Work System Design
Dr. Inderdeep Singh
Department of Mechanical and Industrial Engineering
Indian Institute of Technology, Roorkee

Lecture – 42
Allowances in Time Study

Namaskar friends, welcome to session 42 of our course on work system design and currently, we are in the 9th week of discussion and if you remember in 8th week, we started our discussion on work measurement or time study and in work measurement, if you remember we already have discussed that what is the importance of work measurement, what are the objectives of work measurement, what are the various techniques that are used for work measurement.

What is the equipment that is used for doing time study? Then, we have understood the concept of performance rating, how we can find the value of the performance rating, in the last example if you remember or in the last session, if you remember we have taken different examples at least 3 examples in which we have calculated the normal time from the observed time using the performance rating factor.

And how the rating factor was calculated that also you have understood by now, we have use the Westinghouse method also we have used the PMTS time data also and then with the observed time, we have taken a ratio of the available data in the form of PMTS for the various work elements and then we have calculated a rating factor, we have taken the average value of the rating factor for the 7 manually operated elements.

And we have taken the different that is element number 3 in the previous session, if you remember the element number 3 we have taken as the machine operated elements, so basically whatever I have said today, we have tried to calculate the standard time and what are the various elements of the standard time that we are trying to understand, so our overall objective is to find out the standard time for performing the tasks.

And I have been highlighting it again and again that we have to first find out the best method of doing the job, then for that method, we need to find out what is the standard time required also

sometimes, we find out the time for the current way of doing the job, then we compare it with the best way of doing the job and we try to see that how much time saving is happening by changing the method.

So, time study is useful in comparison purposes also, it is not only for establishing the time standards and calculation of wages and bonus and other benefits for the employees but it also helps us to compare the 2 different methods of doing the task, which we have already covered this is what I am saying as already we cover during our discussion, I am just trying to revise the things.

So, in the previous session we have seen examples; 3 different examples of calculating the rating factor and then or finding out the rating factor and then multiplying it with the observed time to calculate the normal time. So, today we will see that once we have arrived at the normal time, how do we arrive at the normal time? Once again, we can refer back that we do a time study, we try to do the direct observation of the worker who is performing the task.

And we divide the whole tasks into individual elements and for each element, we try to find out the average time, so we may do 10 readings, 15 readings, 20 readings or 20 recordings of the time for one element and then we take the average value of that time and therefore, each and every element we can calculate the rating factor, if possible. If not possible we may calculate the rating factor for the complete work cycle.

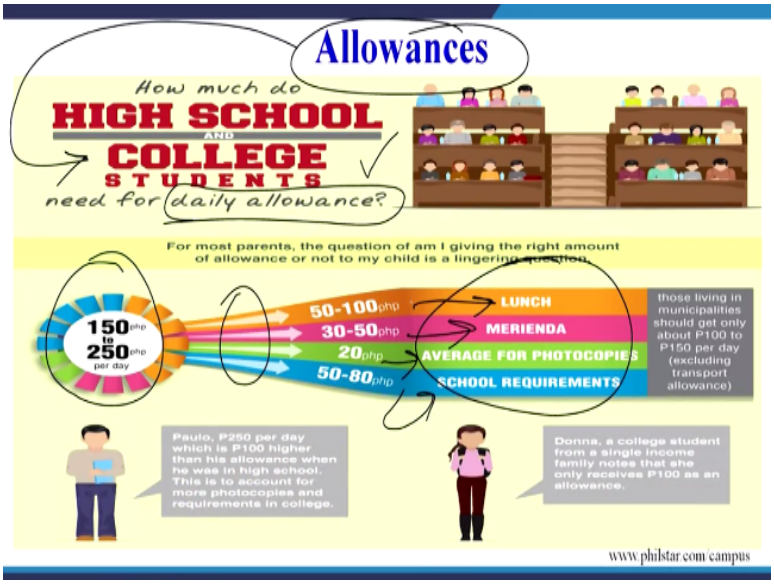
Now, depending upon the type of data, the type of work being done, we can calculate the rating factor and there are number of methods, a number of examples that we have already taken that help us or that teach us to calculate the rating factor. So, we can get the rating factor, we have got the observed time, we multiply the observed time and the rating factor and we are able to get the normal time.

So, by today we know that we have the normal time available with us, how to calculate the standard time, so the standard time will be calculated by adding certain allowances to the normal time, normal time is calculated by the multiplication of the observed time with the rating factor,

all of you know how to calculate the rating factor, we have seen number of examples of rating factor.

Now, from normal time, we move forward, we are now moving forward, we already know how to calculate the normal time and to normal time, we are going to add certain allowances and what are these allowances which are given in the today's presentation. This is the topic of our discussion that what is the various types of allowances that are added to the normal time for calculation of the standard time.

(Refer Slide Time: 05:30)



Now, these allowances we can see with the help of an example, on your screen you can see, so these are the various types of allowances with the help of an example, these are not the actual allowances, if you see this is the question, this is just an example how much do high school and college students need for daily allowance, high school and college students, the word is allowance.

Now, this allowance is in terms of money, some currency, so how much do they need? So, maybe some range is given here, 150 to 250 and then the further division is given, some amount is for lunch and other is for mereinda, another one is an average for photocopies, then another one is school requirements, so this total allowance is further divided into 4 broad categories, so this is

basically some parents usually as parents we feel that how much allowance we must give to our child apart from paying the fee and other charges to the school.

