**UNIT I -WORK STUDY AND ERGONOMICS**

**Session 1**

**Recap:**

 Addressing the concept of process planning and manufacturing process of industry.

**Session objective:**

 After studding this session the learner will be able to understand the concept of work study, objective of workstudy, techniques of work-study.

**Suggested activity:**

 Power point presentation with images of work-study

**Definition:** Work study is a generic term for the techniques of method study and work measurement. These techniques are used in the examination of human work in all its contexts. They lead systematically to the investigation of all the factors which affect the efficiency and economy at the work place in order to affect improvement. Work study was previously known as time and motion study. This was developed by F.W.Taylor and Frank B.Gilberth.

 **IMPROVING PLANT LAYOUT**

Work study consists of method study and work measurement. Work study is considered as an important tool in increasing productivity because of the following reasons.

1. By method study,

* Working condition is improved.
* Work content is reduced.
* Worker’s efficiency is increased.
* Plant layout is improved.

2. By work measurement,

* Ineffective time is reduced.
* Production time is standardized.
* It helps in planning and controlling.

**Conclusion:**

 At the end of this session the learners should understand the concept of work-study and its techniques.

**Website URL**

<http://eng.rmutsb.ac.th/events/industrial/data/Work%20Study/introduction.pdf>

<http://eng.rmutsb.ac.th/events/industrial/data/Work%20Study/introduction.pdf>

**Session 2**

**Recap:**

 Addressing the concept of work study, objective of workstudy, techniques of work-study.

**Session objective:**

 After studding this session the learner will be able to understand the concept of method study, objective of method study, procedure of method-study.

**Suggested activity:**

 Power point presentation with images of method study

**METHOD STUDY**

Method study is the technique of systematic recording and critical examination of existing and

Proposed ways of doing work and developing an easier and economical method.

 **Objectives of Method Study**

1. Improvement of manufacturing processes and procedures.
2. Improvement of working conditions.
3. Improvement of plant layout and work place layout.
4. Reducing the human effort and fatigue.
5. Reducing material handling
6. Improvement of plant and equipment design.
7. Improvement in the utility of material, machines and manpower.
8. Standardization of method.
9. Improvement in safety standard.

 **BASIC PROCEDURE FOR METHOD STUDY**

The basic procedure for conducting method study is as follows:

1. Select the work to be studied.

2. Record.

3. Examine.

4. Develop.

5. Define.

6. Install.

7. Maintain

**Conclusion:**

 At the end of this session the learners should understand the concept of method study and its procedure.

**Website URL**

hyam.bhatawdekar.net/.../work-study-method-study-and-work-measure.

<http://www.ims-productivity.com/page.cfm/content/Tools-Tips-and-Techniques/>

**Session 3**

**Recap:**

 Addressing the concept of work study, objective of method study, objective of method study, procedure of method-study.

**Session objective:**

 After studding this session the learner will be able to understand the concept of Motion study, motion economy principal.

**Suggested activity:**

 Power point presentation with images of principal of motion economy.

**Principles of motion economy:**

* Developed over many years of practical experience in work design
* They are guidelines that can be used to help determine
	+ - Work method
		- Workplace layout
		- Tools, and equipment
* Objective is to maximize efficiency and minimize worker fatigue

The principles of motion economy can be organized into three categories:

1. Principles that apply to the use of the human body
2. Principles that apply to the workplace arrangement
3. Principles that apply to the design of tooling and equipment

**Conclusion:**

 At the end of this session the learners should understand the concept of motion study andprinciples of motion economy.

**Website URL**

www.clib.dauniv.ac.in/E-Lecture/Time%20and%20motion%20study.pdf‎

courses.washington.edu/ie337/Motion%20and%20Time%20Study.pdf‎

**Session 4**

**Recap:**

 Addressing the concept of work study, objective of method study, objective of Motion study, motion economy principal.

**Session objective:**

 After studding this session the learner will be able to understand the concept of

Time study, objective of work measurement.

**Suggested activity:**

 Power point presentation with images of Time study.

**WORK MEASUREMENT**

Work measurement is a technique to establish the time required for a qualified worker to carry out a specified job at a defined level of performance.

**Objectives of work measurement**

1. To reduce or eliminate non-productive time.

2. To fix the standard time for doing a job.

3. To develop standard data for future reference.

4. To improve methods.

**Uses of work measurements**

1. To compare the efficiency of alternate methods. When two or more methods are available

for doing the same job, the time for each method is found out by work measurement. The

Method which takes minimum time is selected.

2. Standard time is used as a basis for wage incentive schemes.

3. It helps for the estimation of cost. Knowing the time standards, it is possible to work out the cost of the product. This helps to quote rates for tenders.

