

Subject Code: 1ET1010401	Subject Title: Complex Variables & Numerical Methods
Pre-requisite Subject	Calculus, Differential equations and Linear algebra

Course Objective:

This course will help student to

1. To understand the applications of Complex numbers and complex variable functions
2. To understand the applications of numerical methods.
3. To solve equations numerically, to evaluate integrals numerically.
4. To solve ordinary differential equations numerically.
5. To apply mathematical concepts in various subjects of relevant branch.

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture	Tutorial	Practical	Credit	Theory		Practical		Total (T+P)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
3	2	-	5	70	30	-	-	100

Subject Contents			
Sr. No	Topic	Total Hours	Weight (%)
1.	Complex Numbers and Functions: Introduction to complex number, complex variable function, Multi-valued function and its branches: Logarithmic function and Complex Exponent function, Limit, Continuity and Differentiability of complex function, Analytic functions, Cauchy-Riemann Equations, Necessary and Sufficient condition for analyticity, Properties of Analytic functions, Laplace Equation, Harmonic Functions, Harmonic Conjugate functions and their Engineering Applications.	7	17
2.	Complex Integration: Curves, Line Integral (contour integral) and its properties, Cauchy- Goursat Theorem, Cauchy Integral Formula, Liouville Theorem (without proof), Maximum Modulus Theorems (without proof).	4	10
3.	Power Series: Convergence (Ordinary, Uniform, Absolute) of power series, Taylor and Laurent Theorems (without proof), Laurent series expansions, zeros of analytic functions, Singularities of analytic functions and their classification Residues: Residue Theorem, Rouche's Theorem (without proof).	5	12
4.	Applications of Contour Integration: Evaluation of various types of definite real integrals using contour integration method.	3	7

5.	Finite Differences and Interpolation: Finite Differences, Forward, Backward and Central operators, Interpolation by polynomials: Newton's forward, Backward interpolation formulae, Gauss and Stirling's central difference formulae and Newton's divided, Lagrange's interpolation formulae for unequal intervals.	6	14
6.	Numerical Integration: Newton-Cotes formula, Trapezoidal and Simpson's formulae, error formulae, Gaussian quadrature formulae.	4	10
7.	Solution of a System of Linear Equations: Gauss elimination, partial pivoting, Gauss-Jacobi method and Gauss-Seidel method.	4	9
8.	Roots of Algebraic and Transcendental Equations: Bisection, false position, Secant and Newton-Raphson methods, Rate of convergence.	5	12
9.	Numerical solution of Ordinary Differential Equations: Euler and Runge-Kutta methods.	4	9

Course Outcome:

The students will be able to apply mathematical concepts to engineering problems of their relevant branches after studying this course.

List of Reference Books:

1. R. V. Churchill and J. W. Brown, Complex Variables and Applications (7th Edition), McGraw-Hill (2003)
2. J. M. Howie, Complex Analysis, Springer-Verlag(2004).
3. M. J. Ablowitz and A.S. Fokas, Complex Variables-Introduction and Applications, Cambridge University Press, 1998 (Indian Edition)
4. S. D. Conte and Carl de Boor, Elementary Numerical Analysis-An Algorithmic Approach (3rd Edition), McGraw-Hill, 1980
5. Chapra S.C, Canale, R P, Numerical Methods for Engineers, Tata McGraw Hill, 2003