KAMARAJ COLLEGE (Autonomous)

Accredited with A+ Grade by NAAC

(Affiliated to Manonmaniam Sundaranar University, Tirunelveli)

THOOTHUKUDI – 628 003

(7 Pages) **Reg. No: ……**

Question Code No : 25O00210 **Sub Code : 24UMMA21**

UG Degree - End Semester Examinations, November 2025

Second Semester

B.Sc. MATHEMATICS

Analytical Geometry (Two & Three Dimensions)

(For those who joined in July 2024 onwards)

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

PART – A ($10 \times 1 = 10$ Marks)

Answer ALL Questions

Choose the correct answer:

1. The lines y =mx and y = m_1x are conjugate diameters of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ then mm_1 =

   (a) $-\frac{b^2}{a^2}$ (b) $\frac{b^2}{a^2}$

   (c) $-\frac{a^2}{b^2}$ (d) $\frac{a^2}{b^2}$

2. The length of the equi conjugate diameter of the ellipse $3x^2+7y^2=21$ is

(a) $\sqrt{20}$ (b) $\sqrt{21}$

(c) $\sqrt{10}$ (d) $\sqrt{210}$

3. The equation of the line perpendicular to the line $p = rcos(\theta - \alpha)$ is

(a) $p' = rcos(\theta - \alpha)$

(b) $p' = rcos(\frac{\pi}{2} + \theta - \alpha)$

(c) $p' = rcos(\pi + \theta - \alpha)$

(d) $p' = rcos(2\pi + \theta - \alpha)$

4. The eccentricity of the conic $\frac{2}{r} = 1 + cos\theta + sin\theta$ is

(a) 2 (b) 1

(c) $\sqrt{2}$ (d) $\sqrt{3}$

5. The distance from the origin to the plane $6x -3y+2z-14=0$ is

(a) 14 (b) 2

(c) 7 (d) 6

6. The intercept on the x-axis of the plane $x+y+z=1$ is

(a) 4 (b) 3

(c) 2 (d) 1

7. The plane _____ is perpendicular to the line

$\frac{x+2}{-1} = \frac{y-3}{1} = \frac{z+4}{3}$

(a) $-x + y + 3z = 4$ (b) $2x - 3y + 4z = d$

(c) $-2x + 3y - 4z = 5$ (d) $x - y - 3z = d$

8. The shortest distance between two intersecting line is

(a) 0 (b) 1

(c) ∞ (d) Positive

9. The centre of the sphere

$x^2 + y^2 + z^2 - 2x + 6y + 4z - 35 = 0$ is

(a) $(-2,6,4)$ (b) $(2, -6, -4)$

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

10. If the distance between the centre of the sphere is equal to the sum of their radii then the two sphere touch

(a) Internally (b) Externally

(c) Orthogonally (d) none

PART – B (5 X 5 = 25 Marks)

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

Answer should not exceed 250 words.

11. (a) A tangent to the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ whose centre is C cuts the circle $x^2 + y^2 = a^2 + b^2$ at C and C'. Prove that CP and C'Q are conjugate diameter of the

ellipse.

(OR)

(b) Show that the locus of the poles w.r.t the parabola $y^2=4ax$ of the tangent to the hyperbola $x^2-y^2=a^2$ is an ellipse.

12. (a) Derive equation of a conic.

(OR)

(b) Find the equation of the normal at the point P whose vectorial angle is α.

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

14. (a) Find the symmetrical form of equation of the line of intersection of the plane $x+5y-z-7=0$ and $2x-5y+3z+1=0$.

(OR)

(b) Find the equation 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.

15. (a) Show that the spheres x^2+y²+z²+6x+10y+22z=245 and x^2+y²+z²-12x-14y-18z+141=0 touch each other. Find the point of contact.

(OR)

(b) Find the equation of the sphere through the circle x^2+y²+z² -9=0, 2x+3y+4z=5 and the point (1,2,3).

PART – C (5 X 8 = 40 Marks)

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

16. (a) If α, β be the angles subtended by the major axis of an ellipse at the extremities of a pair of conjugate diameter, show that cot²α+cot²β is constant.

(OR)

(b) If P and D are the extremities of conjugate diameter of the ellipse, then show that the locus of the midpoint of PD is $\frac{x^2}{a^2} + \frac{y^2}{b^2} = \frac{1}{2}$.

17. (a) Trace the curve $\frac{10}{r}$ = 3cos θ +4 sin θ+5.

(OR)

(b) Derive the equation of the chord of the conic $\frac{l}{r} = 1 + ecos\theta$ Joining the points whose vectorial angles are $\alpha - \beta$ and $\alpha + \beta$.

18. (a) (i) Find the equation of the plane passing through the point (1,-2,3) and the intersection of the plane 2x-y+4z=7 and x+2y-3z+8=0.

(ii) Find the equation of the plane passing through the point (2, 3, −1) which is parallel to the plane 3x−4y+7z=0. Also measure the distance between the two planes.

(OR)

(b) Show that the origin lies in the acute angle between the planes x+2y+2z=0, 4x-3y+12z+13=0. Find the plane bisecting the angle between them and point out which bisect obtuse angle.

19. (a) Find the equation 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) Estimate the shortest distance between the lines $\frac{x-3}{-1} = \frac{y-4}{2} = \frac{z+2}{1}$ and $\frac{x-1}{1} = \frac{y+7}{3} = \frac{z+2}{2}$.

20. (a) A plane passes through the fixed point (a,b,c) and cuts the axes in A,B,C respectively. Show that the locus of the centre of the sphere passing through the points O,A,B,C is $\frac{a}{x} + \frac{b}{y} + \frac{c}{z} = 2$.

(OR)

(b) Show that the plane 2x-y-2z=16 touches the sphere $x^2+y^2+z^2-4x+2y+2z-3=0$. Find the point of contact.