Q.P Code **D 122902**	Total Pages **3**	Name **603197**
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SECOND SEMESTER (CUFYUGP) DEGREE EXAMINATION, APRIL 2025

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 the initial-value problem $\frac{dy}{dx} = \sin x; y(0) = 1$
2	Sketch the region whose area is represented by the definite integral $\int_1^3 (1+x)\ dx$, and evaluate the integral using an appropriate formula from geometry.
3	Evaluate $\int_{1/2}^{1} \frac{1}{2x}\ dx$
4	Find the average value of the function $f(x) = e^x$ over the interval $[-1, \ln 7]$
5	Evaluate $\int_2^4 (3x-1)(x+1)^3\ dx$
6	True or False: "Every level surface of $f(x,y,z) = x + 2y + 3z$ is a plane.". Explain your answer
7	Explain the domain of $f(x,y,z) = \sqrt{25 - x^2 - y^2 - z^2}$
8	Find $\lim_{(x,y)\to(0,0)} \frac{xy}{x^2+2y^2}$ along the line $y = -x$
9	For $n \times n$ matrices $\mathbf{A}$ and $\mathbf{B}$, show that $(\mathbf{AB})^{\mathbf{T}} = \mathbf{B}^{\mathbf{T}}\mathbf{A}^{\mathbf{T}}$
10	Solve the system of homogeneous linear equations $x + 2y = 0, \quad 2x - y = 0$

Section B

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

11	Sketch the region whose area is represented by the definite integral $\int_0^1 \sqrt{1-x^2}\ dx$, and evaluate the integral using an appropriate formula from geometry.
12	Using definite integral, find the area of the region under the curve $y = 3\sin x$ and over the interval $[0, 2\pi/3]$.
13	Find the area of the region enclosed by the curves $$y = \cos 2x, y = 0, x = \pi/4, x = \pi/2$$
14	Evaluate $\int \frac{1}{x(x^2-1)}\ dx$
15	Determine whether the limit exists. If so, find its value. $$\lim_{(x,y,z)\to(0,0,0)} \frac{\sin(x^2+y^2+z^2)}{\sqrt{x^2+y^2+z^2}}$$
16	Find $f_x(1,3)$ and $f_y(1,3)$ for the function $f(x,y) = 2x^3y^2 + 2y + 4x$
17	Solve the following system of linear equations $3x_1 - x_2 + 2x_3 = 5$ $2x_1 + x_2 + x_3 = 1$
18	Construct an orthogonal matrix from the eigenvectors of the symmetric matrix $\begin{pmatrix} 1 & 1 \\ 1 & 0 \end{pmatrix}$

Section C

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

19	Evaluate $\int \frac{3x^2 - 10}{x^2 - 4x + 4}\, dx$
20	Find the eigenvalues and eigenvectors of the following nonsingular matrix **A**. Then without finding $\mathbf{A^{-1}}$, find its eigenvalues and corresponding eigenvectors. $$\begin{pmatrix} 9 & 1 & 1 \\ 1 & 9 & 1 \\ 1 & 1 & 9 \end{pmatrix}$$