Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME - SEMESTER–I(New course)• EXAMINATION – WINTER- 2015

Subject Code: 2714602 **Date: 02/01/2016**

Subject Name: Work System Design and Human Factors Engineering

Time:2:30 pm to 5:00 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)** How Work-study approach is used to improve productivity? – Explain with suitable examples. **07**

(b) Explain the importance of Anthropometric Data and Ergonomics Principles in effective product design with suitable examples. **07**

Q.2 **(a)** Differentiate between… **07**

(i) Operation Process Chart and Flow Process Chart

(ii) Flow Diagram and String Diagram

(b) Define: **07**

(i) Standard Time (ii) Basic Time (iii) Foreign Element (iv) PTS

(v) Policy Allowance (vi) Qualified Worker (vii) Standard Performance

OR

(b) What is rating in Time Study? Why is it done? **07**

Q.3 **(a)** Why a task is to be divided in to elements for Time Study? Explain different elements with examples. **07**

(b) A work measurement study was carried out to ascertain standard time of a small packaging job. The operation was divided in to three different elements and six 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 the tables. **07**

Observed time (Sec.)						
Element	Cycle 1	Cycle 2	Cycle 3	Cycle 4	Cycle 5	Cycle 6
1	110	105	100	110	105	100
2	100	105	100	100	105	100
3	95	95	90	100	95	90

Observed Rating						
Element	Cycle 1	Cycle 2	Cycle 3	Cycle 4	Cycle 5	Cycle 6
1	105	100	95	100	100	95
2	100	90	95	100	95	95
3	100	100	105	110	105	105

The relaxation allowance for element 1 is 2% and for elements 2 and 3 is 4% each. The relaxation allowances are to be considered elements wiz for calculation of basic time. Calculate standard time of the job considering 3% contingency allowance and 2% policy allowance on overall cycle time. If the factory operates one shift of 8 hours per day with 60 minutes as lunch break, how many pieces can be produced at standard time per day?

OR

Q.3 **(a)** A work sampling study was conducted on a Lathe machine to ascertain the proportion of idle time of the same. The preliminary study revealed that the Lathe was found idle for 15% of the time. This study was carried out with 95% confidence level and +/- 5% accuracy. Find out following. **07**

i. Actual size of the sample required for this study.
ii. Accuracy of the study after making 5000 observations wherein the machine was found not working during 1500 observations.
iii. Revised sample size at some point of the study where the Lathe was found working during 3000 times out of total 5000 observations.

(b) Compare PTS with Time Study technique for work measurement. **07**

Develop the activity sequence model and determine the normal time for the following work activity. (Use Table 1 for selection of relevant data).

"A worker reaches up to a job of light weight which is kept on the floor 10 steps away from him. The worker picks up the job from the floor by fully bending and then walks back to his original position. Then he sits down and put the job in a box by simply releasing from the hand."

Q.4 **(a)** Explain 7 steps approach to apply Anthropometric data for product design. **07**

(b) What is Metabolism? Explain the Oxygen debt and Repayment process during work. **07**

OR

Q.4 **(a)** Explain the processes of "acclimation" and "acclimatization" for adapting to hot environment. **07**

(b) Ignorance of basic biomechanics of human body is dangerous in designing any manual material handling work. – Justly the statement with examples. **07**

Q.5 **(a)** Explain the importance of illumination in work place. **07**

(b) Explain different types of displays with their merits and demerits. **07**

OR

Q.5 **(a)** Explain the ill effects of noise and vibrations at work. **07**

(b) Explain different types of controls with their merits and demerits. **07**

Table 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		

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