Total No. of Questions : 8]

SEAT No. :

P4751

[Total No. of Pages : 3

[4760] - 120

M.E. (Mechanical) (Design Engg.)

OPTIMIZATION TECHNIQUES

(2008 Pattern) (Elective - I)

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

Instructions to the candidates:

1) ***Attempt any THREE questions from each section.***
2) ***Answers to the two sections should be written in separate answer books.***
3) ***Neat diagram must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Assume suitable data, if necessary and mention it clearly.***

SECTION - I

Q1) a) What is optimization problem? Give the classification of optimization problem with suitable examples. **[10]**

b) Explain the engineering applications of the optimization. **[6]**

Q2) a) State the necessary and sufficient conditions for the maximization of a multivariable function $f(X)$. **[6]**

b) Find the maximum of the function $f(X) = 2x_1 + x_2 + 10$. **[10]**

Subject to

$$g(X) = x_1^2 + 2x_2^2 = 3$$

using the Lagrange multiplier method.

Also find the effect of changing the right-hand side of the constraint on the optimum value of f.

P.T.O.

Q3) a) Find the second order Taylor series approximation of the function. **[8]**

about the point

$\mathbf{X}^* = \{1, 0, -2\}^T$

b) Minimize $f = x_1^2 - 2x_2^2 - 3x_3^2$ **[8]**

subject to the constraints

using Kuhn-Tucker conditions

Q4) a) With the help of example explain the graphical method of optimization. What are the limitations of this method? **[8]**

b) Explain the simplex algorithm. What is the difference between the simplex algorithm and simplex method? **[10]**

SECTION - II

Q5) a) What is the difference between Newton & Quasi-Newton method in solving an unconstrained minimization problem? **[8]**

b) Minimize the function. **[8]**

using the golden section method with n = 6.

Q6) a) With the help of flowchart explain the steps of Powell's method. **[8]**

b) Compare the gradients of the function. **[8]**

by Forward difference method and backward difference method.

Use a perturbation of 0.005 for x_1 and x_2 in the finite-difference methods.

Q7) a) Minimize **[12]**

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

Take the points in defining the initial simplex as

and $\alpha = 1.0$, $\beta = 0.5$ and $\gamma = 2.0$ For convergence, take the value of ε as 0.2. Perform at least two iterations.

b) What is the reason for possible divergence of Newton's method? **[4]**

Q8) a) What is the difference between the interior and extended interior penalty function methods? **[6]**

b) Minimize **[12]**

$$f(\mathbf{X}) = 9x_1^2 + 6x_2^2 + x_3^2 - 18x_1 - 12x_2 - 6x_3 - 8$$

subject to

$$\mathbf{X}_1 = \begin{Bmatrix} 4.0 \\ 4.0 \end{Bmatrix}, \mathbf{X}_2 = \begin{Bmatrix} 5.0 \\ 4.0 \end{Bmatrix} \text{ and } \mathbf{X}_3 = \begin{Bmatrix} 4.0 \\ 5.0 \end{Bmatrix}$$

$$x_1 + 2x_2 + x_3 \le 4$$

$$x_i \ge 0, \quad i = 1, 2, 3$$

Using starting point

$$\mathbf{X}_1 = \{0, 0, 0\}^T,$$

Complete one step of sequential linear programming method.