Semester-1

GE 1:**Introduction to Algebra and Calculus**

Paper Code: HMTGE1011T, Full Marks: 100 (78 Classes), Total Credit:6=5+1(Th+Tutorial)

MODULE –I (Algebra-1) (39 classes)

Course Objective: *Learning and application of :1. finding simplified expression of zn, z complex, n rational, 2.finding or locating roots of a polynomial equation, 3. notions of equivalence relation and partition and their interdependence, 4. mapping: injective, surjective, internal binary operation.*

Complex Numbers[4] :De Moivre's theorem and its applications(4)

Polynomials[17]: Fundamental Theorem of Classical Algebra (statement only).Nature of roots of an equation (surd or complex roots occur in pairs) (2).Synthetic Division(2)Statement of Descarte' s rule of signs and its applications(2). Statement of Bolzano's theorem on continuity in case of polynomials. Relation between roots and coefficients(2). Symmetric functions of roots(1). Transformation of equations (4).Cardan' s method of solving a cubic & Ferrari's method for a biquadratic equation(3).

Set Theory& Relations [9]:Laws of algebra of sets &De Morgan's laws(2). Cartesian product of sets(2)

Relations on a set. Reflexive, symmetric and transitive properties of a relation on a set(2). Equivalence relations, equivalence class& partitions- illustrative discussions (2).

Mappings[9]: Injective and surjective mapping(2). Composition of mappings—concept only(1). Identity and inverse mappings(2). Binary operations on a set, Identity element & Inverse elements(3)

MODULE –II (Calculus-1) (39 classes)

Course objective*: Learning and application of : 1. Real number system and its completeness in particular, 2. concept of convergence sequence of real numbers, MCT and Cauchy's General Peinciple, in particular, 3.convergence of series of real numbers and related tests, 4. properties of continuous functions defined on closed bounded interval, 5. process of finding successive derivative, 6. convergence of improper integrals and related tests: Beta and Gamma function.*

Real numbers [4]: Axiomatic definition and Cantor's geometric presentation(2), Bounded sets of real numberstheir sup. and inf., Least upper bound axiom(2)

Sequence[10]: Definition , Bounded& unbounded sequence , Monotone sequence(2) Limit of a sequence & its uniqueness .statement of limit theorems(3). Concept of convergence and divergence of monotonic sequences—Statement of Monotone Convergence Theorem and its applications -definition of e. (3) Statement of Cauchy's General Principle of convergence and its applications(2).

Series of real numbers[7]: Convergence and divergence (definitions). Necessary condition of convergence, Geometric & p-series. Cauchy's principle as applied to infinite series (application only)(3). Series of positive terms: Statements of Comparison Test, Ratio Test, Cauchy's Root Test. Raabe 's test—applications(3). Alternating series: statement of Leibnitz Test and its applications(1).

Real valued functions[7]: limit of a function (ε −δ definition and Cauchy's definition) and algebra of limits(3).Continuity of a function at a point and in an interval. Acquaintance (no proof) with the important properties of continuous functions on closed intervals(3). Statement of existence of inverse function of a strictly monotone function and its continuity(1).

Derivative[6]:LHD&RHD, Sign of derivative—monotone increasing and decreasing functions. Relations between continuity and derivability(3). Successive derivatives—Leibnitz Theorem and its applications(3)

Improper integrals[5]: Definition, statement of μ-test and comparison tests-simple applications only(3). Use of Beta and Gamma functions (convergence and useful relations being assumed) (2)

Books Recommended:

(1) Introduction to Real Analysis—Bartle, Sherbert

(2) Calculus (Vol. I)—T.M.Apostol

(3) Undergraduate Analysis—S. Lang

(4) Mathematical Analysis— S. C. Malik and Arora

(5) Advanced Calculus(An Introduction to Classical Analysis) – Louis Brand (Dover)

(6) A First Course in Real Analysis—S. K. Berberian

(7) Advanced Calculus—D. Widder

(8) Mathematical Analysis—Elias Zakon