COMPLEX ANALYSIS

PROF. PRANAV HARIDAS
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Kerala School of Mathematics

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: Algebra and Topology of the complex plane

Week 2: Geometry of the complex plane, Complex differentiation

Week 3: Power series and its convergence, Cauchy-Riemann equations

Week 4: Harmonic functions, Möbius transformations

Week 5: Integration along a contour, The fundamental theorem of calculus

Week 6: Homotopy, Cauchy's theorem

Week 7: Cauchy integral formula, Cauchy's inequalities and other consequences

Week 8: Winding number, Open mapping theorem, Schwarz reflection Principle

Week 9: Singularities of a holomorphic function, Laurent series

Week 10: The residue theorem, Argument principle, Rouche's theorem

Week 11: Branch of the Complex logarithm, Automorphisms of the Unit disk

Week 12: Covering spaces, Picard's theorem