K25FY4440 Pages: 2 Reg No:.....
Name:.....

First Semester FYUGP Degree (Sup) Examination November 2025

KU1DSCMAT117 - CALCULUS AND MATRIX ALGEBRA - I

2024 Admission onwards

Time : 2 hours Maximum Marks : 70

Section A

Answer any 6 questions. Each carry 3 marks.

1. Find the range of $y = \frac{x}{2} + 1$.
2. Write the domain of $f(x) = \frac{1}{2+e^x}$.
3. Reduce the matrix to row echelon form $A = \begin{bmatrix} 0 & 2 \\ 1 & 2 \end{bmatrix}$.
4. Explain what do you mean by a consistent system of linear equations.
5. Write the system of equations corresponding to the augmented matrix $\left[\begin{array}{c|c} A & B \end{array}\right] = \left[\begin{array}{cc|c} 1 & 1 & 0 \\ 1 & 1 & 1 \end{array}\right]$.
6. Determine the integral $\int \cos(7\theta + 3)\, d\theta$.
7. Evaluate $\int \frac{\cos x - \sin x}{\cos x + \sin x}\, dx$.
8. Evaluate $\int_0^{\pi/4} \sec^2 x dx$.

Section B

Answer any 4 questions. Each carry 6 marks.

9. Find the rank of the matrix $\begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{bmatrix}$
10. (a) Find the rank of the matrix $\begin{bmatrix} 1 & 4 & 8 \\ 3 & 1 & 4 \end{bmatrix}$ by reducing to row echelon form.
    (b) Give an example for 2×2 matrices $A \neq 0$ and $B \neq 0$ such that $AB = 0$.

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11. Determine whether the following system of equations is consistent or not.

$$\begin{aligned} x_1 + x_2 + x_3 &= 6 \\ 2x_1 + 2x_2 + 2x_3 &= 12 \\ 3x_1 + 3x_2 + 3x_3 &= 20. \end{aligned}$$

12. Evaluate $\int \frac{x^2}{1+x^2}\,dx$.

13. Evaluate $\int_0^{\ln 2} \frac{e^x}{1+e^x}\,dx$.

14. Using integration, calculate the area of the triangle the equations of whose sides are $y = x$, $y = 0$ and $x = 2$.

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Section C

Answer any 2 questions. Each carry 14 marks.

15. (a) Find the first and second derivative of the function $y = \frac{(x^2+x)(x^2-x+1)}{x^4}$.

    (b) Obtain the derivative $\frac{d}{dx}[\ln \sinh x]$.

16. (a) Find the derivative of $y = \frac{\tan x}{1+\tan x}$ w.r.t. x

    (b) Find the derivative $\frac{d}{dx}(\sin^{-1} x^2)$.

17. (a)Find the range of the function $y = x^2 + 1,\ x \geq 0$, expressed as a function of x.
    (b)State Algebraic properties of the Natural Logarithm.
    (c)If $\lim_{x\to -2} \frac{f(x)}{x^2} = 1$, find $\lim_{x\to -2} \frac{f(x)}{x}$.