also call it as the normal time.

How we will calculate it; we will calculate it by multiplying the observed time with the whatever is the performance rating factor given divided by the standard rating, which is already specified as standard rating is = 100, so what is our observed time? It is 0.16 minutes * the performance rating is given as 125; standard rating is 100, so very easily we can calculate this, so this is our basic time.

And in order to calculate the standard time, we can calculate the standard time using the formula; normal time * 1 + allowances, okay or we can also have calculated another formula that is normal time * 1 divided by 1 – allowances, so we can have different types of formula for calculating the standard time. Now, let us see, what is the solution given?

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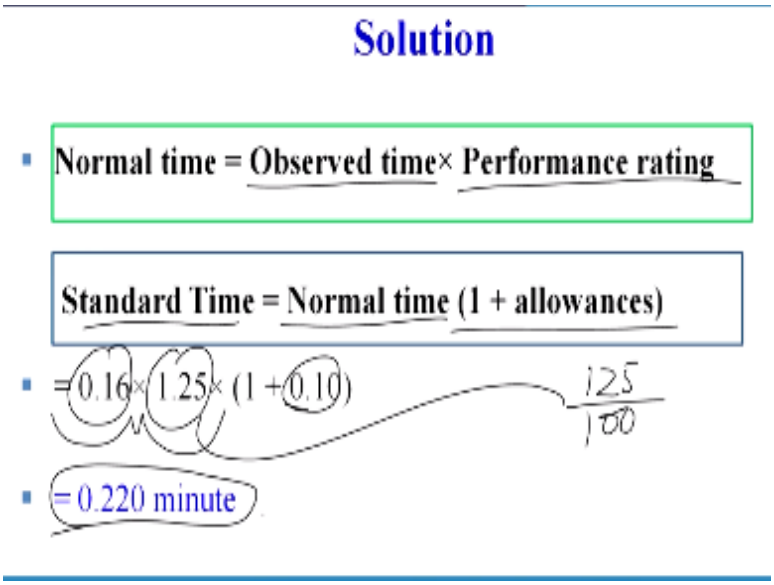

So, the normal time as I have already explained is observed time multiplied by the performance rating, which is the standard time is given by normal time * 1 + allowances which the formula I have already given in the previous slide, now our observed time is 0.16, rating is 1.25, how we are getting 1.25 because this is the rating given to the worker divided by the standard rating 100,

which is given, so this is this we will sum up as the normal time * 1 + allowances. What are the allowances?

Allowances are 10%, if you can go back and see the allowances are 10% allowances, so we can see the 10% allowances are given, so 1 +10 / 100, so we get this value, so this is our standard time, 0.220 minute, so this is the simplest formulation or simplest formulae for calculating the standard time.

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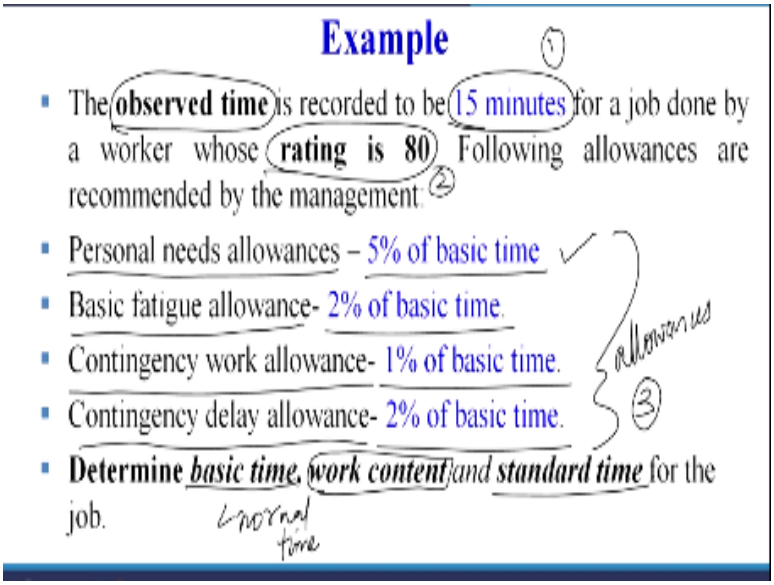

