Approval: 6th Senate Meeting

Course Number: MA-568

Course Name: Real Analysis

Credits: 2.5-0.5-0-3

Prerequisites: IC-110: Limit, Continuity, Differentiability.

Intended for: UG/MS/PhD

Distribution: Elective

Semester: Odd/Even

Preamble: This course is about advance theory of functions and their properties. It is designed to be taught especially to 3rd and 4th year student or first year master's student. This course tries to demonstrate to the students how real number system can be build from very basic axioms.

Course Outline: This course is a rigorous analysis of the real numbers. It covers the fundamentals of mathematical analysis. It discusses the concept of convergence of sequences and series, continuity, differentiability, Riemann integral, sequences and series of functions. The main aim is to show the utility of abstract concepts and teaches an understanding and construction of proofs. It also includes the basics of measure theory.

Course Modules:

1. The real number system: Sets, ordered sets, countable sets; Fields, ordered fields, least upper bounds, the real numbers, derivatives, the chain rule; Rolle's theorem, Mean Value Theorem.

[7 Lect.]

2. Basic Topology: Metric spaces, neighborhoods, open subsets, limit points, closed subsets, dense

subsets; complete metric spaces, connected metric spaces, Compact sets. [6 Lect.]

3. Sequences and Series: Sequence, Subsequence, limits, lim sup and lim inf; Convergence. Continuity: Continuous maps between metric spaces; Intermediate value theorem, images of compact subsets; continuity of inverse maps. [6 Lect.]

4. Convergence: Pointwise convergence, Weierstrass criterion; continuity of uniform limits; application to power series; Spaces of functions as metric spaces, Sequence and series of functions: Uniform convergence, Uniform convergence and continuity, Equicontinuous families of functions, The Stome Weierstrass theoem. [9 Lect.]

5. Introduction to Lebesgue theory: Set functions, Construction of Lebesgue measure, Measure spaces, Measurable functions, Simple functions, Integration. [8 Lect.]

Reference Books:

1. Rudin, Walter. *Principles of Mathematical Analysis (International Series in Pure and Applied Mathematics)*. 3rd ed. McGraw-Hill, 1976. ISBN: 9780070542358.

2. Apostol, Tom M. *Mathematical Analysis*. 2nd ed. Pearson Education, 1974. ISBN: 9780201002881.