(b) Find the equation of the tangent planes of the conicoid $7x^2 - 3y^2 - z^2 + 21 = 0$ which pass through the line :

$7x - 6y + 9 = 0,\ z = 3.$ (8)

7. (a) Reduce the equation

$2x^2 + 7y^2 - 10yz - 8zx - 10xy + 6x + 12y - 6z + 2 = 0$

to a canonical form. (7)

(b) Identify the conic whose polar equation with focus at the origin is given by

$$r = \frac{12}{4 + 5\cos\theta}.$$

Also find its eccentricity and directrix. (8)

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May 2026

B.SC. (MATHEMATICS, MATHEMATICS & COMPUTING) (RE-APPEAR) IV SEMESTER

Analytical Geometry (BMH24–401)

Time : 3 Hours] [Maximum Marks : 75

Instructions :

1. *It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.*
2. *Answer any **four** questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*

PART–A

1. (a) Find the distance between the points (1, –1, 2) and (–1, 1, –2). (1.5)

(b) Find the equation of the sphere having center at (1, –1, 0) and radius 2. (1.5)

(c) Transform the equation $lx + my + n = 0$ into polar equation. (1.5)

(d) Find the transformed equation of :

$x^2 + y^2 - 2x + 4y + 1 = 0$

if the origin is shifted to the point (1, 0). (1.5)

(e) When a general equation of second degree in x and y will represent a pair of straight lines? (1.5)

(f) The equation $xy + yz + zx = 0$ represents a cone. Is this statement true? Explain. (1.5)

(g) Any line on the surface of the cylinder is called its ..... (1.5)

(h) Define right circular cylinder. (1.5)

(i) Write the equation of the Hyperboloid of one sheet. (1.5)

(j) Find the equation of the straight line which is parallel to the line $2x + 3y - 1 = 0$ and passing through the point $(1, -1)$. (1.5)

PART–B

2. (a) Reduce the following equation into canonical form and find its nature

$$x^2 - 5xy + y^2 + 8x - 20y + 15 = 0. \quad (7)$$

(b) Prove that the equation :

$$\frac{l}{r} = 1 + e\cos\theta$$

represents the polar equation a conic while focus is referred as a pole. (8)

3. (a) Find the equation of the polar of the point $(-1, 2)$ with respect to the conic :

$$11x^2 + 24xy + 4y^2 - 2x + 16y + 11 = 0. \quad (7)$$

(b) Find the condition that the line $lx + my + n = 0$ may be a tangent to the conic

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1.$$

Also find the point of contact. (8)

4. (a) Find the equation of the sphere passing through the four points $(0, 0, 0)$, $(0, 1, -1)$, $(-1, 2, 0)$ and $(1, 2, 3)$. (7)

(b) Find the equation of the sphere through the circle

$$x^2 + y^2 + z^2 = 9,\ 2x + 3y + 4z = 5$$

and the point $(1, 2, 3)$. (8)

5. (a) Find the equation of the cone whose vertex is at the origin and which passes through the curve given by the equations

$$ax^2 + by^2 + cz^2 = 1,\ lx + my + nz = p. \quad (7)$$

(b) Find the equation of the enveloping cylinder whose generators touch the sphere $x^2 + y^2 + z^2 = a^2$ and are parallel to the line:

$$\frac{x}{l} = \frac{y}{m} = \frac{z}{n}. \quad (8)$$

6. (a) Find the equation of the right circular cylinder whose guiding curve is the circle given by :

$$x^2 + y^2 + z^2 = 9,\ x - y + z = 3. \quad (7)$$