Reg No:..... K24FY 1473 (B)
Name :.....

First Semester FYUGP Mathematics Examination
NOVEMBER 2024 (2024 Admission onwards)
KU1DSCMAT112 (CALCULUS AND MATRIX ALGEBRA)
(DATE OF EXAM: 4-12-2024)

Time : 120 min Maximum Marks : 70

Part A (Answer any 6 questions. Each carries 3 marks)

1. Find $\frac{d}{dx}(e^x \sin x)$. 3
2. Find the derivative of $\ln 3x$ w.r.t. x. 3
3. Find $\frac{d}{dx}\left(3^{-x}\right)$. 3
4. Determine $\int \frac{1}{2^x}\, dx$. 3
5. Determine the integral $\int x^2 e^{x^3}\, dx$. 3
6. Reduce the matrix $\begin{bmatrix} 5 & \sqrt{3} \\ 0 & 0 \end{bmatrix}$ to its normal form, and hence find the rank. 3
7. Find the inverse of the 2×2 matrix $\begin{bmatrix} \cos 2\theta & \sin 2\theta \\ -\sin 2\theta & \cos 2\theta \end{bmatrix}$. 3
8. Find the characteristic equation of the matrix $A = \begin{bmatrix} -2 & 1 \\ 1 & 2 \end{bmatrix}$. 3

Part B (Answer any 4 questions. Each carries 6 marks)

9. Find an equation for a line that is tangent to the graph of $y = e^x$ and goes through the origin. 6
10. Evaluate $\lim_{x \to \pi/2} \cos\left(2x + \sin\left(\frac{3\pi}{2} + x\right)\right)$. 6
11. Use implicit differentiation to find $\frac{d^2y}{dx^2}$ if $5x^3 - 7y^2 = 10$. 6
12. Find the inverse of the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 0 & -1 & 2 \\ 2 & 4 & -1 \end{bmatrix}$ 6
13. Find the eigen vectors of the matrix $\begin{bmatrix} a & b \\ 0 & c \end{bmatrix}$. 6

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14. Find the eigen vectors of the matrix $\begin{bmatrix} 4 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & -1 \end{bmatrix}$. 6

Part C (Answer any 2 question(s). Each carries 14 marks)

15. (a)Find the inverse 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)Simplify $3\ln\sqrt[3]{t^2-1} - \ln(t+1)$. 14

16. (a)Find the domain and range for the function $g(t) = \cos(e^{-t})$.
(b)Prove that $\cosh^2 x - \sinh^2 x = 1$.
(c)Compute $\lim_{x\to 1} \dfrac{x^2+x-2}{x^2-x}$. 14

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

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

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