Course No	Course Name	L-T-P-Credits
MA 402	**Complex Analysis**	**3-1-0: 4**

Prerequisite: nil

Course Objectives: This course is aimed to provide an introduction to the theories of functions of complex variables; analytic functions; contour integrations and to furnish an introduction to their applications.

Course Outcomes: After successful completion of the course, students will be able to:

1. Represent complex numbers algebraically and geometrically
2. Analyze limit, continuity and differentiation of functions of complex variables.
3. Understand Cauchy-Riemann equations, analytic functions and various properties of analytic functions.
4. Understand Cauchy theorem and Cauchy integral formulas and apply these to evaluate complex contour integrals.
5. Represent functions as Taylor and Laurent series; classify singularities and poles; find residues and evaluate complex integrals using the residue theorem.
6. Understand conformal mapping.

SYLLABUS

Module	Contents	Hours
I	Algebra of complex numbers, operations of absolute value and conjugate, extended complex plane, stereo graphic projection.	03
II	Functions: limit, continuity, derivative, analytic functions, the exponential and logarithmic functions, branch of multi-valued function, branch-cut, trigonometric functions of a complex variable, conformal mapping, bilinear transformations.	09
III	Complex Integration: line integrals, rectifiable curves, Cauchy theorem, index of a closed curve, Cauchy's integral formulae, Cauchy's inequality, Liouville's theorem, Morera's theorem, Taylor series expansion.	12
IV	Singularities: Laurent series expansions, Removable singularities, Poles and essential singularities, zeros of analytic functions, Rouche's theorem, Identity theorem, Maximum modulus theorem, open mapping theorem, Schwartz's lemma, Cauchy's residue theorem; Evaluation of real integrals using Cauchy's residue theorem.	12

Essential Readings:

1. R.V. Churchill and J.W. Brown, "*Complex variables and applications*", McGraw Hill Education, 8th edition, 2017.
2. S. Ponnusamy and H. Silverman, "*Complex variables with applications*", Birkhauser, 2006.

Supplementary Readings:

1. L. V. Ahlfors, "*Complex Analysis*", McGraw Hill Education, 3rd edition, 2017.
2. J. B. Conway, "*Functions of One Complex Variable*", Narosa Publishing House, 2nd edition, 2000.