

First Semester FYUGP Degree (Reg/Sup) Examination
November 2025
KU1DSCMAT112 - CALCULUS AND MATRIX ALGEBRA
2024 Admission onwards

Time : 2 hours

Maximum Marks : 70

Section A

Answer any 6 questions. Each carry 3 marks.

1. Determine $\int \frac{1}{2^x} dx$.
2. Evaluate $\int a^{2x} dx$.
3. Find the inverse of the 2×2 matrix $A = \begin{bmatrix} 1 & 5 \\ 2 & 3 \end{bmatrix}$.
4. Find the characteristic equation of the matrix $A = \begin{bmatrix} -2 & 1 \\ 1 & 2 \end{bmatrix}$.
5. Find the characteristic matrix of the matrix $A = \begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}$.
6. Give an example for a one-to-one function.
7. Simplify the expression: $e^{\ln(x^2+y^2)}$.
8. Calculate $\lim_{x \rightarrow 1} \frac{x^2 + x - 2}{x^2 - x}$.

Section B

Answer any 4 questions. Each carry 6 marks.

9. Find the inverse of the matrix $\begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{bmatrix}$
10. Reduce the matrix $\begin{bmatrix} 1 & 1 & 1 & 2 \\ 2 & 1 & -3 & -6 \\ 3 & -3 & 1 & 2 \end{bmatrix}$ to its normal form, and hence find the rank.
11. Find the eigen vectors of the matrix $\begin{bmatrix} 5 & -2 \\ 9 & -6 \end{bmatrix}$.
12. If $f(x) = x^3 + 1$, find $f^{-1}(x)$ and identify its domain and range.

13. Simplify: $\ln(\cosh x + \sinh x) + \ln(\cosh x - \sinh x)$.
14. If $2 - x^2 \leq g(x) \leq 2 \cos x$ for all x , find $\lim_{x \rightarrow 0} g(x)$, using the Sandwich Theorem.

Section C

Answer any 2 questions. Each carry 14 marks.

15. Find $\frac{dy}{dx}$ using the method of logarithmic differentiation, if

(a) $y = \frac{(x^2 - 8)^{1/3} \sqrt{x^3 + 1}}{x^6 - 7x + 5}$

(b) $y = (\ln x)^{\tan x}$.

16. (a) Find $\frac{dy}{dx}$ if $y = \frac{\cos x}{x} + \frac{x}{\cos x}$

(b) Evaluate $\frac{d}{dx} \left[\frac{1}{2} \sinh (2x + 1) \right]$.

17. (a) Evaluate $\int_0^1 \frac{x^5}{1 + x^{12}} dx$.

(b) Evaluate $\int \cos^3 x dx$.