

**B.A. (Prog.) Semester-VI with Mathematics as Major**  
**Category-II**

**DISCIPLINE SPECIFIC CORE COURSE (DSC-6): 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 DSC-6**

**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 CORE COURSE – 6 (Discipline A-6): PROBABILITY AND STATISTICS

#### 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		
Probability and Statistics	4	3	0	1	Class XII pass with Mathematics	NIL

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

- Make the students familiar with the basic statistical concepts and tools which are needed to study situations involving uncertainty or randomness.
- Render the students to several examples and exercises that blend their everyday experiences with their scientific interests to form the basis of data science.

**Learning Outcomes:** This course will enable the students to:

- Understand some basic concepts and terminology-population, sample, descriptive and inferential statistics including stem-and-leaf plots, dotplots, histograms and boxplots.
- Learn about probability density functions and various univariate distributions such as binomial, hypergeometric, negative binomial, Poisson, normal, exponential, and lognormal.
- Understand the remarkable fact that the empirical frequencies of so many natural populations, exhibit bell-shaped (i.e., normal) curves, using the Central Limit Theorem.
- Measure the scale of association between two variables, and to establish a formulation helping to predict one variable in terms of the other, i.e., correlation and linear regression.

#### SYLLABUS OF DISCIPLINE A-6

##### UNIT-I: Descriptive Statistics, Probability, and Discrete Probability Distributions (15 hours)

Descriptive statistics: Populations, Samples, Stem-and-leaf displays, Dotplots, Histograms, Qualitative data, Measures of location, Measures of variability, Boxplots; Sample spaces

and events, Probability axioms and properties, Conditional probability, Bayes' theorem, and independent events; Discrete random variables & probability distributions, Expected values; Probability distributions: Binomial, geometric, hypergeometric, negative binomial, Poisson, and Poisson distribution as a limit.

**UNIT-II: Continuous Probability Distributions (15 hours)**

Continuous random variables, Probability density functions, Uniform distribution, Cumulative distribution functions and expected values, The normal, exponential, and lognormal distributions.

**UNIT-III: Central Limit Theorem and Regression Analysis (15 hours)**

Sampling distribution and standard error of the sample mean, Central Limit Theorem, and applications; Scatterplot of bivariate data, Regression line using principle of least squares, Estimation using the regression lines; Sample correlation coefficient and properties.

**Practical (30 hours):** Software labs using Microsoft Excel or any other spreadsheet.

- 1) Presentation and analysis of data (univariate and bivariate) by frequency tables, descriptive statistics, stem-and-leaf plots, dotplots, histograms, boxplots, comparative boxplots, and probability plots ([1] Section 4.6).
- 2) Fitting of binomial, Poisson, and normal distributions.
- 3) Illustrating the Central Limit Theorem through Excel.
- 4) Fitting of regression line using the principle of least squares.
- 5) Computation of sample correlation coefficient.

**Essential Reading**

1. Devore, Jay L. (2016). Probability and Statistics for Engineering and the Sciences (9th ed.). Cengage Learning India Private Limited. Delhi. Indian Reprint 2022.

**Suggestive Reading**

- Mood, A. M., Graybill, F. A., & Boes, D. C. (1974). Introduction to the Theory of Statistics (3rd ed.). Tata McGraw-Hill Pub. Co. Ltd. Reprinted 2017.

**DSE Courses of B.A. (Prog.) Semester-VI**

**Category-II**

**DISCIPLINE SPECIFIC ELECTIVE COURSE – 2(i): DISCRETE DYNAMICAL SYSTEMS**

**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		