What is the additional allowance we must give, similarly in case of time study also, we need to give some allowance to the worker, for example if a worker is able to perform a particular task suppose, in one hour, another way of putting the example is suppose, the worker makes a job in one hour, he is in the company for 8 hours in a shift, how many jobs do we expect? Very simple question, he takes 1 hour to complete one job.

And he spends 8 hours in the company or on the shop floor, so it is but natural we will expect that 1 hour per job, 8 hours means 1 job multiplied by 8, so he must be able to complete 8 jobs but this will seldom happen, he will definitely be able to maybe make more than 5 or 6 jobs but not certainly 8, why because we need to give certain allowances to the worker, he may get tired after making 4 jobs.

He is doing manual work, he may be working under awkward postures, he may be working under very, very difficult environmental conditions under hot and humid conditions, so all the conditions, the type of work being done definitely will ask for certain allowances to be given to the worker. He cannot make 8 jobs in 8 hours shift, if he takes 1 hour per job, so we need to understand, we need to give certain allowance to the worker.

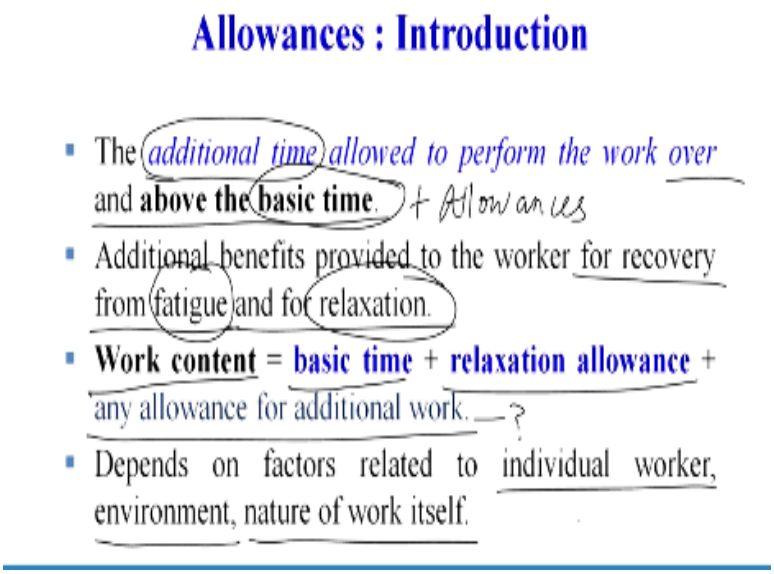
So, there are different types of allowances that we give to the workers and accordingly, we allocate the work to the worker, so the standard time definitely includes some allowances which are added to the normal time and then the standard time is calculated. Similarly, in the example on your screen always the parents are bit confused that how much additional allowance must be given to the child who is studying in a school or college.

So, let us know that what is that allowance we are trying to understand today, now, what are the allowances in case of time study, why I have put the title allowances in time study because we also give certain allowances to our pattern when we do the casting process in manufacturing

technology. So, when we do casting we give some allowances to the pattern but these allowances what we are discussing here different from those allowances.

These are given on timescales or there, the allowances are given as a relaxation of time, there the allowances are given as relaxation on dimensions or length or width or diameter whatever the case may be, so let us try to understand the allowances in context of the time study.

(Refer Slide Time: 09:43)



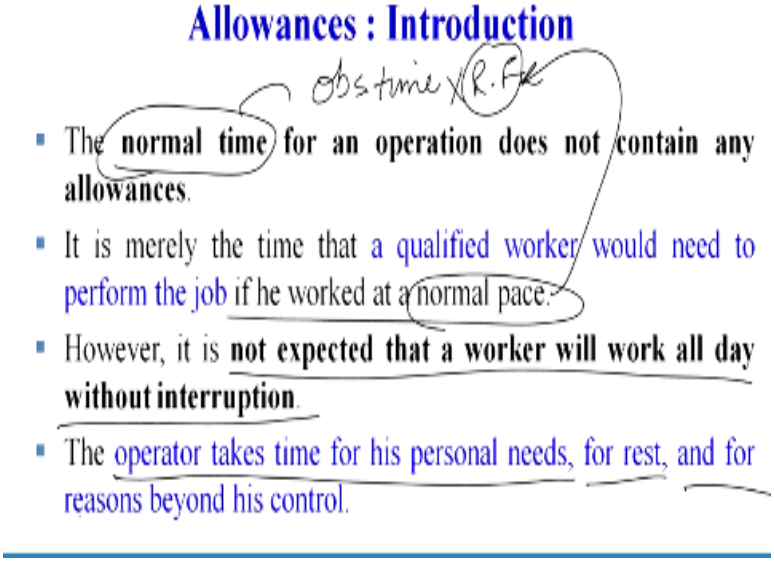
The additional time; so obviously, this is the additional time allowed to perform the work over the; over and above the basic time, so there is a basic time + we are giving some allowances, so allowances are the extra time or the additional time that are provided on top of the basic time to calculate the standard time. Additional benefits provided to the worker for recovery; recovery from fatigue and for relaxation, so 2 important words have come.

