	P.R.Government College (Autonomous) KAKINADA	Program&Semester I B.Sc Major (II Sem) w.e.f.2023-24 admitted Batch			
CourseCode MAT-202 T	**TITLEOFTHECOURSE** **Analytical Solid Geometry & Problem Solving Sessions**				
Teaching	HoursAllocated:60(**Theory**)	L	T	P	C
Pre-requisites:	Basic Mathematics Knowledge on 2-D Geometry	3	-	-	3

CourseObjectives:

The student will demonstrate knowledge of geometry and its applications in the real world.

Course Outcomes:

On Completion of the course, the students will be able to-	
CO1	Get the knowledge of planes.
CO2	Basic idea of lines, sphere and cones.
CO3	Understand the properties of planes, lines, spheres and cones.
CO4	Express the problems geometrically and then to get the solution.

Course with focus on employability/entrepreneurship /Skill Development modules

Skill Development		Employability		Entrepreneurship	

COURSE SYLLABUS:

UNIT – I: The Plane

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 .

UNIT – II: The Line

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 - 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

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

Angle of intersection of two spheres - Conditions for two spheres to be orthogonal - Radical plane; Coaxial system of spheres.

UNIT –V: Cones

Definitions of a cone – vertex, guiding curve and 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 - Enveloping cone of a sphere - Right circular cone - Equation of the right circular cone with a given vertex, axis and semi vertical angle.

Co-Curricular Activities:

Seminar/ Quiz/ Assignments/Three dimensional analytical Solid geometry and its applications/ Problem Solving Sessions.

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 Analytical Geometry of Three Dimensions, by P.K. Jain and Khaleel Ahmed, published by Wiley Eastern Ltd., 1999.
2. 2. Co-ordinate Geometry of two and three dimensions by P. Balasubrahmanyam, K.Y. Subrahmanyam, G.R. Venkataraman published by TataMcGraw -Hill Publishers.
3. 3. Solid Geometry by B. Rama Bhupal Reddy, published by Spectrum University Press.

Additional Inputs : Definition of Cylinder and Right Circular Cylinder .

CO-POMapping:

(1:Slight[Low]; 2:Moderate[Medium]; 3:Substantial[High], '-':NoCorrelation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	2	3	2	3	1	2	2	3	2	3	2
CO2	3	2	3	3	2	3	3	1	3	3	3	2	1
CO3	2	3	2	3	2	3	2	1	2	3	2	2	3
CO4	3	2	3	2	1	2	3	3	1	2	3	1	2

BLUE PRINT FOR QUESTION PAPER PATTERN

COURSE-IV- ANALYTICAL SOLID GEOMETRY

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

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

E.Q = Essay questions (10 marks)

Short answer questions : 4 X 5 = 20 M

Essay questions : 3 X 10 = 30 M

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Total Marks = 50 M

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PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA

I year B.Sc., Degree Examinations - II Semester

Mathematics Course-IV: Analytical Solid Geometry

(w.e.f. 2024-25 Admitted Batch)

Model Paper (w.e.f. 2024-2025)

Time: 2Hrs **Max. Marks: 50M**

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Section -I

Answer any three of the following questions. Must attempt atleast one question from each part.

Each question carries 10 Marks. **3 X 10 = 30M**

Part – A

1. Essay question from unit - I.
2. Essay question from unit - II.
3. Essay question from unit - II.

Part - B

4. Essay question from unit - III.
5. Essay question from unit - IV.
6. Essay question from unit - V.

Section II

Answer any four of the following questions. Each question carries 5 marks. 4 X 5 = 20M

7. Short answer question from unit - I.
8. Short answer question from unit - II.
9. Short answer question from unit – III.
10. Short answer question from unit - III.
11. Short answer question from unit - IV.
12. Short answer question from unit – V.
13. Short answer question from unit – V.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA

I year B.Sc., Degree Examinations - II Semester

Mathematics Course-II: Three Dimensional Analytical Solid Geometry

(w.e.f. 2024-25 Admitted Batch)

QUESTION BANK

Short Answer Questions

Unit-I

1. Find the equation of the plane through (4, 4, 0)and perpendicular to the planes x + 2y + 2z = 5 and 3x + 3y + 2z – 8 = 0 .
2. Find the equation to the plane through the points (2, 2, 1), (9, 3, 6) and perpendicular to the plane 2x + 6y + 6z = 9 .
3. Show that the equation of the plane passing through the points (2, 2, -1), (3, 4, 2), (7, 0, 6) is 5x + 2y – 3z – 17 = 0 .
4. Find the angles between the planes 2x – y + z = 0 , x + y + 2z = 7 .
5. 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.
6. Find the equation of the plane through the line of intersection of x – y +3z = 5 = 0 and 2x + y – 2z + 6 = 0and passing through (-3, 1, 1).

