

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

**SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)**

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

**FIFTH SEMESTER INTEGRATED MCA DEGREE EXAMINATION (S), FEBRUARY 2024  
(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. Determine the orders of the following matrices and perform the indicated operations on the matrices:

$$A = \begin{bmatrix} 5 & 1 \\ 7 & 3 \\ -2 & -1 \end{bmatrix}, B = \begin{bmatrix} 1 & 0 \\ 3 & 2 \end{bmatrix}, C = [1 \quad 2 \quad 0 \quad 3]$$

- (i) AB  
(ii) 7A  
(iii) 3C

2. Evaluate the expression  $(A-I)(A+2I)$  for the matrix  $A = \begin{bmatrix} 3 & 5 \\ -2 & 4 \end{bmatrix}$ .

3. Determine whether the set  $\{[1 \ 1], [1 \ -1]\}$  is linearly independent.

4. Find the rank of the matrix  $A = \begin{bmatrix} 1 & 2 & 4 & 2 \\ 1 & 1 & 3 & 2 \\ 1 & 4 & 6 & 2 \end{bmatrix}$ .

5. Find the eigen values of the matrix  $A = \begin{bmatrix} 8 & -4 \\ 2 & 2 \end{bmatrix}$ .

6. Find the eigen values of  $A^{-1}$  if the matrix  $A$  is  $\begin{bmatrix} 2 & 5 & -1 \\ 0 & 3 & 2 \\ 0 & 0 & 4 \end{bmatrix}$ .

7. Define principle of least squares.

8. What are the normal equations for fitting of a parabola  $y = a + bx + cx^2$ .

9. Explain Lagrange's interpolation formula.

10. Estimate the value of  $y(2)$  from the following data using Lagrange's interpolation formula:

x	1	3	4
y	1	27	64

**PART B***(Answer one full question from each module, each question carries 6 marks)***MODULE I**

11. a) Define singular and non-singular matrices. Find the inverse of the matrix  $A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 4 & 0 \\ 0 & 0 & 2 \end{bmatrix}$ . (2)
- b) Find the inverse of the matrix, if exists,  $A = \begin{bmatrix} 2 & 0 & -1 \\ 0 & 1 & 2 \\ 3 & 1 & 1 \end{bmatrix}$  using Gauss-Jordan method. (4)

**OR**

12. a) Define a diagonal matrix with example. (2)
- b) Evaluate the expression  $(I - A)(A^2 - I)$  for the matrix  $A = \begin{bmatrix} 2 & -1 & 1 \\ 3 & -2 & 1 \\ 0 & 0 & 1 \end{bmatrix}$ . (4)

**MODULE II**

13. a) Determine whether the values  $x = 1, y = -3, z = 2$  are solution to the system
- $$\begin{aligned} x + y + 2z &= 2 \\ x - y - 2z &= 0 \\ x + 2y + 2z &= 1 \end{aligned} \quad (1)$$
- b) Use Gaussian elimination method to solve the system of equations:
- $$\begin{aligned} y - 2z &= 4 \\ x + 3y + 2z &= 1 \\ -2x + 3y + z &= 2 \end{aligned} \quad (5)$$

**OR**

14. Determine the number of solutions to the system
- $$\begin{aligned} 2x - 3y + z &= -1 \\ x - y + 2z &= 2 \\ 2x + y - 3z &= 3 \end{aligned} \quad (6)$$
- Hence find the solution.

**MODULE III**

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

**OR**

16. Diagonalize the Matrix  $A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$ . (6)

**MODULE IV**

17. Apply method of least squares to fit an equation of the form  $y = ax + b$  to the following data:

x	0.5	1.1	1.5	2.1	2.3
y	32	3	34.2	35.1	35.7

 (6)
**OR**

18. Analyze the following data to fit a curve of the form  $y = a + bx^2$ .

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

 (6)
**MODULE V**

19. Estimate the value of  $y(3)$  from the following data, using Lagrange's interpolation formula:

x	0	1	2	4	5	6
y	1	14	15	5	6	19

 (6)
**OR**

20. Using Newton's forward interpolation formula, estimate the value of  $\sin 8^\circ$  for the following data:

$\theta$	5	10	15	20	25	30
$\sin \theta$	0.0871	0.1736	0.2588	0.342	0.4226	0.5

 (6)

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