



## Complex Variables

Course Code	Course Num.	Course Name	Credit Hours	Lec	Lab	Tut	Prerequisites
MAT	312	Complex Variables	4	3	0	2	MAT 311

### *Objectives:*

- To let students learn the complex extensions of elementary functions.
- To let students visualize the geometric meaning of complex functions.
- To let students learn complex derivatives and the Cauchy-Riemann equations, and the relationship between these concepts.
- To let students learn complex sequences, series, and power series.
- To let students learn complex integration, contour integrals, and Cauchy's theorem

### *Syllabus:*

- **Basics:** Euler formula and exponential form of a complex number, basic topological properties, functions of complex variable, elementary functions. Limits, continuity and uniform continuity.
- **Continuity and differentiability:** Limits, continuity and uniform continuity, derivative of a complex function at a point, Cauchy-Riemann equations and differentiability complex functions, derivatives of elementary functions, analytic function at a point, singular points, analytic function and harmonic functions, L'Hopital's rule.
- **Complex integral:** line integral and complex integral, complex form of Green's theorem, Cauchy's and Cauchy-Goursat theorems, complex indefinite integral. Cauchy's integral formula, Argument, Rouche's, Liouville's, and modulus theorems.
- **Complex sequences and series:** Basic definitions, tests of series absolute convergence, power series and uniform convergence, circle of convergence, differentiation and integration of power series, Taylor's series and Laurent's series. type of singular points, Picard's theorem.
- **Residues:** Residues and the residue theorem with applications.
- **Basic concepts of conformal mapping.**

### *References:*

- **Complex Variables**, M. Spiegel, Schaum's Outline, McGraw-Hill (1968).
- **Complex Variables and applications**, R. Churchill and others, McGraw-Hill 5<sup>th</sup> ed. (1989).
- **Complex Variables: Introduction and Applications**, M. Ablowitz, et al, 2<sup>nd</sup> ed. (2003).

