



Question Paper Code : 21F23027

SRI SHAKTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY
COIMBATORE – 641 062
(Autonomous Institution)

B.E / B. Tech. DEGREE EXAMINATION, Nov/Dec 2023

First Semester

21MA105- Matrices and Calculus for Information Science (Regulation 2021)

(Common to AIDS, AIML, CSE, CSE(CS), IT)

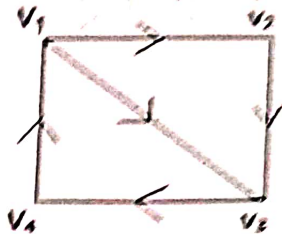
Time : Three Hours

Maximum : 100 Marks

PART – A (Answer ALL questions) (20*0.5=10 Marks)

- 1 A system of linear equations is ----- when there is no solution that satisfies all the equations.
- 2 The Eigen value of A and A^T are -----
(a) Different (b) same (c) negative (d) zero
- 3 Every matrix satisfies its own characteristic equation. Say(True or False)
- 4 If the Eigen values of A are -3,-6,0, then the nature of the matrix is
(a) Positive definite (b) Negative definite (c) Indefinite (d) Negative semi definite.
- 5 The nature of the quadratic form is Indefinite if all the Eigen values is -----
- 6 Write the parametric values of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ are ----- and -----
- 7 The rate of bending of a curve in any interval is called-----
- 8 If $(0,0)$ are the coordinates of the Centre of curvature whose curvature is ρ , then the equation of Circle of curvature is -----
- 9 The value of $\iint \frac{dr d\theta}{r} =$ -----
- 10 Write the formula for volume of solids = -----
- 11 The equation $(ax + b)^2 \frac{d^2y}{dx^2} + P_1(ax + b) \frac{dy}{dx} + P_2y = f(x)$ reduces to homogeneous linear form, if $x =$ -----.
(a) $ax + b = e^z$ (b) $ax + b = e^{z+1}$ (c) $ax + b = e^{z+2}$ (d) 0
- 12 The value for $(1 + D^2)x =$ -----.

- 13 Write the adjacency matrix to represent directed the graph given below.

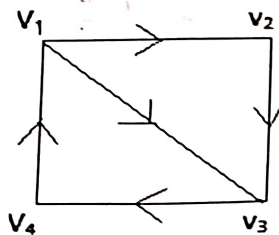


- 14 transformation is used to change the size of an object.
 (a) Translation (b) Scaling (c) Rotation (d) Reflection
- 15 In computer graphics, matrices are commonly used for:
 (a) Sorting algorithms (b) Image processing (c) Database management
 (d) Network protocols
- 16 Which matrix operation is fundamental in machine learning for representing relationships between input and output variables?
 (a) Matrix addition (b) Matrix multiplication (c) Matrix inversion (d) Matrix transposition
- 17 What role does ordinary differential equation play in network protocols?
 (a) Calculating encryption keys (b) Analyzing data structures
 (c) Modelling traffic flow and congestion (d) Managing database transactions
- 18 How is integral calculus applied in numerical methods for solving equations and systems?
 (a) Optimizing algorithms (b) Approximating definite integrals
 (c) Sorting data efficiently (d) Database management
- 19 In cryptography, ordinary differential equations may be used for:
 (a) Encrypting data (b) Hashing passwords
 (c) Sorting algorithms (d) Network security protocols
- 20 Microprocessors are specially designed to process the analog signals into a digital form. Say (True/ False)

PART - B (Answer ALL questions) (5*2=10 Marks)

- 21 The product of two Eigen values of the matrix $\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ is 16. Find the third Eigen value.
- 22 Determine the nature of the Quadratic form $f(x, y, z) = x^2 + 2y^2$
- 23 Show that the radius of curvature at $x = \frac{\pi}{2}$ of the curve $y = 4\sin x - \sin 2x$ is $\frac{5\sqrt{5}}{4}$
- 24 Find the particular integral of $(D^2 - 4D + 4)y = 2^x$
- 25 Find rate of change in blood pressure $B(x) = 305x^2 - 1830x^3$, $0 \leq x \leq 0.16$ when the dosage is 0.1..

