Ref. No. : Ex/Che/HS/B/Mech/T/423/2024(S)

**B.E. CHEMICAL ENGINEERING FOURTH YEAR SECOND SEMESTER SUPPLEMENTARY EXAM– 2024**

**INDUSTRIAL MANAGEMENT**

Time: 3 hr | Full Marks: 100

**Answer any five questions**

1. Write short notes on (Any two): [10×2=20]

   a) Production Planning & Control (PPC) b) Maintenance Management

   c) Statistical Quality Control (SQC) d) Method Study e) Acceptance Sampling

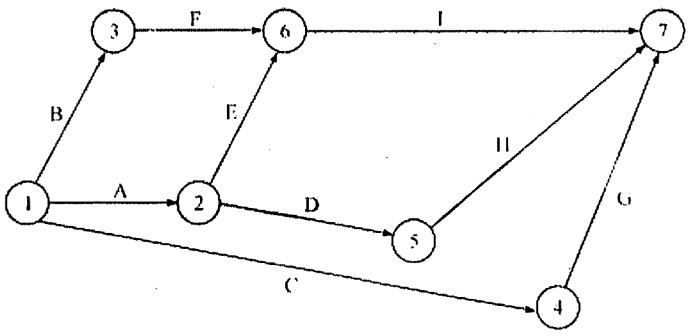
2. (a) The company XYZ has an annual demand of 4,000 units of an item. The cost of each item is Rs. 90/-. The cost of placing an order is Rs. 25/- and the inventory carrying cost is Rs. 9/- .Assume 250 working days per year. Determine
   i. EOQ
   ii. Optimal number of orders per year
   iii. The optimal order cycle time
   iv. Average inventory level if the EOQ is used.
   v. Total cost comprising total annual ordering cost and the carrying cost if the EOQ is used.

   (b) Derive the formula of the EOQ you use in part (a).

   (c) What is the purpose of the ABC classification system? [10 + 5 + 5]

3. The following network diagram represents activities associated with a project:

| Activities | A | B | C | D | E | F | G | H | I |
|---|---|---|---|---|---|---|---|---|---|
| Optimistic time, $t_0$ | 5 | 18 | 26 | 16 | 15 | 6 | 7 | 7 | 3 |
| Pessimistic time, $t_p$ | 10 | 22 | 40 | 20 | 25 | 12 | 12 | 9 | 5 |
| Most likely time, $t_m$ | 8 | 20 | 33 | 18 | 20 | 9 | 10 | 8 | 4 |




[ Turn over

Determine the following: (a) Expected completion time and variance of each activity (b) The earliest and latest expected completion times of each event. (c) The critical path. (d) The probability of expected completion time of the project if the original scheduled time of completing the project is 41.5 weeks. (e) The duration of the project that will have 95 per cent chance of being completed. (For standard normal $Z$=1.645, area under the standard normal curve from 0 to Z is 0.45) [20]

4. (a) Use the graphical method to solve the following linear programming problem:

$$\text{Maximize } z = 7x1 + 3x2$$
$$\text{subject to: } x1 + 2x2 \geq 3$$
$$x1 + x2 \leq 4$$
$$0 \leq x1 \leq 5/2$$
$$0 \leq x2 \leq 3/2$$
$$\text{and } x1, x2 \geq 0$$

(b) Determine an initial basic feasible solution to the following transportation problem by using Vogel's approximation method.

| | | Destination | | | | Supply |
|---|---|---|---|---|---|---|
| | | D1 | D2 | D3 | D4 | |
| Source | S1 | 1 | 5 | 1 | 1 | 40 |
| | S2 | 4 | 3 | 6 | 8 | 30 |
| | S3 | 3 | 2 | 5 | 9 | 40 |
| Demand | | 30 | 40 | 30 | 10 | |

[10+10]

5. (a) We are inspecting 25 successive wafers. Here, the wafer is the inspection unit. The observed number of defects are:

| Wafer Number | Number of Defects | Wafer Number | Number of Defects |
|---|---|---|---|
| 1 | 16 | 14 | 16 |
| 2 | 14 | 15 | 15 |
| 3 | 28 | 16 | 13 |
| 4 | 16 | 17 | 14 |
| 5 | 12 | 18 | 16 |
| 6 | 20 | 19 | 11 |
| 7 | 10 | 20 | 20 |
| 8 | 12 | 21 | 11 |
| 9 | 10 | 22 | 19 |

| | | | |
|---|---|---|---|
| 10 | 17 | 23 | 16 |
| 11 | 19 | 24 | 31 |
| 12 | 17 | 25 | 13 |
| 13 | 14 | | |

Draw the suitable control chart. Comment on whether the process is under control.

(b) What is the importance of a control chart? [12+8]

6. (a) What are the factors (both qualitative & quantitative) to be taken into account for determining a Plant/Facility location?

(b) Godavari Electric Ltd. wanted to set up a new plant for manufacturing industrial heaters. The management of Godavari Electricals identified Kakinada, Vijayavada, and Hyderabad as the potential areas to set up the plant. The fixed cost per year and the variable cost per heater at each of the three locations are given below:

| **Location** | **Fixed Cost/Yr** | **Variable Cost/Unit** |
|---|---|---|
| Kakinada | Rs 2,00,000 | 325 |
| Vijayavada | Rs 2,50,000 | 285 |
| Hyderabad | Rs 3,00,000 | 265 |

The product is expected to be sold at Rs 1050 and company hopes to sell 600 heaters per year. Calculate the likely profit each location and determine the most profitable location for the company.

(c) Differentiate between Plant Layout and Process Layout. [7+7+6]

7. The data on normal time, and cost and crash time and cost associated with a project are shown in the following table.

| *Activity* | *Normal* | | *Crash* | |
|---|---|---|---|---|
| | *Time(weeks)* | *Cost (Rs)* | *Time (weeks)* | *Cost (Rs)* |
| 1 – 2 | 3 | 300 | 2 | 400 |
| 2 – 3 | 3 | 30 | 3 | 30 |
| 2 – 4 | 7 | 420 | 5 | 580 |
| 2 – 5 | 9 | 720 | 7 | 810 |
| 3 – 5 | 5 | 250 | 4 | 300 |
| 4 – 5 | 0 | 0 | 0 | 0 |
| 5 – 6 | 6 | 320 | 4 | 410 |
| 6 – 7 | 4 | 400 | 3 | 470 |
| 6 – 8 | 13 | 780 | 10 | 900 |
| 7 – 8 | 10 | 1,000 | 9 | 1,200 |
| | | 4,220 | | |

Indirect cost is Rs 50 per week. (a) Draw the network diagram for the project and identify the critical path. (b) What are the normal project duration and associated cost? (c) Find out the total float associated with non-critical activities. (d) Crash the relevant activities and determine the optimal project completion time and cost. [20]