

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY
ME – SEMESTER-II(NEW) EXAMINATION – WINTER-2020

Subject Code:3720821

Date: 02/Feb/2021

Subject Name: Optimization Techniques

Time: 02:00 PM To 04:00 PM

Total Marks: 56

Instructions:

1. Attempt any FOUR questions out of EIGHT questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Use the Graph papers wherever required.

- Q.1 (a) Give the detail classification of optimization problems. 07
- (b) For the minimization of multivariable function $f(x)$, explain in detail the necessary and sufficient conditions. 07
- Q.2 (a) Using Lagrange multiplier method, find the dimensions of a cylindrical tin (with top and bottom) made up of sheet metal to maximize its volume such that the total surface area is equal to $A_0 = 24\pi$. 07
- (b) Find the extreme points of the function. 07
- $$f(x_1, x_2) = x_1^3 + x_2^3 + 2x_1^2 + 4x_2^2 + 10$$
- Q.3 (a) A manufacturing firm produces two machine parts using lathes, milling machines, and grinding machines. The different machining times required for each part, the machining times available on different machines, and the profit on each machine part are given in the following table. 07

Type of machine	Machining time required (min)		Maximum time available per week (min)
	Machine Part I	Machine Part II	
Lathes	10	5	2500
Milling machines	4	10	2000
Grinding machines	1	1.5	450
Profit per unit (Rs.)	50	100	

- (b) Describe Dual Simplex Method and its Algorithm. 07

- Q.4 (a) Explain Unrestricted search method for the fixed step size and accelerated step size. 07
- (b) Minimize the function $f(x) = 0.65 - [0.75 / (1+x^2)] - 0.65 * x * \tan^{-1} (1/x)$ using the golden section method with $n = 6$. 07
- Q.5 (a) Minimize $f(x_1, x_2) = x_1 - x_2 + 2*x_1^2 + 2*x_1*x_2 + x_2^2$ by taking the starting point as $X_1 = [0, 0]$ using Newton's method. 07
- (b) Explain in detail the pattern search method of Hooke and Jeeves. 07
- Q.6 (a) Find the dimensions of a rectangular prism type box that has the largest volume when the sum of its length, width, and height is limited to a maximum value of 60 cm and its length is restricted to a maximum value of 36 cm. Use Transformation technique. 07
- (b) Describe the Random Search Method for constrained optimization problem. 07
- Q.7 (a) Simulated annealing is a combinatorial optimization technique. Prove this statement with step by step procedure. 07
- (b) Minimize $f(x_1, x_2) = x_1 - x_2 + 2*x_1^2 + 2*x_1*x_2 + x_2^2$ from the starting point $X_1 = [0, 0]$ using Powell's method. 07
- Q.8 (a) How the Particle swarm optimization technique differ with other Evolutionary Algorithms? Explain in detail. 07
- (b) Explain the interior penalty function method for constrained optimization problem. 07