

Department of Mathematics
Faculty of Mathematics & Computer Science
M.Sc. (Applied Mathematics)

Course Code	AM 104
Course Title	Complex Analysis
Course Credits	04

Course objectives:

The contents of this course form an essential setting for many other courses such as Functional Analysis, Fourier Analysis, ODE, PDE etc.

Review of complex numbers and their properties.

Minimum pre-requisite:

Basic knowledge of differential & integral calculus, real analysis and complex number system will be useful.

Course Structure:

Analytic functions. Stereographic projection, limit, continuity, differentiability, Cauchy-Riemann equations, analytic functions, harmonic functions,

Elementary functions. Exponential function, logarithmic function, branches and derivatives of logarithms, complex exponents, trigonometric functions, hyperbolic functions, inverse trigonometric and hyperbolic functions.

Integrals. Curves and contours, contour integrals, antiderivatives, Cauchy-Goursat theorem, simply and multiply connected domains, Cauchy integral formula, Cauchy theorems, Liouville's theorem, fundamental theorem of algebra. Morera's theorem, maximum modulus theorem.

Series. Convergence of sequences and series, Taylor's theorem, Laurent's series, integrations and differentiation of power series.

Linear fractional transformations. Definition and properties of linear fractional transformations, The transformations $1/z, \sin z, z^2, z^{1/2}$, mapping of upper half plane.

Singularities. Isolated singularities, residues, Cauchy's residue theorem, residues at poles, zeros of analytic functions.

Applications of residues. Improper real integrals (using residue theorem), definite integrals involving sines and cosines.

Some idea of conformal mapping and Schwarz-Christoffel transformation.

Reading suggestions:

- **G.F. Simmons**, *Introduction to Topology and Modern Analysis*, McGraw Hill Book Company, 2010.
- **R.V. Churchill, J.W. Brown and R.F. Verhey**, *Complex Variables and Applications*, McGraw Hill Book Company.
- **E. Kreyszig**, *Introductory Functional Analysis with Applications*, John Wiley & Sons.
- **L.V. Ahlfors**, *Complex Analysis*, McGraw Hill Book Company.

Evaluation and weightage:

- Mid-Term Examination (20%): During the middle of the session, there will be a written examination.
- Assignments (20%): In all 4 assignments will be given, one in each month.
- Quiz/Presentations (20%): As per the lecture schedule, Quiz session will be organized and students may be asked to make presentations. The topics will be assigned during the lectures.
- Term-End Examination (40%): At the end of the session, there will be another written examination.