

Core VIII

Semester IV REAL ANALYSIS-II

Course Objective:

As a second course in real analysis, the objective is to learn on the concept of differentiation, Riemann Integration and their applications. The series of functions and the improper integrals have also been introduced.

Learning Outcomes: After completing the course the student will be able to

- Learn working out problems on derivatives of function and their applications.
- Learn about Riemann Integration and their properties including Improper Integrals.
- Learn on pointwise and uniform convergence of power series.
- Learn to calculate value of improper integrals.

Unit I

Differentiability of a function at a point and in an interval, Caratheodory's theorem, algebra of differentiable functions, relative extrema, interior extremum theorem. Rolle's theorem, Mean value theorems, Cauchy's mean value theorem, Lagrange mean value theorem, intermediate value property of derivatives, Darboux's theorem, applications of mean value theorem, Taylor's theorem and applications.

Unit II

Riemann integration: partitions, conditions of integrability, definition of Riemann integral properties of the Riemann integral, Riemann integral as limit of a sum, mean value theorem for integrals, integration by parts, Fundamental theorems of calculus, Taylor theorem with remainder.

Unit III

Pointwise and uniform convergence of sequence of functions, Cauchy criterion for uniform convergence and Weierstrass M-test, uniform convergence and continuity, term by term integration and differentiation of a series, power series, Abel's theorem, Weierstrass approximation theorem, Taylor series

Unit IV

Improper integrals, integration of unbounded functions with finite limits of integration, comparison tests of convergence, infinite range of integration, integrand as product of

functions convergent at infinity, absolutely convergent integral, tests of convergence, convergence of Beta and Gamma functions, applications.

Books Recommended:

- ✓ *R.G. Bartle D.R. Sherbert, Introduction to Real Analysis, John Wiley and Sons (Asia) Pvt. Ltd., Singapore*
- ✓ *G. Das and S. Pattanayak, Fundamentals of Mathematics Analysis, TMH Publishing Co.*
- ✓ *S. C. Mallik and S. Arora, Mathematical Analysis, New Age International Ltd., New Delhi.*

Book for Reference:

- ✓ *K. A. Ross, Elementary Analysis: The theory of Calculus, Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2004.*
- ✓ *Charles G. Denlinger, Elements of Real Analysis, Jones and Bartlett (Student Edition), 2011.*
- ✓ *A. Kumar, S. Kumaresan, A basic course in Real Analysis, CRC Press, 2014*
- ✓ *e-Learning Source <http://ndl.iitkgp.ac.in> ; <http://ocw.mit.edu> ; <http://mathforum.org>*
- ✓ *Suggested digital platform: NPTEL/SWAYAM/MOOCs.*