OFFICIAL SYLLABUS

MATH 451-INTRODUCTION TO COMPLEX ANALYSIS

Adopted – Fall 2013; Committee: K. Jarosz, M. Song, S. Staples

Catalog description: Analytic functions, Cauchy-Riemann equations, harmonic functions, elements of conformal mapping, line integrals, Cauchy-Goursat theorem, Cauchy integral formula, power series, the residue theorem and applications. Prerequisite: MATH 350 with a grade of C or better or consent of instructor.

Textbook: Fundamentals of Complex Analysis with Applications to Engineering and Science, 3rd edition by Saff & Snider. ISBN-13: 978-0139078743

Course Outline and Topics

Chapter 1. Complex Numbers
- 1.1 The algebra of Complex Numbers
- 1.2 Point Representation of Complex Numbers
- 1.3 Vectors and Polar Forms
- 1.4 The Complex Exponential
- 1.5 Powers and Roots
- 1.6 Planar sets (Optional)

Chapter 2. Analytic Functions
- 2.1 Functions of a Complex Variable
- 2.2 Limits and Continuity
- 2.3 Analyticity
- 2.4 The Cauchy-Riemann Equations
- 2.5 Harmonic Functions

Chapter 3. Elementary Functions
- 3.1 Polynomials and Rational Functions
- 3.2 The Exponential, Trigonometric, and Hyperbolic Functions
- 3.3 The Logarithmic Function
- 3.4 Washers, Wedges, and Walls (Optional)
- 3.5 Complex Powers and Inverse Trigonometric Functions

Chapter 4. Complex Integration
- 4.1 Contours (Optional)
- 4.2 Contour Integrals
- 4.3 Independence of Path
- 4.4 Cauchy's Integral Theorem
- 4.5 Cauchy's Integral Formula and Its Consequences
- 4.6 Bounds for Analytic Functions

Chapter 5. Series Representations for Analytic Functions
- 5.1 Sequences and Series
- 5.2 Taylor Series

5.3 Power Series
5.4 Mathematical Theory of Convergence
5.5 Laurent Series
5.6 Zeros and Singularities
5.7 The point at Infinity

Chapter 6. Residue Theory
6.1 The Residue Theorem
6.2 Trigonometric Integrals over $[0, 2\pi]$
6.3 Improper Integrals of Certain Functions over $(-\infty, \infty)$
6.4 Improper Integrals Involving Trigonometric Functions
6.5 Indented Contours

Chapter 7. Conformal Mapping (Optional)

According to SIUE Graduate School policy (Graduate Catalog, 2013, Chapter 1) "graduate students [in a 400 level course] must complete additional assignments and be evaluated at a higher standard than undergraduate students taking that same 400- level course."