

Fall 2023

MATH 332-001, Fall 2023: Introduction to Functions of a Complex Variable

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MATH 332: Introduction to Functions of a Complex Variable

Fall 2023 Course Syllabus

NJIT Academic Integrity Code: All Students should be aware that the Department of Mathematical Sciences takes the University Code on Academic Integrity at NJIT very seriously and enforces it strictly. This means that there must not be any forms of plagiarism, i.e., copying of homework, class projects, or lab assignments, or any form of cheating in quizzes and exams. Under the University Code on Academic Integrity, students are obligated to report any such activities to the Instructor.

Please be sure you read and fully understand our [DMS Online Exam Policy](#).

COURSE INFORMATION

Course Description: Functions of a complex variable: Cauchy-Riemann equations, Cauchy-Goursat theorem, integration, series, residues, poles, geometrical aspects. Emphasis on techniques. Effective From: Fall 2010.

Number of Credits: 3

Prerequisites: [MATH 211](#) or [MATH 213](#) and [MATH 222](#) all with a grade of C or better

Course-Section and Instructors:

| Course-Section | Instructor |
|----------------|--------------------|
| Math 332-001 | Professor E. Lushi |

Office Hours for All Math Instructors: [Fall 2023 Office Hours and Emails](#)

Required Textbook:

| | |
|-----------|---|
| Title | <i>Complex Variables and Applications</i> |
| Author | Brown |
| Edition | 9th |
| Publisher | McGraw-Hill |
| ISBN # | 978-0073383170 |

University-wide Withdrawal Date: The last day to withdraw with a W is **Monday, November 13, 2023**. It will be strictly enforced.

COURSE GOALS

Course Objectives

- Understand the relevance and broad importance of the theory of analytic functions.
- Learn the meaning of theorems and corollaries describing important properties of analytic functions.
- Learn the connection between the series representations and integration properties of analytic functions.
- Learn applications of the Cauchy Residue Theorem, and its use in calculating certain definite integrals.
- Learn how to apply knowledge of analytic functions to problems in applied math, science and engineering.

Course Outcomes

- Students gain knowledge of the theory of analytic functions of a complex variable, and its broad applicability.
- Students gain a deeper understanding of common elementary transcendental functions through the knowledge of their properties in the complex plane.
- Students are prepared for further study in more advanced mathematics, science and engineering courses.
- Students can apply their knowledge of the theory of analytic functions to solve problems in applied mathematics, fluid dynamics, electrodynamics, and other areas of science and engineering.

Course Assessment: The assessment of objectives is achieved through homework assignments, and in-class quizzes, midterm and final examinations.

POLICIES

DMS Course Policies: All DMS students must familiarize themselves with, and adhere to, the [Department of Mathematical Sciences Course Policies](#), in addition to official [university-wide policies](#). DMS takes these policies very seriously and enforces them strictly.

Grading Policy: The final grade in this course will be determined as follows:

| | | |
|---------------------------|--------------------|-----------------|
| Homework and Quizzes: 20% | Midterm Exams: 30% | Final Exam: 50% |
|---------------------------|--------------------|-----------------|

A **passing final letter grade** will be based on the following tentative cutoffs:

| | | | |
|----|----------|----|---------|
| A | 90 - 100 | C+ | 66 - 75 |
| B+ | 82 - 89 | C | 58 - 65 |
| B | 74 - 81 | D | 50 - 57 |

Attendance Policy: Attendance at all classes will be recorded and is **mandatory**. Please make sure you read and fully understand the [Math Department's Attendance Policy](#). This policy will be strictly enforced.

Homework and Quiz Policy: Homework problem sets will be posted on the [course canvas page](#) at the end of each week, based on the material covered that week. Late homework will not be accepted. Short quizzes will be given at the end of the class on Tuesdays based on the material covered in the previous week.

Exams: There will be one midterm exam and one comprehensive final exam. The final exam will test your knowledge of all the course material taught in the entire course. Make sure you read and understand the [Math Department's Examination Policy](#). This policy will be strictly enforced.

Makeup Exam Policy: There will be **NO MAKE-UP EXAMS** during the semester. If an exam is not taken under rare circumstances where the student has a legitimate reason for missing the exam, the student should contact the Dean of Students office and present written verifiable proof of the reason for missing the exam, e.g., a doctor's note, police report, court notice, etc. clearly stating the date AND time of the mitigating problem. The student must also notify the Math Department Office/Instructor that the exam will be missed.

