

**National Exams December 2016**  
**98-Ind-A2-Analysis and Design of Work**  
**3 hours duration**

**Notes:**

1. If doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer paper, a clear statement of any assumptions made.
2. This is a Closed Book exam. Candidates may use one of two calculators, the Casio or Sharp approved models.
3. Any five questions constitute a complete paper. Only the first five questions as they appear in your answer book will be marked.
4. All questions are of equal value.
5. Write your answers in point-form whenever possible, but fully. Show all the calculations.

**Marking Scheme (marks)**

- |    |         |         |         |
|----|---------|---------|---------|
| 1. | (i) 6,  | (ii) 7, | (iii) 7 |
| 2. | (i) 6,  | (ii) 7, | (iii) 7 |
| 3. | (i) 5,  | (ii) 5, | (ii) 10 |
| 4. | (i) 10, | (ii) 6, | (iii) 4 |
| 5. | (i) 7,  | (ii) 6, | (iii) 7 |
| 6. | (i) 6,  | (ii) 7, | (iii) 7 |
| 7. | (i) 7,  | (ii) 7, | (iii) 6 |

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1. (i) What are the graphical tools available for work methods analysis?  
(ii) Show the basic features of a human-machine chart, including the summary form of such a chart. What are the main uses of a human-machine chart?  
(iii) In the conduct of the operations analysis, explain the importance of: (a) design of parts, and (b) process of manufacture.
  
2. (i) What factors must be considered to provide a safe and healthful workplace for the workers?  
(ii) What are the opportunities for savings through the application of methods engineering and work measurement?  
(iii) In the conduct of operations analysis, explain the importance of the (1) process of manufacture, and (2) set-up and tools.
  
3. (i) What are the major factors affecting fatigue of the operator?  
(ii) State the factors for which fatigue allowance is given in a stopwatch time study?  
(iii) Determine the optimum number of machines that should be assigned to an operator when:

Loading and unloading time per machine	= 2.00 min.
Walking time to next machine	= 0.12 min.
Machine time (power feed)	= 6.00 min.
Machine rate	= \$24.00 per hr.
Operator rate	= \$8.00 per hr.
  
4. (i) For a drill press operation, the following data are known:

Work Elements	Observed time (min./pc.)	Rating %
1. Load drill press	0.20	115
2. Drill hole with automatic power feed	0.25	100
3. Check tolerance of the last piece produced during machine cycle (#2) with go/no-go gauge	0.10	110
4. Unload drill press	0.15	120

The company allows: 5% for personal, 5% for unavoidable delays and 5% for fatigue.

Calculate the normal time and the standard time for the operation in min./pc.

- (ii) Why is it important to maintain time standards properly/accurately, especially for the company which follows a wage incentive program? What procedure would you recommend for a sound program for the maintenance of time standards?
- (iii) Show by means of a typical productivity increase graph or learning, the most desirable stage in the production to establish the time standard.

5.
  - (i) State the concept of Methods-Time Measurement (MTM) system. How was it developed?
  - (ii) Explain the concept of MOST (Maynard Operation Sequence Technique) work measurement technique.
  - (iii) Some companies are experiencing a tendency for their work measurement analysts to become more liberal in their performance rating evaluation over the years. How do fundamental motion data offset the tendency towards creating loose standards?
  
6.
  - (i) What is the basic purpose of employing work sampling techniques? What are the applications or uses of work sampling?
  - (ii) The following data were obtained during the course of the day to establish standard time for a lathe machine operation by means of work sampling: total number of observations = 150, number of observations operator idle = 50, average performance rating = 150%, total time worked per day = 480 min., number of pieces produced per day = 250 pcs. The company allows 5% for personal, 5% for unavoidable delays and 5% for fatigue in establishing time standards. Determine the standard time in min./pc.
  - (iii) Assume that the work sampling study was continued for the second day and a total of 300 observations were obtained, of these observations, the operator was found idle 75 times. Determine the relative and absolute accuracies of operator idle time at a confidence level of 99%.
  
7.
  - (i) State the factors that are generally selected in point-system method of job evaluation plan.
  - (ii) Why is the point-system method preferred over other methods of job evaluation plan?
  - (iii) Why standard hour plan is most commonly used in direct financial plan, compared to piecework and measured day work?