Tennessee Technological University
Mathematics Department

MATH 3810: Complex Variables

I. COURSE DESCRIPTION FROM CATALOG:

Complex numbers, calculus of complex variables, analytic functions, Cauchy's Theorem, series, the Residue Theorem, and applications. Lec. 3. Cr. 3.

II. PREREQUISITE(S):

C or better in MATH 2110.

III. COURSE OBJECTIVE(S):

To enable the student to obtain an understanding of the basics of complex analysis and its applications.

IV. STUDENT LEARNING OUTCOMES:

Upon successful completion of the course students will understand how the general behavior of a function of a complex variable differs from the corresponding function of a real variable; understand what is meant by an analytic function, the importance of an analytic function in complex analysis, and basic equivalent conditions for a function to be analytic, including the satisfaction of the Cauchy-Riemann equations; and be able to use Cauchy's Integral Formula and the Residue Theorem to determine certain contour integrals.

V. TOPICS TO BE COVERED:

Chapter 1 **Complex Numbers**

- 5.1 The Algebra of Complex Numbers
- 5.2 Point Representation of Complex Numbers
- 5.3 Vectors and Polar Forms
- 5.4 The Complex Exponential
- 5.5 Powers and Roots
- 4.6 Planar Sets

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 Washer, Wedges, and Walls
- 3.5 Complex Powers and Inverse Trigonometric Functions

Chapter 4 **Complex Integration**

4.1 Contours
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
5.5 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 **(as time permits)**
6.4 Improper Integrals Involving Trigonometric Functions **(as time permits)**
6.5 Indented Contours **(as time permits)**
6.6 Integrals Involving Multiple-Valued Functions **(as time permits)**

VI. ADDITIONAL INFORMATION:

VII. POSSIBLE TEXTS AND REFERENCES:

Fundamentals of Complex Analysis, 3rd ed., by Saff & Snider
Complex Analysis, 4th ed., Matthews & Howell

VIII. ANY TECHNOLOGY THAT MAY BE USED:

IX. STUDENT ACADEMIC MISCONDUCT POLICY:

Maintaining high standards of academic integrity in every class at Tennessee Tech is critical to the reputation of Tennessee Tech, its students, alumni, and the employers of Tennessee Tech graduates. The Student Academic Misconduct Policy describes the definitions of academic misconduct and policies and procedures for addressing Academic Misconduct at Tennessee Tech. For details, view the Tennessee Tech's Policy 217 – Student Academic Misconduct at Policy Central.

X. DISABILITY ACCOMMODATION:

Students with a disability requiring accommodations should contact the Office of Disability Services (ODS). An Accommodation Request (AR) should be completed as soon as possible, preferably by the end of the first week of the course. The ODS is located in the Roaden University Center, Room 112; phone 372-6119. For details, view the Tennessee Tech's Policy 340 – Services for Students with Disabilities at Policy Central.