DEPARTMENT OF STATISTICS

Course content for the following paper is yet to be approved. Draft syllabus is enclosed for further suggestions. All suggestions are welcome by 11.01.23, Wednesday before 11.59 pm for consideration of the related Committee of Courses to be held on Thursday, 12.01.23.

DISCIPLINE SPECIFIC CORE COURSE – 9: MATHEMATICAL ANALYSIS

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Mathematical Analysis	4	3	0	1	Class XII pass with Mathematics	Nil

Learning Objectives

The learning objectives include:

- To study the Real Analysis, this deals with the analytical properties of real functions and sequences.
- To study the Numerical Analysis, this is the study of algorithms that use numerical approximation for the problems of mathematical analysis.

Learning Outcomes:

After completing this course, students should have developed a clear understanding of:

- Fundamental properties of real number and real-valued functions.
- Analytical properties of sequences.
- Infinite series, their properties and different tests.
- Limits, continuity, differentiability and mean value theorems.
- Fundamentals of numerical analysis, interpolation, numerical integration and difference equation.

SYLLABUS OF DSC-9

Theory

UNIT I **(10 hours)**

Set Theory and Sequences

Completeness: The Completeness property of R; Neighbourhood and limit points: Neighbourhood, Open Set, Closed Set, Limit Point of a Set; Sequences: Definition of a Sequence, Convergent Sequence, Divergent Sequence, Oscillatory Sequence, Cauchy Sequence, Monotone Sequence.

UNIT II **(10 hours)**

Series

Infinite series, positive termed series and their convergence, Comparison test, D'Alembert's ratio test, Cauchy's n^{th} root test, Raabe's test. Gauss test, Cauchy's condensation test and integral test (Statements and Examples only). Absolute convergence of series, Conditional convergence.

UNIT III **(10 hours)**

Limit and Continuity

Review of limit, continuity and differentiability, uniform Continuity and boundedness of a function. Rolle's and Lagrange's Mean Value theorems. Taylor's theorem with Lagrange's and Cauchy's form of remainder (without proof). Taylor's and Maclaurin's series expansions of sin(x), cos(x), log (1+x).

UNIT IV **(15 hours)**

Numerical Analysis

Factorial, finite differences and interpolation. Operators, E and divided difference. Newton's forward, backward and divided differences interpolation formulae. Lagrange's interpolation formulae. Gauss and Stirling interpolation formulae. Numerical integration. Trapezoidal rule, Simpson's one-third rule, three-eights rule, Stirling's approximation to factorial n. Solution of difference equations of first order.

PRACTICAL/LAB WORK – (30 hours)

List of Practical:

1. Formation of difference table, fitting of polynomial and missing terms for equal interval of differencing.
2. Based on Newton's Gregory forward difference interpolation formula.
3. Based on Newton's backward difference interpolation formula.
4. Based on Newton's divided difference and Lagrange's interpolation formula.
5. Based on Gauss forward, Gauss backward central difference interpolation formula.
6. Based on Stirling's central difference interpolation formula.
7. Based on Lagrange's Inverse interpolation formula.

8. Based on method of successive approximation or iteration.
9. Based on method of reversion of series.
10. Based on Trapezoidal Rule, Simpson's one-third rule, Simpson's three-eighth rule, Weddle's rule.
11. To find sum by Euler-Maclaurin summation formula

Essential Readings

- Appostol, T.M. (1987). Mathematical Analysis, 2nd Ed., Narosa Publishing House,New Delh

Suggestive Readings:

- Bartle, R.G. and Sherbert, D.R. (2002). Introduction to Real Analysis, (3rd Ed.,), John Wiley and Sons (Asia) Pte. Ltd., Singapore.
- Ghorpade, S.R. and Limaye, B.V. (2006). A Course in Calculus and Real Analysis, Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint.
- Jain, M.K., Iyengar, S.R.K. and Jain, R.K. (2003). Numerical methods for scientific and engineering computation, New age International Publisher, India.
- Malik, S.C. and Arora, S. (1994). Mathematical Analysis, Second Edition, Wiley Eastern Limited, New Age International Limited, New Delhi.
- Mukherjee, Kr. Kalyan (1990). Numerical Analysis. New Central Book Agency.
- Sastry, S.S. (2000). Introductory Methods of Numerical Analysis, 3rd Ed., Prentice Hall of India Pvt. Ltd., New Delhi.
- Narayan, S. (1987). A course of Mathematical Analysis, 12th revised Ed., S. Chand &Co. (Pvt.) Ltd., New Delhi.
- Somasundram, D. and Chaudhary, B. (1987). A First Course in Mathematical Analysis, Narosa Publishing House, New Delhi.