Total No. of Questions : 6]

SEAT No. :

P4740

[Total No. of Pages :2

[4760]-56
M.E. (Civil) (Structures)
OPTIMIZATION TECHNIQUES
(2008 Pattern) (Elective - IV)

Time : 4 Hours] *[Max. Marks : 100*

Instructions to the candidates:

1) ***Answer any two questions from each section.***
2) ***Answers to the two sections must be written in separate books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Use of electronic pocket calculator is allowed.***
6) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) A beam of uniform rectangular corss-section is to be cut from a log having a circular corss-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. **[13]**

b) State six structural engineering applications of optimization. **[12]**

Q2) a) Solve the following LP problems by the revised simplex method. **[13]**

Minimize $f = 5x_1 + 2x_2 + 5x_3 - 3x_4$

Subject to $2x_1 + x_2 - x_3 = 6$

$3x_1 + 8x_3 + x_4 = 7$

$x_i >= 0, i = 1 \text{ to } 4$

b) Explain revised simplex method, Duality in linear programming, Decomposition principle, and Post-optimality analysis in Linear Programming. **[12]**

Q3) a) Find the minimum of $f = \lambda^5 - 5\lambda^3 - 20\lambda + 5$ by the cubic Interpolation method. **[13]**

b) Minimize the function using the golden section method with n=6. **[12]**

$$f(x) = 0.65 - [0.75 / (1 + x^2)] - 0.65 \times \tan^{-1}(1/x)$$

P.T.O.

SECTION - II

Q4) a) Show that the Newton's method finds the minimum of a Quadratic function in one iteration, **[10]**

$$F(X) = \tfrac{1}{2}X^T[A]X + B^T X + C$$

b) Explain **[15]**

i) Indirect search method and Direct search method,

ii) Random search method and Steepest Descent (Cauchy) method

iii) Univariate and pattern search method,

Q5) a) Design the cantilever beam with X_1 width, X_2 depth and point load P at the end of beam, formulate the problem of determining the cross-sectional dimensions of the cantilever beam for minimum weight. The maximum permissible bending stress is σ_y. **[12]**

b) Minimize the interior penalty function **[13]**

$$f(x_1,x_2) = 1/3\ (x_1 + 1)^3 + x_2$$

Subject to $g1\ (x_1, x_2) = -x_2 + 1 <= 0$

$$g2\ (x_1, x_2) = -x_2 \leq= 0$$

Q6) a) Explain with suitable sketch and examples Selection operator, Crossover Operator and mutation Operator in Genetic Algorithms. **[12]**

b) Differentiate biological neural network and artificial neural network? **[6]**

c) What are the activation functions in artifical neural networks? **[7]**

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