

GANPAT UNIVERSITY
B.TECH. SEM. VII MECHATRONIC ENGINEERING
REGULAR EXAMINATION NOV/DEC-2011 EXAMINATION
MC 704 OPERATION MANAGEMENT

Time: 3 Hrs]

[Total Marks: 70

Instructions:-

1. Attempt **all** Questions.
2. Figure to the **right** indicate full marks.
3. Answers to the two section must be written in **separate** drawing papers
4. Assume suitable data if **necessary**.
5. Draw neat sketch wherever essential.

SECTION - I

Q.1 (A) To product A and B are to be manufactured. One unit of product A requires 2.4 minutes of punch press time and 5 minutes of assembly time. The profit for product A is Rs. 0.60 per unit. One unit of product B requires 3 minutes of punch press time and 2.5 minutes of welding time. The profit for product B is Rs. 0.70 per unit. The capacity of the punch press dept., available for these products is 1200 minutes/week. The welding dept., has an idle capacity of 600 minutes/week and assembly dept., has 1500 minutes/week. Determine the quantities of the product A and B so that total profit is maximized. (4)

(B) Solve the following L.P problem by simplex method. (8)

$$Z \text{ (minimize)} = X_1 - 3X_2 + 3X_3$$

Subject to constrain

$$3X_1 - X_2 + 2X_3 \leq 7$$

$$2X_1 + 4X_2 \geq -12$$

$$-4X_1 + 3X_2 + 8X_3 \leq 10$$

And $X_1, X_2, X_3 \geq 0$

OR

Q.1 (A) A plant manufactures two products A and B. The profit contribution of each product has been estimated as Rs. 20 for product A and Rs. 24 for product B. Each product passes through three departments of the plant. The time required for each product and total time available in each department are as follows: (4)

| Department | Hours required | | Available hours during the month |
|------------|----------------|-----------|----------------------------------|
| | Product A | Product B | |
| 1 | 2 | 3 | 1500 |
| 2 | 3 | 2 | 1500 |
| 3 | 1 | 1 | 600 |

The company has a contract to supply at least 250 units of product B per month. Formulate the problem as an L.P model and solve by Graphical method.

- (B) An air force is experimenting with three types of bombs P, Q and R in which three kinds of explosives, viz. A, B and C will be used. Taking the various factors into account, it has been decided to use the maximum 600 kg of explosive A, at least 480 kg of explosive B and exactly 540 kg of explosive C. Bomb P requires 3, 2, 2 kg, bomb Q requires 1, 4, 3 kg and bomb R requires 4, 2, 3 kg explosives A, B and C respectively. Bomb P is estimated to give the equivalent of a 2 ton explosion, bomb Q, a 3 ton explosion and bomb R, a 4 ton explosion respectively. Under what production schedule can the air force make the biggest bang? Solve by Big-M method (8)

- Q.2 (A) There are 4 jobs each of which has to go through the machines M1, M2, ..., M6 in the order M1, M2, ..., M6. Processing times in minutes are given. Determine the sequence of these four jobs which minimize the total elapsed time and also find the idle time of M1, M2, ..., M6. (4)

| Job | Machine | | | | | |
|-----|---------|----|----|----|----|----|
| | M1 | M2 | M3 | M4 | M5 | M6 |
| A | 20 | 10 | 9 | 4 | 12 | 27 |
| B | 19 | 8 | 11 | 8 | 10 | 21 |
| C | 13 | 7 | 10 | 7 | 9 | 17 |
| D | 22 | 6 | 5 | 6 | 10 | 14 |

- (B) A departmental store wishes to purchase the following quantities of sarees: (8)

| | | | | | |
|------------------|-----|-----|----|-----|-----|
| Types of sarres: | A | B | C | D | E |
| Quantity : | 150 | 100 | 75 | 250 | 200 |

