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| Q.P Code : D141642                                       | Total Pages: 3 | Name <b>760551</b> |
|                                                          |                | Register No.       |
| SECOND SEMESTER (CUFYUGP) DEGREE EXAMINATION, APRIL 2026 |                |                    |
| MATHEMATICS                                              |                |                    |
| MAT2MN102<br>Calculus and Matrix Algebra                 |                |                    |
| 2024 Admission Onwards                                   |                |                    |
| Maximum Time :2 Hours                                    |                | Maximum Marks :70  |

## Section A

All Question can be answered. Each Question carries 3 marks (Ceiling : 24 Marks)

|    |                                                                                                                                                                     |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | Solve $\int \frac{1}{1 + \sin x} dx$                                                                                                                                |
| 2  | Sketch the region whose area is represented by the definite integral $\int_1^4 (2x + 1) dx$ , and evaluate the integral using an appropriate formula from geometry. |
| 3  | Evaluate $\int_{-1}^1 \frac{1}{1 + x^2} dx$                                                                                                                         |
| 4  | Find the average value of the function $f(x) = \frac{1}{\sqrt{1 - x^2}}$ over the interval $[-1/2, 0]$                                                              |
| 5  | Evaluate $\int_1^{\sqrt{3}} \frac{\sqrt{\tan^{-1} x}}{1 + x^2} dx$                                                                                                  |
| 6  | Sketch the graph of $f(x, y) = \sqrt{1 - x^2 - y^2}$                                                                                                                |
| 7  | Explain the domain of $f(x, y, z) = \ln(2 - x - y - z)$                                                                                                             |
| 8  | Find $\lim_{(x,y) \rightarrow (0,0)} \frac{x^2 + y^2}{2xy}$ along the line $y = x$                                                                                  |
| 9  | For an $n \times m$ matrix $\mathbf{A}$ , show that $(\mathbf{kA})^T = \mathbf{k}(\mathbf{A}^T)$                                                                    |
| 10 | Use either Gaussian elimination or Gauss–Jordan elimination to solve the system of linear equations<br>$10x_1 + 15x_2 = 1, \quad 3x_1 + 2x_2 = -1$                  |

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## Section B

All Question can be answered. Each Question carries 6 marks (Ceiling : 36 Marks))

|    |                                                                                                                                                                                                                      |
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| 11 | Evaluate the integral $\int \frac{1}{\sqrt{9-4x^2}} dx$                                                                                                                                                              |
| 12 | Using definite integral, find the area of the region below the interval $[-2, -1]$ and above the curve $y = x^3$ .                                                                                                   |
| 13 | Find the area of the region enclosed by the curves<br>$x^2 = y, x = y - 2$                                                                                                                                           |
| 14 | Evaluate $\int \frac{1}{x^2 - 3x + 4} dx$                                                                                                                                                                            |
| 15 | Determine whether the limit exists. If so, find its value.<br>$\lim_{(x,y,z) \rightarrow (2,0,-1)} \ln(2x + y - z)$                                                                                                  |
| 16 | Find $f_x(x, y)$ and $f_y(x, y)$ for $f(x, y) = 2x^3y^2 + 2y + 4x$ , and use those partial derivatives to compute $f_x(1, 3)$ and $f_y(1, 3)$ .                                                                      |
| 17 | Solve the following system of linear equations<br>$\begin{aligned} x_1 + x_2 + x_3 &= 3 \\ x_1 - x_2 - x_3 &= -1 \\ 3x_1 - x_2 - x_3 &= 5 \end{aligned}$                                                             |
| 18 | Suppose $\mathbf{A}$ is an orthogonal matrix. Then show that<br>1. $\mathbf{A}^{-1}$ is an orthogonal matrix<br>2. $\det \mathbf{A} = \pm 1$<br>3. if $\mathbf{A}^2 = \mathbf{I}$ , then $\mathbf{A}^T = \mathbf{A}$ |

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## Section C

Answer any ONE. Each Question carries 10 marks (1x10=10 Marks))

|    |                                                                                                                                                                                                                                                                          |
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| 19 | Evaluate $\int \frac{3x+1}{3x^2+2x-1} dx$                                                                                                                                                                                                                                |
| 20 | <p>Find the eigenvalues and eigenvectors of the following nonsingular matrix <b>A</b>. Then without finding <math>\mathbf{A}^{-1}</math>, find its eigenvalues and corresponding eigenvectors.</p> $\begin{pmatrix} 1 & 2 & -1 \\ 1 & 0 & 1 \\ 4 & -4 & 5 \end{pmatrix}$ |

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