Cellular Phones: All cellular phones and other electronic devices must be switched off during all class times.

ADDITIONAL RESOURCES

Math Tutoring Center: Located in the Central King Building, Lower Level, Rm. G11 (See: **Fall 2023 Hours**)

Further Assistance: For further questions, students should contact their instructor. All instructors have regular office hours during the week. These office hours are listed on the Math Department's webpage for **Instructor Office Hours and Emails**.

Accommodation of Disabilities: The Office of Accessibility Resources and Services (OARS) offers long term and temporary accommodations for undergraduate, graduate and visiting students at NJIT.

If you need an accommodation due to a disability, please contact the Office of Accessibility Resources and Services at oars@njit.edu, or visit Kupfrian Hall 201 to discuss your specific needs. A Letter of Accommodation Eligibility from the office authorizing student accommodations is required.

For further information regarding self identification, the submission of medical documentation and additional support services provided please visit the Office of Accessibility Resources and Services (OARS) website at:

<https://www.njit.edu/accessibility/>

Important Dates (See: **Fall 2023 Academic Calendar, Registrar**)

| Date | Day | Event |
|----------------------------------|-----------------------|------------------------------|
| September 4, 2023 | Monday | Labor Day |
| September 5, 2023 | Tuesday | First Day of Classes |
| September 11, 2023 | Monday | Last Day to Add/Drop Classes |
| November 13, 2023 | Monday | Last Day to Withdraw |
| November 21, 2023 | Tuesday | Thursday Classes Meet |
| November 23 to November 26, 2023 | Thursday and Saturday | Thanksgiving Recess - Closed |
| December 13, 2023 | Wednesday | Last Day of Classes |
| December 14, 2023 | Thursday | Reading Day 1 |
| December 15, 2023 | Friday | Reading Day 2 |
| December 17 to December 23, 2023 | Sunday to Saturday | Final Exam Period |

Course Outline

| Date | Sections | Topic | |
|------------------------------|----------|------------------------------|--|
| September 05 September 07 | 1 2 | 1-5 6-11 | Complex Algebra; Vectors & Moduli; Complex Conjugate Polar Representation; Products & Powers in Exponential Form; Roots |
| September 12 September 14 | 3 4 | 12 13-14 | Regions in the Complex Plane Functions of Complex Variable; Mappings |
| September 19 September 21 | 5 6 | 15-18 19-23 | Limits and Continuity Derivatives & Analyticity; The Cauchy-Riemann Equations |
| September 26 September 28 | 7 8 | 24-26 27-29 | Analyticity; Cauchy-Riemann Equations in Polar Coordinates, Harmonic Functions; Uniquely Determined Functions; Reflection Principle |
| October 03 October 05 | 9 10 | 30-36 37-39 | The Exponential and Logarithm, The Power Function Trigonometric and Hyperbolic Functions |
| October 10 October 12 | 11 12 | 40 41-49 | Inverse Trigonometric & Inverse Hyperbolic Functions Contour Integrals; Fundamental Theorem of Calculus |
| October 17 October 19 | 13 14 | 50-53 54-56 | The Cauchy-Goursat Theorem The Cauchy Integral Formula |
| October 24 October 26 | 15 16 | MIDTERM 57-59 | The Extensions of the Cauchy Integral Formula |
| October 31 November 02 | 17 18 | 60-65 66-68 | Taylor Series; Power Series Convergence Laurent Series |
| November 07 November 09 | 19 20 | 69-71 72-73 | Uniform Convergence; Integration & Differentiation of Power Series Series Multiplication and Division |
| November 14 November 16 | 21 22 | 74-80 81-84 | Cauchy's Residue Theorem, Zeros and Singularities The Point at Infinity |
| November 21 November 23 | 23 - | 85-87 - | Improper Integrals from Fourier Analysis No class - Thanksgiving Break |
| November 28 November 30 | 24 25 | 88 89-90 | Improper Integrals Continued, Jordan's Lemma Integrals Involving Indented Contours |
| December 05 December 07 | 26 27 | 91 92 | Integration along a Branch Cut Definite Integrals Involving Sines and Cosines |
| December 12 | 28 | REVIEW FOR FINAL EXAM | |

Updated by Professor E. Lushi - 09/01/2023
Department of Mathematical Sciences Course Syllabus, Fall 2023