

**National Exams May 2015**  
**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) 7,  | (ii) 7, | (iii) 6 |
| 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) 7,  | (ii) 6, | (iii) 7 |
| 7. | (i) 7,  | (ii) 6, | (iii) 7 |

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1. (i) State the reasons for making motions at the lowest classification of movements whenever possible. What are the body members involved in the classification of movements?  
(ii) In the context of methods engineering, explain the concept of operations analysis. What are primary approaches to operations analysis?  
(iii) What is the use of operations analysis? Show the basic features of an operation process chart, including the summary form of such a chart.
  
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) In the MTM system, explain the factors that influence the reach and move times.
  - (iii) Explain the concept of MOST (Maynard Operation Sequence Technique) work measurement technique.
  
6.
  - (i) Computerized work sampling will become an increasingly popular method in the future. What are the possible applications of such a method?
  - (ii) How can the validity of work sampling be sold to the operator not familiar with probability and statistical procedure?
  - (iii) It has been decided to determine the percentage of idle time for the numerically-controlled lathe machine. A trial study revealed that out of 150 observations, 30 observations showed that the machine was idle. Determine the number of random observations (sample size) required to achieve an accuracy of  $\pm 10\%$  at a confidence level of 95%.
  
7.
  - (i) State the steps that are followed in installing a point-system of a job evaluation plan.
  - (ii) State the reasons for installing a wage incentive plan in a company. What are the reasons for wage incentive plan failures?
  - (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?