

<b>Devi Ahilya University, Indore, India</b> <b>Institute of Engineering &amp; Technology</b>				<b>MSc – I Year (Applied Mathematics)</b> with Specialization in Computing & Informatics <b>Semester- II</b>				
<b>Subject Code &amp; Name</b>		<b>Instructions</b> <b>Hours per Week</b>			<b>Credits</b>			
<b>AM2PC1: Real Analysis/ Measure Theory</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Total</b>
<b>Duration of Theory Paper:</b> <b>3 Hours</b>		<b>3</b>	<b>1</b>	<b>-</b>	<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>

**Objective:** To study the analytic properties of real functions and sequences, including convergence and limits of sequences of real numbers, the calculus of the real numbers, study measures whose main applications are in the foundations of the Lebesgue integral.

**Prerequisites:** Set theory, algebra of functions and sequence & series of Real and Complex numbers.

### COURSE OF CONTENTS

#### UNIT I

The Riemann-Stieltjes Integral, Definition and existence of the integral, properties of the integral, integration and differentiation, integration of vector-valued functions, rectifiable curves.

#### UNIT II

Rearrangements of terms of a series, Riemann theorem, Sequences and Series of Functions, pointwise and uniform convergence, Cauchy criterion for uniform convergence, Weierstrass M-test, uniform convergence and continuity, uniform convergence and integration, Uniform convergence and differentiation, equicontinuous families of functions, the Stone-Weierstrass Theorem, uniform convergence and Riemann-Stieltjes integral, Abels test for uniform convergence, Dirichlet's test for uniform convergence, power series, Abel's theorem.

#### UNIT III

Lebesgue outer measure, Measurable sets, Measurable functions, Borel and Lebesgue measurability, non measurable sets, Littlewoods three principles, non Borel measurable set, Lebesgue integral of a bounded function over a set of finite measure, the integral of a nonnegative function, the general Lebesgue integral.

#### UNIT IV

Measure space, Measurable functions, Integration, General convergence theorems, signed measure, product measure, inner measure.

#### UNIT V

$L^p$  spaces, convex functions, Jensen's Inequality, Minkowski and Holder inequalities, convergence and completeness of  $L^p$ , approximations in  $L^p$ .

#### BOOKS RECOMMENDED:

- [1] Halsey Royden, Real Analysis, Prentice Hall of India, New Delhi, 3<sup>rd</sup> Edition, 2010.
- [2] Walter Rudin, Principles of Mathematical Analysis, McGraw-Hill Publishing Co. 3<sup>rd</sup> edition, 1976.
- [3] R. G. Bartle and D.R. Sherbert, Introduction to Real analysis, 3<sup>rd</sup> Ed., 2000.
- [4] H. K. Pathak, Real Analysis, Shiksha Sahitya Prakashan, Meerut, 2010.