

COURSE SYLLABUS

Course Title: Introduction to Complex Analysis

Abbreviated Title Intro Complex Analysis
As Appears on Transcript

Course Number: DMAT 456

Credit Hours: 4 credits [semester credit hours]

Course Description: An introductory course on Complex Analysis, emphasizing the visual and computational aspects of the subject. Topics include moving from real numbers to the complex world, complex power series, complex elementary functions, multifunctions, branch points, complex function differentiation, conformal/analytic functions, Cauchy-Riemann equations, complex integration, poles, residues, and winding numbers, Cauchy-Riemann Formula, connections to vector fields.

Prerequisite: Successful completion with grade B or higher in Linear Algebra and Multivariable Calculus or equivalent, or consent of instructor.

Course Workload: 4 semester credit hours • 3 student work hours per credit hour • 14 week Carnegie semester = 168 hours student course workload average

Examination Requirements: Proctored written and oral final examination must be passed at 70% or higher to earn passing grade in course. “B” and “A” grade paths have additional examinations and assignments. See <https://www.distancecalculus.com/grades/> for more information.

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Accredited by New England Commission of Higher Education (NECHE).
See <https://www.rwu.edu/academics/accreditation/> for more information.

E-Textbook:

Complex Analysis by Mathews & Howell

Mathematical Software: LiveMath and Mathematica Computer Algebra & Graphing Systems

ADA ACCOMMODATIONS

Roger Williams University has a continuing commitment to providing reasonable accommodations for students with documented disabilities. Students with disabilities who need accommodations in order to fully

participate in this class are urged to contact Student Accessibility Services, as soon as possible, to explore the arrangements needed to be made to assure access. Student Accessibility Services is open Monday through Friday from 8:00AM to 5:00PM Eastern Time; Email: sas@rwu.edu or Voice: 401-254-3841. For more information about SAS, visit

<https://www.rwu.edu/undergraduate/academics/student-academic-success/student-accessibility-services-sas>

COURSE RULES

Academic Honesty

Academic Dishonesty in a Distance course includes copying or relying upon another person's work. Working with other students is good and encouraged, but the work you submit for this course must be genuinely your own work. Private tutors are allowed, but you must notify the instructor that you have obtained a private tutor to aid in your studies. Any documented instance of Academic Dishonesty will be grounds for immediate failure in this course.

Final (and Other) Examinations

A written and oral proctored final exam will occur at the student's location over video with the course professor; The student must score 70% or higher on this final exam to be eligible to earn a passing grade in the course.

Communication

Communication is the key to success in a Distance course. It is the student's responsibility to keep good communication channels with the instructors during the course; failure to participate in the course does not constitute "dropping" the course (Withdrawal from the course must be requested in writing to the instructors before the completion date deadline)

Roger Williams University Policies & Procedures

Roger Williams University has Policies & Procedures that all students must follow, including the Roger Williams University Student Handbook. Student must agree to follow all stated rules governing student conduct listed on the Roger Williams University website, and at the [Roger Williams University Course Catalog](#)

Course Completion 1 Year Rule

All Distance Calculus students are afforded 1 Year to finish their course from the Date of Enrollment. Students will be placed in the Academic Semester based upon their Date of Enrollment for academic records purposes. If a student does not finish the course, and does not request a Course Withdrawal for a W, then an "F" grade will be issued.

No Chatbots / AI

Students must pledge to **not** use any Chatbot/AI at all - **period**. Student must pledge to **limit** use of search engines (Google, Bing, etc) to a minimal level. Student must pledge to not engage in dishonest disguise of any Chatbot/AI/Search Engine source of information as student's own honest academic work. Verified chatbot usage will result in an "F" course grade, and will be referred to the Roger Williams University Academic Integrity Committee.

Learning Outcomes for DMAT 456 - Introduction to Complex Analysis

1. To understand the generalization of calculus from the real numbers to the complex number system.
2. To understand the generalization of differentiation and integration from freshman calculus to the field of complex numbers.
3. To understand the formulation of elementary trigonometric, exponential, and logarithmic functions in the field of complex numbers.
4. To understand the concepts of analytic / conformal complex functions.
5. To understand the Cauchy-Riemann equations.
6. To understand the concepts of winding numbers, poles, singularities.
7. To understand The Fundamental Theorem of Complex Calculus
8. To understand Cauchy's Formula and the Calculus of Residues
9. To understand the connections to vector field analysis.
10. To understand and utilize software tools to investigate visualization and computational aspects of the subject.

Syllabus Topics Outline for DMAT 456 - Introduction to Complex Analysis

1. Getting Started
 - 1.1 Email and Chat
 - 1.2 Learning About the Course
 - 1.3 Required Hardware
 - 1.4 Software Fundamentals
2. Complex Numbers
 - 2.1 Origin of Complex Numbers
 - 2.2 Algebra of Complex Numbers
 - 2.3 Geometry of Complex Numbers
 - 2.4 Topology of Complex Numbers
3. Complex Functions
 - 3.1 Functions and Linear Mappings
 - 3.2 Power Functions
 - 3.3 Limits and Continuity
 - 3.4 Branches of Functions
 - 3.5 Reciprocal Transformation
4. Analytic and Harmonic Functions
 - 4.1 Differentiability and Analytic Functions
 - 4.2 The Amplitwist Concept
 - 4.3 Cauchy-Riemann Equations
 - 4.4 Analytic = Conformal
 - 4.5 Harmonic Functions
 - 4.6 Visual Differentiations

5. Sequences, Series, and Fractals
 - 5.1 Sequences and Series
 - 5.2 Julia and Mandelbrot Sets
 - 5.3 Geometric Series and Convergence
 - 5.4 Power Series Functions

6. Elementary Functions
 - 6.1 Complex Exponential Function
 - 6.2 Complex Logarithm
 - 6.3 Complex Exponents
 - 6.4 Trigonometric and Hyperbolic Functions
 - 6.5 Inverse Trigonometric and Hyperbolic Functions

7. Complex Integration
 - 7.1 Complex Integrals
 - 7.2 Contours and Contour Integrals
 - 7.3 Cauchy Theorem
 - 7.4 Fundamental Theorem of Integration
 - 7.5 Integral Representations
 - 7.6 Liouville's Theorem

8. Taylor and Laurent Series
 - 8.1 Uniform Convergence
 - 8.2 Taylor Series Representations
 - 8.3 Laurent Series Representations
 - 8.4 Singularities, Zeros, and Poles
 - 8.5 Applications of Taylor and Laurent Series

9. Residue Theory
 - 9.1 The Residue Theorem
 - 9.2 Trigonometric Integrals
 - 9.3 Improper Integrals of Rational Functions
 - 9.4 Improper Integrals of Trigonometric Functions
 - 9.5 Indented Contour Integrals
 - 9.6 Integrand with Branch Points
 - 9.7 The Argument Principle and Rouché's Theorem

10. Conformal Mappings
 - 10.1 Basic Properties of Conformal Mappings
 - 10.2 Bilinear Transformations
 - 10.3 Mappings Involving Elementary Functions

11. Harmonic Functions and Vector Fields
 - 11.1 Vector Fields and Complex Functions
 - 11.2 Fluid Flow
 - 11.3 Sources and Sinks

11.4 Contour Integrals and Flow Along , Flow Across