

GUJARAT TECHNOLOGICAL UNIVERSITY**M. E. - SEMESTER – II • EXAMINATION – WINTER • 2014****Subject code: 725407****Date: 08-12-2014****Subject Name: Advanced Optimization Techniques****Time: 02:30 pm - 05:00 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) (i) Find the extreme values of the function 04

$$f(x) = 4x^3 - 24x^2 + 45x - 25.$$

(ii) Find the extreme values of the function 03

$$f(x, y) = x^2 + 2xy + 2y^2 + 2x + 3y.$$

(b) Use Simplex Method to minimize the function 07

$$f = -6x_1 - 7x_2$$

subject to

$$7x_1 + 6x_2 \leq 42,$$

$$5x_1 + 9x_2 \leq 45,$$

$$x_1 - x_2 \leq 4,$$

$$x_i \geq 0, \quad i = 1 \text{ to } 2.$$

Q.2 (a) Use Interval Halving Method to find the minimum of the function 07

$$f(\lambda) = -\frac{0.5}{\sqrt{1+\lambda^2}} + \sqrt{1+\lambda^2} \left(1 - \frac{0.5}{1+\lambda^2}\right) - \lambda$$

in the interval (0, 1) to achieve an accuracy of within 10% of the exact value.

(b) Find the minimum of the function $f(\lambda) = \lambda^5 - 5\lambda^3 - 20\lambda + 5$ by 07
Fibonacci Method in the interval (0, 5) with $n = 6$.**OR****(b) Find the minimum of the function 07**

$$f(\lambda) = 0.65 - \frac{0.75}{1+\lambda^2} - 0.65 \lambda \tan^{-1} \left(\frac{1}{\lambda} \right)$$

using Secant Method with an initial step size of $t_0 = 0.1$, $\lambda_1 = 0.0$, and $\varepsilon = 0.01$.**Q.3 (a) (i) Write the algorithm of exterior penalty function method. 03****(ii) Write the algorithm of Random Walk Method. 04****(b) Perform two iterations of Univariate method to minimize the function 07**
 $2x_1^2 + x_2^2$ starting from the point $X_1 = [1, 2]^T$. Take $\varepsilon = 0.01$.**OR****Q.3 (a) Use Hooke and Jeeves' method to minimize the function 07**

$$f(x_1, x_2) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$$

from the starting point $X_1 = [0, 0]^T$. Take $\Delta x_1 = \Delta x_2 = 0.8$ and $\varepsilon = 0.1$. Perform two complete iterations.**(b) Perform two iterations of the Cauchy's steepest descent method to 07**
minimize the function $f(x_1, x_2) = 4x_1^2 + 3x_2^2 - 5x_1x_2 - 8x_1$ from the starting point $X_1 = [0, 0]^T$.**Q.4 (a) Write the Basic Genetic Algorithm. What is the difference between an 07**
objective function and a fitness function? What is a real coded genetic algorithm?

- (b) What is a population in an evolutionary algorithm? What is a generation? What is the meaning of global best and local best solution in case of Particle Swarm Optimization algorithm? Starting with the initial population, how will you generate the new population? 07

OR

- Q.4 (a) What are difference vectors in DE? How mutation, crossover and selection are performed in DE? What are control parameters in DE? 07

- (b) Write the QPSO algorithm. Also write about some of its variants. 07

- Q.5 (a) Describe the Travelling Salesman problem. Draw the flow chart of Ant Colony Optimization algorithm when applied to TSP. 07

- (b) Write some applications of evolutionary algorithms. 07

OR

- Q.5 (a) What is the difference between a gene and a meme? Draw the flowchart of a memetic algorithm. 07

- (b) When will you use an evolutionary algorithm? Write the names of some of the evolutionary algorithms and the benchmark problems on which they are used. 07
