JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech IV Year II Semester Examinations, July - 2021
OPTIMIZATION TECHNIQUES IN ENGINEERING
(Mechanical Engineerng)

Time: 3 hours
Max. Marks: 75

Answer any Five Questions
All Questions Carry Equal Marks
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1. Find the minimum of the function $f = \lambda^5 - 5\lambda^3 - 20\lambda + 5$ by the following methods
   a) Fibonacci search in the interval (0, 5)
   b) Golden section method in the interval (0, 5)   [7+8]

2. Minimize $f(x_1, x_2) = x_1 - x_2 + 2 x_1^2 + 2 x_1 x_2 + x_2^2$ starting from the point $x_1 = \begin{Bmatrix} 0 \\ 0 \end{Bmatrix}$ using Fletcher
   Reeves method?   [15]

3. Maximize $f(x) = 6x_1 + 8x_2$
   Subjected to
   $$5x_1 + 10 x_2 \leq 60$$
   $$4x_1 + 4 x_2 \leq 40$$
   $$x_1, \ x_2 \geq 0$$

   Conduct the sensitivity analysis under the following conditions:
   a) Check whether the addition of the constraint $7x_1 + 2x_2 \leq 65$, affects the optimality. If it does, find the new optimum solution.
   b) Check whether the addition of the constraint $6x_1 + 3x_2 \leq 48$ affects the optimality. If it does, find the new optimum solution.   [7+8]

4. Solve the following linear programming problem using the branch and bound method
   Maximize
   $$f(x) = 3 x_1 + 4 x_2$$
   Subjected to
   $$7 x_1 + 11 x_2 \leq 88$$
   $$3 x_1 - x_2 \leq 12$$
   $$x_1, \ x_2 \geq 0, \ x_1, \ x_2 \text{ are integers}$$ [15]

5. Minimize the following function $f(x) = x_1 x_2 x_3^{-2} + 2x_1^{-1} x_2^{-1} x_3 + 5x_2 + 3x_1 x_2^{-2}$ using Geometric
   Programming x_1 and $x_2 > 0$.   [15]

6.a) Explain working principle of genetics algorithm.
   b) Discuss about particle swarm optimization in brief?   [9+6]

7. Given the following LP model, introduce slack, surplus and artificial variables to form an equivalent problem that can be presented to the simplex method to obtain an optimal solution

$$\text{Maximize} \quad Z = 3x_1 + 2x_2 + 8x_3$$
$$\text{Subjected to} \quad 4x_1 - 3x_2 + 12x_3 \geq 12$$
$$x_1 + 4x_3 \leq 6$$
$$x_1 - x_3 = 2 \quad \text{and } x_1 \geq 0 \qquad [15]$$

8.a) Explain the types of simulation models and its applications.
  b) Write about stochastic linear programming.   [8+7]

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