College of Engineering Pune
(An Autonomous Institute of Government of Maharashtra, Pune-411005)
Department of Mathematics
(ILE-18010) 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

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).   **[06 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.   **[08 Hrs]**

Unit III : Complex Integration

Line Integral, Cauchy Integral Theorem, Simply and multiply connected domains, Indefinite integrals, Cauchy Integral formula, Derivatives of Analytic Functions.   **[07 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.

                                                                                          [08 Hrs]

Unit V : Residues and Poles

Singularities and Zeros of Analytic Functions, Residues, The Residue Theorem, Evaluation of Improper Real Integrals.   **[06 Hrs]**

Unit VI : Conformal Mapping and Its Applications

Conformal Mapping, Electrostatic fields, Heat Problems, Two Dimensional Fluid flow.   **[05 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)

Outcomes : Students will be able to

1. **remember** the basic concepts of complex analysis.
2. **understand** and **explain** basic concepts involved in calculus of functions of complex variables.
3. **Analyze** and **make use** of the techniques regarding power series to solve the integrals.
4. **Outline** proofs of theorems, **apply** to solve real and complex integration problems.
5. **apply** concepts of complex analysis to various fields such as integration, conformal mapping.

Note 1 :

- To measure CO1, questions may be of the type- define, identify, state, match, list, name etc.
- To measure CO2, questions may be of the type- explain, describe, illustrate, evaluate, give examples, compute etc.
- To measure CO3, questions will be based on applications of core concepts.
- To measure CO4, questions may be of the type- true/false with justification, theoretical fill in the blanks, theoretical problems, prove implications or corollaries of theorems, etc.
- To measure CO5, some questions may be based on self-study topics and also comprehension of unseen passages.

Note 2 :

All the Course outcomes 1 to 3 will be judged by 75% of the questions and outcomes 4 and 5 will be judged by 25 % of questions.