

CURRICULUM TRANSACTIONAL STRATEGY

MMT-C 202: Real Analysis-II

Syllabus

Prerequisites: Basic Calculus and Elementary Analysis

COURSE OBJECTIVES

1. To develop the theory of semirings, rings, algebra and sigma-algebra.
2. To develop the understanding of the measure as generalization of length.
3. To understand the theory of Lebesgue measure.
4. To understand how Lebesgue measure is generalization of length on \mathbb{R} .
5. To learn the concept of measurable function and its relation with continuous functions.
6. To develop those parts of the theory that are prominent like Cantor set, Steinhaus theorem, Ostriviskies theorem and existence of non-Lebesgue measurable set.
7. To introduce the idea of Lebesgue integral and its relation with Riemann integral.
8. To understand the applications Lebesgue integral in evaluating some improper integrals.
9. To understand some fundamental theorems of Lebesgue integral such as Fatous lemma, Monotone convergence theorem, Dominated convergence theorem.
10. To introduce the theory of absolutely continuous functions and bounded variation and relationship between them.
11. To understand Vitali Conering lemma and its applications.

COURSE OUTLINE

UNIT I

- The basic idea of measure.

- The geometrical representation of measure.
- Properties of sets of positive measure.
- Existence of non-Lebesgue measurable subset of \mathbb{R} .
- Outer measure and outer measure of interval is its length.
- Outer measure generated by semiring.

UNIT II

- Measurable functions and their characterizations.
- Stienhauss theorem on the set of positive measure.
- Ostrovskis theorem on the measurable solution of $f(x+y)=f(x)+f(y)$.
- Convergence a.e. and convergence in measure
- Egroffs theorem.

UNIT III

- Lebesgue integral of bounded functions and the equivalence of Lebesgue integrable function and measurable function.
- Riemann integral as Lebesgue integral.
- Fundamental theorem of calculus.
- Equivalence of Riemann integrable function and a.e. continuous function.
- Upper functions and lower functions.
- Fotous lemma, Monotone convergence theorem.
- Bounded convergence theorem and its applications.

Unit-IV

- Continuous functions and absolutely continuous functions and relation between them.
- Bounded variation functions and its relationship with absolutely continuous functions.
- Monotone function and its relationship with bounded variation function.
- Decomposition of bounded variation function as a difference of two monotone functions.
- Vitali covering lemma and its applications.

Classroom Transaction

Unit	Topic	Activity	No. of Tutorials	No. of lectures
I	Semigroup, Algebra, Sigma-Algebra and Borel Sigma-Algebra	Assignment & Presentation	01	04
	Measure on semiring, Outer measure, Measurable sets and Caratheodory extension of an outer measure..	Assignment & Presentation	01	04
	Lebesgue measure, lebesgue measure of an interval as its length, Existence of non-Lebesgue measurable set.	Assignment and Presentation	01	04
	Total		03	12

Unit	Topic	Activity	Tutorials	Lectures
II	Measurable function and their characterization. Algebra of measurable function.	-	-	02
	Stienhaus theorem on the set of positive measure, Ostrovisks theorem.	Assignment & Presentation	02	04
	Convergence a.e., Convergence in measure and relation between them.	Assignment & Presentation	01	04
	Almost uniform convergence and Egroffs theorem.	Assignment	01	02
	Total		04	12

Unit	Topic	Activity	Tutorials	Lectures
III	Lebesgue Integral of bounded function and Equivalence of Lebesgue integrable and bounded measurable function and RiemannIntegral as Lebesgue integral.	Assignment & Presentation	01	04
	Fundamental theorem of calculus, necessary and sufficient condition for function to be Riemann integrable.	Assignment & Presentation	01	03
	Fatous Lemma and Monotone convergence theorem.	Assignment & Presentation	01	02
	Dominated convergence theorem.	-	01	02
	Applications of dominated convergence theorem..	Assignment	01	02
	Total			04

Unit	Topic	Activity	Tutorials	Lectures
IV	Mionotone functions and its properties	-	-	01
	Vitali covering Lemma and Lebesgues theorem.	Assignment & Presentation	01	03
	Functions of bounded variations and Jordans theorem.	Assignment	01	02
	Absolutely continuous functions and its properties.	Assignment & presentation.	01	02

	Relationship between continuous function, functions of bounded variations and absolutely continuous.	Assignment & presentation	01	02
	Absolutely continuous function and indefinite integral.	Assignment	-	02
	Total		04	12

TEXT BOOKS:

1. James Ward Brown, Ruel V. Churchill, "Complex Variables and Applications", **Mc GRAW HILL INTERNATIONAL EDITION.**
2. Lars V. Ahlfors, "Complex Analysis third edition" , **Mc GRAW HILL INTERNATIONAL EDITION.**
3. S. Ponnusamy, "Complex Variables and Applications" ,**NAROSA.**

REFERECE BOOKS:

1. E. C. Titchmarsh, "The theory of functions", **OXFORD SCIENCE PUBLICATIONS.**
2. Robert E. Green, Steven G. Krantz, "Function theory of one complex variable", **AMERICAN MATHEMATICAL SOCIETY.**