K25FY4382 Pages: 2 Reg No:.....
Name:.....

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 $\lim_{x\to 1} \frac{x^2+x-2}{x^2-x}$.

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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 $\lim_{x \to 0} g(x)$, using the Sandwich Theorem.

Section C

Answer any 2 questions. Each carry 14 marks.

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

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

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

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

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

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

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

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