# COMPLEX VARIABLES AND TRANSFORMS (THEORY) BS-115

Pre-requisite: Applied Calculus
Credit Hours      03
Contact Hours      48

## RECOMMENDED BOOKS

Advanced Engineering Mathematics, 9th Edition, by Erwin Kreyszig

## REFERENCE BOOKS

Complex variables and applications by Brown and Churchill, 9th Edition

## OBJECTIVE OF COURSE

The objective of this course is to discuss the complex number system, different types of complex functions, analytic properties of complex numbers, theorems in complex analysis to carryout various mathematical operations in complex plane.

| S.NO | CLO/PLOS MAPPING | DOMAIN | PLO |
|------|------------------|--------|-----|
| 01 | **Define** the complex number system, complex functions and integrals of complex functions. | C1 | 01, 02 |
| 02 | **Explain** the concept of limit, continuity, differentiability of complex valued functions. | C2 | 01 |
| 03 | **Apply** the results/theorems in complex analysis to complex valued functions. | C3 | 02, 03, 05 |

## COURSE CONTENTS

**Introductory Concepts**
- Introduction to Complex Number System
- Argand diagram
- De Moivre's theorem and its Application Problem Solving Techniques

**Analyticity of Functions**
- Complex and Analytical Functions,
- Harmonic Function, Cauchy-Riemann Equations.
- Cauchy's theoremand Cauchy's Line Integral.
- Singularities, Poles, Residues.
- Contour Integration.

**Laplace transforms**
- **L**aplace transform definition,

- Laplace transforms of elementary functions
- Properties of Laplace transform, Periodic functions and their Laplace transforms,
- Inverse Laplace transform and its properties,
- Convolution theorem,
- Inverse Laplace transform by integral and partial fraction methods,
- Heaviside expansion formula,
- Solutions of ordinary differential equations by Laplace transform,
- Applications of Laplace transforms

**Fourier series and Transform**
- Fourier theorem and coefficients in Fourier series,
- Even and odd functions,
- Complex form of Fourier series,
- Fourier transform definition,
- Fourier transforms of simple functions,
- Magnitude and phase spectra,
- Fourier transform theorems,
- Inverse Fourier transform,

**Solution of Differential Equations**
- Series solution of differential equations,
- Validity of series solution, Ordinary point,
- Singular point, Forbenius method,
- Indicial equation,
- Bessel's differential equation, its solution of first kind and recurrence formulae,
- Legendre differential equation and its solution,
- Rodrigues formula