Now, let us take another example; example number 2, so here the slide is very, very busy but the data is very, very simple, so we can see the observed time already is recorded as 15 minutes, so our first information is already known for a job done by a worker, whose rating is 80, second information is available. Following allowances are recommended by the management, so personal needs allowance, 5% of the basic time, this information is given.

Basic fatigue allowance, 2% of the basic time, contingency work allowance 1% of the basic time, contingency delay allowance 2% of the basic time, so all the allowances; these are given, now you can see this is the third information available with us. As I have told in the very beginning of today's session that there are 3 important things that we must know when we want to calculate the standard time.

The first thing is the observed time, the second thing is the performance rating and the third thing are the allowances, so if we know the 3 things, we can easily compute our standard time, now we need to 1st find the basic time, which is maybe always sometimes called as the normal time, work content; although, we have not seen that basic definition of work content but today we will see that how we can calculate the work content, we have taken it from a standard book.

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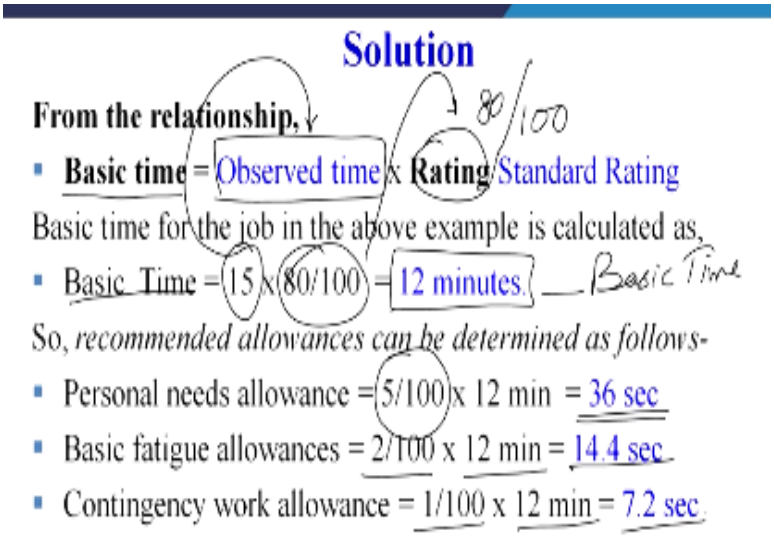

And then the standard time; standard time all of you know that how to calculate the standard time, now let us see the solution. So, basic time all of you know is the observed time multiplied by the rating, which in our case, I think given as 80 divided by the standard rating which is 100, so now let us see the basic time for the job in the above example is calculated as basic time is = 15, which is the observed time already given in the problem.

And 80/100 is the performance rating, which is already known here, so we get 12 minutes as our basic time; first solution. Now, recommended allowances are given, so the recommended allowances if you see in the problem are given as a percentage of the basic time, so basic time already we have calculated as 12 minutes, so 5% of 12 minutes will be the personal needs allowance, so let us see that.

The personal need allowance is 5% that is 5/100 * 12, so it comes out to be 36 seconds, so similarly we can calculate the basic fatigue allowance which is 2% of the basic time 14.4 seconds, contingency work allowance 1% of the basic time, 1/100 * 12, 7.2 seconds.

