

University of Arkansas – Fort Smith
5210 Grand Avenue
P. O. Box 3649
Fort Smith, AR 72913–3649
479–788–7000

General Syllabus

MATH 48073 Complex Analysis

Credit Hours: 3

Lecture Hours: 3

Laboratory Hours: 0

Prerequisite: MATH 43073 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