

GUJARAT TECHNOLOGICAL UNIVERSITY
M. E. - SEMESTER – I • EXAMINATION – WINTER • 2014

Subject code: 2714602**Date: 09-01-2015****Subject Name: Work Systems Design and Human Factors Engineering****Time: 02:30 pm - 05:00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) Explain how Production, Productivity and Profitability are related with suitable example. **07**
- (b) What are the basic objectives of Ergonomics? How the same are being achieved in industrial designs? **07**
- Q.2** (a) List the eight steps approach of Method Study and explain in details how the job will be selected for Method study application. **07**
- (b) Define: Qualified worker, Representative worker, Standard Time, Normal Time, Performance Rating, Governing Element, and Allowance. **07**
- OR**
- (b) List different Work Measurement techniques and explain Cumulative, Fly-back and Differential timing methods used in stop watch time study. **07**
- Q.3** (a) A work measurement study was carried out to ascertain standard time of a small packaging job. The operation was divided in to five different elements and five readings (through stopwatch) were taken for each element along with its performance rating. The observed time in seconds and observed rating are as illustrated in tables below. **07**

Observed time (Sec.)					
Element	Cycle 1	Cycle 2	Cycle 3	Cycle 4	Cycle 5
1	100	105	100	95	105
2	90	95	9	90	95
3	75	70	70	75	70
4	60	65	60	60	65
5	80	85	85	80	85

Observed Rating					
Element	Cycle 1	Cycle 2	Cycle 3	Cycle 4	Cycle 5
1	100	90	110	110	90
2	100	110	110	100	95
3	90	110	90	90	110
4	100	90	100	100	90
5	100	95	90	115	100

The relaxation allowances for elements 1 to 3 are 3% each and for elements 4 and 5 is 5% each. The relaxation allowances are to be considered elements viz for calculation of basic time. Calculate standard time of the job considering 5% contingency allowance on overall cycle time. If the factory operates one shift of 8 hours per day with 1 hour as lunch break, how many pieces can be produced at standard time per day?

- (b) What is PTS? List different types of PTS in use. Develop the activity sequence model and determine the normal time for the following work activity. (Use Table 1 for selection of relevant data). **07**
- A worker has to reach up to a spanner which is kept on a table 07 steps away from him. The table is of short height and hence worker has to bend partially to pick up the spanner. He then comes back to his original position. Then he has to sit down and put the spanner in a bin lying on floor having special slot for storing. He has to apply light pressure to put the spanner in the slot.
- OR**
- Q.3 (a)** A work sampling study was conducted on a machine to ascertain the proportion of idle time of the same. The preliminary study revealed that the machine was found idle for 25% of the time. This study was carried out with 95% confidence level and $\pm 5\%$ accuracy. Find out following. **07**
- Actual size of the sample required for this study.
 - Accuracy of the study after making 4000 observations wherein the machine was found not working during 2000 observations.
 - Revised sample size at the middle of the study where proportion of the machine idleness was found as 20%
- (b) List appropriate chart/diagram to be used for following applications. **07**
- To get the overall view of the major steps of a process.
 - To record the movement of a peon in office.
 - To record the movement of the material for five different products on a common platform.
 - To record the movement of a worker in a jobbing machine shop with the details of his activities.
 - To decide whether an operator can handle two machines at a time or not.
 - To record the movement of two hands with respect to each other in an electronic goods assembly work.
 - To trace the movement of a material on scaled layout drawn on a piece of paper.
- Q.4 (a)** Name the Anthropometric measures no. 7 to 14 as in figure 1 and explain the significance of any two of them in work place and product design. **07**
- (b) What is metabolism? Why is it necessary to understand the process of metabolism in designing a work system? **07**
- OR**
- Q.4 (a)** Explain the indications of heat stress at work and measures to counter the same. **07**
- (b) Explain the impact of illumination and noise at workplace with suitable examples. **07**
- Q.5 (a)** How will you design effective displays and controls for a general man-machine system? Explain with suitable examples. **07**
- (b) Poor body postures results into lower productivity at work. Justify the statement with suitable examples. **07**
- OR**
- Q.5 (a)** Why knowledge of basic biomechanics is important in designing manual material handling tasks? Explain with suitable examples. **07**

- (b) Explain with suitable examples the following three design principles using Anthropometric data. 07

- (a) Designing for Extreme individuals
- (b) Designing for an Adjustable Range
- (c) Designing for the Average

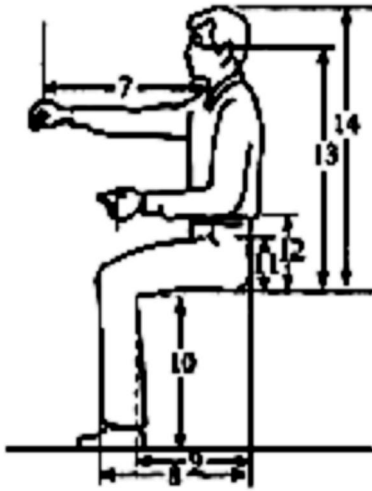


Figure 1

General Move activity sequence model = A B G A B P A				
Index	A = Action distance	B = Body motion	G = Gain control	P = Placement
0	Close ≤ 5 cm (2 in.)			Hold, Toss
1	Within reach (but > 2 in.)		Grasp light object using one or two hands	Lay aside Loose fit
3	1 or 2 steps	Bend and arise with 50% occurrence	Grasp object that is heavy, or obstructed, or hidden, or interlocked	Adjustments, light pressure, double placement
6	3 or 4 steps	Bend and arise with 100% occurrence		Position with care, or precision, of blind, or obstructed, or heavy pressure
10	5, 6, or 7 steps	Sit or stand		
16	8, 9, or 10 steps	Through door, or Climb on or off, or Stand and bend, or Bend and sit		

Table 1
