K26FY0246 Pages: 2 Reg No:................
Name:................

Fourth Semester FYUGP Degree (Reg) Examination April 2026

KU4DSCMAT201 - ANALYTIC GEOMETRY

2024 Admission onwards

Time : 2 hours Maximum Marks : 70

Section A

Answer any 6 questions. Each carry 3 marks.

1. Find the radius of curvature of $y = x^3$ at $(0, 0)$.
2. Find the radius of curvature of $y = \sin x$ at $x = \frac{\pi}{2}$.
3. Find the vertices of the ellipse $\frac{x^2}{36} + \frac{y^2}{25} = 1$.
4. Find the slope of the tangent to $y = \ln x$ at $x = e$.
5. Find the slope of the tangent to the curve $y = x^3$ at $(1, 1)$.
6. Determine the orientation of the curve $x = \cos t, y = \sin t, 0 \le t \le 2\pi$.
7. Write parametric equations for the circle $x^2 + y^2 = 9$ traced clockwise.
8. Find $\frac{dy}{dx}$ for $x = 2t + 1, y = 4t - 3$ at any t.

Section B

Answer any 4 questions. Each carry 6 marks.

9. Derive the standard equation of an ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ using the definition.
10. Find the equation of the ellipse with foci $(\pm 4, 0)$ and vertices $(\pm 5, 0)$.
11. Prove that the curves $x^2 - y^2 = a^2$ and $xy = c^2$ intersect orthogonally.
12. Find parametric equations for the circle of radius 3 centered at $(-2, 4)$ oriented counterclockwise.
13. Find the points on the curve $x = t - 2\sin t, y = 3 - 2\cos t$ where the tangent is horizontal for $0 \le t \le 2\pi$.
14. Find the equation of the tangent and normal to the curve $x = a\cos\theta, y = a\sin\theta$ at $\theta = \frac{\pi}{4}$.

Section C

Answer any 2 questions. Each carry 14 marks.

15. (a) Write the standard forms of parabolas in all four orientations.
    (b) Find the focus and directrix of the parabola $y^2 = 12x$.
    (c) Find the equation of the parabola with vertex at origin and passing through $(2, 8)$ symmetric about y-axis.
16. (a) Find the arc length of the parametric curve $x = 3\cos t, y = 3\sin t$ from $t = 0$ to $t = \pi$.
    (b) Find the arc length of the asteroid $x = a\cos^3\theta, y = a\sin^3\theta$ for $0 \le \theta \le 2\pi$.
    (c) Find the arc length of the parametric curve $x = 2t, y = 2t$ from $t = 0$ to $t = 3$.
17. (a) Find the radius of curvature at $(3a/2, 3a/2)$ on the folium $x^3 + y^3 = 3axy$.
    (b) Show that the radius of curvature at any point of the cycloid $x = a(\theta + \sin\theta), y = a(1 - \cos\theta)$ is $4a\cos\frac{\theta}{2}$.