

Q.P Code : D141642	Total Pages: 3	Name 760554
		Register No.
SECOND SEMESTER (CUFYUGP) DEGREE EXAMINATION, APRIL 2026		
MATHEMATICS		
MAT2MN102		
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 $10x_1 + 15x_2 = 1, \quad 3x_1 + 2x_2 = -1$

Section B

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

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 $x^2 = y, x = y - 2$
14	Evaluate $\int \frac{1}{x^2 - 3x + 4} dx$
15	Determine whether the limit exists. If so, find its value. $\lim_{(x,y,z) \rightarrow (2,0,-1)} \ln(2x + y - z)$
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 $\begin{aligned} x_1 + x_2 + x_3 &= 3 \\ x_1 - x_2 - x_3 &= -1 \\ 3x_1 - x_2 - x_3 &= 5 \end{aligned}$
18	Suppose $\mathbf{A}$ is an orthogonal matrix. Then show that 1. $\mathbf{A}^{-1}$ is an orthogonal matrix 2. $\det \mathbf{A} = \pm 1$ 3. if $\mathbf{A}^2 = \mathbf{I}$, then $\mathbf{A}^T = \mathbf{A}$

Section C

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

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