

8. Gokhroo & others : Real Analysis.  
9. Sharma & Purohit : Elements of Real Analysis.

**3226**  
**THIRD YEAR B. Sc. MATHEMATICS**

**PAPER – II**  
**ABSTRACT ALGEBRA**

**Duration: 3 Hours**

**Max. Marks: 75**

**UNIT – I**

Rings, definition and examples of various kinds of rings, integral domain, division ring, field, characteristic of a ring and integral domain, subring and subfield With examples. Left and right ideals with examples and properties, Principal ideal, principal ideal ring. Maximal, prime and Principal ideals in Commutative rings and their theorems.

**UNIT -II**

Quotient ring, Homomorphism and isomorphism in rings, kernel of homomorphism, Fundamental theorem of ring homomorphism. The three isomorphism theorems in rings, Embedding of a ring into a ring with unity and also into a ring of endomorphism of some abelian groups, Quotient field of an integral domain.

**UNIT - III**

Definition and various examples of vector spaces, subspaces and examples, Intersection, sum and direct sum of two subspaces, Linear span, Linear dependence, independence and their basic properties and problems.

**UNIT- IV**

Basis, Dimension and examples, Finite dimensional vector spaces, Existence theorem for a basis, Extension theorem, Invariance of the number of elements of a basis set, Existence of complementary subspaces of a subspace of a finite dimensional vector space, Dimension of sum (and direct sum) of two subspaces, Quotient space and its dimension.

**UNIT - V**

Linear transformations, Rank and Nullity of a linear transformation, Sylvester law of nullity, to obtain a matrix from a linear transformation and vice-versa and their problems relating to the same and different bases. The algebra of linear transformations, dual space and dual basis and dimension of dual space, bidual space and natural isomorphism (Reflexivity).

**References:**

1. Surjeet Singh and Quazi : Modern Algebra.  
Zarneeruddin
2. I.N.Herstein : Topics in Algebra.
3. R.S.Agrawal : Algebra.
4. Gokhroo, Saini : Advance Abstract Algebra.
5. Shanti Narayan : A Text-Book of Modern Abstract Algebra.
6. Hoffman and Kunze : Linear Algebra, (Second Edition).
7. Purohit, Pareek and Sharma : Linear Algebra.
8. Halmos, Paul R : Finite - Dimensional Vector spaces.