Enrollment No: _____ Exam Seat No:_____

C.U.SHAH UNIVERSITY

Summer Examination-2018

Subject Name: Advanced Optimization Techniques

Subject Code: 5TE02AOT1 Branch: M.Tech. Mechanical (CAD/CAM)

Semester: 2 Date:04/05/2018 Time: 10.30 To 01.30 Marks: 70

Instructions:

(1) Use of Programmable calculator and any other electronic instrument is prohibited.
(2) Instructions written on main answer book are strictly to be obeyed.
(3) Draw neat diagrams and figures (if necessary) at right places.
(4) Assume suitable data if needed.

SECTION – I

Q-1 Attempt the Following questions

a. What do you understand by optimization? **(01)**
b. What is the Lagrange multiplier method? **(01)**
c. Define the term "constrained surface". **(01)**
d. What is an inflection point and how do you identify it? **(01)**
e. Define the term global optima. **(01)**
f. Define the term Posynomial. **(01)**
g. State the function $f(x) = -8x^2$ convex or concave. **(01)**

Q-2 Attempt all questions

(a) Write the different applications of optimizations in various fields of engineering. **(07)**
(b) Minimize $f = x_1^2 + 2x_2^2 + 3x_3^2$ **(07)**
subject to $x_1 - x_2 - 2x_3 \leq 12$, $x_1 + 2x_2 - 3x_3 \leq 8$ Using Kuhn-Tucker Conditions

OR

Q-2 Attempt all questions

(a) Minimize $f(\mathbf{X}) = -3x_1^2 - 6x_1x_2 - 5x_2^2 + 7x_1 + 5x_2$ Subject to $x_1 + x_2 = 5$ using Lagrange multiplier method. **(07)**
(b) State the differences between following entities **(07)**
1. Single objective optimization and multi objective optimization
2. Quadratic programming and geometric programming

Q-3 Attempt all questions

(a) Analyze the function $f(x) = -x_1^2 - x_2^2 - x_3^2 + 2x_1x_2 + 2x_1x_3 + 4x_1 - 5x_3 + 2$ and classify the stationary points as maxima, minima and points of inflection. **(07)**
(b) Differentiate between Fibonacci and golden section methods of optimization in brief. **(07)**

OR

Q-3 **(a)** Using Newton Raphson method find minimum f (x) = $\frac{1}{2}x^2$ – sin x starting with $x_0 = 0.5$, Take required accuracy $\varepsilon = 10^{-5}$ where $|x^{(k+1)} — x^k| < \varepsilon$. **(07)**

(b) Minimize $f(x) = x^4 - 14x^3 + 60x^2 - 70x$ in the range [0 2] by the Golden Section method using N = 4 and Locate this value of x to within a range of 0.3. **(07)**

SECTION – II

Q-4 **Attempt the Following questions**

a. Define a stochastic programming problem. **(01)**

b. What do you understand by a gradient of a function? **(01)**

c. What do you understand by 'penalty method'? **(01)**

d. Answer true or false with justification: The steepest descent directions are the best possible directions. **(01)**

e. Define Fibonacci numbers. **(01)**

f. How genetic algorithm is useful for the optimization of a function? **(01)**

g. Why is refitting necessary in interpolation methods? **(01)**

Q-5 **Attempt all questions**

(a) Minimize $f(x_1, x_2) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$ starting with $(0, 0)^T$, using Cauchy method. **(07)**

(b) Explain interior penalty function method. **(07)**

OR

Q-5 **Attempt all questions**

(a) Minimize $f(x_1, x_2) = 4x_1^2 + 3x_2^2 - 4x_1x_2 + x_1$ starting with $(0, 0)^T$, using conjugate gradient method. **(07)**

(b) Explain Quadratic Interpolation Method of optimization in detail. **(07)**

Q-6 **Attempt all questions**

(a) Prove that optimization in power transmitted by spur gear pair occurs where the tangential load is equal to dynamic load when the criterion for the failure is scoring. Assume dynamic load to be directly proposal to pinion speed **(07)**

(b) Discuss the importance and use of MATLAB Optimization Toolbox for Solving Optimization Problems. **(07)**

OR

Q-6 **Attempt all Questions**

(a) Minimize $f(x) = 2x_1^{-1}x_2^{-1} + \frac{3}{2}x_2^{-2} + 2x_1x_2^2$ by using geometric programming method. **(07)**

(b) Explain the following terms associated with GA: Reproduction, crossover and mutation. **(07)**