

**CC V I- COMPLEX VARIABLE**

**UNIT I**

Elementary Point Set Topology: Sets and Elements – Metric Spaces – Connectedness – Compactness – Continuous Functions – Topological Spaces; Conformality: Arcs and Closed Curves – Analytic Functions in Regions – Conformal Mapping – Length and Area; Linear Transformations: The Linear Group – The Cross Ratio – Symmetry

**UNIT II**

Fundamental theorems in complex integration: Line Integrals – Rectifiable Arcs – Line Integrals as Functions of Arcs – Cauchy's Theorem for a Rectangle – Cauchy's Theorem in a Disk; Cauchy's Integral Formula: The Index of a Point with Respect to a Closed Curve – The Integral Formula – Higher Derivatives.

**UNIT III**

Local Properties of Analytic Functions - Removable Singularities - Taylor's Theorem – Integral representation of the  $n^{\text{th}}$  term - Zeros and Poles – Algebraic order of  $f(z)$  – Essential Singularity - The Local Mapping – The Open Mapping Theorem - The Maximum Principle.

**UNIT IV**

The General Form of Cauchy's Theorem: Chains and Cycles – Simple Connectivity – Homology – The General Statement of Cauchy's Theorem – Proof of Cauchy's Theorem – Locally Exact Differentials – Multiply Connected Regions; The Calculus of Residues: The Residue Theorem – The Argument Principle – Evaluation of Definite Integrals

**UNIT V**

Harmonic Functions: Definition and Basic Properties – The Mean-value Property – Poisson's Formula – Schwarz's Theorem – The Reflection Principle; Power series expansions-Weierstrass's Theorem – The Taylor Series – The Laurent Series;

**TEXT BOOK(S)**

Lars V. Ahlfors, Complex Analysis, Third Ed. McGraw-Hill Book Company, Tokyo, 1979.

UNIT – I	- Chapter 3: 1.1-1.6, 2.1-2.4, 3.1-3.3
UNIT – II	- Chapter 4: 1.1-1.5, 2.1-2.3
UNIT – III	- Chapter 4: 3.1, 3.2, 3.3, 3.4
UNIT – IV	- Chapter 4: 4.1-4.7, 5.1-5.3
UNIT – V	- Chapter 4: 6.1-6.5, and Chapter 5: 1.1-1.3

**REFERENCE(S)**

- [1] Serge Lang, Complex Analysis, Addison Wesley, 1977.
- [2] S. Ponnusamy, Foundations of Complex Analysis, Narosa Publishing House, New Delhi, 1997.
- [3] V. Karunakaran, Complex Analysis.