(b) Find the equation of the conic passing through five points (2, 1), (1, 0), (3, −1), (−1, 0) and (3, −2). **7½**

Unit II

4. (a) Find the equation of the sphere having the circle $x^2 + y^2 + z^2 + 7y - 2z + 2 = 0$; $2x + 3y + 4z - 8 = 0$ as a great circle. **7½**

   (b) Find the equation of the right circular cylinder of radius 2 and axis as the line

   $$\frac{x-1}{2} = \frac{y-2}{1} = \frac{z-3}{2}.$$ **7½**

5. (a) The plane $\dfrac{x}{a} + \dfrac{y}{b} + \dfrac{z}{c} = 1$ meets the co-ordinate axes in A, B, C. Prove that the cone generated by the lines drawn from 0, to meet the circle ABC is : **7½**

   $$yz\left(\frac{b}{c} + \frac{c}{b}\right) + xz\left(\frac{c}{a} + \frac{a}{c}\right) + xy\left(\frac{a}{b} + \frac{b}{a}\right) = 0$$

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AA-343

B. Sc. (Hons.) EXAMINATION, Dec. 2017

(First Semester)

(Dual Degree) (Main & Re-appear)

MATHEMATICS

MAT-215-H

Solid Geometry

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

Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

Note : Attempt *Five* questions in all, selecting at least *one* question from each Unit. Q. No. **1** is compulsory. All questions carry equal marks.

(3-32/*20*)M-AA-343   P.T.O.

1. Attempt any *ten* parts :　　　　**1½ each**

(a)　Define eccentricity and latus rectum of a conic.

(b)　Define pole and polar w.r.t. a conic.

(c)　Find the asymptotes of the curve $\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2} = 1$.

(d)　Write the equation of the choral of contact of tangents drawn from the point (x_1, y_1) w.r.t. the conic $ax^2 + 2hxy + by^2 + 2gx + 2fy + C = 0$.

(e)　When the equation $ax^2 + 2hxy + by^2 + 2gx + 2fy + C = 0$ will represent a real circle.

(f)　Define a cone and a right circular cone.

(g)　Define a generator and guiding curve of a cylinder.

(h)　Write the equations of 3 types of conicoids and name them.

(i)　Define a tangent plane and normal to a conicoid.

(j)　Write the equation of a conicoid. Find its sections by co-ordinate planes and name them.

(k)　Define director sphere of a conicoid.

(l)　What are ruled surfaces ?

Unit I

2. (a)　Find the nature of the curve, centre and the equation of the conic referred to the centre as origin of $13x^2 - 18xy + 37y^2 + 2x + 14y - 2 = 0$.　　**5**

(b)　Trace the conic $9x^2 + 24xy + 16y^2 - 2x + 14y + 1 = 0$.　　**10**

3. (a)　Prove that the difference of the squares of the perpendicular drawn from the centre on any two parallel tangents to two given confocal conics is constant.　　**7½**

(b) Find the equation of the right circular cone whose vertex is at the origin, axis the line $\dfrac{x}{1} = \dfrac{y}{2} = \dfrac{z}{3}$ and which has a vertical angle $60°$. **7½**

Unit III

6. (a) Find the equations of the tangent planes to the surface $x^2 - 2y^2 + 3z^2 = 2$ which are parallel to the plane $x - 2y + 3z = 0$. **7½**

(b) The normal at any point P of the ellipsoid $\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2} + \dfrac{z^2}{c^2} = 1$ meets the principal planes is G_1, G_2, G_3. Show that $PG_1 : PG_2 : PG_3 = a^2 : b^2 : c^2$. **7½**

7. (a) Find the equation of the enveloping cylinder of the conicoid $ax^2 + by^2 + cz^2 = 1$, whose generators are parallel to $\dfrac{x}{l} = \dfrac{y}{m} = \dfrac{z}{n}$. **7½**

(b) Find the centre of the conic given by the equation :

$2x - 2y - 5z + 5 = 0$, $3x^2 + 2y^2 - 15z^2 = 4$.

7½

Unit IV

8. (a) Show that the plane $2x - 4y - z + 3 = 0$ touches the paraboloid $x^2 - 2y^2 = 3z$. Also find the point of contact. **7½**

(b) Find the condition that the line $lx + my + nz + p = 0$, $l'x + m'y + n'z + p' = 0$ may be a generator of the hyperboloid $\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2} + \dfrac{z^2}{c^2} = 1$. **7½**

Or

Prove that two conicoids confocal with a conicoid, touch a given line. **7½**

9. (a) Show that the section of the ellipsoid $9x^2 + 6y^2 + 14z^2 = 3$ by the plane $x + y + z = 0$ is an ellipse with semi axes $\dfrac{1}{2}$ and $\dfrac{3}{\sqrt{22}}$. **7½**

(b) Reduce the equation $2x^2 - 7y^2 + 2z^2 - 10yz - 8zx - 10xy + 6x + 12y - 6z + 5 = 0$ to the standard form and show that it represents a cone. **7½**