Semester-2

Core Paper 3:**Real Analysis-I**

Paper Code: HMTCR2031T, Full Marks: 100 (78 Classes), Total Credit:6=5+1(Th+Tutorial),

Course Objective: *Learning and application of axiomatic definition of real number system, in particular, with completeness, bounded monotone sequence of real numbers and their convergence Cauchy's Limit Theorems and topology of real number system, concept of sub sequential convergence, limit superior, limit inferior, different forms of completeness of real number system and their equivalence, Cauchy's general principle of convergence, absolute and conditional convergence of series of real numbers and related tests*.

Unit-1: Review of Algebraic and Order Properties of R, δ -neighborhood of a point in R **(3).**Idea of countable sets, uncountable sets and uncountability of R **(7).** Bounded above sets, Bounded below sets, Bounded Sets, Unbounded sets, Suprema and Infima, The Completeness Property of R **(7).** The Archimedean Property, Density of Rational (and Irrational) numbers in R with special reference to well-ordering property **(2).** Limit points of a set, Isolated points, Illustrations of Bolzano-Weierstrass theorem for sets**.(5)**

Unit-2: Sequences, Bounded sequence, Convergent sequence, Limit of a sequence **(5).** Limit Theorems, Proof of Squeeze theorem and application **(4).** Monotone Sequences, Monotone Convergence Theorem, Nested interval theorem**(5).** Subsequences, Divergence criteria.**(3**) Monotone Subsequence Theorem , Bolzano Weierstrass Theorem for Sequences.(**4**) Subsequential limit. Limsup and liminf of a sequence.Looking into limsup and limimf from view point of MCT **(6).**

Cauchy sequence, Cauchy's Convergence Criterion (4)

Unit-3: Convergence and divergence of infinite series (3), Cauchy's criterion of convergence (2); Test for convergence: comparison test, limit comparison test, ratio test, Cauchy's n^{th} root test, Raabe's test, Cauchy's condensation test (7); Alternating series, absolute and conditional convergence, Leibnitz test, Abel's and Dirichlet's test (6); Rearrangement of series, Riemann's Rearrangement theorem (Statement only) (2).

Graphical Demonstration (Teaching Aid)

1. Plotting of recursive sequences.
2. Study the convergence of sequences through plotting.
3. Verify Bolzano-Weierstrass theorem through plotting of sequences and hence identify convergent subsequences from the plot.

References:

(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**.**