UNIT-II

7. Find the image of the point (2, -1, 3) in the plane 3x - 2y + z = 9.
8. Find the image of the point (1, 6, 3) in the line $\frac{x}{1} = \frac{y-1}{2} = \frac{z-2}{3}$
9. Find the symmetric form of the equation of the line $x + y + z + 1 = 0 = 4x + y - 2z + 2$.
10. Find the equation to the plane containing the line $\frac{x-1}{2} = \frac{y+1}{-1} = \frac{z-3}{4}$ and is perpendicular to the plane x + 2y + z – 12 = 0.
11. Find the equations of the line through the point (1, 1, 1) and intersecting the lines $2x - y - z - 2 = 0 = x + y + z - 1$; $x - y - z - 3 = 0 = 2x + 4y - z - 4$.
12. Show that the lines $x + 2y - 5z + 9 = 0 = 3x - y + 2z - 5$ and $4x - 5y + z - 4 = 0 = 2x + 3y - z - 3 = 0$ are coplanar.

UNIT-III

13. Find the equation of the sphere through O = (0, 0, 0) and making intercepts a, b, c on the axes.
14. A plane passes through a fixed point (a, b, c) and intersect the axes in A, B, C . Show that the centre of the sphere OABC lies on $\frac{a}{x} + \frac{b}{y} + \frac{c}{z} = 2$
15. Find the centre and radius of the circle $x^2 + y^2 + z^2 - 2y - 4z - 11 = 0$, $x + 2y + 2z - 15 = 0$.
16. Find the equation of the sphere through the circle $x^2 + y^2 + z^2 + 2x + 3y + 6 = 0$, $x - 2y + 4z = 9$ and the centre of the sphere $x^2 + y^2 + z^2 - 2x + 4y - 6z + 5 = 0$.

17. Find the equation of the sphere for which the circle $x^2 + y^2 + z^2 + 7y - 2z + 2 = 0$, $2x + 3y + 4z = 8$ is a great circle .Also find its centre and radius .
18. 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.
19. Find the pole of the plane $x - y + 5z - 3 = 0$ with respect to the sphere $x^2 + y^2 + z^2 = 9$.

UNIT-IV

20. Show that the spheres $x^2 + y^2 + z^2 + 6y + 2z + 8 = 0$, $x^2 + y^2 + z^2 + 6x + 8y + 4z + 20 = 0$ are orthogonal.
21. Find the equation of the sphere which touches the plane $3x + 2y - z + 2 = 0$ at (1. -2, 1) and cuts orthogonally the sphere $x^2 + y^2 + z^2 - 4x + 6y + 4 = 0$.
22. Find the equation to the sphere with (1, 2, -3), (5, 0, 1) as the ends of one of its diameters. Also find as angle between it and the sphere $x^2 + y^2 + z^2 - 2x - 4y - 6z + 10 = 0$.
23. Find the equation to the sphere through the circle given by $x^2 + y^2 + z^2 - 2x - 4y - 11 = 0$, $x^2 + y^2 + z^2 + 2x - y + 12z + 5 = 0$ and through the point (1, -1, -1).
24. Find the equation of the radical plane of the coaxal system whose limiting points are (-1, 2, 1) and (-2, 1, -1).

UNIT-V

25. Show that the general equation of the cone of the second degree which pass through Coordinate axes is $fyz + gzx + hxy = 0$.
26. 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 $\frac{x}{2} = \frac{y}{1} = \frac{z}{1}$.
27. Find the equation of the cone with vertex at (1, 2, 3) guiding curve $x^2 + y^2 + z^2 = 4$, $x + y + z = 1$.
28. Find the equation of the cone whose vertex is (1, 2, 3) and base curve $y^2 = 4ax$, $z = 0$.
29. Find the enveloping cone at the (1, 1, 1) and generators touching the sphere $x^2 + y^2 + z^2 - 2x + 4z - 1 = 0$

Essay Questions

UNIT-I

1. If a plane meets the coordinate axes in A, B, C such that the centroid of the triangle ABC is the point (p, q, r) then show that the equation of the plane is $\frac{x}{p} + \frac{y}{q} + \frac{z}{r} = 3$.
2. A variable plane is at a constant distance 3p from the origin and meets the axes in A, B, C. Show that the locus of the centroid of Δ ABC is $x^{-2} + y^{-2} + z^{-2} = p^{-2}$.
3. Find the planes bisecting the angles between the planes $2x - y + 2z + 3 = 0$ and $3x - 2y + 6z + 8 = 0$. Point out which of the planes bisects the acute angle and which bisects the obtuse angle in which the origin lies.

