Total No. of Questions : 6]

SEAT No. :

P4878

[Total No. of Pages : 2

[5155] - 4
M.E. (Civil Structures)
OPTIMIZATION TECHNIQUES
(2008 Pattern) (Elective - IV)

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

Instructions to the candidates:

1) ***Solve any two questions from each section.***
2) ***Figures to the right indicate full marks.***

SECTION - I

Q1) 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) State six structural engineering applications of optimization. **[12]**

Q2) 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. **[13]**

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

Q3) a) Minimize the function using the golden section method with n = 6. **[12]**

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

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

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SECTION - II

Q4) 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 σy. **[12]**

b) Explain. **[13]**

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) Show that the Newton's method finds the minimum of a Quadratic function in one iteration, $F(X) = \frac{1}{2} X^T [A] X + B^T X + C$ **[12]**

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

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

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

$g2 (x_1, x_2) = -x_2 <= 0$

Q6) a) Differentiate biological neural network and artificial neural network. **[6]**

b) What are the activation functions in artificial neural network? **[7]**

c) Explain with suitable sketch and examples Selection Operator, Crossover Operator and Mutation Operator in Genetic Algorithms. **[12]**