Total No. of Questions : 8]

SEAT No. :

P2105

[Total No. of Pages : 2

[4460] - 609

M.E. (Mechanical) (CADM&E) (Semester - II)

OPTIMIZATION TECHNIQUES

(2012 Pattern) (Elective - III(d))

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

Instructions to the candidates:

1) ***Answer any three questions from each section.***
2) ***Answers to the two sections should be written in separate books.***
3) ***Neat diagrams must be drawn whenever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Use of logarithmic tables, slide rule, Mollier charts, electronic calculator and steam table is allowed.***
6) ***Assume suitable data, if necessary.***

SECTION - I

Q1) 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 (the length is fixed) to carry a concentrated load at the free end. Find the dimensions of the beam that correspond to the maximum tensile (bending) stress carrying capacity. **[10]**

b) Classification of optimization problems. **[6]**

Q2) a) Maximize $f = x_1 + 2x_2 + x_3$ **[10]**

Subject to:

$$\begin{aligned} 2x_1 + x_2 - x_3 &\leq 2 \\ -2x_1 + x_2 - 5x_3 &\geq -6 \\ 4x_1 + x_2 + x_3 &\leq 6 \end{aligned}$$

Where $x_1, x_2, x_3 \geq 0$

b) Explain sensitivity or post-optimality analysis. **[6]**

Q3) a) Find the minimum of $f = \lambda^5 - 5\lambda^3 - 20\lambda + 5$ by the cubic interpolation method. **[10]**

b) Explain successive quadratic estimation. **[6]**

P.T.O.

Q4) Write short notes on (any three) : **[18]**

a) Golden section search method.

b) Duality in linear programming.

c) Optimum design of pins.

d) Cubic search method.

SECTION - II

Q5) 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 Powell's method. **[10]**

b) Explain Multivariable unconstrained optimization. **[6]**

Q6) a) Minimize $f(x_1, x_2) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$ from the point $X_1 = \begin{Bmatrix} 0 & 0 \\ 0 & 0 \end{Bmatrix}$ using random walk method with a starting step length of a $\lambda = 1$. Take $\varepsilon = 0.05$ and $N = 100$. **[10]**

b) Explain cutting plane method. **[6]**

Q7) a) Minimize: $f(x_1, x_2, x_3) = (x_1 - x_2)^2 + (x_2 - x_3)^4$ **[10]**

Subject to: $g_1(X) = x_1(1 + x_2^2) + x_3^4 - 3 = 0$

$-3 \leq x_i \leq 3$, i = 1, 2, 3, ...

Using Generalized Reduced Gradient (GRG) Method.

b) Explain complex search method. **[6]**

Q8) Write short notes on (any three) : **[18]**

a) Geometric programming.

b) Gradient search methods like Cauchy's method.

c) Feasible direction method.

d) Branch and bound method.

✪✡✪✡