

**University of Arkansas – Fort Smith**  
**5210 Grand Avenue**  
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## **General Syllabus**

### **MATH 4803 Complex Analysis**

Credit Hours: 3

Lecture Hours: 3

Laboratory Hours: 0

Prerequisite: MATH 4303 Real Analysis I

Effective Catalog: 2018~2019

#### **I. Course Information**

##### **A. Catalog Description**

An introduction to complex analysis. Topics will include the arithmetic, algebra and geometry of the complex number system and the complex plane, elementary functions of a complex variable, limits, the derivative, the integral, Cauchy's Theorem, Cauchy's Integral Formula, the Maximum Modulus Theorem and series representations for functions.

##### **B. Additional Information - None**

#### **II. Student Learning Outcomes**

##### **A. Subject Matter**

Upon completion of this course, the student will be able to:

1. Prove statements using mathematical induction, direct proofs and proofs by contradiction regarding each of the major course topics;
2. Apply axioms for the algebra, arithmetic and geometry of complex numbers;
3. Calculate limits of functions of complex variables;
4. Differentiate functions of complex variables;
5. Recognize and utilize elementary analytic functions;
6. Apply the theory of integration of functions of a single complex variable including line and contour integrals of a function, Cauchy's Integral Theorem, Cauchy's Integral Formula;
7. Apply the maximum modulus principle;
8. Apply the theory of residues;
9. Apply mapping by elementary functions and conformal mappings;
10. Analyze power series, including finding the radius of convergence and manipulate series; representations of analytic functions.

## **B. University Learning Outcomes**

### **Analytical Skills**

**Critical Thinking Skills:** Students will analyze various mathematical concepts that arise in the study of complex analysis and to draw conclusions and make generalizations based on these concepts.

### **Communication Skills (written and oral)**

Students will communicate mathematics proofs in written form in a precise and effective manner. Oral presentations will be required that will assess students' ability to verbally communicate mathematical ideas.

### **Ethical Decision Making**

Students will recognize and analyze ethical dilemmas. Students will apply ethical concepts and rules to determine viable alternatives in any given situation.

### **Global & Cultural Perspectives**

Students will understand the general concept of theory of complex analysis and prove a variety of theory. Students will communicate findings with others in a global environment using appropriate language.

## **III. Major Course Topics**

- A. Complex numbers and the complex plane
  - 1. The algebra of complex number
  - 2. Vectors and polar forms
  - 3. The complex exponential
  - 4. Powers and Roots
- B. Elementary functions of a complex variable
  - 1. Functions of a complex variable
  - 2. Limits and Continuity
- C. The derivative and analytic functions
  - 1. Analyticity
  - 2. The Cauchy-Riemann equation
- D. The integral including Cauchy's Theorem and Cauchy's Integral Formula
  - 1. Contours
  - 2. Contour integrals
  - 3. Independence of path
  - 4. Cauchy's integral theorem
- E. Mapping by elementary functions and conformal mappings
  - 1. Invariant of Laplace's equation
  - 2. Geometric considerations
  - 3. Mobius transformations
  - 4. The Schwarz-Christoffel transformations
- F. Series representations of analytic functions

1. Taylor series
2. Power series
3. Laurent series
4. The point at infinity