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S. No. of Question Paper : **3069**

Unique Paper Code : **2362572401**

Name of the Paper : **Optimization Techniques**

Name of the Course : **B.Sc. (Programme) Mathematical Science/
B.A. (Programme)**

Semester : **IV**

Duration : **3 Hours**

Maximum Marks : **90**

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt any *five* questions.

All questions carry equal marks.

Use of non-programmable calculator is allowed.

1. (a) Explain the economic applications of unconstrained optimization in business decision-making. 8

(b) Use the gradient search method to minimization the following function : 10

$$f(x_1, x_2) = 3x_1^2 + 2x_2^2 + 4x_1 - 4x_1x_2 - 6 \text{ over } (x_1, x_2) \in \mathbb{R}^2.$$

2. (a) Determine the local maximum or minimum point of the given problem : 8

$$f(x_1, x_2, x_3) = -x_1^2 - 2x_1x_2 - 2x_2 - x_3^2$$

P.T.O.

(b) Test the definiteness of the following matrices :

10

$$(i) \begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix},$$

$$(ii) \begin{bmatrix} 1 & 2 & 1 \\ 2 & 4 & 2 \\ 1 & 2 & 1 \end{bmatrix}.$$

3. (a) Define Convex and Concave functions and show graphically how they determine Maxima and Minima of a given function. 8

(b). Check whether the following functions are convex, concave or neither using Hessian matrix : 10

$$(i) f(x_1, x_2) = 4x_1^3 - 12x_2^2,$$

$$(ii) f(x_1, x_2) = 2x_1^2 + 1.5x_2^2 + 2x_1x_2 + 7x_1 + 8x_2 + 24.$$

4. (a) What is goal programming and how is it different from Linear Programming? What are the different types of goal programming problems ? 8

(b) Formulate the following goal programming and solve it using graphical method. Ogilvy has a new advertising agency with 10 employees; it has received a contract to promote a new product. The agency can advertise by radio and television. The following table provides data about the number of people reached by each type of advertisement and the cost and manpower requirements.

	Data/min advertisement	
	Radio	Television
Exposure (in thousands of persons)	4	8
Cost (in thousands of Rupees)	8	1
Assigned employees	1	2

The contract prohibits Ogilvy from using more than 6 minutes of radio advertisement. Additionally, radio and television advertisement need to reach at least 45,000 people. Ogilvy has set a budget goal of Rs. 1,00,000 for the project. How many minutes of radio and television minutes should Ogilvy use, its management assumes that the exposure goal is twice as important as the budget goal. 10

5. Solve the following goal programming problem by using modified simplex method : 18

$$\text{Minimize } Z = P_1 d_1^- + P_2 d_4^+ + 5P_3 d_2^- + 3P_3 d_3^- + P_4 d_1^+$$

Subject to

$$x_1 + x_2 + d_1^- - d_1^+ = 80$$

$$x_1 + d_2^- = 70$$

$$x_2 + d_3^- = 45$$

$$d_1^+ + d_4^- - d_4^+ = 10$$

$$x_1, x_2, d_1^-, d_2^-, d_3^-, d_1^+, d_4^-, d_4^+ \geq 0$$

P.T.O.

6. (a) Define an Integer Linear Programming Problem (ILPP). Explain its characteristics and how it differs from a Linear Programming Problem ? 10
- (b) A tailor makes wool tweed sport coats and wool slacks. He is able to get a shipment of 150 square yards of wool cloth from Scotland each month to make coats and slacks, and he has 200 hours of his own labour to make them each month. A coat requires 3 square yards of wool and 10 hours to make, and a pair of pants requires 5 square yards of wool and 4 hours to make. He earns \$50 in profit from each coat he makes and \$40 from each pair of slacks. He wants to know how many coats and slacks to produce to maximize profit. Formulate an integer linear programming model for this problem. 8
7. (a) Discuss the advantages and disadvantages of ILPP. 8
- (b) Use Branch and Bound method to solve the following integer programming problem :

$$\text{Max} \quad Z = 2x_1 + 3x_2$$

$$\text{Subject to} \quad 6x_1 + 5x_2 \leq 25$$

$$x_1 + 3x_2 \leq 10$$

$$x_1 \geq 0, x_2 \geq 0 \text{ and are integers.}$$

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