

**National Exams May 2019**  
**17-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) 7, | (ii) 7, | (iii) 6 |
| 3. | (i) 7, | (ii) 7, | (ii) 6  |
| 4. | (i) 8, | (ii) 6, | (iii) 6 |
| 5. | (i) 8, | (ii) 6, | (iii) 6 |
| 6. | (i) 6, | (ii) 7, | (iii) 7 |
| 7. | (i) 7, | (ii) 7, | (iii) 6 |

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) State the basis principles of motion economy for the “use of the human body”.  
(ii) What are the opportunities for savings through the application of methods engineering and work measurement?  
(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. For a drill press operations, the following data are known:

Work Elements	Observed time (min.)	Rating %
1. Load drill press	0.30	120
2. Drill hole with automatic power feed	0.12	100
3. Check tolerance of the last piece produced during machine cycle (#2) with go/no-go gauge	0.08	110
4. Unload drill press	0.25	115

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

- (i) Calculate the normal time and the standard time for the operation in min./pc.
  - (ii) Define performance rating and normal time.
  - (iii) What are the uses of time standards?
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 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) 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?