PARVATHANENI BRAHMAYYA
SIDDHARTHA COLLEGE OF ARTS & SCIENCE
*Autonomous*
Siddhartha Nagar, Vijayawada–520010
*Re-accredited at 'A+' by the NAAC*

**23MAMAL122: ANALYTICAL SOLID GEOMETRY**

**Offered to:** B.Sc. Honours (Mathematics) **Course Type: Major 4** (Core -TH)
**Year of Introduction: 2023-24** **Year of offering: 2023 - 2024**
**Semester**: **II** 75 Hrs **Credits: 4**

## Course Outcomes

| S. No | C.O<br>Upon successful completion of this course, students should have the knowledge and skills to: | Mapping |
|---|---|---|
| 1 | Understand the basic concepts of plane to find the length of perpendicular from a given point to given plane, bisectors of angles between two planes, angle between the pair of planes. | PO6 |
| 2 | Determine the equation of a line in various forms & image of a given point w.r.t. a line and plane. | PO7 |
| 3 | Compute the equations of the hallow spheres through the given points, plane section of a sphere. | PO6 |
| 4 | Determine orthogonal spheres , coaxial system of spheres. The equation of cone, vertex of a cone ,General equation of second degree should represent a cone. | PO7 |
| 5 | Calculate the equation of enveloping cone, reciprocal cone, right circular cone, intersection of two cones with a common vertex. | PO7 |

| CO-PO MATRIX | | | | | | | |
|---|---|---|---|---|---|---|---|
| **CO-PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** |
| **CO1** | | | | | | **2** | |
| **CO2** | | | | | | | **2** |
| **CO3** | | | | | | **3** | |
| **CO4** | | | | | | | **3** |
| **CO5** | | | | | | | **2** |

**UNIT-I: The Plane** **(15Hrs)**

1.1 Equation of plane in terms of its interception the axis, Equations of the plane through the given points

1.2 Length of the perpendicular from a given point to a given plane, Bisectors of angles between two planes.

1.3 Plane passing through the intersection of two given planes, Orthogonal projection on a plane, joint equation of a pair of planes.

**UNIT-II: The Line** **(15Hrs)**

2.1 Equation of a line in symmetric form and parametric form;Angle between a line and a plane.

2.2 The condition that a given line may lie in a given plane. The condition that two given Lines are coplanar.

2.3 Number of arbitrary constants or parameters in the equations of straight line, sets of conditions which determine a line.

2.4 Length of the perpendicular from a given point to a given line.

2.5 The shortest distance between two lines, the length and equations of the line of shortest distance between two straight lines.

**UNIT-III: Spheres – I** **(15Hrs)**

3.1 Definition and equation of the sphere; Equation of the sphere through given points

3.2 Plane sections of a sphere, Great Circle, Small Circle.

3.3 Conditions for a plane to intersect a sphere

3.4 Equation of a Sphere through a given circle

3.5 Intersection of a sphere and a line; tangent plane touching spheres, Power of a point;

3.6 Plane of contact; Polar plane; Pole of a Plane; Conjugate points; Conjugate planes; Conjugate lines or polar lines.

**UNIT-IV: Spheres – II** **(15Hrs)**

4.1 Angle of intersection of two spheres;

4.2 Conditions for two Spheres to be orthogonal;

4.3 Radical plane; Coaxial system of spheres – Simplified from of the equation of two spheres.

**UNIT-V:Cylinders:** **(15Hrs)**

5.1 Definition of a cylinder, Equation to the cylinder whose generators intersect a given Conic and are parallel to a given line

5.2 Enveloping cylinder of a sphere

5.3 The right circular cylinder

5.4 Condition for tangents, Director Sphere.

**TEXT BOOK:**

1. A text book of Mathematics for BA/ B.Sc. Vol-1, by V. Krishna Murthy& others published by S. Chand& Company, New Delhi.

**REFERENCES:**


1 Analytical Solid Geometry by Shanti Narayan and P.K. Mittal, published by S. Chand& Company Ltd.7th Edition.

2 A text book of Analytical Geometry of Three Dimensions by P.K. Jain and Khaleel Ahmed, published by Wiley Eastern Ltd. 1999.

3 Co-ordinate Geometry of two and three dimensions by P. Balasubrahmanyam, K.Y. Subrahmanyam, G.R. Venkataraman published by Tata-MC Gran-Hill publishers Company Ltd. New Delhi.

4 Solid Geometry by B. Rama Bhupal Reddy, published by Spectrum University Press.


## Student Activities:

1) **Class-room activities:** Power point presentations, Assignments
2) **Library activities:** Visit to library and preparation of notes for Assignment problems.
3) **Activities in the Seminars, workshops and conferences:** Participation/presentation in seminar/workshop/conference.

