K25FY4578 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. Find $\frac{d}{dx}(e^x \sin x)$.
2. Differentiate $\sin(x^2 + e^x)$ with respect to x.
3. Simplify the expression: $e^{\ln(x^2+y^2)}$.
4. Determine the value of the limit $\lim_{x\to 0} \frac{\sqrt{x^2+100}-10}{x^2}$.
5. Use Sandwich theorem to obtain $\lim_{\theta\to 0} \cos\theta = 1$.
6. State the equation for the circle of radius 1 centered at the origin.
7. Find the polar coordinates corresponding to the Cartesian coordinate$(-3,\ \sqrt{3})$.
8. Find the Cartesian equation of the surface whose equations in cylindrical coordinates is $r^2 \cos 2\theta = z$.

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Section B

Answer any 4 questions. Each carry 6 marks.

9. Investment companies often use the model $y = Pe^{rt}$ in calculating the growth of an investment. Use this model to track the growth of \$100 invested in 2000 at an annual interest rate of 5.5%.
10. Solve for y in terms of x : $\ln(y^2 - 1) - \ln(y + 1) = \ln(\sin x)$.
11. Solve the hyperbolic equation

$$\cosh x - 5\sinh x - 5 = 0.$$

12. Graph the sets of points whose polar coordinates satisfy the following conditions: $1 \le r \le 2$ and $0 \le \theta \le \frac{\pi}{2}$

13. Find the cylindrical coordinates of the point with Cartesian coordinates $(-5,\ -5,\ 2)$.

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 $\int \frac{\sin 2x}{1 + 4\sin^2 x}\, dx$.

    (b) Find the length of the curve $y = x^{\frac{3}{2}}$ from $x = 0$ to $x = 2$.

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) Suppose u and v are functions of x that are differentiable at $x = 0$ and that $u(0) = 5, u'(0) = -3, v(0) = -1, v'(0) = 2$. Find the values of the following derivatives at $x = 0$.
    (i) $\frac{d}{dx}(uv)$ (ii) $\frac{d}{dx}(7v - 2u)$

    (b) Calculate the derivative $\frac{d}{dx}(\cos^{-1} x^2)$.

    (c) Determine $\frac{d}{dx}\left(\tan\sqrt{1 + x^2}\right)$.

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