**College of Engineering, Pune-5.**

**Department of Mathematics**

 **( MA ) Complex Analysis**

**Final Year B. Tech. (ILOE) Semester VII (All Branches)**

Teaching Scheme Examination Scheme

Lectures : 3 hrs / week Internal Test 1: 20 marks

 Internal Test 2: 20 marks

 End Sem. Exam: 60 marks

**Objectives :** . Many engineering problems may be treated and solved by the methods involving complex numbers and complex functions. Apart from being interesting in its own right, investigating complex numbers and complex analytic functions offers deep insights into many practical problems related to electric circuits, mechanical vibrating systems, heat conduction , fluid flow, electrostatics etc. The aim of this course is to expose the students to basic ideas of Complex Analysis and to give them the glimpse of some physical applications.

**Unit I : Complex Numbers and Functions**

Review of complex numbers and their geometry, Functions of complex variables, Limit, Continuity and Derivatives of functions of complex variables, Analytic functions, Cauchy-Riemann Equations (with proof). **[6 Hrs]**

**Unit II: Elementary Functions and Mapping By Elementary Functions**

Exponential function, Trigonometric and hyperbolic functions, Logarithmic function, Inverse Trigonometric Functions, Transformation of elementary functions, The linear fractional Transformation, Successive transformations. **[8 Hrs]**

**Unit III : Complex Integration**

Line Integral, Cauchy Integral Theorem, Simply and multiply connected domains, Indefinite integrals, Cauchy Integral formula, Derivatives of Analytic Functions. **[7 Hrs]**

**Unit IV : Power series Expansions of Analytic functions**

Review of sequences, series and convergence tests, Power Series, Power Series Expansions of Analytic Functions, Taylor Series(Taylor’s Theorem with Proof), Laurent series(Laurent’s Theorem without Proof), Multiplication, Division , Integration and Differentiation of Power Series.

 **[8 Hrs]**

**Unit V : Residues and Poles**

Singularities and Zeros of Analytic Functions, Residues, The Residue Theorem, Evaluation of Improper Real Integrals. **[6 Hrs]**

**Unit VI : Conformal Mapping** **and Its Applications**

Conformal Mapping, Electrostatic fields, Heat Problems, Two Dimensional Fluid flow.**[5 Hrs]**

**Text Book :**

* Complex Variables and Applications by R. V. Churchill and J. W. Brown (8th Ed.) ( Tata McGraw-Hill )

**Reference Books** **:**

* Advanced Engineering Mathematics by Erwin Kreyszig (9th Ed.) ( Wiley Publication.)
* Complex Analysis for Mathematics and Engineering by J. H. Mathews and R. W. Howell (5th Ed.) (Norosa Publishing House)
* Introduction to Complex Analysis by H. A. Priestley, (2nd Ed.) Indian Edition (Oxford University Press)
* Complex Variables- Introduction and Applications, by M. J. Ablowitz and A. S. Fokas, Cambridge University Press, 1998
* Theory of Functions of a Complex Variable by Shanti Narayan and P. K. Mittal(2nd Ed.) (S. Chand Publication)

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**Outcomes:**

1. Students should know the basic concepts of Complex Analysis.
2. Students should acquire the basic techniques involved in calculus of functions of complex variables.
3. Students should be able to apply the techniques regarding power series.
4. Students should be able to apply the techniques regarding conformal mappings to various fields.