

QP CODE: D2BMT2504	(Pages: 2)	Reg. No :
		Name :
SECOND SEMESTER FYUGP EXAMINATION, APRIL 2026		
(Regular/Improvement/Supplementary)		
Discipline Specific Core (DSC) Courses - Minor		
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.	Sketch the region whose area is represented by the definite integral $\int_0^2 (x-1) dx$ and evaluate the integral using an appropriate formula from geometry.	BL2 CO1
2.	Evaluate $\int \frac{x^5 + 2x^2 - 1}{x^4} dx$.	BL2 CO1
3.	Evaluate $\int_1^5 \frac{dx}{\sqrt{2x-1}}$.	BL2 CO1
4.	Evaluate $\int x \sin 3x dx$.	BL3 CO1
5.	Find the largest region on which the function $f(x, y) = \tan^{-1}(y-x)$ is continuous.	BL2 CO2
6.	Let $f(x, y) = \sqrt{y+1} + \ln(x^2 - y)$. Find $f(e, 0)$ and sketch the natural domain of f .	BL1 CO2
7.	Find $f_x(x, y)$ and $f_y(x, y)$ if $f(x, y) = (x^2 + 5x - 2y)^6$.	BL2 CO2
8.	Determine whether the matrix $A = \begin{bmatrix} 1 & -1 & 1 \\ 1 & -1 & -1 \\ 1 & 2 & 0 \end{bmatrix}$ is orthogonal.	BL2 CO3
9.	Find eigenvalues of $A = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$.	BL2 CO3
10.	Determine values of x and y for which the matrices are equal $\begin{pmatrix} 1 & x \\ y & -3 \end{pmatrix}, \begin{pmatrix} 1 & y-2 \\ 3x-2 & -3 \end{pmatrix}$.	BL1 CO3
(PTO)		

Section B

Answer the following questions. Each carries 6 marks (Ceiling: 36 Marks)

11. Evaluate the following integrals.	BL2	CO1
(a) $\int \sin^2 x \cos x \, dx$ (b) $\int \frac{e^{\sqrt{x}}}{\sqrt{x}} \, dx$		
12. State mean value theorem for integrals and verify for the function $f(x) = x^2 + x$ on $[-12, 0]$.	BL3	CO1
13. Evaluate $\int \frac{2x+4}{x^3-2x^2} \, dx$.	BL3	CO1
14. Sketch the region and find the area of the region enclosed by $y = e^x$ and $y = e^{2x}$, $x = 0$, $x = \ln 2$.	BL3	CO1
15. Evaluate the following limits using the substitution $z = x^2 + y^2$ (Hint: $z \rightarrow 0^+$ if and only if $(x, y) \rightarrow (0, 0)$)	BL2	CO2
(a) $\lim_{(x,y) \rightarrow (0,0)} \frac{\sin(x^2+y^2)}{x^2+y^2}$ (b) $\lim_{(x,y) \rightarrow (0,0)} \frac{1-\cos(x^2+y^2)}{x^2+y^2}$		
16. Find second-order partial derivatives of $f(x, y) = 4x^2 - 2y + 7x^4y^5$.	BL3	CO2
17. Find eigenvalues and eigenvectors of $A = \begin{pmatrix} 7 & 0 \\ 0 & 13 \end{pmatrix}$.	BL2	CO3
18. Solve $\begin{aligned} x_1 + x_2 + x_3 &= 0 \\ x_1 + x_2 + 3x_3 &= 0 \end{aligned}$	BL2	CO3

Section C

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

19. Find the arc length of the curve $24xy = y^4 + 48$ from $y = 2$ to $y = 4$.	BL3	CO1
20. Using the Gram-Schmidt process obtain an orthonormal set of vectors for the matrix $M = \begin{bmatrix} 7 & 4 & -4 \\ 4 & -8 & -1 \\ -4 & -1 & -8 \end{bmatrix}$.	BL3	CO3

CO : Course Outcome

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