Enrollment No._____

NAVRACHANA UNIVERSITY
a UGC recognized University

School: School of Engineering & Technology
Program/s: BSc Data Science
Year: 3rd **Semester:** 5th
Examination: End Semester Examination
Examination year: December - 2021

Course Code: DS305 **Course Name:** Numerical Methods & Simulation
Date: 08/12/2021 **Total Marks:** 40
Time: 11:30 am to 01:30 pm **Total Pages:** 2

Instructions:

- *Write each answer on a new page.*
- *Use of a calculator is permitted.*
- *Write both sections in same answer book.*

	Section-I	**Marks**	**COs***	**BTL#**
Q.1	Attempt **ANY THREE** of the following:	**[3 x 7 = 21]**		
[1]	Evaluate: (a) $\Delta^2 x^3$ (b) $\Delta^3(ae^x)$		CO1, CO2, CO3	BT1, BT2, BT5
[2]	Find approximate root of $x - 2\,sinx = 0$, correct to three decimal places using Newton-Raphson's method. Consider $x_0 = 1.5$. $x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$.		CO1, CO2, CO3	BT1, BT2, BT5
[3]	Solve the following system of equations by using Gauss elimination method: $x + y + 2z = 4,\ 3x + y - 3z = -4,\quad 2x - 3y - 5z = -5$		CO1, CO2, CO3	BT1, BT2, BT4, BT5
[4]	Find the value of y when x=3.2 from the following data using Gauss's forward interpolation formula $y(x) = y_0 + p\Delta y_0 + \frac{p(p-1)}{2!}\Delta^2 y_{-1} + \frac{(p+1)p(p-1)}{3!}\Delta^3 y_{-1} + \cdots$		CO1, CO2, CO3	BT1, BT2, BT5
Q.2	Attempt **ANY ONE** of the following:	**[1 x 9 = 9]**		
[5]	Using the Rungh-Kutta method estimate y(3) for $\frac{dy}{dx} = \frac{x+y}{x}, y(2) = 1.$ Use $h = 0.5.$		CO1, CO2, CO3	BT1, BT2, BT5

x	2.0	2.5	3.0	3.5	4.0
Y	246.2	409.3	537.2	636.3	715.9

[6]	Using Taylor's series method, find $y(0.1)$ correct to four decimal places if $y(x)$ satisfies $\frac{dy}{dx} = x - y^2,\ y(0) = 1.$ Taylor's series is given by: $y(x+h) = y(x) + hy'(x) + \frac{h^2}{2!}y''(x) + \ldots$		CO1, CO2, CO3	BT1, BT2, BT5
	Section-II			
Q3 (a)	**Answer in short:** (i) Square root of number can be found using___ method. (Newton Raphson / Gauss-Sidel) (ii) Bisection method solves transcendental equations. (True / False) (iii) Lagrange interpolation can be used for the data in unequal place. (True / False) (iv) Which operator can solve system of linear equations in Octave?	**[4]**	CO4	BT1, BT2,
Q3 (b)	**Attempt Any TWO:** (i) Write piece of Octave code to find solution of system of linear equations by Gauss-Elimination method. The system is: 2x + 3y + z = 9, x + 2y + 3z = 6, 3x + y + 2z = 8. (ii) Consider an initial value problem: $\frac{dy}{dx} = y$, y(0) = 1, step length h = 0.1. Write piece of Octave code to find solution y(x) using Euler's method. (iii) Write piece of Octave code to apply Newton-Raphson method to find approximate root of the equation f(x) = 2 sinx –x = 0 with initial root x_0 =2.	**[2x3 = 6]**	CO1, CO2, CO3, CO4	BT1, BT2, BT6

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