

First Semester FYUGP Degree (Reg/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. Compute $\log_{11}(121)$ and $\log_4(1)$.
2. Find the value of $\sin^{-1}\left(\frac{-1}{2}\right)$.
3. Find $\frac{d}{dx}(\cot x)$.
4. For any number a , find the derivative of $\ln ax$.
5. Find $\frac{d}{dx}(\sinh x)$.
6. Find the rank of the 2×2 matrix $\begin{bmatrix} 3 & 1 \\ 2 & 4 \end{bmatrix}$.
7. Reduce the matrix to row echelon form $A = \begin{bmatrix} 1 & 2 \\ 3 & -4 \end{bmatrix}$.
8. Write the system of equations corresponding to the augmented matrix $[A \mid B] = \left[\begin{array}{cc|c} 0 & 1 & 1 \\ -1 & 2 & 1 \end{array} \right]$.

Section B

Answer any 4 questions. Each carry 6 marks.

9. Find the value of derivative of the function $s = 5 - 2t^2$ at $t = -2$.
10. Find the tangent line to the curve $y = \sqrt{x}$ at $x = 4$.
11. Find $\frac{dy}{dx}$ if $y = \ln(1 - xe^{-x})$.
12. Find the rank of the matrix $\begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{bmatrix}$.

13. Reduce the given matrix $A = \begin{bmatrix} 1 & 2 & 3 & 0 \\ 2 & 1 & 3 & 2 \\ 3 & 2 & 1 & 3 \\ 6 & 8 & 7 & 5 \end{bmatrix}$ to its row echelon form, and hence find the rank.

14. Find the rank of $A = \begin{bmatrix} 2 & -2 & 0 & 6 \\ 4 & 2 & 0 & 2 \\ 1 & 1 & 0 & 3 \\ 1 & -2 & 1 & 2 \end{bmatrix}$ by reducing to its row echelon form.

Section C

Answer any 2 questions. Each carry 14 marks.

15. (a) Find $\int \frac{3 \cos x + 4}{\sin^3 x} dx$.
 (b) Evaluate $\int \frac{(1+2x)^3}{x^4} dx$.
16. (a) Evaluate $\int_0^2 \frac{x^4}{1+x^2} dx$.
 (b) Evaluate $\int \sqrt{e^x - 1} dx$.
17. (a) Find the domain and range for the function $g(t) = \cos(e^{-t})$.
 (b) Simplify $3 \ln \sqrt[3]{t^2 - 1} - \ln(t - 1)$.
 (c) Compute $\lim_{x \rightarrow 1} \frac{x^2 - x - 2}{x^2 - x}$.