Why we need to give the allowances? Because the worker needs to overcome the fatigue also, the worker needs to relax in between the work he is performing, why he need to relax because the work may be involving, the work may require a lot of physical effort as well as mental strain, so therefore the worker needs to relax and to overcome the fatigue we gave him some allowance in terms of time.

So, the work content normally is the basic time + the relaxation allowance + any allowance for additional work, this we will try to understand what is the additional allowance for addition; or allowance for additional work, this depends on factors related to the individual worker environment in which the worker is performing the task and the nature of the work itself, the nature of the work may involve use of lot of body parts.

It may involve a lot of heavy lifting of jobs or heavy lifting of equipment or heavy lifting of tools, so that work involved may also dictate that how much allowances or what type of allowances must be given for calculation of standard time or must be considered for calculation of the standard time.

(Refer Slide Time: 11:45)



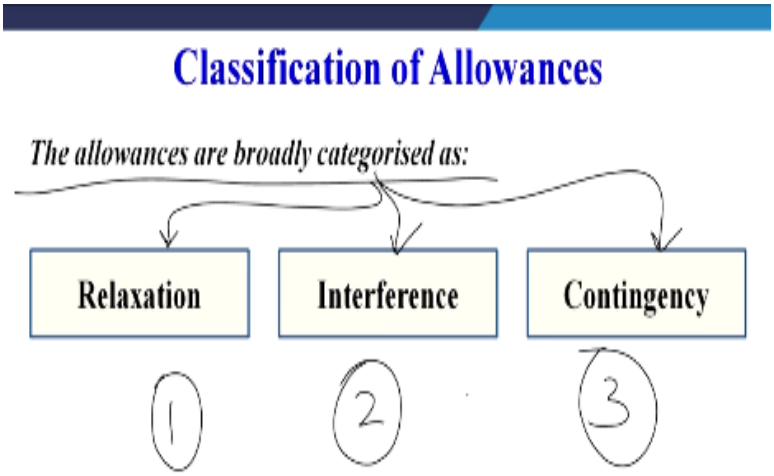
Now, the normal time for an operation does not contain any allowances, so we know that the normal time is usually calculated by multiplying the observed time with the rating factor, so it does not contain the allowances, it is merely the time that a qualified worker would need to perform the job, if he worked at the normal pace and this normally pace is is ensured with the rating factor.

So, normal time basically is a time that is; that a qualified worker would need to perform the job at a normal pace, if he works at a normal pace however, it is not expected that a worker will work all day without interruption, this example I have already explained that it is not possible

practically for a worker to work without any interruption, so some interruption, some stoppages may be unavoidable, some stoppages may be unavoidable.

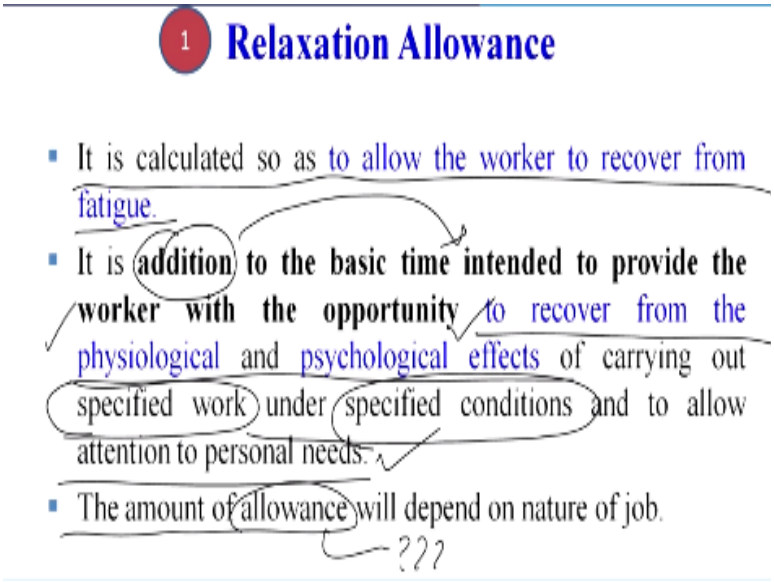
So, for both this avoidable and unavoidable stoppages we have to give some allowance to the worker in terms of additional time, so the operator takes time for his personal needs also, for rest, relaxation we have already seen and for reasons beyond his control or unavoidable circumstances. So, we need to give certain allowances.

(Refer Slide Time: 13:11)



Now, classification of allowances, we can see the allowances are broadly categorised as relaxation allowance, interference allowance and the contingency allowance, so 3 broad categories are there for the allowances and each one of this we will try to understand now.

