



# COMPLEX ANALYSIS

**PROF. PRANAV HARIDAS**

Department of Mathematics

Kerala School of Mathematics

**TYPE OF COURSE** : New | Core | UG/PG

**COURSE DURATION** : 12 weeks (20 Jul' 20 - 9 Oct' 20)

**EXAM DATE** : 18 Oct 2020

**PRE-REQUISITES** : Real Analysis, Linear Algebra

**INTENDED AUDIENCE** : Third year Undergraduate or first year Master's students in various universities.

**INDUSTRIES APPLICABLE TO** : Almost all engineering-based companies

## **COURSE OUTLINE :**

This is a first course in Complex Analysis focussing on holomorphic functions and its basic properties like Cauchy's theorem and residue theorems, the classification of singularities, and the maximum principle. We shall study the singularities of holomorphic functions. If time permits, we shall also study Branches of the complex logarithm through covering spaces and attempt proving Picard's theorem.

## **ABOUT INSTRUCTOR :**

Prof. Pranav Haridas is an Assistant Professor at the Kerala School of Mathematics. His research interests broadly lie in Complex Analysis and more specifically quadrature domains in several complex variables. He is also interested in the study of quasiconformal mappings and Teichmuller spaces. He completed his doctoral studies from the Indian Institute of Sciences, Bangalore.

## **COURSE PLAN :**

**Week 1:** Construction and algebra of the complex numbers

**Week 2:** Geometry of the complex numbers

**Week 3:** Complex differentiation and power series, Convergence of power series

**Week 4:** Differentiability and the Cauchy-Riemann equations, Maximum principle

**Week 5:** Integration along a contour, Integration in rectifiable curves

**Week 6:** The fundamental theorem of calculus, Integration by parts

**Week 7:** Homotopy, Cauchy's theorem

**Week 8:** Cauchy integral formula, Analytic continuation

**Week 9:** Cauchy's inequalities, Uniform limit of holomorphic functions

**Week 10:** Winding number, General Cauchy integral formula

**Week 11:** Singularities of a holomorphic function, Laurent series

**Week 12:** The residue theorem, Argument principle, Rouché's theorem