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E 105

National Institute of Technology Hamirpur
Department of Electrical Engineering
End Sem Examination
Optimization Methods in Engineering (EE-431)

Max Marks: 50

Max Time: 3:00 hrs.

Note: Attempt all the questions.

1. (a) Describe an Optimal Control Problem with an example. (5)
(b) Solve $f(x) = \frac{1}{2}(x_1^2 + x_2^2 + x_3^2)$
Subject to constraints
 $g_1(x) = x_1 - x_2$
 $g_2(x) = x_1 + x_2 + x_3 - 1$ by Lagrangian multiplier method (5)
2. (a) Find the stationary points and corresponding function values for
 $f(x) = 10x_1^6 - 48x_1^5 + 15x_1^4 + 200x_1^3 - 120x_1^2 - 480x_1 + 100$ (5)
(b) Describe the different phases for development of an optimization problem. (5)
3. (a) Write down the algorithm of Simplex Method for unconstrained NLP problem. (6)
(b) Minimize
 $f(X) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$
Take the initial Simplex as $X_1 = \begin{pmatrix} 4 \\ 4 \end{pmatrix}$, $X_2 = \begin{pmatrix} 5 \\ 4 \end{pmatrix}$, $X_3 = \begin{pmatrix} 4 \\ 5 \end{pmatrix}$ and $\alpha = 1$, $\beta = 0.5$, $\gamma = 2.0$.
For convergence use the stopping criteria use $\epsilon = 0.2$ (4)
4. (a) Minimize $f(X) = -x_1x_2$, subject to $g(X) = x_1 + x_2 - 4 \leq 0$ by using Penalty function approach. (4)
(b) Write step by step procedure of Rank 1 Update method and draw flowchart. (5)
(c) Find the minimum value of $f(x) = x^2 + 2x$ within the interval $[-3, 4]$ using Fibonacci method. Obtain the optimal value within 5% of exact value. (5)
5. Describe the step by step procedure of forming the recursive equations in backward and forward manner in a typical Dynamic Programming Problem along with the block diagram. (6)