

B.Sc. MATHEMATICS

FIRST YEAR

PAPER - I : Differential Equations & Solid Geometry

SECOND YEAR

PAPER - II : Abstract Algebra & Real Analysis

THIRD YEAR

PAPER - III : Linear Algebra, Multiple Integrals
and Vector Calculus

PAPER - IV : Electives

1. Numerical Analysis
2. Fourier Series and Integral Transforms

B.A. / B.Sc. MATHEMATICS

FIRST YEAR

Paper -1

DIFFERENTIAL EQUATIONS & SOLID GEOMETRY

DIFFERENTIAL EQUATIONS

UNIT -I

Differential equations of the first order and the first degree:

Linear differential equations, Differential equations reducible to linear form Exact Differential Equations, Integrating factors, Change of Variables, Simultaneous total differential Equations, Orthogonal trajectories in cartesian coordinates

Differential equations of the first order but not of the first degree:

Equations solvable for p , Equations solvable for y , Equations solvable for x ; Equations that do not contain x (or y), Equations of the first degree in x and y - Clairaut's equation.

UNIT - II

Higher order linear differential equations

Solution of homogeneous linear differential equations of order n with constant coefficients, Solution of the non-homogeneous linear differential equations with constant coefficients by means of polynomial operators. Method of undetermined coefficients, Method of variation of parameters, Linear differential equations with non-constant coefficients, The Cauchy - Euler equation

System of linear differential equations:

Solution of a system of linear equations with constant coefficients, An equivalent triangular system. Degenerate Case:

$$P_1(D)P_4(D) - P_2(D)P_3(D)=0.$$

(Prescribed Text Book: Scope and treatment as in Differential Equations and their Applications by Zafar Ahsan, published by Prentice-Hall of India Pvt. Ltd. New Delhi, Second edition: Sections: -2.5, to 2.9, 3.1, 3.2, 4.20, 5.2 to 5.7, 7.2, 7.3, 7.4.)

Reference Book :

Rai Singhania, "*Ordinary and Partial Differential Equations*",
S. Chand & company, New Delhi.

SOLID GEOMETRY

UNIT-III

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, Joint equation of two planes, Orthogonal projection on a plane.

Right Line :

Equations 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 a 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, Intersection of three planes.

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, 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-IV

Cones, Cylinders and Conicoids :

Definitions of a cone, vertex, guiding curve, generators, Equation of the cone with a given vertex and guiding curve, Enveloping cone of a sphere. Quadratic of cones with vertex at origin, Condition that the general equation of the second degree should represent a cone.

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. 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.

The general equation of the second degree, shapes of some surfaces, Nature of Ellipsoid, Nature of Hyperboloid of one sheet.

Prescribed Text Book :

Scope as in **Analytical solid Geometry** by shanti Narayan and P.K Mittal, Published by S.Chand & Company Ltd. Seventeenth edition: Sections : 2.4, 2.7, 2.8, 2.9, 3.1 to 3.8, 6.1 to 6.9, 7.1 to 7.8, 8.1 to 8.2.2.)

Reference Book:

P.K. Jain and Khaleel Ahmed, "A Text book of Analytical Geometry of Three Dimensions" Wiley Eastern ltd. 1999.

SEONCD YEAR

Paper – II

ABSTRACT ALGEBRA & REAL ANALYSIS

UNIT - I : GROUPS:

Binary operations- Definition and properties, Groups- Definition and examples, Elementary properties of groups, Finite groups and group composition tables, Subgroups and cyclic subgroups, Cyclic groups-Elementary properties of cyclic groups, Subgroups of finite cyclic groups. Permutations-groups of permutations, Cayley's theorem, orbits, cycles, even and odd permutations, the alternative groups, cosets, the theorem of Lagrange and its converse. Homomorphism, Definition and examples, properties of homomorphism. The kernel of a homomorphism, normal subgroup. factor groups, The fundamental homomorphism theorem, Normal subgroups and Inner automorphisms.

UNIT - II : RINGS:

Definitions and basic properties, homomorphism and isomorphism, Fields, divisors of zero and cancellation laws, Integral Domain, The characteristic of a ring. Rings of polynomials. Polynomials in an indeterminate, Ideals and factor rings, Homomorphism and factor rings, Fundamental homomorphism theorem, Maximal and prime ideals.

Prescribed text book.

Scope and treatment as in A first course in Abstract Algebra by John B. Fraleigh, Seventh edition, Pearson education (low price edition), New Delhi

Part-I: Sections: 2,4,5,6.

Part-II: Sections: 8,9,10.

Part-III: Sections:13,14.

Part-IV: Sections: 18,19, 22.1, 22.2, 22.3

Part-V: Sections : 26,27.1 to 27.16.

Reference Books

- (1) A first course in Abstract Algebra by John B. Fraleigh, Third edition, Narosa Publishing house.

- (2) Topics in Algebra by I.N.Herstein, Wiley Eastern
- (3) Contemporary Abstract Algebra by Joseph A Gallian, Narosa Publishing House.

UNIT - III:

REAL NUMBERS:

The Completeness properties of \mathbb{R} , Applications of the supremum property. (No question is to be set from this portion)

Sequences and Series-Sequences and their limits, Limit theorems, Monotone Sequences, Sub-sequences and the Bolzano-Weierstrass theorem, The Cauchy's criterion, Properly convergent sequences, Introduction to series, Absolute convergence, test for absolute convergence, test for non-absolute convergence.

Continuous functions : Continuous functions, combinations of continuous functions, Continuous functions on intervals, Uniform continuity.

UNIT - IV :

DIFFERENTIATION AND INTEGRATION:

The derivative, The Mean value theorem, L'Hospital rules, Taylor's theorem. Riemann integral, Riemann integrable functions, Fundamental theorem.

Prescribed text Book:

Scope as in "Introduction to Real analysis", by Robert G. Bartle and Donald R. Sherbert, John Wiley, third edition, Chapter 2(2.3 to 2.4), Chapter 3,(3.1 to 3.7), Chapter 5(5.1 to 5.4), Chapter 6(6.1 to 6.4), Chapter 7(7.1 to 7.3.7), Chapter 9 (9.1 to 9.3.2).

Reference Books:

1. A course of Mathematical Analysis by Shanthi Narayana and P.K..Mittal, S.Chand & Company.
2. Mathematical Analysis by S.C.Malik and Savita Arora, Wiley Eastern Ltd.

