

**National Examinations May 2015**  
**98-Ind-A3- Facilities Planning**  
**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) 8, | (ii) 6,  | (iii) 6  |
| 3. | (i) 5, | (ii) 5,  | (iii) 10 |
| 4. | (i) 8, | (ii) 7,  | (iii) 5  |
| 5. | (i) 6, | (ii) 6,  | (iii) 8  |
| 6. | (i) 6, | (ii) 7,  | (iii) 7  |
| 7. | (i) 8, | (ii) 12, |          |

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**98-Ind-A3 -Facilities Planning**

1. (i) Explain the concept of facilities planning hierarchy by means of a suitable diagram.  
(ii) What are the steps followed for the facilities planning process in a manufacturing facility?  
(iii) State the variety of circumstances that require the need of a plant facility layout study.
2. (i) What are the advantages and disadvantage of non-progressive assembly or progress layout compared to progressive assembly or line layout?  
(ii) State your understanding of computer-integrated manufacturing systems (CIMS).  
(iii) Discuss the dramatic impact of an automated storage and retrieval system (AS/RS) on manufacturing and warehousing.
3. (i) State the steps that are followed to determine the total machine space requirements in the design of an entire manufacturing facility.  
(ii) How would you determine the amount of space per machine?  
(iii) The assembly task elements and their assembly precedence requirements are known. An output of approximately 65 units per hour is required and the plan is to produce them all on one assembly line. Show a schematic of the number of stations. What is the actual possible efficiency? Use *Ranked Positional Weight Technique* in solving the assembly line problem.

Task element	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Element time(min)	0.2	0.4	0.7	0.3	0.8	0.6	0.2	0.2	0.8	0.3	0.5	0.1	0.3	0.6
Preceding elements	-	1	1	2	3	3	4	4	5	6	6	7,8	10,11	9,12,13

4. (i) (a) The average operator of a certain company performs at 100% (average pace) and the range of performance is from about 60% to 140%, and the distribution is assumed to be normal. Determine the station speed of the company's assembly line assuming that it is set for the operator whose pace is 85% of average (Z value for 85% or 15% = 1.04 or, -1.04).  
(b) Suppose the assembly line is decoupled and the line could be set for an average operator, what would be the gain in station speed?  
(ii) Explain the characteristics of the following two programs in the context of computerized layout of multiple items: (a) CRAFT and (b) CORELAP.  
(iii) State the basic requirements of computerized layout programs for multiple items.

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) Explain the characteristics of traditional manufacturing (TM) and contemporary manufacturing (CM).
  - (ii) Briefly state the primary elements of just-in-time (JIT) production system.
  - (iii) What are the most common sources of waste in industry?
  
7.
  - (i) What are the characteristic features of the following: (a) belt conveyor, (b) bridge cranes, and (c) industrial robot.
  - (ii) You have been charged with the responsibility of implementing a facilities design project for bagging ammonium nitrate fertilizers (granular substance) in 10, 20 and 30 kg, plastic and paper bags and shipping through railway box cars. The facility includes screw conveyor system for transporting fertilizers from the production plant to the bagging workstation, automatic weighing scale, turret hopper with spouts for bagging, heat sealer (for plastic bags)/sewing machine (for paper bags), steel wheel conveyor system for moving bags to railway box car and palletizer for stacking bags in the railway box car.
    - (a) Explain the problems that you envisage with particular reference to heat sealer, sewing machine, steel wheel conveyor and palletizer.
    - (b) State the factors that must be considered in the selection and installation of the various material handling equipment.
    - (c) How would you proceed to design such a facility including manpower requirements and work method?