

Devi Ahilya University, Indore, India Institute of Engineering & Technology			MSc – II Year (Applied Mathematics) with Specialization in Computing & Informatics Semester- IV				
Subject Code & Name	Instructions Hours per Week			Credits			
AM4PC1: Complex Analysis	L	T	P	L	T	P	Total
	3	1	-	3	1	-	4
Duration of Theory Paper: 3 Hours							

Learning Objectives:

- To study the techniques of complex variables and functions together with their derivatives, Contour integration and transformations.
- To study complex power series, classification of singularities, calculus of residues and its applications in the evaluation of integrals, and other concepts and properties.

Prerequisites: Set theory, calculus of real functions, algebra of complex numbers.

COURSE OF CONTENTS

UNIT I

Exponential and Trigonometric functions, Analytic (Holomorphic) functions, Necessary and sufficient condition for analyticity (Cauchy-Riemann equations), Polar form of Cauchy-Riemann equations, Harmonic functions, Harmonic Conjugate.

UNIT II

Complex Integration, Cauchy's theorem, Cauchy's Integral formula, higher order derivative of analytic function, Morera's Theorem, Poisson's integral formula for a circle, Cauchy's Inequality, Liouville's theorem.

UNIT III

Expansion of analytic function as power series : Taylor and Laurent theorem, Zeros of an analytic function, Singularities and types, Meromorphic functions, principle of Argument, Roche's theorem, , fundamental theorem of algebra, Maximum Modulus Principle, Schwarz Lemma.

UNIT IV

Residue, Cauchy's Residue theorem, evaluation of definite integrals, their properties and classification. Definitions and examples of conformal transformation, bilinear transformation, their properties and classification.

UNIT V

Harmonic functions and mappings, Inverse mappings, Schwarz's Reflection principle. Analytic continuation, uniqueness of direct analytic continuation and analytic continuation along a curve, power series method of analytic continuation. Homotopic curves, Monodromy theorem, Picard theorem.

Learning Outcomes:

Upon completing the course, students will be able to:

- Students will be equipped with the understanding of the fundamental concepts of complex variable theory and skill of contour integration to evaluate complicated real integrals via residue calculus.
- Apply problem-solving using complex analysis techniques applied to diverse situations in physics, engineering and other mathematical contexts.

BOOKS RECOMMENDED:

- [1] Walter Ruddin, Real and Complex Analysis, McGraw-Hill International Editions, 3/e, 1987.
- [2] Ahifors.L. V., Complex Analysis., McGraw Hill, New York, 2/e,1983.
- [3] Dr. H. K. Pathak, Complex Analysis, ShikshaSahitya publication 2/e, 2007.
- [4] S.Ponnusamy : Foundations of Complex Analysis, Narosa Pub, '97.
- [5] Kasana H.S., Complex Variables: Theory and Applications, Prentice-Hall of India Pvt. Ltd, 2nd edition, 2005.