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**SUBJECT CODE NO:- H-1751**  
**FACULTY OF SCIENCE AND TECHNOLOGY**  
**M.E. (Mechanical)**  
**Advanced Optimization Techniques**  
**(REVISED)**

[Time: Three Hours]

[Max. Marks: 80]

Please check whether you have got the right question paper.

- N.B
1. Solve any three questions from each section.
  2. Figure to right indicates full marks.
  3. Assume suitable data if required and state it clearly
  4. Use of non-programmable calculator is allowed.

**Section A**

- Q.1 Use Fibonacci search method to solve. 13  
 Minimize  $f(X) = X^2 + 54/X$  within bounds (0,5)
- Q.2 Find the minimum of  $f = X(X - 3/2)$  in the interval (0,1) to within 10% of the exact value using Interval Halving method. 13
- Q.3 Minimize  $f(X) = X_1^2 + X_2^2 + X_3^2 + 40X_1 + 20X_2$  13  
 Subject to,  
 $g_1(X) = X_1 - 50 \geq 0$   
 $g_2(X) = X_1 + X_2 - 100 \geq 0$   
 $g_3(X) = X_1 + X_2 + X_3 - 150 \geq 0$   
 Determine whether Kuhn-Tucker conditions are satisfied at the optimum point.
- Q.4 Minimize  $f(X_1, X_2) = X_1 - X_2 + 2X_1^2 + 2X_1X_2 + X_2^2$  starting from the point  $X_1 = \{0\}$  using Cauchy method. 13
- Q.5 Write a short note on (Any Two) 14  
 a) Constrained optimization  
 b) Optimality criteria  
 c) Single variable optimization.

**Section B**

- Q.6 Use two phase simplex method to 13  
 Maximize  $Z = 3x_1 + 2x_2 + 2x_3$   
 Subjected to,  
 $5x_1 + 7x_2 + 4x_3 \leq 7$   
 $-4x_1 + 7x_2 + 5x_3 \geq -2$   
 $3x_1 + 4x_2 - 6x_3 \geq 29/7$   
 $X_1, X_2, X_3 \geq 0$

- Q.7 Use charms penalty methods to  
 Maximize  $Z = 3x_1 - x_2$   
 Subjected to,  
 $2x_1 + x_2 \geq 2$   
 $x_1 + 3x_2 \leq 3$   
 $x_1 \leq 4; x_1, x_2 \geq 0$  13
- Q.8 It has been decided to shift grain from a ware house to factory in an open rectangular box of length  $X_1$  meters, width  $X_2$  meters and height  $X_3$  meters. The bottom, sides and the end of the box cost respectively Rs. 80, Rs. 10 and Rs, 20/m<sup>2</sup>. It cost Rs 1 for each round trip of the box. Assuming that the box will no salvage value, find the minimum cost of transporting 80 m<sup>3</sup> of grain. 13
- Q.9 a) Describe simulated annealing in your own words 07  
 b) Genetic Algorithm for optimization 06
- Q.10 Write a short note on (Any Two) 14  
 a) Global optimization  
 b) Sensitivity Analysis for NLP  
 c) Simplex algorithm.