Registration No.: | | | | | | | | | | |

Total Number of Pages: 02

Course: M.Sc.I
Sub_Code: FMCE907

9th Semester Regular/Back Examination: 2024-25
SUBJECT: Numerical Optimization
BRANCH(S): M.Sc.I (MC)
Time: 3 Hours
Max Marks: 70
Q.Code: R164
Answer Question No.1 (Part-I) which is compulsory, any five from rest (Part-II)
The figures in the right-hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 x 10)**

a) Show that the function $f(x) = 2x_1^2 + x_2^2$ is convex everywhere in $\mathbb{R}^2$.
b) Define Lagrange multiplier.
c) State Bellman's principle of optimality.
d) Locate the stationary points of the function $f(x_1, x_2) = x_1^2 + 2x_2^2 - 4x_1 - 2x_1x_2$.
e) Write two advantages of Powell's Conjugate Direction Method.
f) What is the main difficulty with Marquardt's method?
g) What are the differences between Cauchy's and Newton's search methods?
h) Explain the difference between constraint and unconstraint optimization problems.
i) What is the advantage of penalty functions? Explain with a suitable counter example.
j) Is the statement "The functions involved in Gradient-based optimization methods are not necessarily differentiable or continuous." true? If not correct it.

Part-II

Long Answer Type Questions (Answer Any five)

Q2 **a)** Discuss the importance of Kuhn-Tucker conditions in nonlinear programming problems. **(5+5)**
b) Using Fibonacci Search method minimize the function $f(x) = x^2 + \frac{54}{x}$.

Q3 **a)** Write a short not on Golden Section Search method. **(5+5)**
b) Examine $z = 6x_1x_2$ for maxima and minima under the requirement $2x_1 + x_2 = 10$.

Q4 **a)** Discuss the applications of dynamic programming. **(5+5)**
b) Write all the steps of exploratory move in the Hooke-Jeeves method.

Q5 **a)** Discuss the difference between Cauchy's method and Marquardt's method. **(5+5)**
b) Starting from the point $(1,1)^T$, perform two iterations of DFP method to find a stationary point of the function $f(x_1, x_2) = 10 - x_1 + x_1x_2 + x_2^2$.

Q6 **a)** Consider the minimization problem: $f(x_1, x_2) = 2x_1^2 + x_2^2 + 2x_1x_2 + x_1 - x_2$. Use the Fletcher-Reeves's conjugate gradient method to find the minimizer. Start with the initial solution $x^{(0)} = (0,0)^T$. **(5+5)**

b) Solve the equations $2x_1 + x_2 = 5,\ 3x_1 - 2x_2 = 2$ by formulating suitable optimization problem.

Q7 **a)** Use Zoutendijk's feasible direction method to solve the problem: **(5+5)**
$\min f(x) = (x-5)^2$ subject to $2 \leq x \leq 3$. Take starting point $x^{(0)} = 2$.

b) Write short note on Sequential Quadratic Programming method.

Q8 **a)** Write short note on Sequential Linear Programming method. **(5+5)**

b) Discuss the Computational difficulties associated with interior penalty function method.