

National Examinations May 2011
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) 8, | (ii) 6, | (iii) 6 |
| 4. | (i) 8, | (ii) 7, | (iii) 5 |
| 5. | (i) 10, | (ii) 5, | (iii) 5 |
| 6. | (i) 6, | (ii) 7, | (iii) 7 |
| 7. | (i) 8, | (ii) 12, | |

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1. (i) Briefly explain the concept of facilities planning hierarchy by means of a suitable diagram.
(ii) State the steps that are followed for the facilities planning process in a manufacturing facility.
(iii) What are the pitfalls in the selection of a manufacturing plant site?
2. (i) What are the advantages and disadvantages of non-progressive assembly or process layout compared to progressive assembly or line layout?
(ii) State your understanding of computer-integrated manufacturing systems (CIMS).
(iii) The market estimate of a product is 20,000 pieces and requires three processing steps: (1) milling, (2) boring, and (3) grinding. The scrap rate at the three processing operations are: (1) 6%, (2) 5%, and (3) 4% and the rework rates are (1) 4%, (2) 3%, and (3) 2%. For each operation calculate the following: (a) production quantity scheduled (pieces), and (b) expected number of good pieces produced.
3. (i) Describe the (Muther's) Systematic Layout Planning (SLP) procedure by means of a diagram. State the steps followed in the SLP procedure.
(ii) State the variety of circumstances that require the need of a plant facility layout study.
(iii) What are the advantages and disadvantages of product (line production) layout?
4. (i) What is a unit load? State the advantages and disadvantages of a unit load?
(ii) Explain the characteristics of an automated storage and retrieval system (AS/RS).
(iii) Explain the concept of computer integrated manufacturing systems (CIMS).
5. (i) 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* (preferably) or trial and error method 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

- (ii) What is the purpose of buffer design in flow lines? State the two buffering techniques that use decoupling for the purpose.
- (iii) State the two major costs involved in providing a buffer.

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?