

**M.E. PRODUCTION ENGINEERING FIRST YEAR FIRST SEMESTER EXAM 2025
ADVANCES IN OPERATIONS RESEARCH**

Answer any five questions)

- 1.(a) What is a two-person zero-sum game? State the assumptions of a two-person zero-sum game. Define saddle point. What is a fair game? (2+4+2+2)
- (b) Obtain the optimal strategies for both players and the value of the game for two-person zero-sum game whose payoff matrix is given below: (10)

Player B	I	II	III	IV	V
Player A					
I	2	-1	5	-2	6
II	-2	4	-3	1	0

- 2.(a) Consider a certain community in a well-defined area with three types of grocery stores; for simplicity we shall call them I, II and III. Within this community (we assume that the population is fixed), there always exists a shift of customers from one grocery store to another. A study was made on January 1st and it was found that 1/4 shopped at store I, 1/3 store II, and 5/12 at store III. Each month store I retains 90% of its customers, and losses 10% of them to store II. Store II retains 80% of its customers, and loses 10% of them to store I and 10% to store III. Store III retains 40% of its customers and loses 50% of them to store I and 10% to store II.
- (i) What proportion of customers would each store retain by February 1st and March 1st?
- (ii) Assuming that the same pattern continues, what would be the long-run distribution of customers among the three stores? (15)
- (b) Differentiate binary-coded and real-coded genetic algorithm. (5)
- 3.(a) With a proper flowchart, describe the procedural steps of Genetic Algorithm. (8)
- (b) Using the Interval Halving method, solve the following NLP problem:
Minimize $f(x) = x(2x - 7)$ in the interval (0, 4.00) within 10% of the exact value. (12)
- 4.(a) Using dynamic programming method, solve the following LP problem: (10)
Maximize $z = 2x_1 + 7x_2$
Subject to $x_1 \leq 4$
 $x_2 \leq 5$
 $2x_1 + 3x_2 \leq 6$
 $x_1, x_2 \geq 0$
- (b) Maximize $f(x) = x/2$ for $x \leq 3$
 $= -x + 3$ for $x > 3$
in the interval (0,8) using Fibonacci search method with $N = 6$. (10)
- 5.(a) Solve the following problem by geometric programming method: (10)
Minimize $Z = 3x_1x_2^{-1}x_3^3 + 2x_1^{-2}x_3^{-2} + 20x_3^2 + 4x_1^{-2}x_2x_3^{-3}$, $x_1, x_2, x_3 > 0$
- (b) Describe the procedural steps of simulated annealing. How it differs from genetic algorithm? (6+4)
- 6.(a) A manufacturer of toys makes two types of toys, A and B. Processing of these two toys is done on two machines X and Y. Toy A requires two hours on machine X and six hours on machine Y. Toy B requires four hours on machine X and five hours on machine Y. There are 16 hours of time per day available on machine X and 30 hours on machine Y. The profit obtained on selling these two types of toys is Rs. 3 and Rs. 7 respectively. What should be the daily production of each of the two toys? (A non-integer solution for this problem will not be accepted). (14)
- (b) With practical examples, state how integer programming problems can be classified. (6)
- 7.(a) Describe the procedural steps of dichotomous search method in non-linear programming. (10)
- (b) What is a dual problem? How it relates to a primal problem? With illustration, describe how a primal problem can be converted into a dual problem? (2+4+4)