(Refer Slide Time: 13:29)

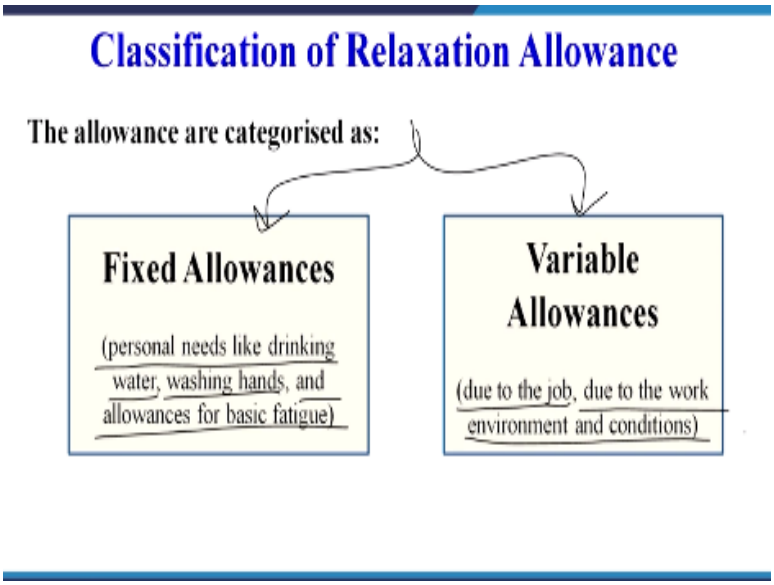


First one is the relaxation allowance, so the relaxation allowance, it is calculated so as to allow the worker to recover from fatigue, which already has been highlighted in today's discussion only, it is addition to the basic time, why this is added? This addition is done to provide the worker with the opportunity to recover from the physiological and psychological effects of carrying out the specified work, which has been assigned to him under specified conditions.

And to allow attention to the personal needs, he may like to go for drinking water, he may wish to visit the toilet or the lavatory or maybe his personal needs whatever, so this is the time that is the relaxation allowance, it is given for may be recovering from the physiological and psychological effects also. The amount of allowance how much; will depend upon the nature of the job.

So, if the job is very, very involved, too much of hard work is required, you may like to give slightly more relaxation allowance, if it is office job only maybe the operator has to work in an AC environment, sitting on a comfortable chair, so the relaxation allowance can be slightly on the lower side. So, we have seen that what are the components of the relaxation allowance to recover from the physiological, psychological personal needs.

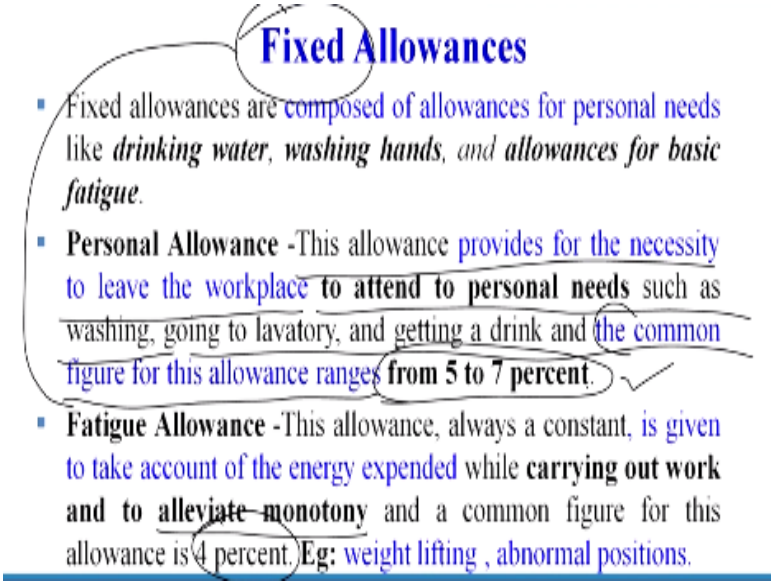
(Refer Slide Time: 15:21)



So, 3 important we can say areas that will govern that how much relaxation allowance must be given, now relaxation allowance can further be classified as fixed allowances and the variable allowances. Now, fixed allowances you can see fixed allowances are like personal needs like drinking water, washing hands and allowances for basic fatigue, variable allowances are due to the nature of the job, due to the work environment and the conditions.

So, we can have fixed allowances for all these and variable for all these, now due to the job as I have already explained, it can be office job or a shop floor hard labour job, so depending upon the job, we can give the variable allowances, so the allowances are variable depending upon the nature of the job, we can vary the degree or the amount of allowance being added to the normal time.

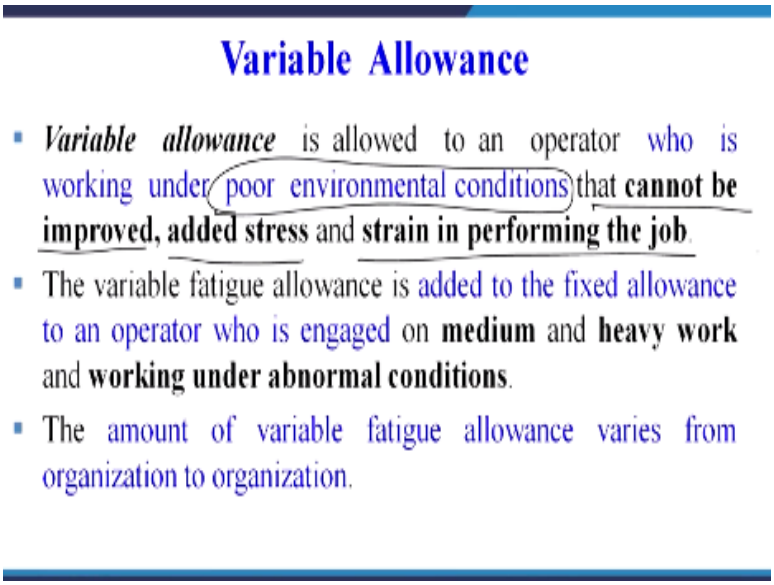
(Refer Slide Time: 16:16)



Whereas, there are few allowances which are averaged out which are fixed in nature, now the fixed allowances we can slightly deliberate in detail. The fixed allowances are composed of allowances for personal needs like drinking water, washing hands and allowances for basic fatigue, so the personal allowance; so this allowance provides for the necessity to leave the workplace to attend to the personal needs such as washing, going to lavatory and getting a drink and the common figure for this allowance, so this is important.

