

B. TECH.
(SEM VII) THEORY EXAMINATION 2022-23
OPERATIONS RESEARCH

Time: 3 Hours

Total Marks: 100

Note: Attempt all Sections. If you require any missing data, then choose suitably.

SECTION A

1. Attempt *all* questions in brief. 2x10 = 20

- (a) What are the steps involved in OR?
- (b) Write few limitations of Linear programming.
- (c) What is meant by optimality test in transportation problem?
- (d) Explain major difference between a transportation and assignment problems
- (e) What is critical path?
- (f) Explain the meaning of crashing in network technique
- (g) What are the limitations of Game Theory?
- (h) Explain the following queuing system (M/M/C):(∞/FIFO).
- (i) Differentiate between different costs involved in inventory problems.
- (j) What is group replacement?

SECTION B

2. Attempt any *three* of the following: 10x3 = 30

- (a) What are the advantages, limitations and applications of linear programming?
- (b) Solve the following transportation problem by VAM and then make optimality test by stepping stone method.

| | D ₁ | D ₂ | D ₃ | D ₄ |
|----------------|----------------|----------------|----------------|----------------|
| P ₁ | 19 | 30 | 50 | 12 |
| P ₂ | 70 | 30 | 40 | 60 |
| P ₃ | 40 | 10 | 60 | 20 |

- (c) Explain the following terms
 - (i) Total float
 - (ii) Interference float
 - (iii) Independent float
 - (iv) Free float
- (d) Even though there are several manufactures of scooters, two firms with brand names Prachi and Pavitra mainly market their scooters in western India. If both manufactures make changes in the model in the same year, then their respective market share remain constant. Likewise, if neither makes model changes, then also their market share remain constant. The payoff matrix in terms of increased/decreased % market share under possible conditions is given.

| Prachi | Pavitra | | |
|--------------|-----------|--------------|--------------|
| | No Change | Minor Change | Major Change |
| No Change | 0 | -4 | -10 |
| Minor Change | 3 | 0 | 5 |
| Major Change | 8 | 1 | 0 |

- (i) Find the value of the game.
- (ii) What change should Prachi consider if this information is available?

- (e) Renuka Fibre products limited produces a special fibre at the rate of 1000 meters per hour. The fibre is used in the other products made by Renuka at the rate of 40,000 metres per day (in the 8 hour day). The cost of fibre is Rs. 10 per metre. The inventory carrying cost is 25 percent and set up costs are Rs. 8100 per set-up. Compute the optimal number of cycles required in a year for the manufacture of this special fibre. Also calculate time between two orders and batch cycle time.

SECTION C

3. Attempt any one part of the following: 10x1 = 10

- (a) An airplane can carry a maximum of 200 passengers. A profit of Rs. 400 is made on each first class ticket and a profit of Rs. 300 on each economy class ticket. The airlines reserves at least 20 seats for first class. However at least 4 times as many passengers prefer to travel by economy class than by the first class. Determine how many of each type of tickets must be sold to maximize the profit of the airlines? What is the maximum profit?
- (b) Use simplex method to solve the following linear programming problem
 Maximize $Z = 6X_1 + 4X_2$
 Subject to $2X_1 + 3X_2 \leq 30$
 $3X_1 + 2X_2 \leq 24$
 $X_1 + X_2 \geq 3$
 $X_1, X_2 \geq 0$

4. Attempt any one part of the following: 10x1 = 10

- (a) Define a transportation problem. Briefly describe the steps of the Vogel's approximation method to obtain an initial basic feasible solution.
- (b) There are four machines and four operators. Operator 1 charges Rs. 6, 7, 7 and 8 on machines I, II, III and IV respectively. Operator 2 charges Rs. 7, 8, 9 and 7, operator 3 charges Rs. 8, 6, 7 and 6, and operator 4 charges Rs. 8, 7, 6 and 9 respectively. Assign one operator to one machine so that overall payment is minimum.

5. Attempt any one part of the following: 10x1 = 10

- (a) A small assembly plant assembles PC's through 9 interlinked activities. The time duration for which is given below:

| Activity | 1-2 | 1-3 | 1-4 | 2-5 | 3-6 | 3-7 | 4-6 | 5-8 | 6-9 | 7-8 | 8-9 |
|-----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Duration (hrs.) | 2 | 2 | 1 | 4 | 8 | 5 | 3 | 1 | 5 | 4 | 3 |

- (i) Draw a network diagram for it.
 (ii) Find the critical path and its duration.
- (b) What is PERT? Define optimistic time, pessimistic time and most likely time and explain how you will estimate the expected time to complete the activity in PERT technique.

6. Attempt any one part of the following: 10x1 = 10

- (a) Explain the graphical method of solving $2 \times n$ and $m \times 2$ games.
- (b) In a factory cafeteria the customers have to pass through 3 counters, They buy coupons at the first counter, select and collect the snacks at the second counter and collect tea at the third. The server at each counter takes on an average 1.5 minutes although the distribution of service time is approximately exponential. If the arrival of customers to the cafeteria is approximately Poisson at an average rate of 6/hr, calculate
 - (i) the average time a customer spends waiting in the cafeteria
 - (ii) the average time of getting the service
 - (iii) the most probable time in getting the service.

7. Attempt any one part of the following: 10x1 = 10

- (a) Derive EOQ formula for the manufacturing model without shortages.
- (b) The initial cost of an item is Rs. 15000 and maintenance and running costs (in Rs) for different years are given below:

| Year | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|--------------|------|------|------|------|------|------|-------|
| Running cost | 2500 | 3000 | 4000 | 5000 | 6500 | 8000 | 10000 |

What is the replacement policy to be adopted if the capital is worth 10% and there is no salvage value?

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