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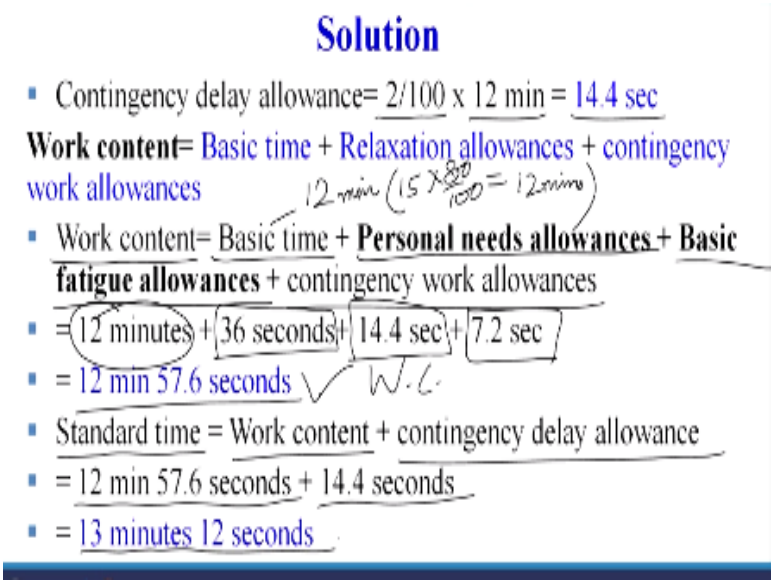

Contingency delay allowance 2% of the basic time; that is 14.4 seconds, so we have now calculated all the allowances, we have calculated the basic time, we now know that the standard formulation for calculating the standard time, we know the basic time, we know the allowances; different types of allowances, now we can very easily calculate the standard time but before the standard time in the problem, if you see we have also been asked to calculate the work content.

So, we will try to see what is the standard formula for work content, so the work content is usually given by the basic time, which in our case we have found out as 12 minutes, how; by multiplying the observed time with the performance rating, so this is giving us 12 minutes which we have already seen, so basic time is known to us, personal needs allowance already we know in the previous slide, we have calculated.

It is given as some percentage of the basic time, basic fatigue allowance is also calculated, contingency work allowance has also been calculated, so the personal needs allowance was calculated as 36 seconds, basic fatigue allowance was calculated a 14.4 seconds and that

contingency work allowance was calculated as 7.2 seconds, so we add all these 3 to our basic time of 12 minutes, we get 12 minutes and 57.6 seconds as our work content.

Now, we have also been asked to calculate the standard time, so the standard time in terms of work content is given as work content + the contingency delay allowance. Now, work content is 12 minutes 57.6 seconds and the contingency delay allowance is calculated as 14.4 seconds, which is 2% of the basic time, so basic time is 12 minutes, 2% of the basic time is giving us a contingency delay allowance of 14.4 seconds.

So, we add these, so we calculate the standard time for this job as 30 minutes and 12 seconds, so this is another way of calculating the standard time based on the work content and the contingency delay allowance.

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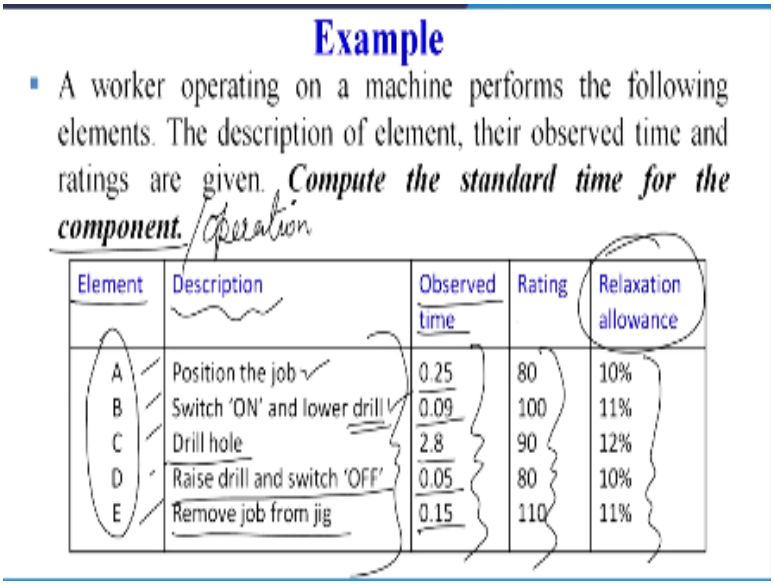

Now, let us come to example number 3; in example number 3, we can see a different type of data is given. In previous cases, the directly the observed time was given for an operation or a task, here the work has been divided into various elements, you can see that 5 work elements are there, these are the work elements which is A, B, C, D and E, so the 5 work elements, their description is also given.

