

Under-Graduate Programme with MATHEMATICS; 4th Semester

MATHEMATICS

MMT426J1: REAL ANALYSIS – I

Theory: 3 Credits (45 Hours)

MAJOR COURSE

Credits: 4 (3-TH + 1-TUT)

Tutorial: 1 Credits (15 Hours)

Course Objectives: To make students learn about the real numbers, (ii) properties of real numbers, (iii) sequences and series of real numbers, (iv) various tests of convergence and the completeness property of $\mathbb{R}$.

Course Outcome: (i) The students can apply these concepts to understand complex problems. (ii) The students shall be able to test the convergence of a sequence and series.

Theory: 3 Credits

Unit –I

Real Numbers, Field and Order structure, Bounded and unbounded sets of real numbers, supremum and infimum (lub and glb), Order completeness of $\mathbb{R}$, Archimedean property, Rational and Irrational density theorems, Dedekind's property, $\mathbb{R}$ as ordered field, Incompleteness of the set of rational numbers.

Unit –II

Sequences of real numbers, bounds of a sequence, Convergence of sequences, Limit points of sequences, subsequences, Bolzano-Weirstrass theorem, limit inferior and limit superior, Theorems on limit and convergence of sequences, Cauchy's criteria for convergence of sequences, Cauchy sequences, Bounded monotonic sequences, Nested Interval theorem.

Unit –III

Infinite Series: Convergence and Divergence of a series, Necessary Condition for Convergence of a series, Cauchy's Criteria for Convergence of a series, Geometric Series, Series of positive terms, Test for convergence: Comparison test, Cauchy's root test, D-Alembert's ratio test, Raabe's test.

Tutorial: 1 credit

Unit –IV

Open and Closed sets: Neighbourhood of a point, Interior of a set, Open set, Problems based on limit point of a set, Bolzano-Weierstrass theorem for sets, Closed sets, Closure of a set and related results. Cardinality of a set, countable and uncountable sets, countability of the set of Rational numbers and uncountability of reals, some simple related results.

Books Recommended

1. S. C. Malik, Real Analysis, New Age International.
2. T. M. Apostol, Mathematical Analysis, Narosa Publications, 2nd edition.
3. S. C. Malik, Mathematical Analysis, New Age International.
4. R. Goldberg, Methods of Real Analysis, Oxford IBM Publication, 1970
5. W. Rudin, Real and Complex Analysis, McGraw Hill, 3rd edition.