Course Outline for MATH 5302, Applied Complex Analysis

MATH 5302 Applied Complex Analysis (3 units)
Prerequisite: Graduate standing in Mathematics, MATH 410, or MATH 3301.

Complex variables and associated topics. Branch cuts, series and product expansions. Asymptotic evaluation of integrals. Conformal mapping; applications and examples. Fourier and Laplace transforms and applications. 3 lectures. Formerly MATH 520.

Course Learning Objectives	
1	Describe the behavior and properties of select special functions such as the Gamma, Bessel's, and Zeta functions.
2	Use analytic continuation to extend the definitions of functions on the real line to the complex plane.
3	Use residue theory to evaluate complicated complex contour integrals.
4	Apply Laplace and Fourier transforms to solve ordinary differential equations.
5	Derive and apply methods for the asymptotic approximation of real and complex contour integrals.
6	Define and derive key behavior and properties of conformal maps such as the Schwarz-Christoffel and Möbius transformations.
7	Apply conformal transformations to physical applications such as ideal fluid flow, heat flow, and electrostatics.

Expanded Course Content

Textbooks, materials, and/or other resources
Ablowitz and Fokas: Complex Variables, Introduction and Applications

Week	Readings	Topics of Discussion
1	Section 2.1	Analytic functions, ideal fluid flow
2	Section 3.4	Special functions (gamma, Bessel, zeta)
3	Section 4.3	Contour integration, principal value integrals

Week	Readings	Topics of Discussion
4	Sections 4.3 - 4.4	Integrals with branch points
5	Section 4.5	Laplace transforms
6	Section 4.5	Fourier transforms
7	Section 4.6	Applications of transforms to differential equations
8	Section 6.2	Laplace-type integrals: Laplace method for complex contours
9	Section 6.3	Fourier-type integrals: method of stationary phase
10	Section 6.4	Method of steepest descent
11	Section 5.2	Conformal transformations
12	Section 5.3	Critical points and inverse mappings
13	Section 5.4	Physical applications of conformal mappings
14	Section 5.6	Schwarz-Christoffel Transformations
15	Section 5.7	Möbius Transformations

Method of Assessment

The possible methods of assessment are written individual examinations, quizzes, in-class worksheets and presentations, projects, and homework. One or more midterms and a cumulative final exam are required.

Instructional Mode

The instructional mode for this class is face-to-face. This designation means that the essential academic standards of the course require in-class student engagement, and thus remote instruction is not appropriate.