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

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FIFTH SEMESTER INTEGRATED M.C.A DEGREE EXAMINATION (R), DECEMBER 2022
(2020 SCHEME)

Course Code: **20IMCAT301**

Course Name: **Numerical Methods**

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

Non-programmable scientific calculators may be permitted.

PART A

(Answer all questions. Each question carries 3 marks)

1. Show that $AB = CB$ but $A \neq C$ for $A = \begin{bmatrix} 3 & 2 \\ 1 & 0 \end{bmatrix}$, $B = \begin{bmatrix} 2 & 4 \\ 1 & 2 \end{bmatrix}$ and $C = \begin{bmatrix} 1 & 6 \\ 3 & -4 \end{bmatrix}$.
2. Define a skew-symmetric matrix and determine whether the matrix $A = \begin{bmatrix} 0 & 2 & -3 \\ -2 & 0 & 1 \\ 3 & -1 & 0 \end{bmatrix}$ is skew-symmetric or not.
3. Determine whether the vectors $[1 \quad 3], [2 \quad -1], [1 \quad 1]$ are linearly independent or not.
4. Find the rank of the matrix $\begin{bmatrix} 3 & 0 & 2 & 2 \\ -6 & 42 & 24 & 54 \\ -21 & -21 & 0 & -15 \end{bmatrix}$.
5. If $\lambda = 1$ is an eigenvalue of $A = \begin{bmatrix} 2 & -1 & 0 \\ 3 & -2 & 0 \\ 0 & 0 & 1 \end{bmatrix}$, find the remaining eigenvalues of A without using the characteristic equation.
6. Determine whether $A = \begin{bmatrix} 2 & 1 \\ 0 & 2 \end{bmatrix}$ is diagonalizable or not.
7. Define the principle of least squares.
8. Write the normal equations to fit a second-degree equation of the form $y = ax^2 + bx + c$.
9. Use Newton's backward interpolation to find the interpolating polynomial for the following data.

x	1	2	3
y	2	6	18

10. Write the Newton's divided difference interpolation formula.

PART B

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

MODULE I

11. Find the inverse of the matrix $A = \begin{bmatrix} 2 & 0 & -1 \\ 0 & 1 & 2 \\ 3 & 1 & 1 \end{bmatrix}$. (6)

OR

12. Partition the matrix $B = \begin{bmatrix} 3 & 2 & 0 & 0 \\ -1 & -1 & 0 & 0 \\ 0 & 0 & 2 & 1 \\ 0 & 0 & 1 & -1 \end{bmatrix}$ into block diagonal matrix and find B^2. (6)

MODULE II

13. Using Gauss elimination method, solve the system of equations. (6)

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

OR

14. Using Gauss-Seidel method, solve the following system of equations. (6)

$$27x + 6y - z = 85$$
$$x + y + 54z = 110$$
$$6x + 15y + 2z = 72$$

MODULE III

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

OR

16. Using power method, find the dominant eigenvalue and a corresponding Eigen vector for the matrix $\begin{bmatrix} 0 & 1 \\ -4 & 6 \end{bmatrix}$. (6)

MODULE IV

17. Fit a curve of the form $y = a + bx^2$ to the following data by converting the equation $y = a + bx^2$ into linear form. (6)

x	1	2	3	4	5	6
y	0.56	0.89	1.04	1.63	2.95	4.5

OR

18. Formulate a linear relationship of the form $T = at + b$ between temperature and time from the following data, using the method of least squares. (6)

$t(hrs)$	0.5	1.1	1.5	2.1	2.3
$T(℃)$	32.0	33.0	34.2	35.1	35.7

MODULE V

19. Apply Lagrange's Interpolation method to find the value of y when $x = 10$, given the following table of values of x and $y = f(x)$. (6)

x	5	6	9	11
$y = f(x)$	12	13	14	16

OR

20. Health surveys are conducted in a city every 10 years. The following data gives the number of people (in thousands) having heart diseases as found from the records of the survey. (6)

Year	1961	1971	1981	1991	2001	2011
No. of people	16	19	23	28	34	41

Use Newton's forward interpolation method to estimate the number of people with heart diseases in the year 1965.

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