Ref No:

Ex/PG/EE/T/116A/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

(33 marks for this part)

No. of Questions	PART – I Answer any two (one mark reserved for well-organized answers)	Marks
(1)	With the help of a suitable example explain the steps to be followed in solving a Travelling salesman problem using Genetic Algorithm. Also explain, how Crossover and Mutation operations may be performed in real coded Genetic Algorithm.	(16)
(2)	Explain, how Branch and Bound technique may be used to solve an assignment problem.	(16)
(3)	With the help of a suitable example explain how nonlinear Simplex method works through the application of its basic operators namely reflection, expansion and contraction.	(16)

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No. of Questions	PART - II Answer Question No. 1 and *any one* from the rest	Marks
1) (a)	Find the extreme points of the following function and also determine their nature $f(x_1,x_2) = x_1^3+2x_2^3+3x_1^2+5x_2^2+15$ Also write down the necessary and sufficient conditions you have applied to solve the problem.	(6+4)
(b)	Discuss how Quasi-Newton method overcomes the drawbacks of Newton's method of optimization.	(7)
2) (a)	Show that the direction opposite to that of the gradient vector of a function is the steepest descent direction.	(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: $f(x_1,x_2) = 3x_1^2+2x_2^2+x_1x_2-2x_1+x_2$	(8)
3) (a)	Derive the necessary condition for a point to be an extreme point of the function $f(x_1,x_2)$ subject to the equality constraint $g(x_1,x_2)=0$. Therefrom define the term 'Lagrangian Multiplier' and discuss its significance in optimization problem in presence of equality constraint.	(8)
(b)	Find the extreme point and its nature for the following function using the method of Lagrangian Multiplier $f(x_1,x_2) = 3x_1+4x_2+10$ subject to the constraint $2x_1+3x_2^2=5$	(8)

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No. of Questions	PART - III Answer any two (two mark reserved for well-organized answers)	Marks
(1)	Explain Linear programming problem and its characteristics. Also explain with a proper flowchart how optimal solution of a Linear Programming problem is obtained by SIMPLEX algorithm.	(16)
(2)	Use the graphical method to solve the problem: Maximize $Z = 2x_1 + x_2$ Subject to $x_2 \le 10$ $2x_1 + 5x_2 \le 60$ $x_1 + x_2 \le 18$ $3x_1 + x_2 \le 44$ $and\ x_1 \ge 0,\ x_2 \ge 0.$ Also find the solution of the problem described above using the SIMPLEX method.	(16)
(3)	In the following problem use the simplex method of Linear Programming to show that the function Z is unbounded. *Maximize* $Z = 5x_1 + x_2 + 3x_3 + 4x_4$ *subject to* $x_1 - 2x_2 + 4x_3 + 3x_4 \le 20$ $-4x_1 + 6x_2 + 5x_3 - 4x_4 \le 40$ $2x_1 - 3x_2 + 3x_3 + 8x_4 \le 50$ $and\ x_1 \ge 0,\ x_2 \ge 0,\ x_3 \ge 0,\ x_4 \ge 0.$	(16)