MATHEMATICS 352

COMPLEX ANALYSIS

I. Introduction

  A. Catalog Description

  The calculus of functions with complex numbers as inputs and outputs has surprising depth and richness. The basic theory of these functions is developed in this course. The standard topics of calculus (function, limit, continuity, derivative, integral, series) are explored in this new context of complex numbers leading to some powerful and beautiful results. Applications include using conformal mappings to solve boundary-value problems for Laplace's equation. Satisfies the proof-based requirement in major contracts. *Prerequisites: MATH 280 and 290 or permission of the instructor.* Offered Spring semester.

  B. Objectives

    1. General understanding of analytic functions including the exponential and logarithm functions.

    2. General understanding of limit, continuity, and derivative.

    3. General understanding of line integrals, Cauchy's theorem, and Cauchy's integral formula.

    3. Ability to manipulate power series.

    4. Ability to evaluate definite integrals with the residue theorem.

    5. Ability to solve boundary-value problems using conformal mapping.

  C. Prerequisites

  Math 280 and Math 290 or permission of the instructor.

II. Required Topics

  A. Complex numbers

  Algebra and elementary topology.

  B. Differentiation

  Cauchy-Riemann equations, analytic functions, harmonic functions.

  C. Integration

  Line integrals, Cauchy Integral Theorem, Cauchy Integral Formula, theoretical consequences.

  D. Series

  Taylor and Laurent series, local properties of analytic functions.

  E. Poles and residues

  Residue theorem, evaluation of definite integrals.

  F. Conformal mapping

  Theory and examples. Boundary-value problems.

II. Required Topics (cont.)

   G. Special functions

       Exponential, logarithm, fractional linear.

   H. Optional topics

       Further treatment of conformal mapping, Poisson integral formula, Riemann surfaces.

III. Bibliography

Ahlfors   <u>Complex</u> <u>Analysis</u>

Churchill/Brown   <u>Complex</u> <u>Variables</u> <u>&</u> <u>Applications</u>

Dettman   <u>Applied</u> <u>Complex</u> <u>Variables</u>

Henrici   <u>Applied</u> <u>&</u> <u>Computational</u> <u>Complex</u> <u>Analysis</u>

Hille   <u>Analytic</u> <u>Function</u> <u>Theory</u>

Kyrala   <u>Applied</u> <u>Functions</u> <u>of</u> <u>a</u> <u>Complex</u> <u>Variable</u>

Marsden/Hoffman,   <u>Basic</u> <u>Complex</u> <u>Analysis</u>

Wunsch   <u>Complex</u> <u>Variables</u> <u>with</u> <u>Applications</u>