Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – I • EXAMINATION – WINTER • 2014

Subject code: 710903N **Date: 03-12-2014**

Subject Name: Engineering Optimization

Time: 10:30 am - 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.**

Q.1	**(a)**	Classify engineering optimization techniques with suitable examples based on **a.** Nature of constraints **b.** Nature of equations involved **c.** Deterministic nature of variables	**07**
	(b)	Define: Design space, feasible region, active constraints, constrained surface and behavior constrained	**07**
Q.2	**(a)**	Find the extreme points of the function: $f(x_1, x_2) = x_1^3 + x_2^3 + 2x_1^2 + 4x_2^2 + 6$	**07**
	(b)	Find the dimensions of a box of largest volume that can be inscribed in a sphere of unit radius.	**07**
		OR	
	(b)	A beam of uniform rectangular cross section is to be cut from a log having a circular cross section of diameter 2a. The beam has to be used as a cantilever beam (the length is fixed) to carry a concentrated load at the free end. Find the dimensions of the beam that correspond to the maximum tensile (bending) stress carrying capacity.	**07**
Q.3	**(a)**	Minimize $f(x) = 0.65 - [0.75/(1 + x^2)] - 0.65x \tan^{-1}(1/x)$ in the interval [0,3] by the Fibonacci method using n = 6.	**07**
	(b)	Find the minimum of $f = \lambda^5 - 5\lambda^3 - 20\lambda + 5$ using quadratic interpolation upto two iterations accuracy.	**07**
		OR	
Q.3	**(a)**	Minimize $f(x) = 0.65 - [0.75/(1 + x^2)] - 0.65x \tan^{-1}(1/x)$ by the Golden Section method using n = 6.	**07**
	(b)	Find the minimum of the function $f(\lambda) = 0.65 - 0.75/(1 + \lambda^2) - 0.65\lambda \tan^{-1} 1/\lambda$ using the Newton–Raphson method with the starting point $\lambda_1 = 0.1$. Use $\varepsilon = 0.01$ for checking the convergence.	**07**
Q.4	**(a)**	Explain multilayer feedback network used in ANN	**07**
	(b)	Explain the following terms associated with GA: Reproduction, crossover and mutation.	**07**
		OR	
Q.4	**(a)**	How genetic algorithm is useful for the optimization of a function? Also explain step wise procedure of GA used to optimize a function.	**07**
	(b)	Write short note on simulated annealing	**07**
Q.5	**(a)**	Minimize $f(x_1, x_2) = (x_1 + 1)^3/3 + x_2$ subject to $g_1(x_1, x_2) = 1 - x_1 \le 0$, $g_2(x_1, x_2) = -x_2 \le 0$ using penalty function method	**07**
	(b)	What do you understand by a gradient of a function. Explain its significance in the field of optimization.	**07**
		OR	
Q.5	**(a)**	Minimize $f(X) = x_1^2 + x_2^2$, subjected to : $x_1 + x_2 >= 4$, $2x_1 + x_2 >= 5$, $x_1 >= 0$, $x_2 >= 0$ using Kuhn-Tucker conditions.	**07**
	(b)	Explain interior penalty function method.	**07**

****