The description is; positioning the job, switch on and lower the drill, so when we look at the drill we can very easily understand that it is the drilling operation, then drill the hole, raise the drill and switch off and remove the job from the jig, which is used for holding the job, so 5 work elements are there which add up to the drilling of whole operation. Now, for each work element, the average observed time is also given.

Now, what is the average observed time for positioning of job, 0.25, switch on 0.09, drill the hole, 2.8, raise the drill, 0.05 and remove job from the jig, 0.15, so we have the observed time for each and every element of the task or operation. So, there are 5 elements, the description is given, the observed time is also given, then for each and every element, the rating is also given. So, 80, 100 maybe for removing the job, it is 110.

And the relaxation allowance is given for each of the work elements, now this is the data that is available, now what is the problem statement; the problem statement says a worker operating on a machine performs the following elements, the description of the element, their observed time and the ratings are given, now compute the standard time for the component or for the; we can say, for this drilling operation, okay.

So, for this operation now, which is comprising of 5 elements for which observed time for each and every element + the rating for each and every element + the relaxation allowance for each and every element is given. Now, how we can go about it; just you can think it over for a minute that how to go about it, how we can solve this problem. In the previous problems, what was their; what was the input data available with us.

In this problem, what is the additional information available with us, so what is the difference if you can figure out, you can see that in the previous 2 problems that we have seen the observed time was directly given for the whole operation or the task or the activity or the job, here the total work of drilling has been divided into 5 different elements. So, what we can do; either we can add all the observed time and then add; takes average rating.

And then add up all the allowances and do the averaging and then do the standard calculation multiplying by the observed time, which is average of this with the rating; average rating and then adding the average allowances, we can calculate that can be one strategy, the other one can be for individual elements, we can do the individual multiplication and get the results, so you can try both the result; or both the theories or both the approaches to compute the standard time and see the order of difference.

But we have tried to do it theoretically by doing it for; for doing it on individual element to element bases why, because many a times there will be some elements which may take a considerable amount of time, so we need to focus more on those elements and tried to see that how we can change or which the area where we must focus in order to improve our method of doing the work or can some improvements be done in that particular element, which is the most time consuming element in the whole operation.

So that the overall standard time can be manipulated for better productivity and better efficiency, so therefore element by element computation sometimes give you the micro details which are very, very useful. So, let us see now the calculations, now this is a solution, so we can see computation of standard time is shown in the table, so the standard time is the normal time + 1 * 1 + allowances.

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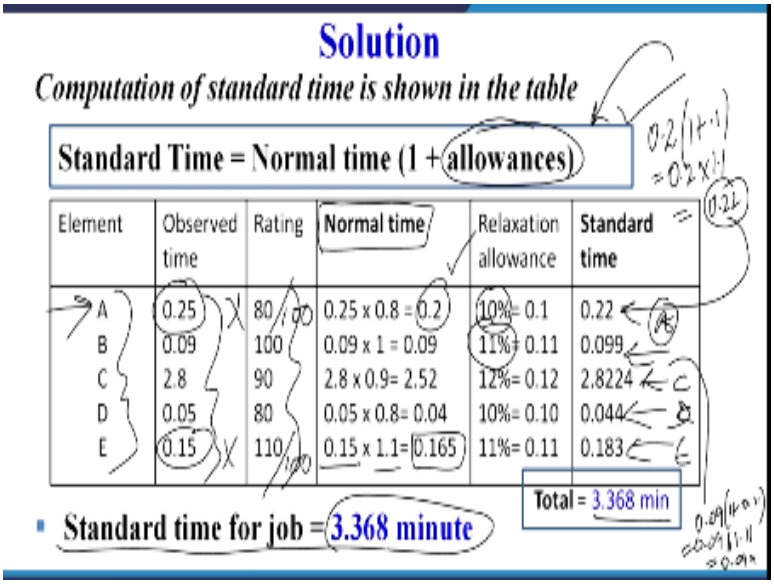