4. It helps to plan the workload of man and machine.

5. It helps to determine the requirement of men and machine. When we know the time to produce one piece and also the quantity to be produced, it is easy to calculate the total requirement of men and machines.

**Conclusion:**

 At the end of this session the learners should understand the concept of Time study, objective of work measurement.

**Website URL**

kalyan-city.blogspot.com/.../work-measurement-techniques-methods-or.ht...

[www.slideshare.net/Nazir118/work-measurement-and-*productivity*](http://www.slideshare.net/Nazir118/work-measurement-and-productivity)

**Session 5**

**Recap:**

 Addressing the concept of Time study, objective of work measurement.

**Session objective:**

 After studding this session the learner will be able to understand the concept of

Time study, techniques of time study.

**Suggested activity:**

 Quiz.

1. What is time study?

2. Give use of time study.

3. What are objective of time study?

4. What are the techniques of time study?

5. What is stop watch time study?

**TECHNIQUES OF WORK MEASUREMENT**

The different techniques used in work measurement are

1. Stop watch time study.

2. Production study.

3. Work sampling or Ratio delay study.

4. Synthesis from standard data.

5. Analytical estimating.

6. Predetermined motion time system.

**Conclusion:**

 At the end of this session the learners should understand the concept of techniques of time study.

**Website URL**

http://www.explorehr.org/articles/HR\_Planning/Work\_Measurement\_Methods.html

**Session 6**

**Recap:**

 Addressing the concept of Time study, objective of work measurement, techniques of time study.

**Session objective:**

 After studding this session the learner will be able to understand the concept of

Time study, procedure of work measurement

**Suggested activity:**

 Board presentation.

**Procedure for conducting stop watch time study**

The following procedure is followed in conducting stop watch time study:

1. Selecting the job.

2. Recording the specifications.

3. Breaking operation into elements.

4. Examining each element.

5. Measuring using stop watch.

6. Assessing the rating factor.

7. Calculating the basic time.

8. Determining the allowances.

9. Compiling the standard time.

**Conclusion:**

 At the end of this session the learners should understand the concept of procedure of time study.

**Website URL**

courses.washington.edu/ie337/Motion%20and%20Time%20Study.pdf‎

https://www.timestudy.co.uk/‎

**Session 7**

**Recap:**

 Addressing the concept of Time study, objective of work measurement, techniques of time study, procedure of time study.

**Session objective:**

 After studding this session the learner will be able to understand the concept of

Stop watch Time study, time study board and equipment.

**Suggested activity:**

 Board presentation.

 **Stop watch time study**

***Measuring Time with a Stop Watch***

There are two methods of timing using a stop watch. They are

1. Fly back or Snap back method.

2. Continuous or Cumulative method.

***1. Fly back method***

Here the stop watch is started at the beginning of the first element. At the end of the element the

reading is noted in the study sheet (in the WR column). At the same time, the stop watch hand is

snapped back to zero. This is done by pressing down the knob, immediately the knob is released.

The hand starts moving from zero for timing the next element. In this way the timing for each

element is found out. This is called observed time (O.T.) .

***2. Continuous method***

Here the stop watch is started at the beginning of the first element. The watch runs continuously

throughout the study. At the end of each element the watch readings are recorded on the study

sheet. The time for each element is calculated by successive subtraction. The final reading of the

stop watch gives the total time. This is the observed time (O.T.).

**Conclusion:**

 At the end of this session the learners should understand the concept of stop watch time study and its types.

**Website URL:**

http://courses.washington.edu/ie337/Motion%20and%20Time%20Study.pdf

*https://www.timestudy.co.uk/*‎

**Session 8**

**Recap:**

 Addressing the concept of Time study, objective of stop watch time study, procedure of time study.

**Session objective:**

 After studding this session the learner will be able to understand the concept of Standard time, Normal time calculation.

**Suggested activity:**

 Board presentation.

**CALCULATION OF STANDARD TIME**

Standard time or allowed time is the total time in which a job should be completed at standard performance. It is the sum of normal time (basic time) and allowances. Policy allowance is notincluded.Standard time is worked out in a stop watch time study in the following manner.

**Observed time**

This is the actual time observed by using a stop watch. The observed time of an operation is the total of the elemental times. The time study for the same job is conducted for a number of times. The average of the Observed times is calculated.

**Basic or normal time**

Basic time is the time taken by a worker with standard performance. Basic time is calculated from

the observed time by applying the rating factor.

Basic time orNormal time = Observed time ×(Rating of the operator/Standard rating 100)

**Allowed time or standard time**

The standard time is obtained by adding the following allowances with the basic or normal time.

