Course Code: 0541-223 (Stat-223) Course Title: Real Analysis
Marks: 100 Credits: 03 Number of Class: 42

Rationale:

To expose the students to the basics of real analysis and complex variables for their subsequent course work. It is the part of the essential foundation for advanced study in many areas of pure and applied mathematics.

Objectives:

The objectives of this course are to:

- Define the real numbers, least upper bounds, and the triangle inequality.
- Define the limit of a function at a value, a limit of a sequence, and the Cauchy criterion.
- Describe continuity of a function and uniform continuity of a function.
- Recognize alternating, convergent, conditionally and absolutely convergent series and prove various theorems related to derivatives.
- Prove Rolle's theorem, extreme value theorem, and the Mean Value Theorem.
- Define Riemann integrable functions and prove results related to Riemann sums and integrals.

Learning Outcomes:

By the end of the course, students should be able to:

CLO1	Describe fundamental properties of the real numbers leading to formal real analysis and rigorous arguments.
CLO2	Demonstrate understanding of limits in sequences, series, differentiation and integration.
CLO3	Work with complex numbers and compute limits of sequences and complex functions.
CLO4	Compute functions of one complex variable and evaluate complex integrals along paths.
CLO5	Apply complex differentiation, Cauchy theorem and Cauchy integral formula.

Mapping between PLOs and CLOs of Statistics program

	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8
CLO1	3	2	2					
CLO2		2					2	
CLO3	2			1			2	
CLO4	2						2	
CLO5	2	2			2			

Course Content, Teaching and Assessment Strategy

CLOs	Course Content	Teaching S.	Assessment S.	No. of Lec.
CLO1	**Series:** Function and Real Valued Function. Open set, Dense Set, Countability, Compact, Connected sets, Monotonic and Additive Classes of Sets. Convergence Principle, Convergence and Absolute Convergence of Series.	Interactive Class, Open Discussion, Participatory Q/A, Online resources and Practical	Assignments, Class Tests, Presentation, Attendance and Final Examination	3
CLO2	Comparison Test, Ratio Test, Root Test and Integral Test. Rearrangement of Absolutely Convergent Series, Cauchy's Convergence, Multiplication of Absolutely Convergent Series.			5
CLO3	**Real Functions:** Continuity, Uniform Continuity, Properties of Continuous Functions, Exponential, Logarithmic, Trigonometric Functions, Rolle's Theorem.			4
CLO3	Mean Value Theorems, Cauchy's Mean Value Theorem, Taylor's Theorem with Lagrange's and Cauchy's form of the Remainder.			10
CLO4	**Riemann Integral:** Existence of Riemann Integral of Continuous Functions, Simple Properties, First and Second Mean Value Theorem.			10
CLO5	Improper Integrals, Infinite Integrals, Sequences and Series of Functions, Uniform Convergence, Term-by-Term Integration and Differentiation.			10

Mapping of Course Learning Outcomes (CLOs) with Teaching–Learning & Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
CLO1	Classroom Discussion	Class Test, Mid Term, Quiz
CLO2	Problem-solving Activities	Assignment and Presentation
CLO3	Lecture and Reflective Discussion	Midterm Exam
CLO4	Discussion and Slide Show	Final Exam
CLO5	Lecture and Discussion	Final Exam

Text Book

1. Rudin, W. (1976): *Real Analysis*, Academic Press, New York.

Reference Books

1. Apostol, T. (1992): *Mathematical Analysis*, McGraw Hill, New York.
2. Binmore, G.H. (1965): *Foundation of Analysis*, C.U.P., London.
3. Burkill, J.C. (1962): *A First Course in Mathematical Analysis*, C.U.P., London.