

GUJARAT TECHNOLOGICAL UNIVERSITY**M. E. - SEMESTER – I • EXAMINATION – WINTER • 2013****Subject code: 714602****Date: 26-12-2013****Subject Name: Work System Design and Human Factors Engineering****Time: 10.30 am – 01.00 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) “Increase in production does not mean increase in productivity always and increase in productivity does not mean increase in profitability always.” - Justify the statement taking suitable quantitative example. **07**

(b) Any product designed without considering Anthropometry data and Ergonomic aspects will be a failure in long run. – Agree? Why? Support your answer with suitable examples. **07**

Q.2 (a) Explain various factors causing ineffective time (excess work content) and remedies for the same. **07**

(b) List different charts and diagrams used in work study technique with their specific application. **07**

OR

(b) Classify allowances given in time study technique and explain the same with suitable examples. **07**

Q.3 (a) What is MOST? Develop the activity sequence model and determine the normal time for the following work activity using Table 1. **07**

“A worker walks 10 steps, picks up a small part from the floor, returns to his original position, and places the part on his worktable.”

(b) 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 20% of the time. This study was carried out with 95% confidence level and +/- 5% accuracy. What should be the actual size of the sample required for this study? Find out revised sample size at the middle of the study where the proportion of machine idleness was found as 15%. Also find out accuracy of the study after making 6000 observations wherein the machine was found working during 5000 observations. **07**

OR

Q.3 (a) Explain the basic concept behind use of principles of motion economy in work system design. List with justifications which principles of motion economy you will apply in designing a computer work station. **07**

(b) Following are the particulars of machining a job on a lathe machine. **07**

- i) Loading the job: 1 min.
- ii) Machining on auto feed: 4 min.
- iii) Unloading the job: 1 min.

Draw man-machine chart (*with conventional notations taking appropriate scale on your answer book only*) for above activities. The operator is then asked to operate two lathes simultaneously for the same job. The machines are located very near and hence the time taken for walking between the machines can be ignored. Draw man –machine chart for this case also and find out what will be the increase in the % utilization of the operator. If the shift timing is 8 hrs. with 1.5 hrs. total rest period, what will be the increase in productivity in this case?

- Q.4 (a) Explain different methods available for measurement of human energy expenditure during work. 07
- (b) Explain human information processing cycle with suitable example. 07
- OR**
- Q.4 (a) List and explain with suitable examples the criteria to be satisfied while designing the displays and controls for any systems/machine/workplace. 07
- (b) What are the signs of visual fatigue at work? Explain the remedies for the same. 07
- Q.5 (a) Name the anthropometric measures (no. 1 to 6 and 18) illustrated in figure 1 and mention their significance. 07
- (b) “Any manual material handling work need to be designed with consideration of basic biomechanics of human body.” – Justify the statement. 07
- OR**
- Q.5 (a) Which mechanism of adapting to hot environment is more complex – “acclimation” or “acclimatization”? Explain with suitable examples. 07
- (b) Suggest appropriate work posture with justifications for following jobs. 07
- Working on metallurgical microscope
 - Light assembly with repetitive movements
 - Lifting load of around 5 kg.

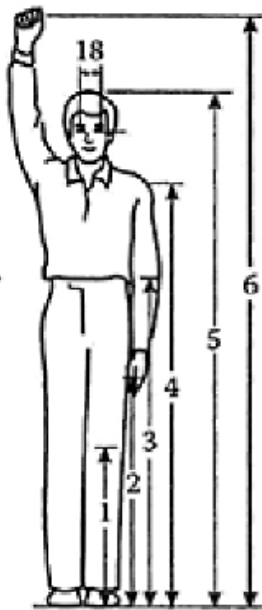


Figure 1

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