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PART - C (Answer any five questions) (5*14=70 Marks)

- 26 (i) Test the consistency of the system of equations $2x + y + z = 3$, $x - 2y - z = 1$, $3x + 4y + 3z = 5$. (7)

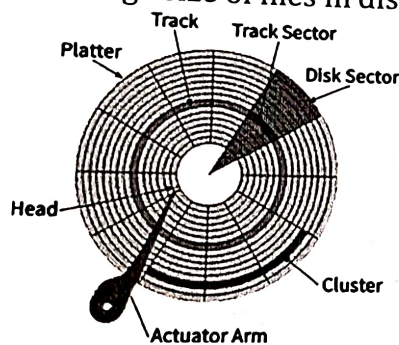
- (ii) Using Cayley - Hamilton theorem for the matrix $A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 3 & -3 \\ -2 & -4 & -4 \end{bmatrix}$, find its inverse. (7)

- 27 Reduce the Quadratic Form $8x^2 + 7y^2 + 3z^2 - 12xy + 4xz - 8yz$ to a canonical form through an orthogonal transformation (14)

- 28 (i) Prove that the radius of curvature at any point of a cycloid $x = a(\theta + \sin \theta)$, $y = a(1 - \cos \theta)$ is $4a \cos \frac{\theta}{2}$. (8)

- (ii) A triangle misplaced at the location (pixel) (4,6), (2,2), (6,2) on the Monitor. To obtain correct location of the triangle that need to be rotate by 60 degrees. Use appropriate (CG) Computer Graphics place the triangle at correct position. (6)

- 29 (i) The size of files in magnetic disk is given by $f(x) = 3(10^{-4} X (1000-x))$ where x is the measure of the distance from the disk where the value ranges from 0 to 16. Find the average size of files in disk. (7)



- (ii) Find, using a double integral, the area that lies outside the circle $r = a$ and inside the cardioid $r = a(1 + \cos \theta)$. (7)

- 30 Find the evolute of the rectangular hyperbola $xy = c^2$ (14)

- 31 (i) Find the volume of sphere $x^2 + y^2 + z^2 = a^2$ without transformation. (7)

- (ii) Solve $\frac{dx}{dt} + y = \sin t$, $x + \frac{dy}{dt} = \cos t$ (7)

- 2 (i) Find the Eigen values and Eigen vectors of $A = \begin{bmatrix} 11 & -4 & -7 \\ 7 & -2 & -5 \\ 10 & -4 & -6 \end{bmatrix}$ (7)

- (ii) A polygon Image has four vertices and the following pixel values represents the location of points A (20,10), B (60,10), C (60,30), D (20,30) on the 2D plane (X and Y axis values). Maximize(Scale) the size of the image by the thrice (Scaling factor) of its original position. (7)

PART - D (Answer the questions) (1*10=10 Marks)

- 33 (a) Series RL circuit with $R = 50\Omega$ and $L = 5H$ has a constant voltage $V = 200\text{ v}$ applied at $t = 0$ by the closing of a switch. Find the current in the circuit using $Ri + L \frac{di}{dt} = V$. (10)

(OR)

- (b) Sita coughs when a foreign object is in the windpipe. The velocity of the cough depends on the size of the object. Suppose a person has a windpipe with a 22-mm radius. If a foreign object has a radius r , in millimetres, then the velocity V , in millimetres per second, needed to remove the object by a cough is given by $V(r) = k(22r^2 - r^3)$, $0 \leq r \leq 20$ Where k is some positive constant. For what size object is the maximum velocity required to remove the object which can be calculated with the help of remote IoT based sensors? (10)