Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME SEMESTER – I EXAMINATION – SUMMER 2017

Subject code: 714704 **Date:12/05/2017**

Subject Name: Optimization Theory and Practice

Time:02:30 p.m. to 05:00 p.m. **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q:1		The agricultural research institute suggested to a farmer to spread out at least 4800 kg of a special phosphate fertilizer and not less than 7200 kg of a special nitrogen fertilizer to raise productivity of crops in his fields. There are two sources for obtaining these – mixtures A and B. Both of these are available in bags weighing 100 kg each and they cost Rs 40 and Rs 24 respectively. Mixture A contains phosphate and nitrogen equivalent of 20 kg and 80 kg respectively, while mixture B contains these ingredients equivalent of 50 kg each. Write this as a linear programming problem to determine how many bags of each type farmer should buy in order to obtain the required fertilizer at minimum cost. Solve this LPP using graphical and simplex method.	**14**
Q:2	**(a)**	Explain the various steps of Random Walk Method used to optimize non linear unconstrained problem.	**07**
	(b)	Explain the simulated annealing method of optimization.	**07**
		OR	
	(b)	How is the crossover operation performed in Genetic Algorithms(GA)? What is the purpose of mutation? How is it implemented in GA?	**07**
Q:3	**(a)**	Find the dimension of a box of largest volume that can be inscribed in a sphere of unit radius.	**07**
	(b)	A beam of uniform rectangular cross section is to be cut from a log having circular cross section of diameter 2a. The beam has to be used as a cantilever beam to carry a concentrated load at the free end. Find the dimensions of the beam that correspond to maximum bending stress carrying capacity.	**07**
		OR	
Q:3	**(a)**	Find the dimensions of a rectangular box of volume V = 1000 cm^3 for which the total length of 12 edges is minimum using Lagrange's multiplier method.	**07**
	(b)	Discuss the necessary and sufficient conditions for single variable optimization problem. Find the maximum and minimum values of the function:	**07**

$$f(x) = 12x^5 - 45x^4 + 40x^3 + 5$$

Q:4 **(a)** Explain the classification of the optimization problems with suitable example for each case. **07**

(b) Find the minimum of f(x) = x(x-1.5) in interval (0.0 1.0) to within 10% of exact value. **07**

OR

Q:4 **(a)** Explain the interval halving method of nonlinear programming. **07**

(b) Minimize $f(x) = 0.65-[0.75/(1+x^2)]-0.65\tan^{-1}(1/x)$ in the interval of [0,3] by the Fibonacci method using n =6. **07**

Q:5 **(a)** Explain the various steps of univariate method of unconstrained optimization techniques. **07**

(b) Minimize $f(x_1, x_2) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$ from the starting point $x_1 = \begin{Bmatrix} 0 \\ 0 \end{Bmatrix}$ using Powell's method. **07**

OR

Q:5 **(a)** Explain the transformation techniques and penalty function method of constrained optimization. **07**

(b) Explain the particle swam optimization method. **07**

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