(Following Paper ID and Roll No. to be filled in your Answer Book)

**PAPER ID : 2786**　Roll No. ☐☐☐☐☐☐☐☐☐☐☐

# B. Tech.

## (SEM. VII) THEORY EXAMINATION 2011–12

## OPERATIONS RESEARCH

*Time : 3 Hours*　　　　　　　　　　*Total Marks : 100*

**Note :**– Attempt **all** questions.

1. Attempt any **two** parts of the following :　　　(10×2=20)

(a) What is Operations Research ? Explain briefly the different phases of Operations Research and general method for solving Operations Research models.

(b) Obtain the dual of the following Linear Programming Problem and solve by Simplex Method :

$$\text{Min } Z = x_1 + x_2 + x_3$$

Subject to constraints

$$x_1 - 3x_2 + 4x_3 \geq 5$$
$$x_1 - 2x \geq 3$$
$$2x_2 - x_3 \geq 0$$
$$x_1, x_2, x_3 \geq 0$$

(c) A resourceful home decorator manufactures two types of lamps say A and B. Both the lamps go through two technicians, first a cutter and second a finisher.

Lamp A requires 2 hours of the cutters time and 1 hour of the finishers time. Lamp B requires 1 hour of cutters and 2 hours of finishers time. The cutter has 104 hours and finishers 76 hours of available time each month. Profit on one lamp A is Rs. 6.00 and one lamp B is Rs. 11.00. Assuming that he can sale all that he produces, how many of each type lamps should be manufactured to obtain the best return ? Use graphical method to solve and find the maximum profit.

2. Attempt any **two** parts of the following : **(10×2=20)**

(a) What is the difference between a Transportation and Assignment Problem ? Use Vogel's Approximations to find the initial possible solution of the following problem :–

Destination

| | | 1 | 2 | 3 | 4 | 5 | Supply |
|---|---|---|---|---|---|---|---|
| | 1 | 16 | 16 | 13 | 22 | 17 | 50 |
| Source | 2 | 14 | 14 | 13 | 19 | 15 | 60 |
| | 3 | 19 | 19 | 20 | 23 | 18 | 50 |
| | 4 | 21 | 21 | 30 | 18 | 20 | 50 |
| Demand | | 30 | 20 | 70 | 30 | 60 | |

(b) Define the mathematical formulation of the assignment problem. There are five jobs to be assigned, one each to 5 machines and the associated cost matrix is as follows :

Man

| | | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| | A | 11 | 17 | 8 | 16 | 20 |
| | B | 9 | 7 | 12 | 6 | 15 |
| Job | C | 13 | 16 | 15 | 12 | 16 |
| | D | 21 | 24 | 17 | 28 | 26 |
| | E | 14 | 10 | 12 | 11 | 15 |

(c) Find the order of processing that minimizes the total Elapsed time required to complete the following jobs :–

| Job | | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| Processing | $A_i$ | 2 | 5 | 4 | 3 | 2 | 1 |
| Time | $B_i$ | 6 | 8 | 1 | 2 | 3 | 5 |

3. Attempt any **two** parts of the following : **(10×2=20)**

(a) Write short notes on :
   (i) Minimal Spanning Tree Problem
   (ii) Maximum Flow Problem
   (iii) Minimum Cost Problem.

(b) Explain the following terms used in PERT :
   (i) Pessimistic Time

(ii) Optimistic Time

(iii) Most Likely time.

(c) The following table lists the activities of a maintenance project :–

| Activity | Duration in months |
|----------|--------------------|
| 1–2 | 2 |
| 1–3 | 2 |
| 1–4 | 1 |
| 2–5 | 4 |
| 3–6 | 5 |
| 3–7 | 8 |
| 4–7 | 3 |
| 5–8 | 1 |
| 6–8 | 4 |
| 7–9 | 5 |
| 8–9 | 3 |

(i) Draw the Project Network.

(ii) Find the critical path and duration of the project.

4. Attempt any **four** parts of the following : (5×4=20)

(a) Explain the terms : pure strategy, mixed strategy, saddle point, competitive games and payoff matrix.

(b) Solve the two people Zero sum game whose payoff matrix :

|            |     | Player B |     |     |
|------------|-----|----------|-----|-----|
|            |     | I        | II  | III |
| Player A   | I   | 15       | 2   | 3   |
|            | II  | 6        | 5   | 7   |
|            | III | –7       | 4   | 0   |

(c) Use Graphical Method to solve the game whose payoff matrix :

|          |    | Player B |    |     |    |
|----------|----|----------|----|-----|----|
|          |    | I        | II | III | IV |
| Player A | I  | 2        | 1  | 0   | –2 |
|          | II | 1        | 0  | 3   | 2  |

(d) Solve the following game whose payoff matrix :

Player B

|  |  | I | II | III | IV |
|---|---|---|---|---|---|
|  | I | 3 | 2 | 4 | 0 |
| Player A | II | 3 | 4 | 2 | 4 |
|  | III | 4 | 2 | 4 | 0 |
|  | IV | 0 | 4 | 0 | 8 |

(e) State some of the important distribution of arrival and service times.

(f) Discuss Queuing Models and give some important applications.

5. Attempt any **two** parts of the following :           (10×2=20)

(a) What is replacement ? Explain the different types of replacement models.

(b) The cost of machine is Rs. 6100/- and its scrap value is Rs. 100/-. The maintenance costs found from experience are as follows :

| Year | : | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| Costs in Rs. | : | 100 | 250 | 400 | 600 | 900 | 1200 | 1600 | 2000 |

When should the machine be replaced ?

(c) Derive Wilson's EOQ Formula. What are its practical limitations ?

A Precision engineering factory consumes 50,000 units of a component per year. The ordering receiving and handling costs are Rs. 3.00 per order while the trucking costs are Rs. 12.00 per order. Further details are as follows :

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 50,000 units, calculate the Economic Order Quantity.