BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION SP/2025)

CLASS: BTech
BRANCH: CSE/ECE/EEE

SEMESTER : IV/ADD
SESSION : SP/2025

SUBJECT: MA203 NUMERICAL METHODS

TIME: 02 Hrs.

FULL MARKS: 25

INSTRUCTIONS:
1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates

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Q.	Question	Marks	CO	BL
Q.1(a)	(i) What is the correct normalized scientific notation for 0.0307318293 with 4 signifant digits? (ii) What is the round-off error in representing 20/3 in a 6-significant digit computer that chops the last significant digits? (iii) What is the round-off error in representing 20/3 in a 6-significant digit computer that rounds the last significant digits? (iv) What is the truncation error in the calculation of $f'(x)$ that uses the approximation $f'(x) = \frac{f(x+\Delta x)-f(x)}{\Delta x}$ for $x^3, \Delta x = 0.4$ and $x = 5$.	[2]	1	2
Q.1(b)	In the calculation of the volume of a cube of normal size 5 inches, the uncertainty in the measurement of each side is 10%. Find the uncertainty in the measurement of the volume.	[3]	1	2
Q.2	Find the estimate of the root of $x^2 - 4 = 0$ by using the Newton-Raphson method. Assume that the initial guess of the root is 3. Conduct three iterations. Also, calculate the approximate error, true error, absolute relative approximate error, and the absolute relative true error at the end of each iteration. Show them in the following tabular form	[5]	1	2

Iteration	Root Estimate	Approx Error	True Error	Abs Rel Approx Err	Abs Rel True Err

Q.3 Use the LU decomposition method to solve the following simultaneous linear equations. [5] CO 2 BL 2

$$\begin{bmatrix} 25 & 5 & 1 \\ 64 & 8 & 1 \\ 144 & 12 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 106.8 \\ 177.2 \\ 279.2 \end{bmatrix}$$

Q.4(a) Find the solution to the following system of equations using the Gauss-Seidel method. [2] CO 2 BL 2

$12x_1 + 3x_2 - 5x_3 = 1, x_1 + 5x_2 + 3x_3 = 28, 3x_1 + 7x_2 + 13x_3 = 76$

Use $(x_1, x_2, x_3) = (0.74275,\ 3.1644,\ 3.9708)$ as the initial guess and conduct two iterations.

Q.4(b) Using the power method, find the largest eigenvalue and the corresponding eigenvector of [A] = $\begin{bmatrix} 1.5 & 0 & 1 \\ -0.5 & 0.5 & -0.5 \\ -0.5 & 0 & 0 \end{bmatrix}$. Use $[X^{(0)}] = (1, -0.2, -0.2)$ as the initial guess and conduct three iterations. [3] CO 2 BL 2

Q.5 The upward velocity of a rocket is given as a function of time in the following Table. [4+1] CO 3 BL 2

t (s)	0	10	15	20	22.5	30
$v(t)$(m/s)	0	227.04	362.78	517.35	602.97	901.67

a) Determine the value of the velocity at $t = 16$ seconds with third order polynomial interpolation using Newton's divided difference polynomial method.

b) Using the third order polynomial interpolant for velocity, find the acceleration of the rocket at $t = 16$ s.

:::::03/03/2025 E:::::