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EME023

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 140657

Roll No. | | | | | | | | | | |

B. Tech.

(SEM. VI) THEORY EXAMINATION, 2014-15

OPTIMIZATION TECHNIQUES IN ENGINEERING

Time : **3** Hours] [Total Marks : **100**

1 Attempt any two of the following : (2×10=20)

(a) An open cylindrical vessel is to be constructed to transport 100 m^3 of grain from a warehouse to a factory. The sheet metal used for the bottom and sides cost Rs. 100 and Rs. 15 per square meter respectively. If it costs Rs. 2 for each round trip of the vessel, find the dimensions of the vessel for minimizing the transportation cost. Assume that the vessel had no salvage upon completion of the operation.

(b) Define Genetic Algorithm. What is the basic operation used in Genetic Algorithm? How genetic algorithm is different from the other methods of optimization?

(c) Find the dimensions of a box of largest volume which can be inscribed in a sphere of unit radius.

2 Attempt any two of the following : (2×10=20)

(a) With the help of derivation discuss the Lagrange multiplier method and its significance.

(b) Discuss the concept of feasible direction method of constrained optimization technique and write the algorithm for the same.

(c) Discuss the different steps of Random walk direct search method of unconstrained optimization in brief.

3 Attempt any two of the following : (2×10=20)

(a) In a certain reservoir pump installation, the first cost of the pipe is given by $(10D+ 50D^2)$, where D is the diameter of the pipe in cm. The cost of reservoir decreases with an increase in the quantity of fluid handled and is given by (20/Q) where Q is the rate at which the fluid is handled (cubic meter per second). The pumping cost is given by $(300Q^2/ D^5)$. Find the optimal size of the pipe and the amount of fluid handled for minimum overall cost.

(b) Customer arrives at a service facility to get required service. The inter arrival and service times are constant and are 108 minutes respectively. Simulate the system for 14 minutes. Determine the average waiting time of a customer and idle time of the service facility.

(c) Show that the gradient vector represents the direction of Steepest Ascent? Give the flow chart of Simulated Annealing procedure.

4 Attempt any two of the following : (2×10=20)

(a) Complete one iteration of Rosen's Gradient projection method for the following problem :

Minimize $f(x) = (x_1-1)^2 + (x_2-2)^2 - 4$ subject to $x_1+2x_2 \leq 5$, $4x_1+3x_2 \leq 10$, $6x_1+x_2 \leq 7$, $x_1, x_2 \geq 0$, use the starting point $x_1 = \{1\ 1\}$.

(b) Minimize $f(x) = 3x_1^2 + 4x_2^2$ subject to $x_1 + 2x_2 = 8$, using exterior penalty function method with the calculus method of unconstrained minimization.

(c) Check the convexity of the following problem :

Minimize $f(x_1, x_2) = x_1^3 - x_2^3$

Subject to constraints

$x_1 \geq 0$, $x_2 \leq 0$

5 Attempt any two of the following : (2×10=20)

(a) Design a steel frame work of height h, width w, and depth d at a minimum cost. The cost of all horizontal members in one direction is Rs 200w and in other direction, it is Rs 300d. The cost of vertical column is Rs 500h. The frame must enclose a total volume of at least $600m^3$. Formulate the design optimization problem, transcribe it into the standard normalized form and create a linear approximation at the point w=10, d=10, and h=4.

(b) Explain the term Fuzzy logic. What are Sugeno and Mamdani Fuzzy Inference systems? Can one be transformed into another? Define the union of two Fuzzy sets A and B. How is the optimum solution defined in a Fuzzy environment?

(c) Minimize $f(Y) \_ \%2 (y_1^2 + y_2^2 + y_3^2 + y_4^2)$, subject to :

$g_1(Y) = y_1 + 2y_2 + 3y_3 + 5y_4^2 - 10 = 0$

$g_2(Y) = y_1 + 2y_2 + 5y_3 + 6y_4^2 - 15 = 0$