



SEMESTER – 3

BRANCH	Subject Title	Subject Code
B.Sc. (Mathematic – Major)	<u>Abstract algebra and linear algebra</u>	MAM1-131

Learning outcomes:-

The course will enable the students to:

1. Recognize consistent and inconsistent systems of linear equations by the row echelon form of the augmented matrix, using the rank of matrix.
2. To find the Eigen values and corresponding Eigen vectors for a square matrix.
3. Using the knowledge of vector calculus in geometry
4. Enhance the knowledge of three dimensional geometrical figures (eg, cone and cylinder).

Unit – 1

1.1 Historical background:

1.1.1 A brief historical background of the Algebra in the context of India and Indian heritage and culture

1.1.2 A brief biography of Brahmagupta

1.2 Groups, Subgroups and their basic properties

1.3 Cyclic groups

1.4 Coset decomposition

1.5 Lagrange's and Fermat's theorem

1.6 Normal subgroups

1.7 Quotient groups



Unit - 2

- 2.1 Homomorphism and Isomorphism of groups: 2.2 Fundamental theorem of homomorphism
- 2.3 Transformation and permutation group S_n ($n < 5$)
- 2.4 Cayley's theorem 2.5 Group automorphism
- 2.6 Inner automorphism
- 2.7 Group of automorphisms

Unit - 3

- 3.1 Definition and basic properties of rings
- 3.2 Ring homomorphism
- 3.3 Subring
- 3.4 Ideals
- 3.5 Quotient ring
- 3.6 Polynomial ring
- 3.7 Integral domain
- 3.8 Field

Unit - 4

- 4.1 Definition and examples of Vector space
- 4.2 Subspaces
- 4.3 Sum and direct sum of subspaces
- 4.4 Linear span, Linear dependence, linear independence and their basic properties
- 4.5 Basis
- 4.6 Finite dimensional vector space and dimension
 - 4.6.1 Existence theorem
 - 4.6.2 Extension theorem



4.6.3 Invariance of the number of elements

4.7 Dimension of sum of subspaces

4.8 Quotient space and its dimension

Unit -5

5.1 Linear transformation and its representation as a matrix

5.2 Algebra of linear transformation

5.3 Rank-Nullity theorem

5.4 Change of basis, dual space, bi-dual space and natural isomorphism

5.5 Adjoint of a linear transformation

5.6 Eigenvalues and Eigenvectors of a linear transformation

5.7 Diagonalization



SEMESTER - 4

BRANCH	Subject Title	Subject Code
B.Sc. (Mathematic – Major)	<u>Advanced Calculus and Partial Differential Equation</u>	MAM1-141

Course learning outcomes:-

The course will enable the students to:

1. Sketch curves in a plane using its Mathematical properties in the different coordinate systems of reference.
2. Using the derivatives in Optimization, Social sciences. Physics and Life sciences etc.
3. Formulate the Differential equations for various Mathematical models.
4. Using techniques to solve and analyze various Mathematical models.

Unit -1

1.1 Historical background:

1.1.1 A brief historical background of Calculus and partial differential equations in the context of India and Indian heritage and culture

1.1.2 A brief biography of Bodhayana

1.2 Field structure and ordered structure of $\mathbb{R}$, intervals, bounded and unbounded sets, supremum and infimum, completeness in $\mathbb{R}$, absolute value of a real number.

1.3 Sequence of real numbers

1.4 Limit of a sequence

1.5 Bounded and monotonic sequences



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- 1.6 Cauchy's general principle of convergence
 - 1.7 Algebra of sequence and some important theorems

UNIT 2

- 2.1 Series of non-negative terms
- 2.2 Convergence of positive term series
- 2.3 Alternating series and Leibnitz's test
- 2.4 Absolute and Conditional Convergence of Series of real terms
- 2.5 Uniform continuity
- 2.6 Chain rule of differentiability
- 2.7 Mean value theorems and their geometrical interpretations

UNIT - 3

- 3.1 Limit and continuity of functions of two variables
- 3.2 Change of variables
- 3.3 Euler's theorem on homogeneous functions
- 3.4 Taylor's theorem for functions of two variables
- 3.5 Jacobians
- 3.6 Maxima and Minima of functions of two variables
- 3.7 Lagrange's multiplier method 3.8 Beta and Gamma Functions

UNIT 4

- 4.1 Partial differential equations of the first order
- 4.2 Lagrange's solution
- 4.3 Some special types of equations which can be solved easily other than the general method
- 4.4 Charpit's general method
- 4.5 Partial differential equations of second and higher orders



UNIT 5

5.1 Classification of partial differential equations of second order

5.2 Homogeneous and non-homogeneous partial differential equations of constant coefficients

5.3 Partial differential equations reducible to equations with constant coefficients



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