

7. (a) Prove that the sum of the squares of the reciprocals of any three mutually perpendicular diameter of an ellipsoid is constant. 4
- (b) Show that the plane $8x - 6y - z = 5$ touches the paraboloid $\frac{x^2}{2} - \frac{y^2}{3} = z$ and find the point of contact. 4

Section D

8. (a) Find the conditions that any *two* lines $\frac{x}{l_1} = \frac{y}{m_1} = \frac{z}{n_1}$; $\frac{x}{l_2} = \frac{y}{m_2} = \frac{z}{n_2}$ be the axes of the section of conicoid $ax^2 + by^2 + cz^2 = 1$ by a plane through them. 4
- (b) Reduce the equation :
 $4x^2 + 9y^2 + 36z^2 - 36yz + 24zx - 12xy - 10x + 15y - 30z + 6 = 0$
 to the standard form. 4

Subject Code—52460

B. Sc. EXAMINATION

(Reappear Batch 2017)

(First Semester)

MATHEMATICS

BM-113

Solid Geometry

Time : 3 Hours

Maximum Marks : 40

Note : Attempt *Five* questions in all, selecting *one* question from each Section. Q. No. 1 is compulsory.

(Compulsory Question)

1. (a) Find the equation of the circle with radius a and touching the initial line at pole. 1.6
- (b) Find the equation of conjugate hyperbola to the general conic. 1.6

- (c) Define conjugate diameter. 1.6
- (d) Find the equations of the tangent planes to the surface $x^2 - 2y^2 + 3z^2 = 2$ which are parallel to the plane $x - 2y + 3z = 0$. 1.6
- (e) Define enveloping cone. 1.6

Section A

2. Trace the conic :
 $9x^2 - 6xy + 17y^2 + 30x - 74y + 17 = 0$. 8
3. (a) Prove that in general two parabolas can be drawn through four given points. 4
- (b) Prove that the conics :
 $x^2 - y^2 - 4x + 2y + 2 = 0$
 and $x^2 + 3y^2 - 4x - 6y + 4 = 0$
 are confocal. 4

Section B

4. (a) Find the equation of the sphere, through the circle $x^2 + y^2 + z^2 = 1$, $2x + 4y + 5z = 6$ and touching the plane $z = 0$. 4

- (b) Two spheres of radius 3 cm and 4 cm cut each other orthogonally. Find the radius of the common circle. 4

5. (a) Find the equation of the right circular cone whose vertex is (0, 0, 0); which passes through (1, 1, 2) and the axis

$$\frac{x}{2} = \frac{y}{-4} = \frac{z}{3}. \quad 4$$

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

$$\frac{x}{l} = \frac{y}{m} = \frac{z}{n}. \quad 4$$

Section C

6. (a) Find the condition that the plane $lx + my + nz = p$ should touch the conicoid $ax^2 + by^2 + cz^2 = 1$. 4
- (b) Prove that six normals can be drawn from a given point to the ellipsoid. 4

9. Find the coordinate of the vertex and equation to the axis of the hyperbolic paraboloid :

$$4x^2 - y^2 - z^2 = 2xy - 8x - 4y + 8z - 2 = 0. \quad 8$$