M.Sc. DEGREE EXAMINATION,NOVEMBER 2018
II Year III Semester
Core Elective
OPERATIONS RESREARCH

Time : 3 Hours **Max.marks :75**

Section A $(10 \times 2 = 20)$ Marks

Answer any **TEN** questions

1. What is dynamic programming?
2. State Bellman's principle of optimality.
3. What is decision tree?
4. Explain the difference between risk and uncertainity.
5. What are the costs involved in inventory?
6. Define Lead time.
7. Define Balking and Reneging.
8. Define Transient State and Steady State.
9. What are called Stationary points.
10. What is quadratic programming?
11. State Baye's theorem.
12. Customer arrives at the firstclass ticket counter of a theatre at a rate of 12 per hour. There is one clerk serving the customer at the rate of 30 per hour. What is the probability that there are more than 2 customers in the counter.

Section B $(5 \times 5 = 25)$ Marks

Answer any **FIVE** questions

13. Define the following dynamic programming terms:

    (a) Stage (b) State (c) State Variable (d) return function (e) State Transformation function.

14. Suppose a company can produce any number of the products A,B and C and the pay-offs under different states of nature for demand, good,fair and poor are known.

States of Nature

Product	Good	Fair	Poor
A	7,00,000	3,00,000	1,50,000
B	5,00,000	4,50,000	0
C	3,00,000	3,00,000	3,00,000

Decide the best course of action according to (i) Maximax criterion (ii) Maximin criterion (iii) Minimax regret criterion (iv) Laplace criterion.

15. The production department of a company requires 3,600kg of raw material for manufacturing a particular item per year. It has been estimated that the cost of placing an order is Rs.36 and the cost of carrying inventory is 25 per cent of the investment in the inventories. The price is Rs.10 per kg.Determine an ordering policy for raw material.

16. Customers arrive at a one-window drive-in bank according to a Poisson distribution with mean of 10 per hour. Service time per customer is exponential with a mean of 5 minutes. The space in front of the window, including that for the serviced car, can accommodate a maximum of 3 cars. The other cars can wait outside this space.

    a. What is the probability that an arriving customer can drive directly to the space in front of the window?

    b. What is the probability that an arriving customer will have to wait outside the indicated space?

    c. How long is an arriving customer expected to wait before starting service?

17. A firm has a total revenue function, $R = 20x - 2x^2$, and a total cost function, $C = x^2 - 4x + 20$ where x represents the quantity. Find the revenue maximizing output level and the corresponding value at profit, price and total revenue.

18. A Contractor has to supply 10,000 bearings per day to an automobile manufacturer. He finds that when he starts production run, he can produce 25,000 bearings per day. The cost of holding a bearing in stock for a year is Rs.200 and the set-up cost of a production run is Rs.1,800. How frequently should production run be made?

19. The probability of demand for hiring cars on any day in a given city is as follows:

Number of cars demanded	0	1	2	3	4
Probability	0.1	0.2	0.3	0.2	0.2

    Cars have a fixed cost of Rs.90 each day to keep the daily hire charges (variable costs of running) Rs.200. If the car-hire company owns 4 cars, what is its daily expectation? If the company is about to go into business and currently has no car, how many cars should it buy?

Section C $(3 \times 10 = 30)$ Marks

Answer any **THREE** questions

20. Use dynamic programming to solve the following linear programming problem.

    Maximize$Z = 3x_1 + 5x_2$

    subject to the constraints

    (a) $x_1 \leq 4$ (b) $x_2 \leq 6$ (c) $3x_1 + 2x_2 \leq 18$ and $x_1, x_2 \geq 0$

21. A toy manufacturer is considering a project of manufacturing a dancing doll with three different movement designs. The doll will be sold at an average of Rs.10. The first movement design using 'gears and levels' will provide the lowest tooling and set up cost of Rs.1,00,000 and Rs.5 per unit of variable cost. A Second design with spring action will have a fixed cost of Rs.1, 60,000 and variable cost of Rs.4 per unit. Yet another design with weights and pulleys will have a fixed cost of Rs.3, 00,000 and variable cost Rs.3 per unit. The demand events that can occur for the doll and the probability of their occurrence is given below:

	Demand (units)	Probability
Light demand	25,000	0.10
Moderate demand	1,00,000	0.70
Heavy demand	1,50,000	0.20

a. Construct a payoff table for the above project.

b. Which is the optimum design?

c. How much can the decision-maker afford to pay in order to obtain perfect information about the demand?

22. (a) A product is sold at the rate of 50 pieces per day and is manufactured at a rate of 250 pieces per day. The set-up cost of the machines is Rs.2, 000 and the storage cost is found to be Rs.0.15 per piece per day. With labour charges of Rs.3.20 per piece, material cost at Rs.2.10 per piece and overhead cost of Rs.4.10 per piece, find the minimum cost batch size if the interest charges are 8 percent(assume 300 working days in a year). Compute the optimal number of cycles required in a year for manufacturing of this product.

(b) The demand for an item in a company is 18,000 units per year, and the company can produce the item at a rate of Rs.3, 000 per month. The cost of one set-up is Rs.500 and the holding cost of one unit per month is 15 paise. The shortage cost of one unit is Ra.240 per year. Determine the optimum manufacturing quantity and the number of shortages. Also determine the manufacturing time and the time between set-ups.

23. If the arrivals are completely random, then prove that the probability distribution of number of arrivals in a fixed time interval follows a Poisson distribution.

24. Use Wolfe's method to solve the quadratic programming problem:

Maximize $Z = 4x_1 + 6x_2 - 2x_1^2 - 2x_1x_2 - 2x_2^2$

subject to the constraint $x_1 + 2x_2 \leq 2$ and $x_1, x_2 \geq 0$