

**National Exams December 2010**  
**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.

**Marking Scheme (marks)**

- |    |        |            |           |
|----|--------|------------|-----------|
| 1. | (i) 6, | (ii) 8,    | (iii) 6   |
| 2. | (i) 7, | (ii) 7,    | (iii) 6   |
| 3. | (i) 7, | (ii)(a) 7, | (ii)(b) 6 |
| 4. | (i) 9, | (ii) 6,    | (iii) 5   |
| 5. | (i) 7, | (ii) 7,    | (iii) 6   |
| 6. | (i) 6, | (ii) 7,    | (iii) 7   |
| 7. | (i) 7, | (ii) 6,    | (iii) 7   |

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1. (i) State the broad areas of opportunities for savings through the application of methods engineering and work measurement.  
(ii) Show the basic features of a flow process chart, including the summary form of such a chart. What are the main uses of such a chart?  
(iii) As an industrial engineer, you are asked to make methods improvement in a metal cutting manufacturing plant. State the various areas of the operation you would investigate to achieve your objective.
2. (i) State the basis principles of motion economy for the “use of the human body”.  
(ii) State the body members involved in the five classifications of movements. Explain the concept that all motions should be made at the lowest classification of movements.  
(iii) State briefly the macroscopic approaches to making improvements in the workplace.
3. (i) Why are performance rating and allowances so critical and controversial in stop-watch time study? What approaches may be taken to alleviate the problems of performance rating and allowances in industry?  
(ii) In a stop-watch time study, the following information is provided for a given work element: number of readings = 25, mean element time = 0.20 min., standard deviation = 0.06 min.  
(a) Calculate the range of elemental time values at a confidence level of 95% and the percentage of the accuracy level.  
(b) Suppose it is desired in the above problem that the mean elemental time should be within the accuracy level of 10% with a confidence level of 95%. Determine the number of observations or readings that must be taken to achieve this.
4. (i) For a drill press operations, the following data are known:

Work Elements	Observed time (min.)	Rating %
1. Load drill press	0.25	110
2. Drill hole with automatic power feed	0.15	100
3. Check tolerance of the last piece produced during machine cycle (#2) with go/no-go gauge	0.08	115
4. Unload drill press	0.20	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) What are the uses of time standards?
- (iii) State the steps that are followed in a stopwatch time study.

5.
  - (i) State the concept of Methods-Time-Measurement (MTM) system. How was it developed?
  - (ii) Some companies are experiencing a tendency for their work measurement analysts to become more liberal in their performance rating over a period of years. How do fundamental motion data offset this tendency toward creating loose standards?
  - (iii) What is the basic advantage of using Maynard operation sequence technique or MOST?
  
6.
  - (i) What is the basic purpose of employing work sampling technique?
  - (ii) What is the basis of work sampling theory? When does the binomial distribution approach normal distribution?
  - (iii) State the advantages and disadvantages of work sampling over stop-watch time study.
  
7.
  - (i) What is the purpose of job evaluation? Explain the concept of job analysis in the context of job evaluation.
  - (ii) What are the principal benefits of a properly installed job evaluation plan?
  - (iii) What are the common methods used for job evaluation? Explain briefly.