

DSE Courses of B.Sc. (Physical Sciences/Mathematical Sciences) Sem-VI

Category-III

DISCIPLINE SPECIFIC ELECTIVE COURSE – 4(i): ELEMENTARY 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		
Elementary Mathematical Analysis	4	3	1	0	Class XII pass with Mathematics	Discipline A-5: Elements of Real Analysis

Learning Objectives: The primary objective of this course is to introduce:

- Sequential criterion for limits and continuity of real-valued functions.
- Riemann integral of real-valued function f on $[a, b]$ using Darboux sums.
- Pointwise and uniform convergence of sequences and series of functions.

Learning Outcomes: This course will enable the students to:

- Apply sequential continuity criterion for the proof of intermediate value theorem.
- Understand the basic tool used to calculate integrals
- Apply uniform convergence for term-by-term integration in power series expansion.

SYLLABUS OF DSE-4(i)

UNIT-I: Continuous Functions (12 hours)

Sequential criterion for limits and continuity of functions, Continuity on intervals, Intermediate value theorem and applications; Uniform continuity.

UNIT-II: The Riemann Integral (15 hours)

Riemann integration, criterion for integrability and examples; Integrability of continuous and monotone functions, Algebraic properties of the Riemann integral, Fundamental theorem of calculus (first form).

UNIT-III: Uniform Convergence (18 hours)

Sequences and series of functions: Pointwise and uniform convergence, Uniform Cauchy criterion, Weierstrass M-test, Implications of uniform convergence in calculus; Power series, Radius and interval of convergence, Applications of Abel's theorem for power series.

Essential Reading

1. Denlinger, Charles G. (2011). Elements of Real Analysis. Jones & Bartlett India Pvt. Ltd. Student Edition. Reprinted 2015.

Suggestive Readings

- Bartle, Robert G., & Sherbert, Donald R. (2011). Introduction to Real Analysis (4th ed.). John Wiley & Sons. Wiley India Edition 2015.
- Ross, Kenneth A. (2013). Elementary Analysis: The Theory of Calculus (2nd ed.). Undergraduate Texts in Mathematics, Springer. Indian Reprint.

DISCIPLINE SPECIFIC ELECTIVE COURSE-4(ii): INTRODUCTION TO MATHEMATICAL MODELING

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		
Introduction to Mathematical Modeling	4	3	0	1	Class XII pass with Mathematics	Discipline A-3: Differential Equations

Learning Objectives: The main objective of this course is to introduce:

- Compartmental models and real-life case studies through differential equations, their applications and mathematical modeling.
- Choosing the most appropriate model from competing types that have been fitted.
- Fitting a selected model type or types to the data and making predictions from the collected data.

Learning Outcomes: The course will enable the students to:

- Learn basics of differential equations and compartmental models.
- Formulate differential equations for various mathematical models.
- Construct normal equation of best fit and predict the future values.

SYLLABUS OF DSE-4(ii)

UNIT-I: Compartmental Models (15 hours)

Compartmental diagram and balance law; Exponential decay, radioactive dating, and lake pollution models; Case study: Lake Burley Griffin; Drug assimilation into the blood; Case study: Dull, dizzy or dead; Exponential growth, Density-dependent growth, Equilibrium solutions and stability of logistic equation, Limited growth with harvesting.

UNIT-II: Interacting Population Models and Phase-plane Analysis (15 hours)