So, this data is already available I think, I have already spoken on this, observed time is also available rating is also available, so our calculation starts from here that is a normal time, so normal time is calculated by multiplying the observed time with the rating divided by the standard rating, so it is 0.25 * 0.8 that is nothing but 80 divided by the standard rating that is 100, so we get this normal time for the first element as 0.5.

Similarly, 0.5 multiplied by 110 divided by standard rating, so 0.15 multiplied by 1.1, 0.165 that the normal time, so to this normal time, we will have to add the allowances, how we will add the allowances for calculation of standard time, this is given here. So, the standard time is = the normal time * 1 + allowances, so allowances already are given in the problem statement, you can refer back.

So, the allowances are already given, relaxation allowance is given, a special type of allowance, this is not a special but this is an allowance, which is usually given to overcome the fatigue. Special allowance is already I have told are; what are the special allowances, you can also now maybe remember those allowances, one is the policy allowance, another one is the rework allowance.

So, relaxation allowances are standard allowance, which is given to overcome the fatigue, so now let us see the allowance is already given, so standard time is for each and every element the standard time is = the normal time, the normal time has already been calculated * 1 + allowance, so relaxation allowance is 10% which means 0.1, it is 11%, which means 0.11, so this is in percentage.

So, then the standard time we can calculate using this 0.; let us see for element A; how we can calculate? So, for element A, we can calculate it as 0.2 is the normal time * 1 + the allowance that is 10% which means 0.1, so it is 0.2 * 1.1, which comes out to be 0.22, so this is the standard time for element A. Similarly, we can calculate the standard time for element B, which will nothing be; it can be calculated as 0. ; Normal time is 0.09 * 1 + the allowance given as 0.11.

So, we can very easily see, this will be 0.09 * 1.11, which will come out to be 0.099, so that way we can do the calculation for B and similarly, for element C, we will calculate the standard time D and then for E; D and then for E, so for each element we will do the same calculation using the standard formula and then the total time will be the summation of all this, so we will add up all these elements; elemental standard times to calculate the standard time for performing the job.

And this will help us; this will help us in identifying that which is the element, which is taking the maximum time and here you can see the maximum time is for element C and what is the description for element C, let us go back and see element C is drilling of hole, so we can try to now understand that this particular element of the total work cycle is taking the maximum time, what can be done in order to improve this element.

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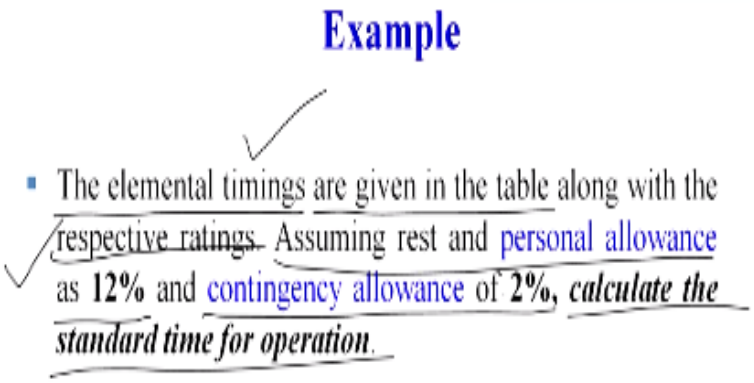

So, this is a standard calculation, now this is example 4, which I will leave for all of you as an problem statement, you can try to calculate the standard time using this data, the elemental timings again the elemental timings are there, which means the total work is divided into the individual elements, they are given in the table, which I will show you in the next slide along with the respective ratings.

