Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject code: 714704N Date: 02-12-2014

Subject Name: Optimization Theory and Practice

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 10 grams of Alloy A contains 2 grams of copper, 1 gram of zinc and 1 gram of lead. 10 grams of Alloy B contains 1 gram of copper, 1 gram of zinc and 1 gram of lead. It is required to produce a mixture of these alloys, which contains at least 10 grams of copper, 8 grams of zinc, and 12 grams of lead. Alloy B costs 1.5 times as much per Kg as alloy A. Find the amounts of alloys *A* and *B*, which must be mixed in order to satisfy these conditions in the cheapest way. Use simplex method. **14**

Q:2 **(a)** Explain the various steps of Random Jumping Method used to optimize nonlinear unconstrained problem. Also mention the advantages and disadvantages of Random search methods. **07**

(b) Draw the flow chart for Simulated annealing algorithm. **07**

OR

(b) What are the basic operations used in Genetic algorithm? What is the fitness function in Genetic algorithm? **07**

Q:3 **(a)** 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 univariate method. **07**

(b) Draw the flow chart for Powellôs method of unconstrained optimization. **07**

OR

Q:3 Explain the interior penalty and exterior penalty optimization techniques for single variable function f(X) =αx_1 , subjected to $g_1(X) = \beta - x_1$. **14**

Q:4 **(a)** Find the extreme points of the function **07**

Minimize $f(x_1, x_2) = x_1^3 + x_2^3 + 2x_1^2 + 4x_2^2 + 6$

(b) Find the dimensions of a box of largest volume that can be inscribed in a sphere of unit radius. **07**

OR

Q:4 **(a)** 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 to carry a concentrated load at a free end. Find the dimensions of the beam correspond to the maximum bending stress capacity. (Bending stress σ = MY/I, M = Bending moment, Y = Distance of extreme fibre, I = Moment of inertia) **07**

(b) Find the maximum of the function **07**

$f(x_1, x_2) = 2x_1 + x_2 + 10$

subject to

$g(x_1, x_{2)} = x_1 + 2x_2^2 - 3$

Using Lagrange multiplier method.

Q:5 **(a)** Find the minimum of f =x(x-1.5) in the interval (0.0, 1.0) to within 10% of the exact value using Dichotomous search method. **07**

(b) Minimize $f(\lambda) = 0.65 - \frac{0.75}{1+\lambda^2} - 0.65\lambda \tan^{-1}\frac{1}{\lambda}$ using quasi Newton method with starting point λ =0.1 and step size $\Delta\lambda$ = 0.01 in central difference formula. Use ε = 0.01 for checking convergence. **07**

OR

Q:5 **(a)** Minimize $f(x) = 0.65 - \frac{0.75}{1+x^2} - 0.65x \tan^{-1}\frac{1}{x}$ in the interval [0,3] by Fibonacci method using n = 6. **07**

(b) Explain the secant method of one dimensional nonlinear optimization. **07**

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