

**National Examinations December 2016**  
**98-Ind-A3- Facilities Design**  
**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 calculations.

**Marking Scheme (marks)**

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

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1. (i) What are the objectives of facilities planning?  
(ii) State the important questions that must be resolved in developing a material handling plan that will support manufacturing and distribution.  
(iii) State the issues that may have a long range impact on the strategic facilities plan.
2. (i) Explain your understanding of: (a) material flow planning hierarchy, (b) work simplification approach to material flow and (c) principle of minimizing the cost of material flow.  
(ii) Explain the concept of activity relationship and space requirements used as a foundation for the facility plan.  
(iii) What are the advantages and disadvantages of product (line production) layout?
3. (i) A company works 8 hour days for 5 days per week. The production line of the company is operated 7 hours per day. Given the information in the table below, determine the theoretical minimum number of stations the line should be designed for an output of 130 units per week. Show a schematic of the number of stations. What is the actual possible efficiency? Use the *Ranked Positional Weight Technique* in solving the assembly line problem.

Task element	1	2	3	4	5	6	7	8	9	10	11	12
Element time(min)	12	6	6	2	2	12	7	5	1	4	6	7
Preceding elements	-	1	2	2	2	2	3,4	7	5	9,6	8,10	11

- (ii) In progressive assembly, state the reasons for the increase in the line balancing delay.
- (iii) State the manner by which modifications to standard technique can be made to balance assembly/flow lines.
4. (i) A manufacturing product has a market estimate of 15,000 components and requires four processing steps: (a) turning, (b) milling, (c) drilling, and (d) grinding. The scrap rate of the four processing operations are: (a) 6%, (b) 5%, (c) 4%, and (d) 3% and the rework rates are: (a) 4%, (b) 3%, (c) 3% and (d) 1%. For each operation, calculate the following: (a) production quantity (pieces) scheduled, and (b) expected number of good pieces produced.  
(ii) State the basic requirements of computerized layout programs for multiple items.  
(iii) What are the basic problems associated with computerized layout program that limit its use in industry?

5. (i) What is the purpose of buffer design in flow lines? State the two buffering techniques that use decoupling for the purpose.  
(ii) State the two major costs involved in providing a buffer.  
(iii) Describe the Muther's Systematic Layout Planning (SLP) procedure by means of a diagram. State the steps followed in the SLP procedure.
6. (i) State the steps that are followed in designing a material handling system.  
(ii) What are the desirable attributes of shipping and receiving facilities plans?  
(iii) State the characteristics of: (a) powered roller conveyors, (b) bridge cranes, and (c) industrial robots.
7. ((i) What are the advantages of centralizing tool and gauge cribs in a production plant?  
(ii) State under what circumstances it would be desirable to decentralize tool and gauge cribs.  
(iii) As an industrial engineer you are asked to conduct a feasibility study to justify the consolidation of tool and gauge cribs and providing a dispatching system in a manufacturing plant so that tools and gauges can be delivered directly to the production operators and manufacturing inspectors.  
(a) Explain clearly the specific advantages of such a system.  
(b) How would you conduct the study with particular reference to the collection of the relevant data and information to justify the project?