

May-2026

**B.Sc. (H) MATHEMATICS - IV SEMESTER  
ANALYTICAL GEOMETRY ( BMH - 401 )**

Max. Marks:75

Time: 3 Hours

- 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**

- Q1 (a) Explain polar equation of a straight line in perpendicular form. (1.5)
- (b) Define the following: (1.5)
- (i). Director circle
  - (ii). Conjugate points
  - (iii). Conjugate diameters
- (c) Find the equation of the tangent to the conic (1.5)
- $$x^2 + 2xy - y^2 + 2x + 4y + 1 = 0$$
- at the point (-2, 1)
- (d) Express the equation of sphere in central form. (1.5)
- (e) Find the equation of the sphere whose centre is (1, 2, 3) and it passes through (-3, 2, 0). (1.5)
- (f) What do you understand by central conicoids? Explain. (1.5)
- (g) Define Director Sphere. (1.5)
- (h) Define the following: (1.5)
- (i). Ruled Surfaces
  - (ii). Developable surfaces
  - (iii). Skew Surfaces
- (i) Prove that the section of the conicoid (1.5)
- $$ax^2 + by^2 + cz^2 = 1$$
- by the cone
- $$\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 0$$
- is a parabola. (1.5)
- (j) Define Paraboloids. (1.5)

**PART -B**

- Q2 (a) Find the centre of the conic (8)
- $$2x^2 - 72xy + 23y^2 - 4x - 28y - 48 = 0$$
- And show that it represents a hyperbola. Also find its equation referred to the centre as origin.
- (b) Find the equation of the tangent and normal to the: (7)
- (i) Parabola  $y^2 = 9x$ , at the point (1, -3)
  - (ii) Conic  $x^2 + 2y^2 - 4y = 0$ , at the point (0, 0)

- Q3 (a) Find the limiting points of the co-axial system of spheres: (8)

$$x^2 + y^2 + z^2 + 3x - 3y + 6 = 0$$

$$x^2 + y^2 + z^2 - 6y - 6z + 6 = 0$$

- (b) Find the equation of the sphere through the origin and the circle given by the equations (7)

$$x^2 + y^2 + z^2 = 1$$

and

$$x^2 + y^2 + z^2 + x + 2y + 3z - 5 = 0$$

- Q4 (a) Prove that the sum of the square of the reciprocals of any three mutually perpendicular diameters of an ellipsoid is constant. (8)

- (b) Find the equation of the enveloping cone from the point  $(x_1, y_1, z_1)$  w.r.t. the conicoid (7)

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

- Q5 (a) Show that the plane  $2x - 4y - z + 3 = 0$  touches the paraboloid (8)

$$x^2 - 2y^2 = 3z$$

Also find the coordinates of the point of contact.

- (b) Determine the nature of the section of central conicoid (7)

$$ax^2 + by^2 + cz^2 = 1$$

by the plane

$$lx + my + nz = p$$

- Q6 (a) Prove that the followings conics are confocal: (8)

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

$$x^2 + 3y^2 - 4x - 6y + 4 = 0$$

- (b) Find the centre and radius of the following sphere: (7)

(i).  $x^2 + y^2 + z^2 - 2x + 4y - 6z = 2$

(ii).  $2x^2 + 2y^2 + 2z^2 + 2x - 4y + 2z = 15$

- Q7 (a) Show that the plane  $x + 2y + 3z = 2$  touches the conicoid (8)

$$x^2 - 2y^2 + 3z^2 = 2$$

Also find the point of contact.

- (b) Show that the section of the surface (7)

$$yz + zx + xy = a^2$$

by the plane

$$lx + my + nz = p$$

will be a parabola if

$$\sqrt{l} + \sqrt{m} + \sqrt{n} = 0$$

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