

P.R. GOVT. COLLEGE (AUTONOMOUS), KAKINADA
I year B.Sc., Degree Examinations - II Semester
Mathematics Course-II: Three Dimensional Analytical Solid Geometry
(w.e.f. 2021-22 Admitted Batch)

Total Hrs. of Teaching-Learning: 75 @ 6 hr/Week

Total credits: 05

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Course Outcomes: After successful completion of this course, the student will be able to

- Get the knowledge of planes.
 - Basic idea of lines, sphere and cones.
 - Understand the properties of planes, lines, spheres and cones.
 - Express the problems geometrically and then to get the solution
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COURSE SYLLABUS:

UNIT – I: The Plane

(12 Hours)

Equation of plane in terms of its intercepts on the axis, Equations of the plane through the given points, Length of the perpendicular from a given point to a given plane, Bisectors of angles between two planes, Combined equation of two planes, Orthogonal projection on a plane.

UNIT – II: The Line

(12 Hours)

Equation of a line; Angle between a line and a plane; The condition that a given line may lie in a given plane; The condition that two given lines are coplanar; Number of arbitrary constants in the equations of straight line; Sets of conditions which determine a line; The shortest distance between two lines; The length and equations of the line of shortest distance between two straight lines; Length of the perpendicular from a given point to a given line.

UNIT – III: The Sphere

(12 Hours)

Definition and equation of the sphere; Equation of the sphere through four given points; Plane sections of a sphere; Intersection of two spheres; Equation of a circle; Sphere through a given circle; Intersection of a sphere and a line; Power of a point; Tangent plane; Plane of contact; Polar plane; Pole of a Plane; Conjugate points; Conjugate planes.

UNIT – IV: The Sphere and Cones

(12 Hours)

Angle of intersection of two spheres; Conditions for two spheres to be orthogonal; Radical plane; Coaxial system of spheres; Simplified form of the equation of two spheres.

Definitions of a cone; vertex; guiding curve; generators; Equation of the cone with a given vertex and guiding curve; equations of cones with vertex at origin are homogenous; Condition that the general equation of the second degree should represent a cone.

UNIT –V: Cones

(12 Hours)

Enveloping cone of a sphere; right circular cone: equation of the right circular cone with a given vertex, axis and semi vertical angle: Condition that a cone may have three mutually perpendicular generators; intersection of a line and a quadric cone; Tangent lines and tangent plane at a point; Condition that a plane may touch a cone; Reciprocal cones; Intersection of two cones with a common vertex.

Co-Curricular Activities:

(15 Hours)

Seminar/ Quiz/ Assignments/ Applications of Differential Equations to Real life Problem /Problem Solving.

Prescribed Text Book:

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

Reference Books :

1. A text book of Mathematics for BA/B.Sc Vol 1, by V Krishna Murthy & Others, published by S. Chand & Company, New Delhi.
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,
4. G.R. Venkataraman published by Tata-MC Gran-Hill Publishers Company Ltd., New Delhi.

Additional Inputs :

Definition of Cylinder and Right Circular Cylinder .

BLUE PRINT FOR QUESTION PAPER PATTERN
COURSE-II, THREE DIMENSIONAL ANALYTICAL SOLID GEOMETRY

Unit	TOPIC	S.A.Q	E.Q	Marks allotted to the Unit
I	The Plane	2	1	20
II	The Line	2	1	20
III	The Sphere	1	1	15
IV	The Sphere and Cones	1	2	25
V	Cones	1	1	15
	Total	7	6	95

S.A.Q. = Short answer questions (5 marks)

E.Q = Essay questions (10marks)

Short answer questions : 4X5= 20M

Essay questions : 3X10=30M

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Total Marks = 50M

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Model Paper (w.e.f. 2021-2022)

Time: 2Hrs 30 min

Max. Marks: 50M

PART - I

Answer any FOUR questions. Each question carries FIVE marks.
4X5=20M

- Find the equation of the plane through the point $(-1, 3, 2)$ and perpendicular to the planes $x+2y+2z=5$ and $3x+3y+2z=8$.
- Find the equation to the plane through the points $(1, 1, 1)$, $(1, -1, 1)$ and $(-7, -3, -5)$. Show that it is parallel to y - axis.
- Find the image of the point $(2, -1, 3)$ in the plane $3x-2y+z=9$.
- Find the equations of the line through the point $(1, 1, 1)$ and intersecting the lines $2x - y - z - 2 = 0 = x + y + z - 1$; $x - y - z - 3 = 0 = 2x + 4y - z - 4$.
- 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.
- Find the equation to the cone which passes through the three coordinate axes and the lines $\frac{x}{1} = \frac{y}{-2} = \frac{z}{3}$ and $\frac{x}{2} = \frac{y}{1} = \frac{z}{1}$.
- Find the equation of the enveloping cone of the sphere $x^2 + y^2 + z^2 + 2x - 2y = 2$ with its vertex at $(1, 1, 1)$.

PART - II

Answer any THREE questions. Each question carries TEN marks.
3X10=30M

- A plane meets the coordinate axes in A, B, C. If the centroid of $\triangle ABC$ is (a, b, c) , show that the equation of the plane is $\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 3$.
- Find the shortest distance between the lines $\frac{x-2}{2} = \frac{y-2}{3} = \frac{z-3}{4}$ and $\frac{x-2}{3} = \frac{y-4}{4} = \frac{z-5}{5}$.
- 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.
- Find the limiting points of the coaxial system of spheres $x^2 + y^2 + z^2 - 8x + 2y - 2z + 32 = 0$, $x^2 + y^2 + z^2 - 7x + z + 23 = 0$.

5. Prove that if the angle between the lines of intersection of the plane $x + y + z = 0$ and the cone $ayz + bzx + cxy = 0$ is $\pi/2$, then $a + b + c = 0$ and is $\pi/3$, if $\frac{1}{a} + \frac{1}{b} + \frac{1}{c} = 0$
6. Prove that the equation $\sqrt{fx} \mp \sqrt{gy} \mp \sqrt{hz} = 0$ represents a cone that touches the coordinate planes and find its reciprocal cone.