The common figure because this is fixed, so the common figure usually is from 5 to 7%, mostly it is fixed within the range of 5 to 7%. Fatigue allowance; this allowance always a constant is given to account of the energy expended while carrying out work and to alleviate monotony and a common figure for this allowance is 4%, so it is 5 to 7% personal allowance, around 4% is the fatigue allowance.

(Refer Slide Time: 17:31)



For example, if you are working in the abnormal positions, you may like to add 4% to the normal time for calculating the standard time for doing the work. Now, variable allowance; variable allowance is allowed to an operator who is working under poor environmental conditions, what are these poor environmental conditions? This can be maybe very hot and humid condition, it can be maybe high humid, humidity is required in the working environment because of the process requirement.

So, in that case we would like to add some variable allowance which is going to help us to calculate the standard time for that worker in performing the task, so these conditions that cannot be improved, they cannot be improved because they are process constraint, so the process has to function in those environmental conditions only. For example, you are melting a metal, so obviously the temperature has to be more in that environment, it is a process requirement.

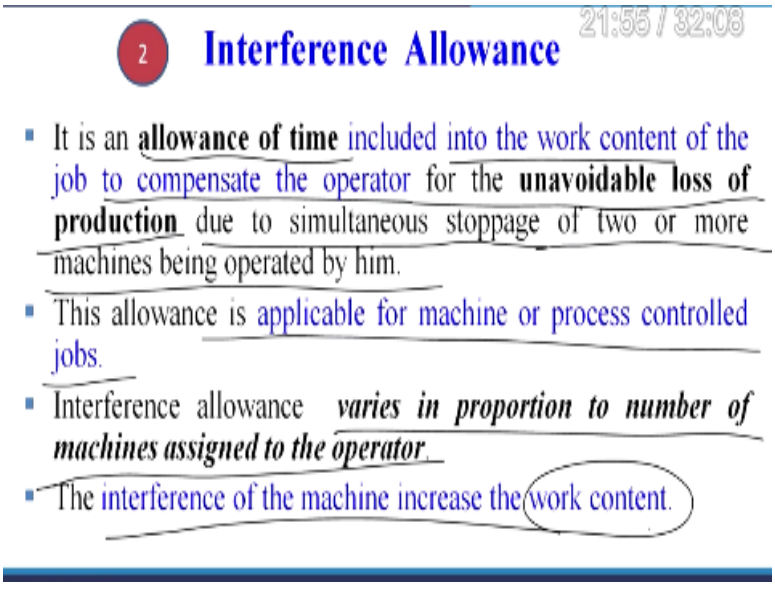
So, you cannot improve that that adds a stress and strain in performing the job, so there are 2 types, sometimes the physical conditions are detrimental, in a second case the conditions are very stressful and may cause mental strain in those conditions, we would like to provide a variable allowance of maybe the range because it is a variable that the range will be very, very wide for the worker in order to calculate the standard time.

So, the variable fatigue allowance is added to the fixed allowance to an operator who is engaged on medium and heavy work and working under the abnormal conditions, so we can see that we can; variable allowance is going to help us to account for the abnormal conditions of working, the working environment is not congenial to the worker, so in that case the variable allowance will be used.

So, the amount of the variable allowance because it is variable already, it will vary from organisation to organisation, so we have seen that within the relaxation allowance, we have further categorised into the fixed allowances and the variable allowances, so variable is more related to the type of the work being done, the working conditions being provided to the worker and the fixed one or more of less related to the drinking water, going to the toilet or the lavatories.

Or maybe if you can go back and see, he is attending to the personal needs, washing hands and then sometimes to overcome the fatigue involved in doing the work, so there are the relaxation allowances is further divided into fixed allowances, variable allowances.

(Refer Slide Time: 20:04)



Then, the second one is the interference allowance, the first one was the relaxation, the second one is the interference allowance, so interference as we know we would not like to interfere into anybody's else work, so that is basic meaning of interfere, so let us see what is the interference

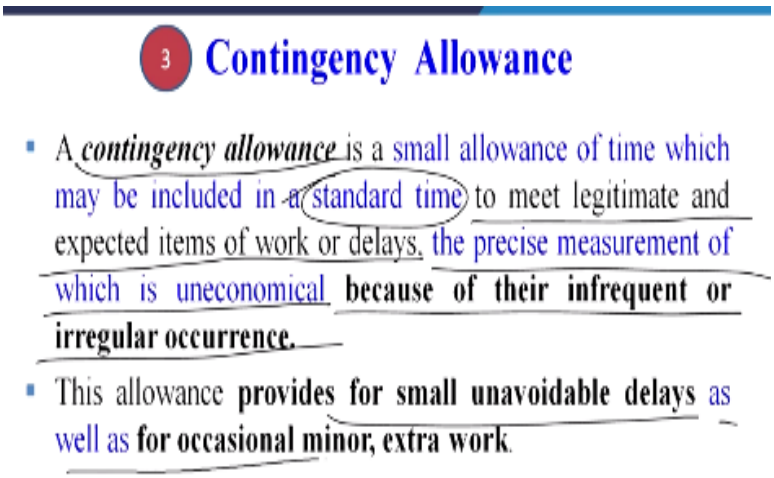
allowance. It is an allowance of time included into the work content of the job, why, why this allowance of time is included into the work content?

