GUJARAT TECHNOLOGICAL UNIVERSITY
Bachelor of Engineering
Subject Code: 3130005
Semester – III
Subject Name: Complex Variables and Partial Differential Equations

Type of course: Basic Science Course

Prerequisite: Geometry, trigonometry, calculus and ODE.

Rationale: This subject is a powerful tool for solving a wide array of applied problems.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	2	0	5	70	30	0	0	100

Content:

Sr. No.	Content	Total Hrs	% Weightage
01	Polar Form of Complex Numbers, Powers and Roots, Complex Variable – Differentiation : Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties.	12	28%
02	Complex Variable - Integration : Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Sequences, Series, Convergence Tests, Power Series, Functions Given by Power Series, Taylor and Maclaurin Series, Uniform Convergence.	08	20%
03	Laurent's series; Zeros of analytic functions, singularities, Residues, Cauchy Residue theorem (without proof), Residue Integration Method, Residue Integration of Real Integrals.	06	14%
04	First order partial differential equations, solutions of first order linear and nonlinear PDEs, Charpit's Method	06	14%
05	Solution to homogeneous and nonhomogeneous linear partial differential equations second and higher order by complementary function and particular integral method. Separation of variables method to simple problems in Cartesian coordinates, second-order linear equations and their classification, Initial and boundary conditions, Modeling and solution of the Heat, Wave and Laplace equations.	10	24 %

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
7	**28**	**35**	0	0	0

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary from above table. This subject will be taught by Maths faculties.

Reference Books:
(1)   Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley and Sons.
(2)   Peter O'Neill, Advanced Engineering Mathematics, 7th Edition, Cengage.
(3)   Dennis G. Zill, 4th edition, Advanced Engineering Mathematics, 4th Edition, Jones and Bartlett Publishers.
(4)   Dennis G. Zill, Patrick D. Shanahan, A First Course in Complex Analysis with Applications, Jones and Bartlett Publishers.
(5)   S. J. Farlow, Partial Differential Equations for Scientists and Engineers, Dover Publications, 1993.
(6)   Ian Sneddon, Elements of Partial Differential Equations, McGraw Hill.
(7)   J. W. Brown and R. V. Churchill, Complex Variables and Applications, McGraw Hill.

Course Outcome:

Sr. No.	CO statement	Marks % weightage
CO-1	convert complex number in a polar form, plot the roots of a complex number in complex plane, find harmonic conjugate of analytic functions and apply conformal mapping in geometrical transformation	28%
CO-2	evaluate complex integration by using various result, test convergence of complex sequence and series and expand some analytic function in Taylor's series	20%
CO-3	find Laurent's series and pole of order, and apply Cauchy Residue theorem in evaluating some real integrals	14%
CO-4	form and solve first order linear and nonlinear partial differential equations	14%
CO-5	apply the various methods to solve higher order partial differential equations, modeling and solve some engineering problems related to Heat flows, Wave equation and Laplace equation	24 %

List of Open Source Software/learning website:
        MIT Opencourseware. NPTEL.