1. Rest and personal allowance or relaxation allowance.

2. Process allowance or unavoidable delay allowance.

3. Contingency allowance.

4. Special allowance.

Policy allowance may be added to the standard time if the management wants.

**Conclusion:**

 At the end of this session the learners should understand the concept of Standard time, Normal time.

**Website URL:**

<http://en.wikipedia.org/wiki/Standard_time_%28manufacturing%29>

**Session 9**

**Recap:**

 Addressing the concept of Time study, objective of normal time, Standard time.

**Session objective:**

 After studding this session the learner will be able to understand the concept of

Ergonomics, objective of Ergonomics.

**Suggested activity:**

 Power point presentation.

**ERGONOMICS**

Ergons means ‘work’ and Nomos means ‘Natural laws’. Ergonomics or its American equivalent

‘Human Engineering may be defined as the scientific study of the relationship between man and

his working environments.

Ergonomics implies ‘Fitting the job to the worker’. Ergonomics combines the knowledge of a

psychologist, physiologist, anatomist, engineer, anthropologist and a biometrician.

**Objectives**

The objectives of the study of ergonomics is to optimize the integration of man and machine inorder to increase work rate and accuracy. It involves

1. The design of a work place befitting the needs and requirements of the worker.
2. The design of equipment, machinery and controls in such a manner so as to minimize mental and physical strain on the worker thereby increasing the efficiency, and
3. The design of a conductive environment for executing the task most effectively.

Both work study and Ergonomics are complementary and try to fit the job to the workers;however Ergonomics adequately takes care of factors governing physical and mental strains.

**Conclusion:**

 At the end of this session the learners should understand the concept of Ergonomics, objective of Ergonomics.

**Website URL:**

<http://ergo.human.cornell.edu/dea3250notes/ergorigin.html>

**Session 10**

**Recap:**

 Addressing the concept of Time study, objective of Ergonomics, objective of Ergonomics.

**Session objective:**

 After studding this session the learner will be able to understand the concept of

Principle of Ergonomics, Application of Ergonomics.

**Suggested activity:**

 Power point presentation.

**Applications**

In practice, ergonomics has been applied to a number of areas as discussed below

1. Working environments 2. The work place and 3. Other areas.

***1. Working environments***

*(a)* The environment aspect includes considerations regarding light, climatic conditions (i.e., temperature, humidity and fresh air circulation), noise, bad odour, smokes, fumes, etc., which affect the health and efficiency of a worker.

*(b)* Day light should be reinforced with artificial lights, depending upon the nature of work.

*(c)* The environment should be well-ventilated and comfortable.

*(d)* Dust and fume collectors should preferably be attached with the equipments giving rise to them.

***2. Work place layout***

**Design considerations**

*(a)* Materials and tools should be available at their predetermined places and close to the worker.

*(b)* Tools and materials should preferably be located in the order in which they will be used.

*(c)* The supply of materials or parts, if similar work is to be done by each hand, should be

duplicated. That is materials or parts to be assembled by right hand should be kept on right

hand side and those to be assembled by the left hand should be kept on left hand side.

*(d)* Gravity should be employed, wherever possible, to make raw materials reach the operator and to deliver material at its destination (e.g., dropping material through a chute).

*(e)* Height of the chair and work bench should be arranged in a way that permits comfortable work posture.

**Conclusion:**

 At the end of this session the learners should understand the Application of Ergonomics and principles of ergonomics.

**Website URL:**

http://www.danmacleod.com/ErgoForYou/10\_principles\_of\_ergonomics.htm

**REVIEW QUESTIONS**

1. Define work study.

2. Explain the importance of working condition.

3. What do you mean by Ergonomics?

4. Define method study. What are the objectives of method study?

5. Explain the basic procedure for method study.

6. What are the types of charts used in method study?

7. Draw the symbols used in process chart.

8. Explain the operation process chart with an example.

9. What are types of flow process chart?

10. Explain main type flow process chart with an example.

11. Explain two-handed process chart with an example.

12. Explain man-machine chart.

13. Explain flow diagram and string diagram.

14. What is work measurement?

15. What are the techniques used for work measurement?

16. Describe the procedure for conducting stop watch time study.

17. Define rating factor.

18. Compare flyhack and continuous method of stop watch measurement.

19. Define basic time. How will you calculate the basic time?

20. What is allowance? What are the various types of allowances.

21. What is standard time? How will you calculate it?

22. What is production study? State its uses.

23. What is ratio delay study and explain the procedure of ratio delay study?

24. Explain the procedure involved in synthesising from standard data.

25. Explain analytical estimating. State its advantages.

26. Define predetermined motion time study.

27. Define Ergonomics.

28. State the objectives of ergonomics.

29. Explain the application of ergonomics with an example.