To compensate the operator for the unavoidable loss of production due to simultaneously; simultaneous stoppage of 2 or more machines being operated by him, simultaneous stoppage of 2 or more machines operated by him. Now, suppose a worker is operating 2 machines, simultaneously the work is over on the 2 machines, he can attend to one machine only at a time in the meanwhile the second machine will be idle.

So, the interference allowances given or added to the work content to account for this type of interference, this allowance is applicable for machine or process control job. So, wherever a person is operating the machine, this type of allowances is given in those cases only. Interference allowance varies in proportion to the number of machines at assigned to a worker. Now, suppose if the operator is operating 5 or 6 different machines, the probability of interference or idle time on various machines may be more.

So, the interference allowance is roughly proportional to the number of machines being operated or the proportion of a number of machines assigned to the operator, the interference of the machine increases the work content and this work content already we have discussed in our previous sessions.

(Refer Slide Time: 22:02)



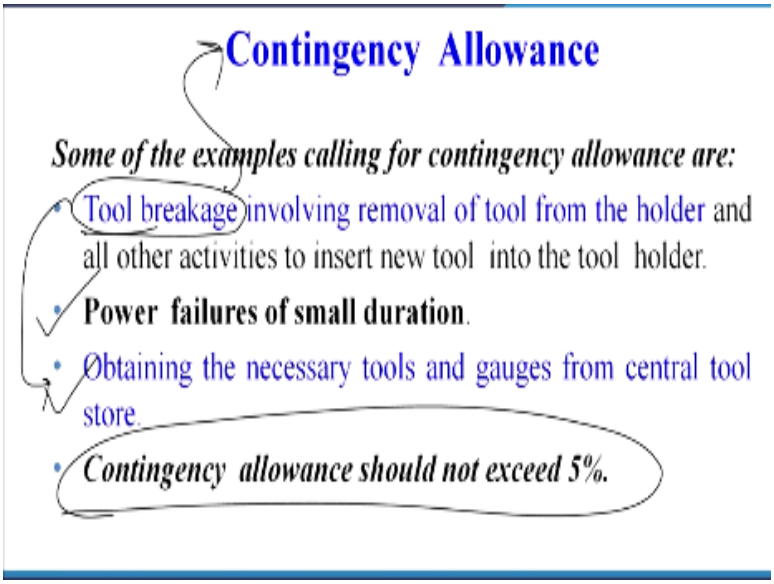
The third one is the contingency allowance, now we have seen that how, what type of allowance is; we have seen the relaxation allowance which is further divided into 2, the fixed allowances and the variable allowances, we have seen the interference allowance, then there is the contingency allowance; a contingency allowance is a small allowance of time which may be included in the standard time.

So, this is another allowance, which is included in the standard time, why? To meet legitimate and expected items of works or delays, the precise measurement of which is uneconomical because of their infrequent or irregular occurrences. So, when the person is operating a machine or he is doing a work with hand tools, there may be certain unexpected outcomes or unexpected maybe the things or unexpected happenings that may happen.

So, the precise measurement of which is uneconomical because of their infrequent or irregular occurrence, so these happenings are not frequent, these happenings are not regular, they are irregular, they are infrequent, so for those we give some allowances to the worker. So, the contingency allowance is small allowance of time which may be included in a standard time why; to meet the legitimate and expected items of work or delays.

So, sometimes there can be delay in the work, the precise measurement is uneconomical, why? Because they not frequent, they are not regular, this allowance provides for small unavoidable delays as well as for occasional minor or extra work.

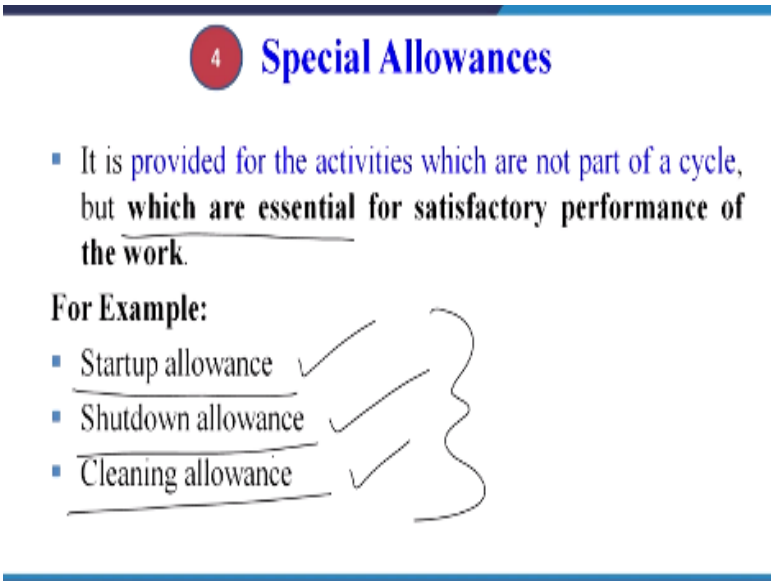
(Refer Slide Time: 23:42)



So, contingency allowance, some examples are given here, some of the examples calling for contingency allowance are tool breakage involving removal of tool from the holder and other activities to insert new tool into the tool holder, so maybe tool breakage can be one of the reasons for giving the contingency, so tool breakage is not regular activities, irregular, infrequent you cannot schedule the tool breakage, it can happen anytime.

