Lecture plan

<u>PMC 103: Complex Analysis</u>

Semester: Spring 2019
Course instructor: Amrik Sen

L T P Credit
3 1 0 3.5

Course Objective: The course aims to introduce the theory of complex analysis to graduate students with applications to solve problems in the mathematical sciences and engineering.

Lecture number	Topics covered
1-5	Introduction to complex numbers, geometrical interpretation, different representations of complex numbers, mappings and projections (including stereographic projection and bilinear transformation), functions of complex variables, examples of elementary functions like exponential, trigonometric and hyperbolic functions, elementary calculus on the complex plane (limits, continuity, differentiability)
6-9	Cauchy Riemann equations, analytic functions, harmonic functions with examples
10-14	Branch points and branch cuts, multi-valued functions (eg. logarithmic function and its branches, Riemann surfaces)
15-20	Cauchy's integral theorem, Cauchy integral formula for higher derivatives, Morera's theorem, Liouville's theorem, maximum-modulus principle, Schwarz lemma - with examples
21-26	Power series, Taylor and Laurent series, convergence, definition of holomorphic and meromorphic functions, zeros and poles, classification of singular points, removable singularities, Weierstrass theorems (M test and factor theorem)
27-34	Residue calculus: general form of Cauchy's theorem, Cauchy residue theorem, zeros and poles, evaluation of definite integrals using residue theorem (principal value integrals and integrals with branch points), argument principle and Roche's theorem (eg. with application to prove the fundamental theorem of algebra), residue at infinity.
35-38	Elementary conformal maps (Schwarz-Christoffel transformation), analytic continuation, method of analytic continuation (eg. application in defining the Riemann-Zeta function)

Total lecture hours: **38**
Total tutorial hours: **13**

Signature of Course Co-ordinator