

Branch Name:	Electrical Engineering
Program Code:	ET109
Course Name:	Complex Variables & Numerical Methods
Course Code:	1ET1090401
Pre-requisite Course:	Calculus, Differential equations and Linear algebra

Course Objectives:

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.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)								
Lecture	Tutorial	Practical	Credit	Theory				Practical				Total
				University Assessment		Continuous Assessment		University Assessment		Continuous Assessment		
				Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
3	2	-	5	28	70	12	30	-	-	-	-	100

Course Contents:

Sr. No.	Topic	Total Hours	Weightage (%)
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.	07	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).	04	10
3	Power Series: Convergence (Ordinary, Uniform, And 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, Rouché's Theorem (without proof).	05	12
4	Applications of Contour Integration: Evaluation of various types of definite real integrals using contour integration method.	03	07
5	Finite Differences and Interpolation: Finite Differences, Forward, Backward and Central operators, Interpolation by polynomials: Newton's forward, Backward interpolation formulae,	06	14

	Gauss and Stirling's central difference formulae and Newton's divided, Lagrange's interpolation formulae for unequal intervals.		
6	Numerical Integration: Newton-Cotes formula, Trapezoidal and Simpson's formulae, error formulae, Gaussian quadrature formulae.	04	10
7	Solution of a System of Linear Equations: Gauss elimination, partial pivoting, Gauss-Jacobi method and Gauss-Seidel method.	04	09
8	Roots of Algebraic and Transcendental Equations: Bisection, false position, Secant and Newton-Raphson methods, Rate of convergence.	05	12
9	Numerical solution of Ordinary Differential Equations: Euler and Runge-Kutta methods.	04	09

Text Books:

1. R. V. Churchill and J. W. Brown, Complex Variables and Applications (7th Edition), McGraw-Hill (2003).
2. Numerical Methods for engineers. S C Chapra and R P Canale, McGraw Hill International Edition.

Reference Books:

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

List of Open Source Software/learning website:

1. NPTEL Video Lectures. www.nptel.ac.in.
2. <http://ocw.mit.edu/courses/mathematics/18-06-linear-algebra-spring2010/video-lectures>.
3. <http://ocw.mit.edu/courses/mathematics/18-02-multivariable-calculus-fall-2007/video>.

LAB/Practical- NA

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Evaluate exponential, trigonometric and hyperbolic functions of a complex number.	2 Understanding
CLO2	Define continuity, differentiability, analyticity of a function using limits. Determine where a function is continuous/discontinuous, differentiable/non-differentiable, analytic/not analytic or entire/not entire.	2 Understanding
CLO3	Evaluate a contour integral with an integrand which have singularities lying inside or outside the simple closed curve.	2 Understanding 5 Evaluation
CLO4	Find fixed and critical point of Bilinear Transformation.	3 Applying
CLO5	Calculate Finite Differences of tabulated data. find an approximate solution of algebraic equations using appropriate method.	3 Applying
CLO6	Find an approximate solution of Ordinary Differential equations using appropriate iterative method.	3 Applying 5 Evaluation

Mapping of CLOs with POs & PSOs

Course Learning Outcomes	Program Outcomes (POs)												Program Specific Outcomes(PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CLO1	H	M														
CLO2	H	M														
CLO3	H	M	L													
CLO4		H	M													
CLO5	M	H	M													
CLO6	M		H													

H: High, M: Medium, L: Low