Power failures for small duration which is irregular infrequent, obtaining the necessary tools and gauges from the central store maybe sometimes after the tool breakage, contingency allowance should not exceed 5%, so that is also important. Then, apart from these 3 that are main categories of allowances that is the relaxation allowance, the interference allowance and the contingency allowance.

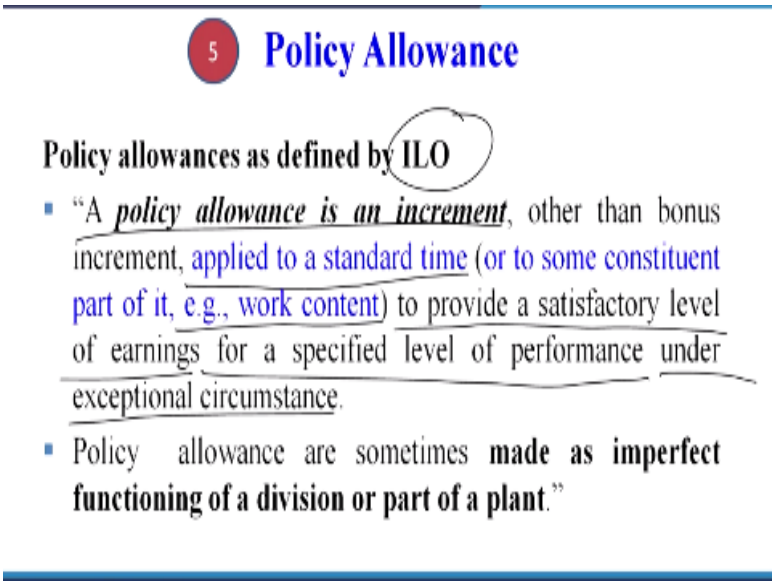
(Refer Slide Time: 24:41)



There are other allowances such as the special allowances, now special allowances; these are provided for the activities which are not a part of the cycle, so cycle we take that when the work has started and when the work has stopped but prior to that we need to give the start-up allowance, we need to give the shutdown allowance, we need to give the clearance or the cleaning allowance.

So, it is provided for the activities which are not a part of a cycle but which are essential, so all these are essential, you need to start up, you need to stop the machine, you need to clean the machine after completing the work, so these are essential for the satisfactory performance of the works. So, these types of special allowances are also given, when we calculate the standard time.

(Refer Slide Time: 25:26)

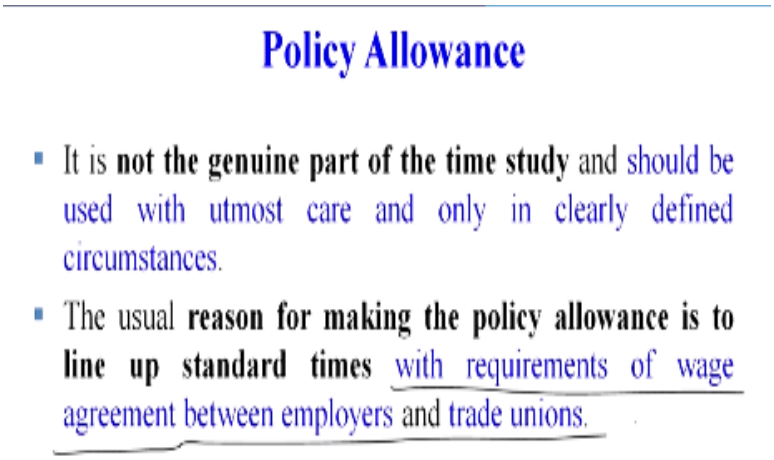


Then, there is a policy allowance, which you may be kind of agreement between the trade unions and the management or the administration, so policy allowance is defined by the ILO is given here, a policy allowance is an increment other than the bonus increment applied to the standard time, so this will be used for calculating the standard time or to some constituent part of it that is the work content.

So, maybe we will add this allowance into the work content or for the calculation of the standard time, why, why do we need to add the policy allowance, this is given here. To provide a satisfactory level of earnings for a specified level of performance under exceptional circumstances, so there are; this is may be to ensure that a satisfactory level of earnings for a specified level of performance.

So, this will ensure that satisfactory earnings are given or being done by a worker for performing the satisfactory level of performance, so that is basically a policy allowance which is normally decided between the workers as well as the administration. Policy allowances are sometimes made as imperfect functioning of a division or a part of the plant.

