

GUJARAT TECHNOLOGICAL UNIVERSITY**BE- SEMESTER-V (NEW) EXAMINATION – WINTER 2024****Subject Code:3154201****Date:25-11-2024****Subject Name:Optimization Techniques****Time:10:30 AM TO 01:00 PM****Total Marks:70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

		Marks
Q.1	(a) Describe any six technical uses of optimization.	03
	(b) Discuss Constraint Surface and Objective Function.	04
	(c) Define local maxima, minima & global maxima minima for single & multivariable real valued functions. Also state the necessary and sufficient condition for the maxima & minima of multivariable function $F(\bar{X}) = f(x_1, x_2, \dots, x_n)$.	07
Q.2	(a) Find the local & global maxima minima for the single variable function $f(x) = 3x^4 + 4x^3 - 12x^2 + 12$.	03
	(b) Find the extreme values of function of two variables $f(x, y) = x^3 + 3xy^2 - 15x^2 - 15y^2 + 72x$	04
	(c) Formulate optimization problem mathematically “A rectangular box open at the top is to have a volume of 32 cubic units. Find the dimensions of the box requiring least material for its construction.” Also solve it using Hessian matrix optimization criteria.	07
	OR	
	(c) Solve the Linear programming problem by simplex method Max $Z = 32x_1 + 26x_2$ Subject to $x_1 + 2x_2 \leq 10$ & $x_1 + x_2 \leq 6$ $x_1, x_2 \geq 0$	07
Q.3	(a) Define & explain Unimodal Function with suitable example.	03
	(b) Explain the Newton Raphson method for finding direct roots of an equation.	04
	(c) Solve the Linear programming problem by Penalty Method Max $Z = 3x_1 + 2x_2$ Subject to $x_1 + x_2 \leq 4$ & $x_1 - x_2 \geq 2$ $x_1, x_2 \geq 0$	07
	OR	
Q.3	(a) Maximize the function using Exhaustive search method $f(x) = x^2 + \frac{54}{x}$ on $[0,5]$ by dividing interval in to 10 parts.	03
	(b) Explain the Dichotomous search method for Minimization with suitable example.	04
	(c) Slove the non-linear minimization problem by Univariate method Minimize $f(x_1, x_2) = 2x_1^2 + x_2^2$ starting from point $X_1 = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$.	07
Q.4	(a) Explain Interval Halving search method minima.	03
	(b) Draw the flow chart of Powell's conjugate search method.	04

- (c) Using Golden section search method find approx. minimum value of $f(x) = x^2 - 2.6x + 2$ on $[-2,3]$ up to six iterations **07**

OR

- Q.4** (a) What is Neural-Network based Optimization? Give the name any three Neural-Network based Optimization. **03**

- (b) Using Fibonacci search method find approx. minimum value of $f(x) = x^2$ on $[-5,1]$ for $n = 4$. **04**

- (c) Explain Hooke's and Jeeves' direct search method in detail. **07**

- Q.5** (a) Explain the approach of basic penalty method briefly. **03**

- (b) Advantages & Limitation of Genetic Algorithm. **04**

- (c) Solve the non-linear minimization problem by Steepest descent method Minimize $f(x_1, x_2) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$ starting from point (0,0). **07**

OR

- Q.5** (a) Explain concept of Explain Sequential linear programming briefly. **03**

- (b) Advantages & disadvantages of Fuzzy optimization techniques **04**

- (c) Explain the Newton's method for minimize optimization. **07**
