Enrollment No._____

NAVRACHANA UNIVERSITY
a UGC recognized University

School: School of Engineering and Technology
Program/s: B. Sc (Data Science)
Year: 2nd **Semester:** 4th
Examination: End Semester Examination
Examination year: May 2023

Course Code: DS212 **Course Name:** Optimization Techniques
Date: 18/05/2023
Time: 10 am to 12 pm

Total Marks: 40
Total Pages: 1

Instructions:

- *Write each answer on a new page.*
- *Use of a calculator is permitted.*

Q. No.	Details	Marks	COs*	BTL#
Q.1	**Answer in short:** (i) When does the system of non-homogeneous linear equations has infinitely many solutions? (ii) If $f''(x_0) = 0$, then point of inflection may occur at x0. (True/False) (iii) The Newton's method fails if ___. ($f'(x_0) = 0$ / $f''(x_0) = 0$) (iv) If a function has local minimum at a point x0 then, Hessian matrix at x0 must be negative definite. (True / False) (v) Minimum of a function occurs in the direction of ___ gradient. (negative / positive) (vi) What is the effect of epsilon value on the convergence of Bisection method?	**6**	CO1	BT1, BT2
Q.2	**Attempt the following:** (i) Check consistency of the system: $2x + 4y - 2z = 0$; $3x + 5y = 1$. (ii) Find second order partial derivatives f_{xx}, f_{xy} , f_{yx} and f_{yy} for $f(x,y) = x^3y^4 + ye^{2x}$.	**10**	CO1, CO2	BT1, BT3, BT6
Q.3	**Attempt Any TWO:** (i) Find local minimum of $f(x) = x^2 + 54/x$ using Bisection method in interval (2, 5). Compute x1, x2, x3, x4. (ii) Find local minimum of $f(x) = x / \log(x)$ using Newton's method. Take initial point x0 = 2. Compute x1, x2, x3, x4, x5. (iii) Find local optima of the function $f(x) = 3x^4 - 4x^3 - 24x^2 + 48x + 15$, if any, by applying necessary and sufficient optimality conditions.	**16**	CO2	BT3, BT4
Q.4	**Attempt Any ONE:** (i) Apply Steepest Descent method to find local minimum of function $f(x, y) = 2x^2 + y^2$ with initial point x0 = [1, 2]. Perform two iterations. (ii) Find the local optimum points of the function $f(x, y) = x^2 + 3xy + 2y^2 - 5x - 8y + 4$ by applying first and second order optimality conditions.	**8**	CO3, CO4	BT2, BT3, BT4

**********End of Question Paper**********