Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. IST Semester–Remedial Examination – July- 2011

Subject code: 710903

Subject Name: Engineering Optimization

Date:11/07/2011 **Time: 10:30 am – 01:00 pm**

Total Marks: 60

Instructions:

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

Q.1 **(a)** Find the dimensions of a box of largest volume that can be inscribed in a sphere of unit radius. **06**

(b) Define : Design variables, preassigned parameters, design space, feasible region, active constraints, constraint surface and behavior constraints. **06**

Q.2 **(a)** For which type of problems Kuhn-Tucker conditions are implemented for the optimization. Write Kuhn-Tucher conditions. **06**

Determine whether the constraint qualification and Kuhn-Tucker conditions are satisfied at the optimum point which is (0,0) for the following problem:

Minimize $f(X)=(x_1-1)^2+(x_2)^2$,

subjected to $g_1(X)=x_1^3-2x_2\leq 0$, $g_2(X)=x_1^3+2x_2\leq 0$.

(b) Which are the different methods for the optimization of multivariable unconstrained problems and explain any one method. **06**

OR

(b) Write necessary and sufficient conditions for Lagrange multiplier method. Explain with a significant example. **06**

Q.3 **(a)** Minimize $f(x) = x^2+50/x$ using Fibonacci method with an accuracy of 0.1 in an interval [0 5]. **06**

(b) Minimize $f(x) = (100-x)^2$ in an interval of [60 150] using Golden section method. **06**

OR

Q.3 **(a)** Find the minimum of $f(x) = x^5-5x^3-20x+5$ using Quadratic interpolation method. **06**

(b) Minimize $f(x) = 2x^2+16/x$ using Newton-Rapson method. **06**

Q.4 **(a)** Minimize $f(X)=x_1^2+x_2^2-2x_1x_2$ using Steepest Decent Method starting from the point (1,0). **06**

(b) Explain with detailed steps the procedure for the optimization using Genetic Algorithm (GA) **06**

OR

Q.4 **(a)** What is the significance of gradient of a objective function and constraints. **06**

(b) What is the principle for the working of simulated annealing (SA) . Explain in detail. **06**

Q.5 **(a)** Explain feasible direction method for the optimization of a function. **06**

(b) Minimize $f(X) = 4x_1 + x_1x_2^{-2} + 4x_1^{-1}x_2$ using geometric programming method. **06**

OR

Q.5 **(a)** What do you understand by 'penalty method'? Which are the different penalty function methods? Explain any one in detail. **06**

(b) Solve by cutting plane method: **06**

Minimize $f(x)=-x_1-x_2$,

subjected to $g_1(x)=2x_1-x_2^2-1\geq 0$, $g_2(x)=9-0.8x_1^2-2x_2\geq 0$, $0\leq x_1\leq 5$ and $0\leq x_2\leq 4$.

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