## CO-CURRICULAR ACTIVITES:

- Quiz Competitions, Seminars
- Group Discussions

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**23MAMAL122: ANLYTICAL SOLID GEOMETRY** **SEMESTER – II**
**Max. Marks: 70** **Time: 3hrs.**

**Section – A**

**Answer the following questions** **(5x4=20 Marks)**

1. (a) Find the equation of the plane through (4, 4, 0) and perpendicular to the planes x+2y+2z and 3x+3y+2z-8=0. (CO1, L2)

   (OR)

   (b) Find the angle between the planes 2x-3y-6z =6 and 6x+3y-2z=18. (CO1, L2)

2. (a) Find the image of the point (2,-1,3) in the plane 3x-2y+z=9 (CO2, L3)

   (OR)

   (b) Find the equation of the plane through the origin and containing the line x-3y+2z+3=0=3x-y+2z-5. (CO3, L3)

3. (a) Find the equations of the spheres passing through the circle $x^2 + y^2 = 4$, z=0 and is intersected by the plane x+2y+2z=0 in a circle of radius 3. (CO3, L3)

   (OR)

   (b) Find the equation to the sphere through O=(0,0,0) and making intercepts a, b, c on the axes. (CO3, L3)

4. (a) Find the equation of the sphere which touches the plane $3x + 2y - z + 2 = 0$ *at* $(1,-2,1)$ and cuts orthogonally the sphere $x^2 + y^2 + z^2 - 4x + 6y + 4 = 0$ (CO4, L2)

   (OR)

   (b) Find the radical centre of the sphere

   $x^2 + y^2 + z^2 + 4y = 0,\ x^2 + y^2 + z^2 + 2x + 2y + 2z + 2 = 0,$

   $x^2 + y^2 + z^2 + 3x - 2y + 8z + 6 = 0, x^2 + y^2 + z^2 - x + 4y - 6z - 2 = 0,$

   (CO4, L2)

5. (a) Find the equation of the cylinder whose generators are parallel to $\frac{x}{1} = \frac{y}{2} = \frac{z}{3}$ and which Passes through the curve $x^2 + y^2$=16, z=0 (CO5, L3)

   (OR)

   (b) Find the equation of a right circular cylinder of radius 2 whose axis passes through the point (1, 2, 3) and has direction rations (2, -3, 6). (CO5, L3)

## Section – B

**Answer the following questions.** **(5 x 10 = 50 Marks)**

6. (a) Prove that the equation $2x^2 - 6y^2 - 12z^2 + 18yz + 2zx + xy = 0$ represents a pair of planes, and find the angle between them. (CO1, L2)

(OR)

(b) Find the bisecting plane of the acute angle between the planes 3x-2y+6z+2 =0, 2x-y+2z+2=0 (CO1, L2)

7. (a) Find the image of the line $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$ in the plane x+y+z=1 (CO2, L3)

(OR)

(b). Find the length and equations to the line of S.D between the lines $\frac{x-2}{3} = \frac{y-3}{4} = \frac{z-1}{2}, \frac{x-4}{4} = \frac{y-3}{5} = \frac{z-2}{3}$ (CO2, L3)

8. (a) Show that the plane 2x-2y+z+12=0 touches the sphere $x^2 + y^2 + z^2 - 2x - 4y + 2z - 3 = 0$ and find the point of contact. (CO3, L3)

(OR)

(b). Show that the two circles $x^2 + y^2 + z^2 - y + 2z = 0, x - y + z = 2,$ $x^2 + y^2 + z^2 + x - 3y + z - 5 = 0,\ 2x - y + 4z - 1 = 0$ lie on the same sphere and find its equation. (CO4,L3)

9. (a) If $r_1, r_2$ are the radii of two orthogonal spheres, then the radius of the circle of their intersection is $\frac{r_1 r_2}{\sqrt{r_1^2 + r_2^2}}$ (CO4, L3)

(OR)

(b). Find the limiting points of the co-axial system of spheres of which two members are $x^2 + y^2 + z^2 + 3x - 3y + 6 = 0$ , $x^2 + y^2 + z^2 - 6y - 6z + 6 = 0$(CO3, L3)

10. (a) Find the equation to the right circular cylinder whose guiding circle is $x^2 + y^2 + z^2 = 9$ , x-y+z=3 (CO5, L3)

(OR)

(b). Find the equation of the enveloping cylinder of the sphere $x^2 + y^2 + z^2 - 2x + 4y - 1 = 0$, having its generators parallel to the line x=y=z. (CO5, L3)

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