# Teaching Plan: B.A. (Prog.) /B.Sc. (Physical Sc.) with Mathematics, Semester-5

## Discipline A-5: Elements of Real Analysis

**Weeks 1 and 2:** Field and order properties of $\mathbb{R}$, basic properties and inequalities of the absolute value of a real number.
[1]: Chapter 1 (Sections 1.1, and 1.2).

**Weeks 3 and 4:** Bounded above and bounded below sets, Suprema and infima, The completeness axiom and the Archimedean property of $\mathbb{R}$.
[1]: Chapter 1 (Section 1.6 [1.6.1 to 1.6.14, Theorems 1.6.2 and 1.6.10 without proofs]).
[1]: Chapter 1 (Section 1.5 [1.5.1, 1.5.2, and 1.5.9]).

**Weeks 5 and 6:** Convergence of a real sequence, Algebra of limits.
[1]: Chapter 2 (Section 2.1).
[1]: Chapter 2 (Section 2.2 [2.2.1 to 2.2.14, Theorems 2.2.8, 2.2.12, and 2.2.13 (d to f) without proofs]).

**Week 7:** The squeeze principle and applications.
[1]: Chapter 2 (Section 2.3 [2.3.1 to 2.3.14, Theorems 2.3.6, 2.3.10, and 2.3.14 without proofs]).

**Weeks 8 and 9:** Monotone sequences, Monotone convergence theorem and applications.
[1]: Chapter 2 (Section 2.5 [2.5.1 to 2.5.10, Theorems 2.5.5 and 2.5.7 without proofs).

**Week 10:** Cauchy sequences, Cauchy criterion for convergence and applications.
[1]: Chapter 2 (Section 2.7 [2.7.1 to 2.7.6, Theorem 2.7.4 without proof]).

**Week 11:** Convergence and divergence of infinite series of real numbers, Necessary condition for convergence, Cauchy criterion for convergence of series.
[1]: Chapter 2 (Section 8.1).

**Weeks 12 to 14:** Tests for convergence of positive term series, Applications of the integral test, Comparison tests, D'Alembert's ratio test, Cauchy's *n*th root test, Raabe's test.
[1]: Chapter 2 (Section 8.2 [8.2.1 to 8.2.12, 8.2.14, 8.2.15, 8.2.17, 8.2.21, and 8.2.22, with all theorems without proofs]).

**Week 15:** Alternating series, Leibniz alternating series test, Absolute and conditional convergence.
[1]: Chapter 2 (Section 8.3 [8.3.1 to 8.3.10, Theorems 8.3.2, and 8.3.4 without proofs]).

**Essential Reading**

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