Tenders are submitted by four different manufacturers who undertake to supply not more than the quantities mentioned below (all types of sarees combined);

| | | | | |
|------------------|-----|-----|-----|-----|
| Manufacturers : | W | X | Y | Z |
| Total Quantity : | 300 | 250 | 150 | 200 |

| Manufacturer | Sarees | | | | |
|--------------|--------|-----|-----|-----|-----|
| | A | B | C | D | E |
| W | 275 | 350 | 425 | 225 | 150 |
| X | 300 | 325 | 450 | 175 | 100 |
| Y | 250 | 350 | 475 | 200 | 125 |
| Z | 325 | 275 | 400 | 250 | 175 |

How should the orders be placed optimally?

OR

- Q.2 (A) A salesman has to visit five cities A, B, C, D and E. The distances (in hundred km) between the five cities are as follows: (4)

| From City | To City | | | | |
|-----------|---------|----|----|----|----|
| | A | B | C | D | E |
| A | - | 17 | 16 | 18 | 14 |
| B | 17 | - | 18 | 15 | 16 |
| C | 16 | 18 | - | 19 | 17 |
| D | 18 | 15 | 19 | - | 18 |
| E | 14 | 16 | 17 | 18 | - |

If the salesman start from city A and has to come back to city A, which route should he select so that total distance travelled by him minimized?

- (B) A company has four manufacturing plants and five warehouses. Each plant manufactures the same product which is sold at different prices in each warehouse area. The cost of manufacturing and cost of raw materials are different in each plant due to various factors. The capacities of the plants are also different. The data are given in the following table: (8)

| Item | Plant | | | |
|---------------------------------|-------|-----|-----|----|
| | 1 | 2 | 3 | 4 |
| Manufacturing cost Rs. Per unit | 12 | 10 | 8 | 8 |
| Raw material cost Rs. Per unit | 8 | 7 | 7 | 5 |
| Capacity per unit time | 100 | 200 | 120 | 80 |

The company has five warehouses. The sale prices, transportation costs and demands are given in following table:

| Warehouse | Transportation Cost Rs. Per unit | | | | Sales price | Demand per unit (Rs) |
|-----------|----------------------------------|---|---|----|-------------|----------------------|
| | 1 | 2 | 3 | 4 | | |
| A | 4 | 7 | 4 | 3 | 30 | 80 |
| B | 8 | 9 | 7 | 8 | 32 | 120 |
| C | 2 | 7 | 6 | 10 | 28 | 150 |
| D | 10 | 7 | 5 | 8 | 34 | 70 |
| E | 2 | 5 | 8 | 9 | 30 | 90 |

- Formulate this problem as a transportation problem to maximize profit.
- Find the solution using VAM method.
- Test for optimality and find the optimal solution.

- Q.3 (A) The activities of a project are tabulated below with immediate predecessors and normal and crash time cost. (5)

| Activity | Immediate Predecessor | Normal | | Crash | |
|----------|-----------------------|------------|----------|------------|----------|
| | | Time(days) | Cost(Rs) | Time(days) | Cost(Rs) |
| A | - | 3 | 200 | 2 | 400 |
| B | - | 8 | 250 | 5 | 700 |
| C | - | 5 | 320 | 4 | 380 |
| D | A | 9 | 410 | 4 | 800 |
| E | C | 2 | 600 | 1 | 670 |
| F | B, E | 6 | 400 | 1 | 950 |
| G | B, E | 12 | 550 | 6 | 1000 |
| H | D | 11 | 300 | 9 | 400 |

Find:

- Draw the network and identify the critical path.
- What are the normal project duration and associated cost?
- Suitably crash the activities so that the normal duration may be reduced by 3 at minimum cost. Also find the project cost for this shortened duration if the indirect cost per day is Rs. 25.

