MTH4011 Analysis – I

Programme: M.Sc. Year: 1st Year Semester: Odd (2018-19)
Course: Core Credits: 4(3L+T) Hours : 40 L + Weekly Tutorials

Course Context and Overview (100 words): Analysis I is a foundational course in Mathematics, leading on to other areas of analysis, such as topology and measure theory, complex analysis, functional analysis, and harmonic analysis. It also provides essential tools for application areas such as theoretical computer science, physics and engineering. Moreover, this course is an introduction to devising mathematical proofs and learning to write them up. This course covers the fundamentals of Mathematical analysis: Metric Spaces, Compact Sets, Relationship b/t compact, closed sets, Compactness, Heine-Borel Theorem, the convergence of sequences and series, continuity, Uniform Continuity, differentiability, Riemann integral, continuity and differentiability of a function of several variables.

Course outcomes (COs):

On satisfying the requirements of this course, students will have the knowledge and skills to:
CO1. Explain the fundamental concepts of real analysis and prove techniques.
C02. Demonstrate accurate and efficient use of real analysis techniques
C03. Demonstrate the capacity for mathematical reasoning through analysing, proving and explaining concepts from real analysis
C04. Apply problem-solving using real analysis techniques to other mathematical contexts.

Course Topics:

Topics	
UNIT – I	8
Finite, Countable, and Uncountable sets. Metric spaces, neighbourhoods, open set, limit point, closed set, perfect set, dense set, open relative, Compact sets, Heine - Borel theorem, Weierstrass Theorem, Perfect sets, Separated subsets, Connected sets, separable space.	
Unit-II	7
Sequences in Metric spaces (or Euclidean Spaces), subsequences, Convergence, Cauchy Sequences, complete metric space, monotonic sequence, limsup, liminf. Series, Convergence of series, test of convergence, Power Series, Absolute convergence.	
Unit III:	6

Limit and continuity of functions defined on a metric space, continuity and compactness, continuity and connectedness, discontinuities, Limit at infinity, Uniformly continuous. Differentiability, Mean value theorem, Continuity of Derivatives.	
Unit IV: Riemann and Riemann -Stieltjes integrals: Definition and existence of Integral, properties of integral, Integration and differentiations, The fundamental theorem of calculus. Improper integral.	7
Unit V Sequence of functions, pointwise convergence, uniform convergence, uniformly convergence and continuity, uniformly convergence and integration, uniformly convergence and differentiation.	7
UNIT – VI: Functions of several variables: limit, continuity, directional derivative, partial derivative, differentiability.	5

Text Book:

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

Reference Books:

- Apostol, Tom M.: Mathematical Analysis, 2nd ed., Narosa, 2002.
- Ghorpade and Limaye: A Course in Multivariable Calculus and Analysis, 1st ed., Springer, 2009.

URL for the course:

Additional Resources (NPTEL, MIT Video Lectures, Web resources etc.):
https://ocw.mit.edu/courses/mathematics/18-100b-analysis-i-fall-2010/index.htm

Evaluation Methods:

Item	Weightage (%)
Quizes	20%
Midterm	30%
Final Examination	50%

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Last Update: 21/10/2019