(Master of Science) (Mathematics)
(M.Sc.) (Mathematics) Semester (II)

Course Code	PS02CMTH51	Title of the Course	Real Analysis - I
Total Credits of the Course	04	Hours per Week	04 hours

Course Objectives:	1. Students will learn generalization of Classical Riemann Integration Theory 2. Students will start learning modern mathematical analysis.

Course Content		
Unit	Description	Weightage* (%)
1.	**Lebesgue Measurable Sets** Algebra and σ-algebra of sets; Borel sets and Borel σ-algebra in $\mathbb{R}$; Structure Theorem for open subsets of $\mathbb{R}$; G_δ-sets and F_σ-sets; (Lebesgue) Outer measure in $\mathbb{R}$; Basic results on outer measure; Lebesgue Measurable sets; Lebesgue measure on $\mathbb{R}$; Basic results on Lebesgue measure; Construction of a non-measurable set, and a non-Borel set	25%
2.	**Lebesgue Measurable Functions** Simple function and its canonical form; (Lebesgue) Measurable functions; Basic results on measurable functions; Littlewood's three principles; Egoroff's theorem; Simple Approximation Theorem; Convergence in measure; Relation between pointwise convergence & convergence in measure Monotone function and its continuity; Riemann Integral (Quick Revision before starting Lebesgue integral).	25%
3.	**Lebesgue Integration** Lebesgue integral of a measurable simple function and basic results Lebesgue integral of a bounded function over a measurable set E of finite measure and basic results; Bounded convergence theorem; Lebesgue integral of a nonnegative measurable function; Fatou's lemma; Monotone Convergence Theorem;	25%

	Beppo-Levis theorem; General Lebesgue integral; Lebesgue Dominated Convergence Theorem; Comparison of Riemann and Lebesgue integral	
4.	**Differentiation and Lebesgue Integral** Functions of bounded variation and basic results; Jordan's Lemma on functions of bounded variation; Lipchitz functions and basic results; Differentiation of an integral; Continuity and bounded variation of indefinite integral; Absolutely continuous functions and basic results; Relation between indefinite integral and absolute continuity; Different forms of fundamental theorem of integral calculus.	25%

Teaching-Learning Methodology	Classroom teaching, Presentation by students, Supply of information about online resources

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Quizzes, Assignments, and Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course,	
1.	Students will experience the power of Lebesgue theory
2.	Students will be able to apply the theory in mathematical finance, mathematical statistics, and other branches of basic sciences.

Suggested References:	
Sr. No.	References
1.	Royden H. L. and Fitzpatrick P. M., Real Analysis (Fourth Edition), Pearson, 2010.
2.	Rana I. K., An Introduction to Measure and Integration, Narosa Publication House, New Delhi, 1997.
3.	De Barra G., Introduction to Measure Theory, Van Nostrand Reinhold Co., 1974.

On-line resources to be used if available as reference material
On-line Resources

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