# Outline No.: 08

**Date:** **Time:** 09:15 AM **Week:**

| SL No. | Title | Content | Remark |
|---|---|---|---|
| 1 | Topic | Cauchy's Integral Formulae | CO3, PO2 |
| 1.1 | Pre-requisite Topics | Complex Numbers, Complex Functions, Complex Differentiation, Contour Integration, Singularities and Laurent Series, Residue Theory, Basic Theorems of Complex Analysis, and Fundamental Theorems from Real Analysis. | |
| 1.2 | Learning Outcomes | The study of Cauchy's Integral Formula equips you with a deeper understanding of complex analysis and provides powerful tools for evaluating integrals and understanding the properties of analytic functions. Here are the learning outcomes that you can expect to achieve by studying Cauchy's Integral Formula:<br><br>**a. Understand the Concept of Analytic Functions**<br>• **Outcome**: You will gain a solid understanding of **analytic (holomorphic) functions**, which are central to complex analysis. You'll learn about the conditions under which a function is analytic and how these functions behave in the complex plane.<br>• **Key Knowledge**: The **Cauchy-Riemann equations**, which provide the necessary conditions for a function to be analytic, and the significance of these functions in relation to contour integration.<br>**b. Master the Application of Contour Integration**<br>• **Outcome**: You will learn how to compute **contour integrals** of complex functions over closed paths. Specifically, you will understand how **Cauchy's Integral Formula** relates contour integrals of analytic functions to the evaluation of function values at points inside the contour.<br>• **Key Knowledge**: The relationship between contour integrals and the behavior of analytic functions inside and outside the contour.<br>**c. Apply Cauchy's Integral Formula to Evaluate Complex Integrals**<br>• **Outcome**: You will be able to apply **Cauchy's Integral Formula** to evaluate complex integrals, especially integrals of analytic functions where the integrand has a simple pole or other singularities.<br>• **Key Knowledge**: The formula's ability to express the value of a function at a point inside a contour in terms of an integral around the contour.<br><br>$f(a)=1/2\pi i\int_C\{f(z)\}/\{z-a\}\ dz$<br><br>• You'll also be able to compute integrals of functions using **complex residue** theory.<br><br>**d. Learn to Use Cauchy's Integral Formula for Function Evaluation**<br>• **Outcome**: You'll develop the ability to **evaluate analytic functions at a point** inside a closed contour using the integral around that contour. This is particularly useful for deriving properties of functions in both theoretical and applied contexts.<br>• **Key Knowledge**: Understanding how to apply the formula in specific scenarios, such as when dealing with rational functions, | |