

B.A./B.Sc. FIRST YEAR MATHEMATICS SYLLABUS  
SEMESTER – II, PAPER - 2  
SOLID GEOMETRY

**60 Hrs**

**UNIT – I (12 hrs) : 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, Orthogonal projection on a plane.

**UNIT – II (12 hrs) : 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; 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 (12 hrs) : 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 (12 hrs) : Sphere & Cones :**

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; Enveloping cone of a sphere; Equations of cones with vertex at origin are homogenous; Condition that the general equation of the second degree should represent a cone; Condition that a cone may have three mutually perpendicular generators;

**UNIT – V (12 hrs) Cones & Cylinders :**

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; Right circular cone; Equation of the right circular cone with a given vertex; axis and semi-vertical angle.

Definition of a cylinder; Equation to the cylinder whose generators intersect a given conic and are parallel to a given line; Enveloping cylinder of a sphere; The right circular cylinder; Equation of the right circular cylinder with a given axis and radius.

**Reference Books :**

1. Analytical Solid Geometry by Shanti Narayan and P.K. Mittal, Published by S. Chand & Company Ltd. 7th Edition.
2. A text book of Mathematics for BA/B.Sc Vol 1, by V Krishna Murthy & Others, Published by S. Chand & Company, New Delhi.
3. A text Book of Analytical Geometry of Three Dimensions, by P.K. Jain and Khaleel Ahmed, Published by Wiley Eastern Ltd., 1999.
4. 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.

**Suggested Activities:**

Seminar/ Quiz/ Assignments/ Project on Application of Solid Geometry in Engineering

**UNIT – I (12 hrs) : 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, Orthogonal projection on a plane.

**UNIT – II (12 hrs) : 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; 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 (12 hrs) : 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;

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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; Enveloping cone of a sphere; Equations of cones with vertex at origin are homogenous; Condition that the general equation of the second degree should represent a cone; Condition that a cone may have three mutually perpendicular generators;

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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; Right circular cone; Equation of the right circular cone with a given vertex; axis and semi-vertical angle.

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**Suggested Activities:**

Seminar/ Quiz/ Assignments/ Project on Application of Solid Geometry in Engineering

**UNIT – I (12 hrs) : The Plane :**

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15. A text Book of Analytical Geometry of Three Dimensions, by P.K. Jain and Khaleel Ahmed, Published by Wiley Eastern Ltd., 1999. S.

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**Suggested Activities:**

Seminar/ Quiz/ Assignments/ Project on Application of Solid Geometry in Engineering

**SEMESTER-II (2023-2024)**  
**COURSE 3: DIFFERENTIAL EQUATIONS**  
**Theory Credits: 4 5 hrs/week**

**Course Outcomes**

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

1. Solve first order first degree linear differential equations.
2. Convert a non-exact homogeneous equation to exact differential equation by using an integrating factor.
3. Know the methods of finding solution of a differential equation of first order but not of first degree.
4. Solve higher-order linear differential equations for both homogeneous and non-homogeneous, with constant coefficients.
5. Understand and apply the appropriate methods for solving higher order differential equations.

**Course Content**

**Unit – 1**

Differential Equations of first order and first degree

Linear Differential Equations – Bernoulli's Equations - Exact Differential Equations – Integrating factors - Equations reducible to Exact Equations by Integrating Factors -

i) Inspection Method ii) 1

$Mx Ny$  □

iii) 1

$Mx Ny$  □

**Unit – 2**

Differential Equations of first order but not of first degree

Equations solvable for  $\frac{dy}{dx}$ , Equations solvable for  $\frac{dx}{dy}$ , Equations solvable for  $\frac{dy}{dx}$  – Clairaut's equation -Orthogonal Trajectories: Cartesian and Polar forms.

**Unit – 3**

Higher order linear differential equations

Solutions of homogeneous linear differential equations of order  $n$  with constant coefficients - Solutions of non-homogeneous linear differential equations with constant coefficients by means of polynomial operators

(i)  $ax$

$Q(x) e^{ax} = (ii) \frac{d^2y}{dx^2} + p \frac{dy}{dx} + qy = S e^{ax}$  (or)  $C e^{ax}$

**Unit – 4**

Higher order linear differential equations (continued.)

Solution to a non-homogeneous linear differential equation with constant coefficients P.I. Of  $\frac{d^2y}{dx^2} + p \frac{dy}{dx} + qy = R e^{ax}$

$\frac{d^2y}{dx^2} + p \frac{dy}{dx} + qy = R \cos px$  when  $\frac{d^2y}{dx^2} + p \frac{dy}{dx} + qy = R \sin px$

P.I. of  $\frac{d^2y}{dx^2} + p \frac{dy}{dx} + qy = R e^{ax}$  when  $\frac{d^2y}{dx^2} + p \frac{dy}{dx} + qy = R a^2$ , where  $a$  is a function of  $x$  P.I. Of  $\frac{d^2y}{dx^2} + p \frac{dy}{dx} + qy = R$  when  $\frac{d^2y}{dx^2} + p \frac{dy}{dx} + qy = x$ , where  $a$  is a function of  $x$

**Unit – 5**

Higher order linear differential equations with non-constant coefficients

Linear differential Equations with non-constant coefficients; Cauchy-Euler Equation; Legendre Equation; Method of variation of parameters

Activities

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

Text Book

Differential Equations and Their Applications by Zafar Ahsan, published by Prentice-Hall of India Pvt. Ltd, New Delhi-Second edition.

Reference Books

1. Ordinary and Partial Differential Equations by Dr. M.D. Raisinghania, published by S. Chand & Company, New Delhi.
2. Differential Equations with applications and programs – S. Balachandra Rao & HR Anuradha-Universities Press.
3. Differential Equations -Srinivas Vangala&Madhu Rajesh, published by Spectrum University Press.

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**SEMESTER-II (2023-2024)**  
**COURSE 4: ANALYTICAL SOLID GEOMETRY**  
Theory Credits: 4 5 hrs/week

Course Outcomes

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

1. understand planes and system of planes
2. know the detailed idea of lines
3. understand spheres and their properties
4. know system of spheres and coaxial system of spheres
5. understand various types of cones

Course Content

Unit – 1

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 - Orthogonal projection on a plane.

Unit – 2

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 - 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 – 3

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 – 4

Spheres (continued)

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.

Unit – 5

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.

Activities

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

Text Book

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

Reference Books

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  2. Co-ordinate Geometry of two and three dimensions by P. Balasubrahmanyam, K.Y. Subrahmanyam, G.R. Venkataraman published by TataMcGraw -Hill Publishers.
  3. Solid Geometry by B. Rama Bhupal Reddy, published by Spectrum University Press.
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