4. Prove that the equation represents a pair of planes , and find the angle between them .
   $6x^2 + 4y^2 - 10z^2 + 3yz + 4zx - 11xy = 0$
5. Show that the equation $x^2 + 4y^2 + 9z^2 - 12yz - 6zx + 4xy + 5x + 10y - 15z + 6 = 0$ represents a pair of parallel planes and find the distance between them.

UNIT-II

6. Prove that the lines $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$; $\frac{x-2}{3} = \frac{y-3}{4} = \frac{z-4}{5}$ are coplanar. Also find their point of intersection and the plane containing the lines.
7. Prove that $\frac{x+4}{3} = \frac{y+6}{5} = \frac{z-1}{-2}$ and $3x - 2y + z + 5 = 0 = 2x + 3y + 4z - 4 = 0$ are coplanar. Find the point of intersection.
8. Find the length and equations of shortest distance between the line $\frac{x-2}{2} = \frac{y-2}{3} = \frac{z-3}{4}$ and $\frac{x-2}{3} = \frac{y-4}{4} = \frac{z-5}{5}$.
9. Find the length and equation of the shortest distance between the lines $\frac{x}{1} = \frac{y}{2} = \frac{z}{1}$ and $x + y + 2z - 3 = 0 = 2x + 3y + 3z - 4$.
10. Find the S.D and the equations of the line of S.D between the lines $3x - 9y + 5z = 0 = x + y - z$ and $6x + 8y + 3z - 10 = 0 = x + 2y + z - 3$.

UNIT-III

11. A sphere of radius k passes through the origin and meet the axes in A, B, C. Show that the centroid of the triangle ABC lies on the sphere $9(x^2 + y^2 + z^2) = 4k^2$
12. 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 .
13. Find the equation of the sphere passing through the circle $x^2+y^2=4$, $z=0$ and is intersected by the plane $x+2y+2z=0$ in circle of radius 3 .
14. 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.
15. Find the pole of the plane $x + 2y + 3z = 7$ w.r.t the sphere $x^2 + y^2 + z^2 - 2x - 4y - 6z + 11 = 0$

UNIT-IV

16. Find the equation of the sphere which touches the plane $3x + 2y - z + 2 = 0$ at $(1, -2, 1)$ and cuts orthogonally to the sphere$x^2 + y^2 + z^2 - 4x + 6y + 4 = 0$.
17. Show that the radical line of the spheres $x^2 + y^2 + z^2 - 4x + 3 = 0$, $x^2 + y^2 + z^2 - 6y + 3 = 0$, $x^2 + y^2 + z^2 + 4x + 2y - 4z + 3 = 0$, is $\frac{x}{3} = \frac{y}{2} = \frac{z}{7}$.
18. Find the radical centre of the spheres $x^2 + y^2 + z^2 + 4y = 0$, $x^2 + y^2 + z^2 + 2x + 2y + 2z + 2 = 0$, $x^2 + y^2 + z^2 + 3x - 2y + 8z + 6 = 0$, $x^2 + y^2 + z^2 - x + 4y - 6z - 2 = 0$

19. If r_1 , r_2 are the radii of two orthogonal spheres then the radius of the circle of their intersection is $\frac{r_1 r_2}{\sqrt{{r_1}^2+{r_2}^2}}$.

20. Find the limiting points of the coaxal system of spheres determined by

$x^2 + y^2 + z^2 + 4x - 2y + 2z + 6 = 0,\ x^2 + y^2 + z^2 + 2x - 4y + 2z + 6 = 0.$

UNIT-V

21. 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 $\frac{1}{a} + \frac{1}{b} + \frac{1}{c} = 0$.

22. Show that two lines of intersection of the plane $ax + by + cz = 0$ with the cone $yz + zx + xy = 0$ will be perpendicular if 1/a + 1/b +1/c =0.

23. The equation of a right circular cone with vertex at (α, β, γ) semi vertical angle θ and axis having direction ratios $(l, m, n)$is $[l(x-\alpha) + m(y-\beta) + n(z-\gamma)]^2 = (l^2 + m^2 + n^2)((x-\alpha)^2 + (y-\beta)^2 + (z-\gamma)^2)\cos^2\theta$.

24. Find the equation to the right circular cone whose vertex is P(2,-3,5) and axis PQ which makes equal angles with the axis and which passes through A(1,-2,3).

25. Find the equation to the right circular cone whose vertex is (1, -2, -1), axis the line $\frac{x-1}{3} = \frac{y+2}{4} = \frac{z+1}{5}$ and semi vertical angle 60^0.

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