K25FY4384 Pages: 2 Reg No:.....
Name:.....

First Semester FYUGP Degree (Reg/Sup) Examination November 2025

KU1DSCMAT116 - CALCULUS AND COORDINATE SYSTEMS

2024 Admission onwards

Time : 2 hours Maximum Marks : 70

Section A

Answer any 6 questions. Each carry 3 marks.

1. If $f(x) = 4 - x^2$, evaluate the derivatives $f'(-3)$ and $f'(0)$.
2. Find $\frac{d}{dx}(e^x \sin x)$.
3. Use the laws of exponents to simplify the following expressions:
   (a)$4^{\frac{1}{3}}.4^{\frac{1}{6}}$
   (b) $(8^{\frac{1}{9}})^3$.
4. State the sandwich theorem.
5. Determine $\lim_{t\to 1} \frac{t-1}{t}$.
6. Check whether $r = -1$ is an equation for the circle of radius 1 centered at the origin or not.
7. Find the polar coordinates corresponding to the Cartesian coordinate$(-3, \sqrt{3})$.
8. Obtain the equation in cylindrical coordinates of the cylinder whose Cartesian equation is $x^2 + y^2 = 2x$.

Section B

Answer any 4 questions. Each carry 6 marks.

9. If $f(x) = \frac{x+2}{x-1}$, find $f^{-1}(x)$ and identify the domain and range of $f^{-1}(x)$
10. Express the following logarithms in terms of $\ln 5$ and $\ln 7$
    (a) $\ln(1/125)$ (b) $\ln(9.8)$ (c) $\ln(7\sqrt{7})$.
11. Evaluate $\lim_{x\to\pi/2} \cos\left(2x + \sin\left(\frac{3\pi}{2} + x\right)\right)$.
12. Graph the sets of points whose polar coordinates satisfy the following conditions:
    $1 \le r \le 2$ and $0 \le \theta \le \frac{\pi}{2}$

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13. Find the Cartesian coordinates of the point with cylindrical coordinates $\left(4,\ \frac{2\pi}{3},\ 5\right)$.

14. Obtain the equation in cylindrical and spherical coordinates of the paraboloid whose Cartesian equation is $x^2 + y^2 = 4 - z$

Section C

Answer any 2 questions. Each carry 14 marks.

15. (a) Evaluate $\int \frac{\sec^2 x}{1 - \tan^2 x}\, dx$.

    (b) Find the surface area of a cone formed by rotating about the x-axis, the line $y = 2x$ between $x = 0$ and $x = h$.

16. (a) Evaluate $\int \frac{6x^2 + 2\cos x}{x^3 + \sin x} dx$.

    (b) Find the volume of a cone enclosed by the surface formed by rotating about the x-axis, the line $y = 2x$ between $x = 0$ and $x = h$.

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

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

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