Course Code:	Couse Title	L-T-P	Credits
IMAT1C005T	Introduction to Real Analysis	3-1-0	4

Objective: The aim of this course is to understand the axiomatic foundation of the real number system, in particular the notion of completeness and some of its consequences; understand the concepts: neighborhood of a point, countable sets , sequence and series, functions of bounded variation and Riemann integral.

CO 01	Learn about the algebraic and order Properties of *real numbers,* Idea of countable sets and uncountable sets
CO 02	Understand the sequences of real numbers and the convergence of sequences.
CO 03	Understand the ~~and~~ series of positive terms. Difference between conditional and absolute convergence of alternating series.
CO 04	Riemann integral, partition, upper and lower integrals, existence of the Riemann integral, basic properties, fundamental theorem of integral calculus, integration by parts, applications.
CO 05	Learn about the monotonic functions, functions of bounded variation, rectifiable curves.

Course Contents

Unit-1

Algebraic and order Properties of *real numbers,* Idea of countable sets and uncountable sets, Uncountability of **R**. Bounded Sets, Supremum and Infimum of sets in **R**, The Completeness Property of **R**, The Archimedean Property. limit superior, limit inferior.

Unit-2

Density of Rational (and Irrational) numbers in **R**, Limit pointsof a set, Isolated points, Bolzano-Weierstrass theorem, Sequences, Bounded sequence, Convergent sequence, Limit of a sequence. Limit Theorems, Monotone Sequences, Monotone Convergence Theorem.Cauchy sequence, Cauchy's Convergence Criterion.

Unit-3

Infinite series, convergence and divergence of infinite series, Cauchy Criterion, Test for Convergence: Comparison test, Limit Comparison test, Ratio Test, Cauchy's n^{th} root test, Integral test, Alternating series, Leibniz test, Absolute and Conditional convergence.

Unit-4

Riemann integral, partition, upper and lower integrals, existence of the Riemann integral, basic properties, fundamental theorem of integral calculus, integration by parts, applications

Unit-5

Monotonic functions, Definition, basic properties of functions of bounded variation and examples, Lipschitz functions and examples, Jordan decomposition, Variation for continuous, monotonic and differentiable functions, Relation between the monotonicity and the differentiability, The derivative of the variation.

Reference Books:

1. T.M. Apostol, Calculus Volumes 1 and 2 (2nd edition), Wiley Eastern, 1980
2. W. Rudin, Principles of Mathematical Analysis (3rd edition), McGraw Hill, 1953
3. T.M. Apostol, Mathematical Analysis (2nd edition), Narosa Publishing, 1985
4. R.R. Goldberg, Methods of Real Analysis
5. H.L. Royden, Real Analysis (3rd edition), Prentice Hall, 2008
6. Terrance Tao, Analysis I & II, TRIM Series, Hindustan Book Agency

Shalabh

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