

Reg. No.:

Name :



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**TERM END EXAMINATIONS (TEE) – May 2023**

<b>Programme</b>	<b>: B.Tech.</b>	<b>Semester</b>	<b>: Summer Semester 2022-23</b>
<b>Course Title/ Course Code</b>	<b>: Applied Numerical Methods/ MAT2003</b>	<b>Slot</b>	<b>: B11+B12+B13+B14+B15</b>
<b>Time</b>	<b>: 1½ hours</b>	<b>Max. Marks</b>	<b>: 50</b>

**Answer ALL the Questions**

Q. No.	Question Description	Marks
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**PART - A ( 30 Marks)**

- |   |  |    |
|---|--|----|
| 1 | (a) Check the solvability of the following system of equations using Gauss Seidel iteration method. If not, solve the following system by rearranging. Perform three iterations with the initial approximation $X^{(0)} = (1, 0.8, 0.5)^T$ , | 10 |
|---|--|----|

$$\begin{aligned}x_1 + 3x_2 + x_3 &= 4 \\4x_1 + 2x_2 + x_3 &= 4 \\3x_1 + 2x_2 + 6x_3 &= 7.\end{aligned}$$

**OR**

- |   |   |    |
|---|---|----|
|   | (b) The equation $2e^{-x} = \frac{1}{x+2} + \frac{1}{x+1}$ has two roots. Calculate the roots up to five decimal places using Newton Raphson method. Take initial approximation $x_0 = -0.6, 0.8$ respectively. | 10 |
| 2 | (a) Using Newton's divided difference scheme, find the equation of the biquadratic curve passing through the points $(-4, 1245)$ , $(-1, 33)$ , $(0, 5)$ , $(2, 9)$ and $(5, 1335)$ .                           | 10 |

**OR**

- |  |  |    |
|--|--|----|
|  | (b) A particle moves at the following velocities $v$ (m/sec) at different instant of time $t$ as described follows. Find the acceleration of the particle at $t = 1.1$ sec, $1.5$ sec, | 10 |
|--|--|----|

Time ( $t$ )	1.1	1.2	1.3	1.4	1.5
Velocity ( $v$ )	2.0091	2.0333	2.0692	2.1143	2.1667

- 3 (a) Consider  $f(x) = \frac{x}{\sin x}$ ,  $f(0) = 1$ . Evaluate the integral 10

$$I = \int_0^{0.5} f(x) dx$$

by taking  $h = 0.25, 0.125, 0.0625$  successively using Trapezoidal rule.

Hence improve the value of the integral using Romberg's method, correct up to three decimal places.

**OR**

- (b) Consider one dimensional heat equation: 10

$$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2} \text{ in } 0 \leq x \leq 5, t \geq 0.$$

Given that,  $u(x, 0) = 20$ ,  $u(0, t) = 0$ ,  $u(5, t) = 100$ .

Find the solution of heat equation, using the Crank-Nicolson scheme with step size  $h=1$  and  $k=1$  up to two time level.

**PART - B (20 Marks)**

- 4 Given the points satisfying  $(0,0)$ ,  $(\pi/2, 1)$  and  $(\pi, 0)$  the function  $y = \sin x$ , ( $0 \leq x \leq \pi$ ), determine the value of  $y(\pi/6)$  using cubic spline approximation. Instead of  $h = \pi/2$ , if we consider  $h = \pi/4$ , what will be the better approximation value of  $y(\pi/6)$  using this method? 10
- 5 Consider the nonlinear initial value problem  $\frac{dy}{dx} + y^2 = x$ ,  $y(0) = 1$ . Find the value  $y(0.4)$  using Adam-Bashforth predictor corrector method. Initial values are given as follows:  $y(0.1) = 0.9117$ ,  $y(0.2) = 0.8494$ ,  $y(0.3) = 0.8061$ . 10

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