

**National Exams December 2009**  
**98-Ind-A2, Analysis & 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.

Front Page

**Marking Scheme (marks)**

- |    |         |         |          |
|----|---------|---------|----------|
| 1. | (i) 7,  | (ii) 7, | (iii) 6  |
| 2. | (i) 7,  | (ii) 7, | (iii) 6  |
| 3. | (i) 7,  | (ii) 5, | (iii) 10 |
| 4. | (i) 10, | (ii) 6, | (iii) 4  |
| 5. | (i) 8,  | (ii) 6, | (iii) 6  |
| 6. | (i) 6,  | (ii) 7, | (iii) 7  |
| 7. | (i) 7,  | (ii) 6, | (iii) 7  |

**National Examination December 2009**  
**98-Ind-A2 –Analysis and Design of Work**

1. (i) Explain the importance of (a) design of parts, and (b) materials, in the conduct of the operations analysis.  
(ii) Show the basic features of a flow process chart including the summary form of such a chart.  
(iii) What are the uses of the: (a) flow process chart, and (b) flow diagram?
  
2. (i) What are the macroscopic approaches to making improvements in the workplace with particular reference to: (a) physical environment, (b) physiological factors, (c) psychological factors, and (d) sociological factors?  
(ii) State the manner by which the principles of motion economy can be applied for the design of tools and equipment.  
(iii) Why should the methods analyst accept as a part of his or her responsibility to provide good working conditions for the operators? Do working conditions appreciably affect output? Explain.
  
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) What are the advantages and disadvantages of predetermined motion times compared to step-watch time study?
  - (ii) How would you explain to a worker in your company who knows nothing about MTM (Methods-Time Measurement), what it is and how it is applied?
  - (iii) Explain the factors that influence the reach and the move times in the MTM system.
  
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 = 115%, 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 (for both days). 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) What are the principal negative considerations that should be understood prior to the installation of a point job evaluation plan?
  - (ii) What are the principal benefits of a properly installed job evaluation plan?
  - (iii) Explain the characteristics of the following direct financial plans: (a) piece work, (b) standard hour plan, and (c) measured day work. Which incentive plan is most commonly used in industry, and why?