

Ref No:

Ex/PG/ELE/PC/T/112C/2025

**M.E. ELECTRICAL ENGINEERING FIRST YEAR FIRST SEMESTER
EXAM 2025**

SUBJECT: - OPTIMIZATION TECHNIQUES

Full Marks: 100

Time: Three hours

Use a separate Answer-Script for each part

(34 marks for this part)

No. of Questions	PART - I (two mark reserved for well-organized answers)	Marks																													
(1)	With the help of a suitable example explain the steps to be followed in solving an optimization problem using Genetic Algorithm. Also explain, how Crossover and Mutation operations may be performed in real coded Genetic Algorithm.	(16)																													
(2)	A-four person's four jobs assignment problem is given in the following matrix, where the matrix-elements represent the time taken by a person to perform a job. Solve the problem using the Branch and Bound algorithm following the restriction that each person can be assigned only one job. Explain the role of 'Branching' and 'Bounding' in this technique. <table><tr><th rowspan="2">Persons</th><th colspan="4">Jobs</th></tr><tr><th>1</th><th>2</th><th>3</th><th>4</th></tr><tr><td>A</td><td>2</td><td>10</td><td>9</td><td>7</td></tr><tr><td>B</td><td>15</td><td>4</td><td>14</td><td>8</td></tr><tr><td>C</td><td>13</td><td>14</td><td>16</td><td>11</td></tr><tr><td>D</td><td>4</td><td>15</td><td>13</td><td>9</td></tr></table>	Persons	Jobs				1	2	3	4	A	2	10	9	7	B	15	4	14	8	C	13	14	16	11	D	4	15	13	9	(16)
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No. of Questions	PART - II Answer Question No. 1 and <i>any one</i> from the rest	Marks
1) (a)	Find the extreme points of the following function and also determine their nature $f(x_1, x_2) = 2x_1^3 + 3x_2^3 + 5x_1^2 + 6x_2^2 + 10$ Also write down the necessary and sufficient conditions you have applied to solve the problem.	(6+4)
(b)	Show that the direction opposite to that of the gradient vector of a function is the steepest descent direction. Write down the computational steps of Steepest Descent method. What is the major drawback of this method?	(8)
2) (a)	What are the major drawbacks of Newton's method of optimization? Discuss how Quasi-Newton method overcomes those drawbacks.	(10)
(b)	Write down the computational steps of Davidon- Fletcher- Powell method.	(5)
3) (a)	Find the extreme point and its nature for the following function using the method of Lagrangian Multiplier $f(x_1, x_2) = 3x_1 + 2x_2 + 15$ subject to the constraint $2x_1 + x_2^2 = 5$	(8)
(b)	Starting from the point (0,0) show two steps of iteration of the Steepest Descent method for finding the minimum point of the following function $f(x_1, x_2) = x_1^2 + 2x_2^2 + 3x_1x_2 - x_1 + x_2$	(7)

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No. of Questions	PART - III Answer any two (one mark reserved for well-organized answers)	Marks
1)	(a) Describe the working principle and characteristics of Linear programming problem. In this regard also explain the motivation behind the SIMPLEX method of Linear programming problem. (b) Draw and explain the flowchart of solving the linear programming problem using the SIMPLEX method.	(4+4) (8)
2)	Using the SIMPLEX method of solving a linear programming problem solve the following problem: Minimize $f = 2x_1 + 3x_2 + 2x_3 - x_4 + x_5$ subject to the constraints $3x_1 - 3x_2 + 4x_3 + 2x_4 - x_5 = 0$ $x_1 + x_2 + x_3 + 3x_4 + x_5 = 2$ and $x_i \geq 0, i = 1 \text{ to } 5$ Also, comment on the solution so obtained.	(16)
3)	Consider the following problem: Maximize $f = 2x_1 + 5x_2 + 3x_3$ subject to the constraints $x_1 - 2x_2 + x_3 \geq 20$ $2x_1 + 4x_2 + x_3 = 50$ and $x_1 \geq 0, x_2 \geq 0, x_3 \geq 0$ Use the simplex method step by step to solve the problem	(16)