

17HS33 REAL ANALYSIS

Course Description and Objectives:

This course will focus on the proofs of basic theorems of analysis. The way to establish the proofs, many new concepts will be introduced. Understanding the basic concepts and their properties are important for the development of the present and further courses.

Course Outcomes:

Upon completion of the course, the student will be able to achieve the following outcomes:

| COs | Course Outcomes |
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| 1 | Determine the Riemann integrability and the Riemann- Stieltjes integrability of a bounded function and proved a selection of theorems concerning integration. |
| 2 | Recognize the difference between pointwise and uniform convergence of a sequence of functions. |
| 3 | Determine the continuity, differentiability, and integrability of functions defined on subsets of the real line. |
| 4 | Illustrate the derivatives of higher order and differentiation of integral. |
| 5 | Able to learn advanced the Lebesgue measure and Lebesgue integral with related problems. |

Skills:

1. Understanding the basic analysis.
2. Evaluate the convergence of functions.
3. Identify the advances in analysis.

UNIT – I (12 hrs) : REAL NUMBERS :

The algebraic and order properties of \mathbb{R} , Absolute value and Real line, Completeness property of \mathbb{R} , Applications of supreme property; intervals. No. Question is to be set from this portion.

Real Sequences: Sequences and their limits, Range and Boundedness of Sequences, Limit of a sequence and Convergent sequence.

The Cauchy's criterion, properly divergent sequences, Monotone sequences, Necessary and Sufficient condition for Convergence of Monotone Sequence, Limit Point of Sequence, Subsequences and the Bolzano-weierstrass theorem – Cauchy Sequences – Cauchy's general principle of convergence theorem.

UNIT –II (12 hrs) : INFINITIE SERIES :

Series: Introduction to series, convergence of series. Cauchy's general principle of convergence for series tests for convergence of series, Series of Non-Negative Terms.

1. P-test
2. Cauchy's n^{th} root test or Root Test.
3. D'-Alemberts' Test or Ratio Test.
4. Alternating Series – Leibnitz Test.

Absolute convergence and conditional convergence, semi convergence.

UNIT – III (12 hrs) : CONTINUITY :

Limits: Real valued Functions, Boundedness of a function, Limits of functions. Some extensions of the limit concept, Infinite Limits. Limits at infinity. No. Question is to be set from this portion.

Continuous functions : Continuous functions, Combinations of continuous functions, Continuous Functions on intervals, uniform continuity.

UNIT – IV (12 hrs) : DIFFERENTIATION AND MEAN VALUE THEORMS :

The derivability of a function, on an interval, at a point, Derivability and continuity of a function, Graphical meaning of the Derivative, Mean value Theorems; Role's Theorem, Lagrange's Theorem, Cauchy's Mean value Theorem

UNIT – V (12 hrs) : RIEMANN INTEGRATION :

Riemann Integral, Riemann integral functions, Darboux theorem. Necessary and sufficient condition for R – integrability, Properties of integrable functions, Fundamental theorem of integral calculus, integral as the limit of a sum, Mean value Theorems.

Reference Books:

1. Real Analysis by Rabert & Bartely and D.R. Sherbart, John Wiley.
2. A Text Book of B.Sc Mathematics by B.V.S.S. Sarma and others, Published by S. Chand & Co., New Delhi.
3. Elements of Real Analysis as per UGC Syllabus by Shanthi Narayan and Dr. M.D. Raisingkania S. Chand & Co., New Delhi.

Suggested Activities:

Seminar/ Quiz/ Assignments/ Project on Real Analysis and its applications