JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

T-3, EXAMINATION- 2022

B. Tech. III Semester (CE)

COURSE CODE (CREDITS): 18B11MA311 (03) MAX. MARKS: 35

COURSE NAME: NUMERICAL METHODS

COURSE INSTRUCTORS: MDS MAX. TIME: 120 Minutes.

Note: *All questions are compulsory. Marks are indicated against each question in square brackets. Scientific calculator is allowed.*

Quest.(1) Prove that: **(CO-3)[2]**

$$\Delta + \nabla = \frac{\Delta}{\nabla} - \frac{\nabla}{\Delta} .$$

Quest.(2) Perform three iteration of the Gauss-Jacobi iteration method for solving the system of equations **(CO-2)[4]**

$$\begin{bmatrix} 6 & 1 & 1 \\ 1 & 4 & -1 \\ 1 & -1 & 5 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 20 \\ 6 \\ 7 \end{bmatrix}$$

Quest.(3) Find a real root of $3x + \sin x = e^x$, correct to four decimal places using the Newton-Raphson method. **(CO-1)[4]**

Quest.(4) **(a)** Evaluate $\int_0^2 \int_0^2 f(x,y)dxdy$ by Trapezoidal rule for the following data: **(CO-5)[3+3]**

$y \rightarrow$ / $x \downarrow$	0	0.5	1	1.5	2
0	2	3	4	5	5
1	3	4	6	9	11
2	4	6	8	11	14

(b) The distances (x cm) traversed by a particle at different times (t seconds) are given below

t	0.0	0.1	0.2	0.3	0.4	0.5	0.6
x	3.01	3.16	3.29	3.36	3.40	3.38	3.32

Find the velocity of the particle at $t = 0.5$ seconds.

Quest.(5) **(a)** Solve the initial value problem $\frac{dy}{dx} = x(y - x)$, $y(2) = 3$, in the interval $[2, 2.4]$ using Runge- Kutta fourth order method with step size $h = 0.2$ **(CO-6)[6+3]**

(b) A boundary value problem is defined by

$$\frac{d^2y}{dx^2} = x - y,$$

subject to the boundary conditions

$$y(0) = 0, \qquad y(1) = 2.$$

With $h = 0.5$, use the finite-difference method to determine the value of $y(0.5)$.

Quest.(6) By using the method of least squares, fit a second degree parabola to the following data:

x	-3	-2	-1	0	1	2	3
y	1.1	1.3	1.6	2.0	2.7	3.4	4.1

(CO-4)[5]

Quest.(7) The function $u(x, y)$ satisfies Laplace's equation $u_{xx} + u_{yy} = 0$, at all points with in the square given below and has the boundary values as indicated. Perform three iterations and compute a solution by using Jacobi's methods. **(CO-6)[5]**