

## MA-631 COMMUTATIVE ALGEBRA-I (3 Credits)

**Commutative Rings:** Definition and examples, Integral domains, unit, irreducible and prime elements in ring, Types of ideals, quotient rings, Rings of fractions, Ring homomorphism, Definitions and examples of Euclidean Domains, Principal ideal domains and Unique Factorization domains.

**Polynomial and Formal Power series Rings:** Construction of Formal Power series ring  $R[[X]]$  and Polynomial ring  $R[X]$  in one indeterminate. Formal power series and Polynomial rings in a indeterminate, i.e.  $R[[X_1, X_2, \dots, X_n]]$  and  $R[X_1, X_2, \dots, X_n]$ , Factorization in polynomial rings, Irreducibility Criteria.

**Noetherian Rings:** Definition and examples. Polynomial extension of Noetherian domains, Quotient ring of Noetherian rings, Ring of Fractions of Noetherian rings.

**Dimension of Rings:** Chain of prime ideals in a domain, Length of chain of prime ideals, Dimension of ring, Dimension of Polynomial rings.

**Integral Dependence:** Ring extension, Integral element, Almost integral element, Integral closure of a domain, Complete integral closure of domain, integrally closed domain. Completely integrally closed domain.

**Valuation Rings:** Valuation map and value group, Rank of a valuation, Definition and examples of valuation rings, Valuation map and valuation ring, Valuation ring is integrally closed.

**Discrete Valuation Rings and Dedekind domains:** Fractional ideals, finitely generated fractional ideals, invertible fractional ideals, Discrete valuation rings and its examples.

Definitions and examples of Dedekind domains. Dedekind domain is integrally closed, Noetherian and has dimension one.

### RECOMMENDED BOOKS:

1. O. Zariski and P. Samuel, Commutative Algebra, Vol. 1, Springer-Verlag, New York, 1958.
2. M. F. Atiyah and L. G. Macdonald, Introduction to Commutative Algebra, Addison Wesley Pub. Co., 1969.
3. R. Gilmer, Multiplicative Ideal Theory, Marcell Dekker, New York, 1972.
4. H. Matsumura, Commutative Ring theory, Cambridge University Press, 1986.