- (B) A computer software company has broken down the process of integrating a computer system into its operation into several steps. Some of the steps cannot begin until other are completed, and these relationships are shown in the accompanying table. In addition, estimates of the most likely, optimistic, and pessimistic times required for each are listed below:

| Activity | Immediate predecessor | Expected time (weeks) | | |
|----------|-----------------------|-----------------------|-------------|-------------|
| | | Optimistic | Most likely | Pessimistic |
| A | - | 2 | 3 | 4 |
| B | - | 6 | 4 | 11 |
| C | A | 2 | 5 | 8 |
| D | A | 1.5 | 3.5 | 8.5 |
| E | B | 5 | 7 | 9 |
| F | B | 2 | 5.5 | 6 |
| G | C | 1.5 | 2.5 | 6.5 |
| H | C, D | 3 | 4 | 11 |
| I | G | 4 | 6 | 8 |
| J | H, E | 3 | 4.5 | 9 |
| K | F | 5 | 6 | 7 |
| L | I, J, K | 1 | 3 | 11 |

- Draw a PERT chart for this project, and calculate the critical path.
- By how much time activity F be delayed without delaying the project as whole?
- If labour costs Rs. 1500 per week find the probability that the labour costs for this project will exceed Rs. 36,000.
- Company wishes to budget an amount for labour costs that will be sufficient with 95 percent probability. How much should they budget?

SECTION – II

- Q.4 (A) Mention the reasons for keeping Inventory. (3)
- (B) What do you mean by Product Development? Explain the term “simplification” in detail. (4)
- (C) A firm producing paints, plans to use simple exponential smoothing to forecast weekly demand and has collected the past data for 15 weeks as shown below: (4)

| Week No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Actual demand | 30 | 35 | 20 | 15 | 10 | 10 | 15 | 20 | 30 | 35 | 30 | 10 | 12 | 20 | 30 |

Determine forecast for 15th week using simple moving average. Compute the forecast for 16th week using $\alpha=0.2$.

OR

- Q.4 (A) State the objectives of production planning and control. (3)
- (B) Define forecasting. Write the need of sales forecasting. Also discuss the basic elements of sales forecasting. (4)
- (C) A motor company requires 50000 units of a speedometer per year. The ordering, receiving and handling cost is Rs.3 per order, while inspection cost is Rs.12 per order. Interest cost Rs.0.06 per unit per year. Deterioration and obsolescence cost Rs.0.004 per unit per year. Storage cost Rs.1000 per year for 50000 units. (4)
- Calculate the following:
- EOQ
 - Reorder period
 - Number of order per year
 - Total variable cost of inventory

- Q.5 (A) Give the classification of production planning and control. Also discuss the active phase of PPC in detail. (4)
- (B) Define quality control. Explain the need of quality control in industry. (4)
- (C) Explain the following term: (4)
1. Delphi method
 2. Market survey
 3. Sales force estimate

OR

- Q.5 (A) Compare the following: (4)
1. Single sampling Vs Double sampling
 2. Job production Vs Batch production
- (B) Explain the control phase of production planning and control in detail. (4)
- (C) Describe the "EOQ model with stock out allowed". (4)
- Q.6 (A) A factory requires 18000 units per year, each costing Rs.27. The cost per order is Rs.150 and the inventory carrying charges working out to 20 percent of the average inventory. Find the economic order quantity and number of orders per year. (6)
- Would you accept a 2 percent discount on a minimum supply quantity of 1200 units? Compare the total cost in both the cases.
- (B) The following table gives the no. of errors in alignment observed at the final inspection of a certain model of a car. (4)

| | | | | | | | | | | | | | |
|--------------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Car no. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| No. of alignment defects | 7 | 6 | 6 | 7 | 4 | 7 | 8 | 12 | 9 | 9 | 8 | 5 | 5 |
| Car no. | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | |
| No. of alignment defects | 9 | 8 | 15 | 6 | 4 | 13 | 7 | 8 | 15 | 6 | 6 | 10 | |

Calculate control limits and draw suitable charts. Also comment on the result.

- (C) Compare sampling inspection and 100% inspection. (2)

BEST OF LUCK