KAMARAJ COLLEGE (Autonomous)

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(Affiliated to Manonmaniam Sundaranar University, Tirunelveli)

(4 Pages) **Reg. No:……**

Question Code: 26E00201 **Course Code : 24UMMA21/25UMMA21**

UG Degree - End Semester Examinations, April 2026

Second Semester

B.Sc. MATHEMATICS

Analytical Geometry (2 & 3 Dimensions)

(For those who joined in July 2024 and June 2025 onwards)

Time : 3Hours **Maximum : 75 Marks**

PART – A ($10 \times 1 = 10$ Marks)

Answer ALL Questions

Choose the correct answer :

CO:1 K:1 1. Find the polar of $(ae, 0)$ with respect to the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$.

(a) $x = a$ (b) $x = ab$

(c) $x = \frac{a}{e}$ (d) $x = ae$

CO:1 K:2 2. Infer the standard equation of the rectangular hyperbola.

(a) $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ (b) $\frac{y^2}{a^2} - \frac{x^2}{b^2} = 1$

(c) $x^2 - y^2 = a^2$ (d) $x^2 + y^2 = a^2$

CO:2 K:1 3. Which one of the following represents equation of the line in polar coordinates?

(a) $r\sin(\theta - \alpha) = p$ (b) $r\sin(\theta + \alpha) = p$

(c) $r\cos(\theta - \alpha) = p$ (d) $r\cos(\theta + \alpha) = p$

CO:2 K:2 4. If the pole lies on the circumference of the circle then infer the equation of the circle.

(a) $r = 2a\cos\theta$ (b) $r = a\cos 2\theta$

(c) $r = 2a\sin\theta$ (d) $r = a\sin 2\theta$

CO:3 K:1 5. Find the equation to the plane through $(3, 4, 5)$ parallel to the plane $2x + 3y - z = 0$.

(a) -13 (b) 13

(c) 12 (d) 50

CO:3 K:2 6. Outline the angle between the planes $2x - y + z = 6, x + y + 2z = 3$

(a) $\frac{\pi}{6}$ (b) $\frac{\pi}{3}$

(c) $\frac{\pi}{4}$ (d) $\frac{\pi}{2}$

CO:4 K:1 7. Find the direction ratios of the straight line $\frac{x-2}{2} = \frac{y-1}{-1} = \frac{z}{-3}$.

(a) $2, 1, 0$ (b) $2, -1, -3$

(c) $-2, -1, 0$ (d) $-2, 1, 3$

CO:4 K:2 8. If $al + bm + cn = 0$, then interpret the angle between the plane $ax + by + cz + d = 0$ and the line $\frac{x-x_1}{l} = \frac{y-y_1}{m} = \frac{z-z_1}{n}$.

(a) $0°$ (b) $45°$

(c) $60°$ (d) $90°$

CO:5 K:1 9. Find the equation of the sphere with center $(-1, 2, -3)$ and radius 3 units.

(a) $x^2 + y^2 + z^2 + 2x - 4y + 6z + 5 = 0$

(b) $x^2 + y^2 + z^2 - x + 2y = 0$

(c) $x^2 + y^2 + z^2 + x - 2y + 3z = 0$

(d) $x^2 + y^2 + z^2 - 2x + 4y - 6z + 6 = 0$

CO:5 K:2 10. The plane section of a sphere is a _____

(a) Cone (b) Square

(c) Cylinder (d) Circle

PART – B (5 X 5 = 25 Marks)

Answer ALL Questions choosing either (a) or (b).

Answer should not exceed 250 words.

CO:1 K:3 11. (a) Identify the locus of the poles of normal chords of the ellipse.

(OR)

(b) Make use of the equations of hyperbola and its conjugate, find a relation connecting e and e' where e and e' represents the eccentricities of the hyperbola and its conjugate.

CO:2 K:4 12. (a) Discover the locus of the foot of the perpendiculars drawn from the pole to the tangents to the circle $r = 2a\cos\theta$.

(OR)

(b) Analyze and prove that the chords of a rectangular hyperbola which subtended a right angle at a focus touch a fixed parabola.

CO:3 K:4 13. (a) Discover the equation of the plane passing through the points $(3, 1, 2)$, $(3, 4, 4)$ and perpendicular to the plane $5x + y + 4z = 0$.

(OR)

(b) Assume that a plane passing through the line of intersection of the planes $x + y + z = 1$, $2x + 3y + 4z - 7 = 0$ and perpendicular to the plane $x - 5y + 3z = 5$. Find the equation of the plane.

CO:4 K:3 14. (a) Identify the image of the point $(1, -2, 3)$ in the plane $2x - 3y + 2z + 3 = 0$.

(OR)

(b) Identify the equations of the orthogonal projection of the line $\frac{x-2}{4} = \frac{y-1}{2} = \frac{z-4}{3}$ on the plane $8x + 2y + 9z - 1 = 0$.

CO:5 K:3 15. (a) Applying the definition of great circle, find the equation of the sphere for which the circle $x^2 + y^2 + z^2 - 2x + 4y - 6z + 7 = 0$, $2x - y + 2z = 5$ is a great circle.

(OR)

(b) Identify the equation of a sphere which touches the sphere $x^2 + y^2 + z^2 - 6x + 2z + 1 = 0$ at the point $(2, -2, 1)$ and passes through the origin.

PART – C (5 X 8 = 40 Marks)

Answer ALL Questions choosing either (a) or (b).
Answer should not exceed 500 words.

CO:1 K:3 16. (a) Identify the locus of midpoint of normal chords to the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$.

(OR)

(b) If α and β be the angles subtended by the major axis of an ellipse at the extremities of a pair of conjugate diameters, show that $\cot^2 \alpha + \cot^2 \beta$ is a constant.

CO:2 K:4 17. (a) Trace the conic $\frac{2}{r} = 1 + \cos\theta + \sin\theta$.

(OR)

(b) If the normal at L, one of the extremities of the latus rectum of the conic $\frac{l}{r} = 1 + e\cos\theta$, meets the curve again in Q, Examine that $SQ = l \cdot \frac{1+3e^2+e^4}{1+e^2-e^4}$.

CO:3 K:4 18. (a) Determine the equation of the plane passing through the points $(2, -5, -3)$, $(-2, -3, 5)$ and $(5, 3, -3)$.

(OR)

(b) Build an argument to show that the origin lies in the acute angle between the planes $x + 2y + 2z = 0$, $4x - 3y + 12z + 13 = 0$. Predict the planes bisecting the angles between them and point out which bisects the obtuse angle.

CO:4 K:5 19. (a) Determine the equations of the image of the line $\frac{x-1}{2} = \frac{y+2}{-5} = \frac{z-3}{2}$ in the plane $2x - 3y + 2z + 3 = 0$.

(OR)

(b) Determine the shortest distance between the lines $\frac{x-3}{-1} = \frac{y-4}{2} = \frac{z+2}{1}; \frac{x-1}{1} = \frac{y+7}{3} = \frac{z+2}{2}$.

CO:5 K:3 20. (a) Identify the equation of the sphere passing through the four points $(2, 3, 1)$, $(5, -1, 2)$, $(4, 3, -1)$ and $(2, 5, 3)$.

(OR)

(b) Identify the equation of the sphere which passes through the circle $x^2 + y^2 + z^2 - 2x - 4y = 0$, $x + 2y + 3z = 8$ and touches the plane $4x + 3y = 25$.