Roll No. | | | | | | | | | | | | |

Total No. of Pages : 03

Total No. of Questions : 18

B.Tech.(CSE) (O.E. 2011 Onwards) (Sem-6)

OPTIMIZATION TECHNIQUES

Subject Code : CH-304

M.Code : 71555

Time : 3 Hrs. Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

1. Define the property of continuity.
2. What are the six steps used to solve optimization problem.
3. What is constrained problem and give one example.
4. Give the classification of optimization problems.
5. Are the following functions continuous? (a) $f(x) = 1/x$ and (b) $f(x) = \ln(x)$
6. State disadvantages of Newton's method for one-dimensional search?
7. State the Kuhn-Tucker conditions.
8. What is the difference between local optimal point and global optimal point?
9. Is it necessary that the Hessian matrix of the objective function always be positive definite in an unconstrained minimization problem?
10. Find two non-negative numbers whose sum is 9 and so that the product of one number and the square of the other number is a maximum.

SECTION-B

11. Does the following set of constraints form an convex region ?

$$g_1(x) = -(x_1^2 - x_2^2) + 9 \geq 0 \text{ and } g_2(x) = -x_1 - x_2 + 1 \geq 0$$

12. Apply golden section one dimensional search technique to reduce the interval of uncertainty for the maximum of the function $f = 6.64 + 1.2x - x^2$ from [0, 1] to less than 2 percent of its original size.

13. Consider the objective function,

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

Find the stationary points and classify them using the Hessian matrix.

14. Minimize $f(x) = x^2 - x$ using Secant method, with the two points $x = -3$ and $x = 3$.

15. Find the dimensions of a cylindrical tin (with top and bottom) made up of a sheet metal to maximize its volume such that the total surface area is equal to 22π.

SECTION-C

16. In crystal NaCl, each Na^+ or Cl^- ion is surrounded by 6 nearest neighbors of opposite charge and 12 nearest neighbors of the same charge. Two sets of forces oppose each other : the columbic attraction and the hard-core repulsion. The potential energy $u(r)$ of the crystal is given by the Lennard-Jones potential expression,

$$u(r) = 4\epsilon\left[\left(\frac{\sigma}{r}\right)^{12} - \left(\frac{\sigma}{r}\right)^{6}\right] \text{ where } \sigma > 0,\ \varepsilon > 0 \text{ are constants.}$$

a) Does the Lennard-Jones potential $u(r)$ have stationary points (s)? If it does, locate it (them).

b) Identify the nature of the stationary point(s) min, max, etc.

c) What is the magnitude of the potential energy at the stationary point(s).

17. Estimate the minimum of :

$$f(x)=3x^2+\frac{12}{x^3}-5 \text{ in the interval } \frac{1}{2}\le x\le \frac{5}{2}.$$

By using Powell's method with initial point $x1 = 0.5$ and step size $\Delta = 0.5$. For convergence use parameters

$$\left|\frac{Difference\ in\ x}{x}\right|\le 3\times10^{-2} \text{ and } \left|\frac{Difference\ in\ F}{F}\right|\le 3\times10^{-3}$$

18. Maximize the objective function, using simplex method.

$$Z = 40x_1 + 88x_2$$

Subject to

$$2x_1 + 8x_2 \le 60$$

$$5x_1 + 2x_2 \le 60$$

$$x_1 \ge 0$$

$$x_2 \ge 0$$

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.