Register No.: ..... Name: .....

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FIFTH SEMESTER INTEGRATED MCA DEGREE EXAMINATION (R), DECEMBER 2023
(2020 SCHEME)

Course Code: **20IMCAT301**

Course Name: **Numerical Methods**

Max. Marks: **60** **Duration: 3 Hours**

Non-programmable calculator may be permitted in the examination hall.

PART A

(Answer all questions. Each question carries 3 marks)

1. Find AB and BA for the matrices $A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}$ and $B = \begin{bmatrix} -7 & -8 \\ 9 & 10 \\ 0 & -11 \end{bmatrix}$.

2. Find the inverse of the given matrix, if it exists, $A = \begin{bmatrix} 1 & 1 \\ 3 & 4 \end{bmatrix}$.

3. Determine whether the following system of equations is consistent:
$$x + y - z = 1$$
$$x + y - z = 0$$

4. Find the rank of the given matrices:
   (i) $A = \begin{bmatrix} 1 & 2 & 0 \\ 3 & 1 & -5 \end{bmatrix}$

   (ii) $B = \begin{bmatrix} 4 & 1 \\ 2 & 3 \\ 2 & 2 \end{bmatrix}$

5. The product of two eigen values of the matrix $A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ is 16.

   Find the third eigen value of A.

6. Find the sum and product of the eigen values of the matrix $A = \begin{bmatrix} 3 & 1 & -1 \\ 0 & 2 & 6 \\ 0 & 0 & 6 \end{bmatrix}$.

7. Define principle of least squares.
8. What are the normal equations for fitting of a straight line $y = ax + b$.
9. Explain Lagrange's interpolation formula.
10. Estimate the value of $f(7)$ from the following data using Newton's divided difference interpolation formula:

x	5	6	9	11
y	12	13	14	16

PART B

(Answer one full question from each module, each question carries 6 marks)

MODULE I

11. a) Define trace of a matrix. Find the trace of the matrix $A = \begin{bmatrix} 3 & 0 & 1 \\ 1 & 0 & 2 \\ 0 & 0 & 1 \end{bmatrix}$. (2)

b) Find the inverse of the matrix $A = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 3 \end{bmatrix}$ using Gauss-Jordan method. (4)

OR

12. a) Define symmetric and skew-symmetric matrices with examples. (3)

b) Show that $AB = CB$ but $A \neq C$ for $A = \begin{bmatrix} 3 & 2 \\ 1 & 0 \end{bmatrix}, B = \begin{bmatrix} 2 & 4 \\ 1 & 2 \end{bmatrix}$, $C = \begin{bmatrix} 1 & 6 \\ 3 & -4 \end{bmatrix}$. (3)

MODULE II

13. Write the set of equations associated with the given augmented matrix and the specified variables and then solve. (6)

$[A|B] = \begin{bmatrix} 0 & 0 & 2 & 3 & 0 \\ 1 & 0 & 3 & 1 & 0 \\ 1 & 1 & 2 & 0 & 0 \end{bmatrix}$, x_1, x_2, x_3, x_4.

OR

14. Use Gaussian elimination method to solve the system of equations: (6)

$x + 3y + 2z = 0$
$-x - 4y + 3z = -1$
$2x - z = 3$
$2x - y + 4z = 2$

MODULE III

15. Find the eigen values and eigen vectors of the matrix (6)

$A = \begin{bmatrix} 2 & 1 & -1 \\ 1 & 1 & -2 \\ -1 & -2 & 1 \end{bmatrix}$.

OR

16. Diagonalize the matrix $A = \begin{bmatrix} 1 & 0 & -1 \\ 1 & 2 & 1 \\ 2 & 2 & 3 \end{bmatrix}$. (6)

MODULE IV

17. Apply method least squares to fit an equation of the form $y = a + bx$ to the following data: (6)

x	1	2	3	4	5
y	12	25	38	47	65

OR

18. Analyze the following data to fit a second-degree parabola of the form $y = a + bx + cx^2$. (6)

x	0	1	2	3	4
y	1.2	1.7	2.1	2.8	5.9

MODULE V

19. Compute the approximate value of $f(0.25)$ using Newton's forward interpolation formula from the following data: (6)

x	0	0.5	1	1.5	2
y	1	1.0513	1.1052	1.1618	1.2214

OR

20. Use Lagrange's interpolation formula to find the value of y, when $x = 10$ from the following data: (6)

x	5	6	9	11
y	12	13	14	16

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