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Code No: 138GM

R16

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech IV Year II Semester Examinations, July - 2021

OPTIMIZATION TECHNIQUES IN ENGINEERING

(Mechanical Engineering)

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Time: 3 hours

Max. Marks: 75

Answer any Five Questions
All Questions Carry Equal Marks

AG 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 $f(x_1, x_2) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$ starting from the point $x_1 = \begin{Bmatrix} 0 \\ 0 \end{Bmatrix}$ using Fletcher
Reeves method? [15]

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

Conduct the sensitivity analysis under the following conditions:

AG 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

AG AG Subjected to $f(x) = 3x_1 + 4x_2$
 $7x_1 + 11x_2 \leq 88$
 $3x_1 - x_2 \leq 12$
 $x_1, x_2 \geq 0, x_1, x_2$ are integers [15]

5. Minimize the following function $f(x) = x_1x_2x_3^{-2} + 2x_1^{-1}x_2^{-1}x_3 + 5x_2 + 3x_1x_2^{-2}$ using Geometric
Programming x_1 and $x_2 > 0$. [15]

AG 6.a) Explain working principle of genetics algorithm. [15]
b) Discuss about particle swarm optimization in brief? [9+6]

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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

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$$\begin{aligned} \text{Maximize } Z &= 3x_1 + 2x_2 + 8x_3 \\ \text{Subjected to } &4x_1 - 3x_2 + 12x_3 \geq 12 \\ &x_1 + 4x_3 \leq 6 \\ &x_1 - x_3 = 2 \quad \text{and } x_1 \geq 0 \end{aligned}$$

[15]

- 8.a) Explain the types of simulation models and its applications.

- b) Write about stochastic linear programming.

[8+7]

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