So, first thing is we need to calculate the basic or the normal time, so we elemental timings are given to us, ratings are given to us, so 2 important information is given in the table. What is the

third information required to calculate the standard time, I think all of you must be able to answer, what is required? So, allowances is another thing, so let us see, assuming the rest and personal allowance as 12% and contingency allowance as 2%.

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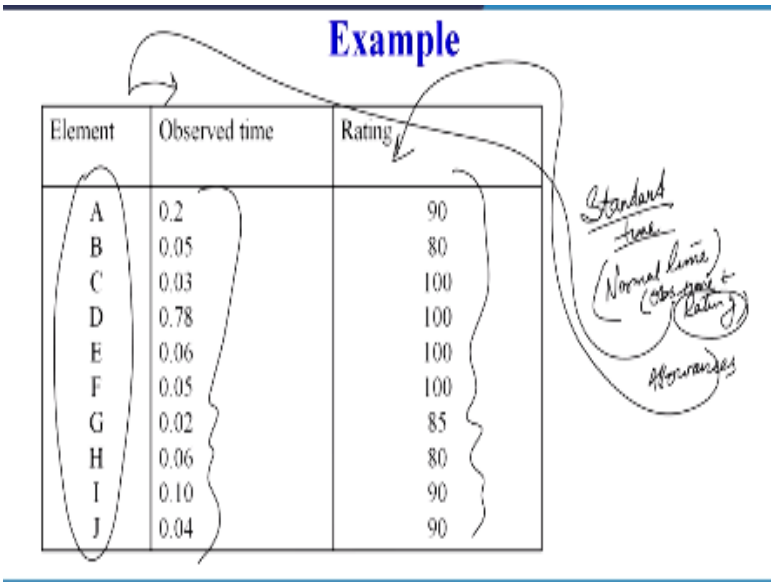

Calculate the standard time for operation, so the allowances are given, the contingency allowance is 2% interest and personal allowance is 12%, so we can do the calculation, so this is the problem statement, the data is given to you in the next slide, this is the data, these are the number of elements; A to J, observed time is given, rating for each and every element is given and allowances are also given.

If we can refer back to the previous slide, allowances are rest and personal allowance as 12% and contingency allowance of 2%, so then based on this information, we need to calculate the; what we need to calculate? We need to calculate the standard time, so for this for standard time, what all we require? We require normal time and for normal time what do we require; we require the observed time and + we require the rating.

So, observed time is also given. if you can go and see observed time is given, rating also is required, rating is also given, allowance for standard time, allowances are required which is also given in the previous slide, so all the information that is required to calculate the standard time is

given in the problem statement, now the calculations have to be done and the standard time needs to be established.

So, with this we come to the end of today's session that is session number 24th; session number 25th; sorry, session number 44th not the 24 session number 44th and in session number 45, our target will be to take real case scenario and try to see that how the standard time can be calculated may be a particular case study we will take and then we will start our discussion regarding the other techniques of setting up the standard time.

Right now, we have only taken the time study technique in which we know the observed time maybe that observed time is recorded using a stopwatch, so we know the observed time, we know the rating, we know the how much allowances have to be given based on that we calculate or compute the standard time, so we will now try to see that how the standard time can be calculated or can be established using the approach of work sampling or using the approach of predetermined motion time systems.

So, we will try to understand the other techniques which can be useful because this technique requires the direct observation of the worker, so one-time study analyst is fixed for one worker, so it is a time consuming process, so we will see that what can be the other techniques, where using statistics we can calculate the standard time. So, with this I conclude the today’s session, I will try to address the other issues regarding the work sampling and PMTS in the subsequent sessions. Thank you.