Core III

Semester II

Real Analysis-I

Course Objective:

The objective of the course is to introduce the basics of real number system and the properties of sequence and series of real numbers. The ideas of completeness, least upper bound property, denseness, limit, continuity and uniform continuity will also be introduced. This is one of the core courses essential to start doing mathematics.

Learning Outcomes:

On successful completion of this course, students will be able to

- Learn basics of real number system and test countability of a set.
- Know on sequence of real numbers and their basic properties.
- Test convergence of an infinite series.
- Find limit and continuity of functions and test uniform continuity of functions.

Unit I

Finite and infinite sets, countable and uncountable sets, examples, algebraic and order Properties of R, uncountability of R, completeness property of **R,** applications of the supermom property, Intervals, nested interval property, denseness of rationals in R.

Unit II

Sequence and their limits, limit theorems, monotone sequences, monotone Convergence theorem, subsequences, divergence criteria, monotone subsequence theorem, Bolzano Weierstrass theorem for sequences, Cauchy sequence, Cauchy's convergence criterion.

Unit III

Infinite series, convergence and divergence of infinite series, Cauchy criterion, Tests for convergence: comparison test, limit comparison test, ratio test, Cauchy's nth root test, Raabe's test, integral test, alternating series, Leibniz test, absolute and conditional convergence.

Unit IV

Limits of functions, limit theorems, some extensions of limit concept, continuous functions and their combinations, continuous functions on intervals, boundedness theorem, maximum

minimum theorem, intermediate value theorem, uniform continuity, examples, uniform continuity theorem.

Books Recommended:

- ✓ *R. G. Bartle and D. R. Sherbert, Introduction to Real Analysis, 3rd Edn., John Wiley and Sons (Asia) Pvt. Ltd., Singapore, 2002.*
- ✓ *G. Das and S. Pattanayak, Fundamentals of Mathematical Analysis, TMH Publishing Co., 30th reprints, 2021.*

Books for Reference:

- ✓ S. *C. Mallik and S. Arora, Mathematical Analysis, New Age International Publications.*
- ✓ *A. Kumar, S. Kumaresan, A basic course in Real Analysis, CRC Press, 2014.*
- ✓ *Brian S. Thomson, Andrew. M. Bruckner, and Judith B. Bruckner, Elementary Real Analysis, Prentice Hall, 2001.*
- ✓ *Gerald G. Bilodeau , Paul R. Thie, G. E. Keough, An Introduction to Analysis, Jones & Bartlett, Second Edition, 2010.*
- ✓ *e-Learning Source http://ndl.iitkgp.ac.in ; http://ocw.mit.edu ; http://mathforum.org*
- ✓ *Suggested digital platform: NPTEL/SWAYAM/MOOCs.*