

QP CODE: D2BMT2405	(Pages: 2)	Reg. No :
		Name :
SECOND SEMESTER FYUGP EXAMINATION, APRIL 2025		
MINOR COURSE		
MAT2MN102 : Calculus and Matrix Algebra		
(Credits: 4)		
Time: 2 Hours	Maximum Marks: 70	
Section A		
Answer the following questions. Each carries 3 marks (Ceiling: 24 marks)		
1. Solve the initial value problem $\frac{dy}{dt} = \frac{1}{t}, y(-1) = 5$.	BL1	CO1
2. State Fundamental Theorem of Calculus, Part 2.	BL1	CO1
3. Write the partial fraction decomposition form of $\frac{5}{x(x^2-4)}$.	BL2	CO1
4. Evaluate $\int x \cos 2x \, dx$.	BL2	CO1
5. Describe the graph of the function $f(x, y) = 1 - x - \frac{1}{2}y$ in an xyz coordinate system.	BL1	CO2
6. Find the largest region on which the function $f(x, y) = \sin^{-1}(xy)$ is continuous.	BL2	CO2
7. Evaluate $\lim_{(x,y) \rightarrow (0,0)} e^{-\left(\frac{1}{x^2+y^2}\right)}$ using the substitution $z = x^2 + y^2$ (Hint: $z \rightarrow 0^+$ if and only if $(x, y) \rightarrow (0, 0)$).	BL3	CO2
8. Define diagonal matrix and scalar matrix and give example for each matrix.	BL1	CO3
9. Find the eigenvalues of $A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 1 & -3 & 3 \end{bmatrix}$.	BL3	CO3
10. Suppose A is an orthogonal matrix. Is A^2 orthogonal ?	BL2	CO3
Section B		
Answer the following questions. Each carries 6 marks (Ceiling: 36 Marks)		
11. Sketch the region whose signed area is represented by the definite integral, and evaluate the integral using an appropriate formula from geometry. (PTO)	BL2	CO1

	(a) $\int_0^4 x \, dx$ (b) $\int_0^3 \left(1 - \frac{x}{2}\right) dx$		
12.	Evaluate the following integrals. (a) $\int t^4 \sqrt[3]{3-5t^5} \, dt$ (b) $\int \cos 2t \sin^5 2t \, dt$	BL2	CO1
13.	Evaluate (a) $\int_0^2 3x^2(1+x^3)^3 \, dx$ (b) $\int_{-\ln 3}^{\ln 3} \frac{e^x}{e^x + 4} \, dx$.	BL2	CO1
14.	Find the arc length of the curve $y = x^{\frac{3}{2}}$ from $(1, 1)$ to $(2, 2\sqrt{2})$.	BL3	CO1
15.	Let $f(x, y) = xe^{-y} + 5y$. (a) Find the slope of the surface $z = f(x, y)$ in the x -direction at the point $(3, 0)$. (b) Find the slope of the surface $z = f(x, y)$ in the y -direction at the point $(3, 0)$.	BL3	CO2
16.	Confirm that the mixed second-order partial derivatives of $f(x, y) = 4x^2 - 8xy^4 + 7y^5 - 3$ are the same.	BL3	CO2
17.	Solve $\begin{aligned} x_1 - x_2 - x_3 &= 8 \\ x_1 - x_2 + x_3 &= 3 \\ -x_1 + x_2 + x_3 &= 4 \end{aligned}$	BL2	CO3
18.	Construct an orthogonal matrix from the eigenvectors of the symmetric matrix $A = \begin{pmatrix} 1 & 9 \\ 9 & 1 \end{pmatrix}$.	BL3	CO3

Section C

Answer any one question. Each carries 10 marks (1 x 10 = 10 Marks)

19.	Sketch the region and find the area of the region that is enclosed between the curves $y = x^2$ and $y = x + 6$.	BL3	CO1
20.	Find eigenvalues and eigenvectors of $A = \begin{pmatrix} -1 & 2 \\ -7 & 8 \end{pmatrix}$.	BL3	CO3

CO : Course Outcome

BL : Bloom's Taxonomy Levels (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)