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(2066)

16129(J) June-16

B. Tech 6th Semester Examination

Optimization Methods for Engineering System (NS)

NS-300C

Time : 3 Hours **Max. Marks : 100**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt any five questions selecting at least one from each section A, B, C & D. Section E is compulsory.

SECTION - A

1. (a) State the necessary and sufficient conditions for the maxima of a multi variable function. (10)

   (b) Convert an inequality constrained problem into an equivalent unconstrained problem. (10)

2. (a) State five engineering applications of optimization. (10)

   (b) Find the dimensions of open rectangular box of volume V for which the amount of material required for manufacturer (surface area) is minimum. (10)

SECTION - B

3. Find the minimum of the function $f = \lambda^5 - 5\lambda^3 - 20\lambda + 5$ by the following methods:

   (i) Golden section method in the interval (0, 5).

   (ii) Fibonacci search in interval (0, 5). (20)

4. Write a computer program to implement the steepest descent method of unconstrained minimization with direct root method of one dimensional search. (20)

SECTION - C

5. (a) What is the difference between the interior and extended interior penalty function methods? (10)

   (b) What is the geometric interpretation of the reduced gradient? Is the generalized reduced gradient zero at optimum solution? (10)

6. (a) Minimize the following function

   $$f(x) = x_1^{-2} + \frac{1}{4}x_2^2 x_3$$

   subject to

   $$\frac{3}{4}x_1^2 x_2^{-2} + \frac{3}{8}x_2 x_3^{-2} \le 1, \quad x_i > 0, i = 1, 2, 3$$ (10)

   (b) What is normality condition in a geometric programming problem? (10)

SECTION - D

7. (a) How can you solve a trajectory optimization problem using dynamic programming? (10)

   (b) Solve the following problem by dynamic programming.

   $$\underset{d_i \ge 0}{\text{maximize}} \sum_{i=1}^{3} d_i^2$$

   subject to

   $d_i = x_{i+1} - x_i, \quad i = 1, 2, 3$

   $x_i = 0, 1, 2, \ldots 5, \quad i = 1, 2$

   $x_3 = 5, \quad x_4 = 0$ (10)

8. Define the following terms:

   (i) Cutting plane

   (ii) Gomory's constraint (20)

SECTION - E

9. (a) How to solve a maximization problem as a minimization problem?

   (b) What is unimodal function?

   (c) What is univariate method?

   (d) Is the generalized reduced gradient zero at optimum solution?

   (e) What is the curse of dimensionality?

   (f) Give two engineering examples of a discrete programming problem.

   (g) What is branch and bound method?

   (h) What is graphical optimization?

   (i) State the Kuhn-Tucker Condition.

   (j) What is one dimensional minimization problem?

(2×10=20)