(Refer Slide Time: 26:52)

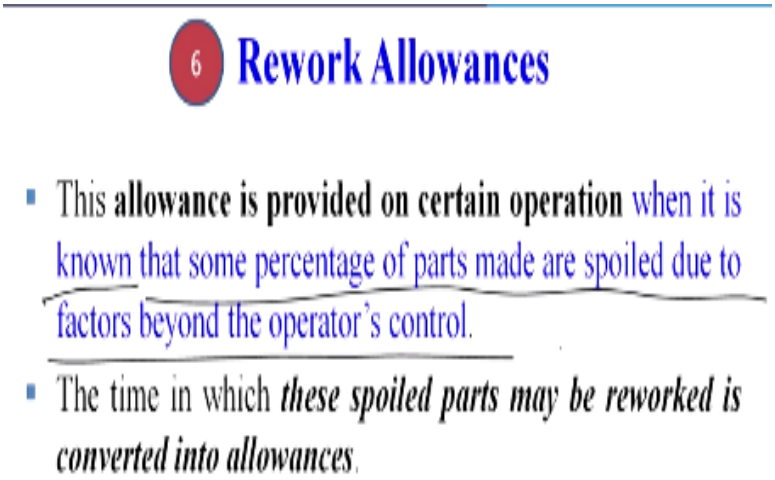


It is not the genuine part of the time study and should be used with utmost care and only in clearly defined circumstances, so it is not that in all cases we are going to add the policy allowance for calculation of the standard time, in rare circumstances, in special circumstances only the policy allowance will be used. Definition also is quite wide though it depends that where the policy allowance has to be used.

The usual reason for making the policy allowance is to line up standard times with requirements of wage agreement; with requirements of wage agreement between the employers and the trade unions. So, sometimes maybe there is an agreement between the trade unions and the employer and in order to justify the salary being given to the workers for a specific job or work being completed by the workers at defined level of performance, this allowance is added for calculating the standard time.

Because the standard time is going to directly influence the salary being given to the worker, so there is a understanding between the unions and the worker; sorry the union and the administration or the management and in order to maybe satisfy or in order to justify the salary being given to the workers sometimes, the policy allowance may be added into the standard time.

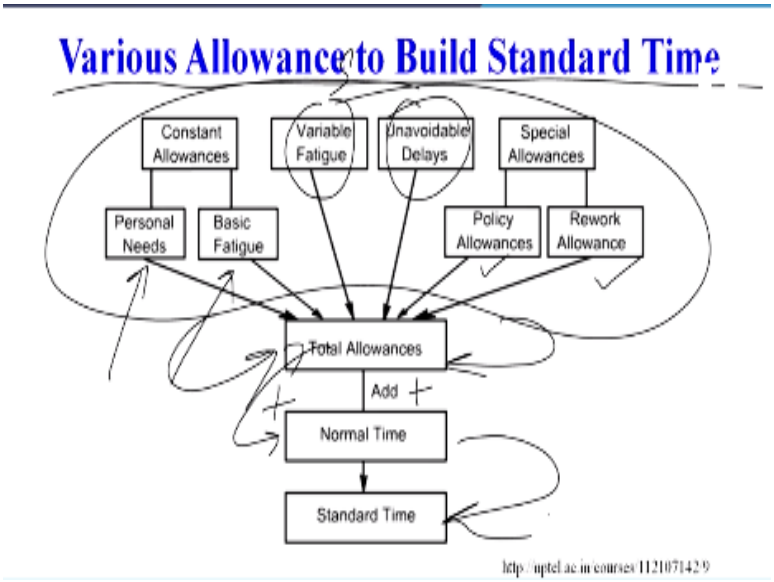
(Refer Slide Time: 28:22)



Then, rework allowances; this allowance is provided on certain operation when it is known, it is already known that some percentage of parts made are spoiled due to factors beyond the operators control. So, when we already know that the efficiency of production may not be under 100%, all parts may not pass the quality check, some of them will be rejected in that case a rework allowance is added.

The time in which these spoiled parts maybe reworked is converted into the allowance, so we know that these parts are defective, there will be some time required to rework these parts, so that much time can be given as an allowance, now because that much time is given as an allowance, so the worker now can manufacture the defined number of parts because the parts which are defective have been reworked and that time is given as a allowance to the worker.

(Refer Slide Time: 29:20)



So, this is the summary of the allowances, these are the various allowances to build the standard time; these are the various allowances which we have already seen today, there are constant allowances like personal needs, basic fatigue, there are variable fatigue allowances depending upon the type of work being given to the worker, allowances due to unavoidable delays, then special allowances such as policy allowance and rework allowance.

So, we add up all these allowances into the total allowance and a total allowance are then combined with the normal time that we have already calculated in our previous sessions we have seen that from the observed time, we can have multiplied with the rating factor which can be found out by number of different methods, so once we know the rating factor, we have found out the observed time for the various elements, very easily they can calculate the normal time.

And for in that normal time, we will combine it, we will add all these allowances into one total allowance, which will be added to the normal time, so the total allowances + the normal time will give you the standard time. So, with this I conclude the today's session, we have today tried to understand the various types of allowances that must be considered when we are doing the time study or the work measurements.

What is the importance of these allowances in which circumstances we must provide these allowances and why they are required and once we have decided what are the total allowances

given to the worker in the form of time, we can very easily calculate the standard time required for performing the job. So, once again to summarise we can get the observed time after the direct measurement, we can multiply it with the rating factor to get the normal time.

And we can add the allowances to the normal time to calculate the standard time and in our subsequent sessions, we will try to take numerical based problems on calculation of standard time, thank you.