MATH 656: Complex Variables I
Spring 2025 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.

Use of AI: This course expects students to work without artificial intelligence (AI) assistance in order to better develop their skills in this content area. While it is impossible to enforce such an expectation, please bear in mind that the midterm and final exams, which together consist of 80% of the grade, will be done without the assistance of AI. Home assignments, therefore, would only serve as a preparation for these exams if done independently.

COURSE INFORMATION

Course Description: The theory and applications of analytic functions of one complex variable: elementary properties of complex numbers, analytic functions, elementary complex functions, conformal mapping, Cauchy integral formula, maximum modulus principle, Laurent series, classification of isolated singularities, residue theorem, and applications.

Number of Credits: 3

Prerequisites: MATH 545 or MATH 645 or departmental approval.

Course-Section and Instructors:

Course-Section	Instructor
Math 656-002	Professor Amir Sagiv

Office Hours for All Math Instructors: Spring 2025 Office Hours and Emails
Tentatively: Monday and Tuesday 1pm-2pm, CUL 617, always with an email at least 24 hours prior.

Textbook: A suggested supplementary reference text is:

Title	*Complex Variables: Introduction & Applications*
Author	M.J. Ablowitz and A.S. Fokas
Edition	2nd
Publisher	Cambridge University Press

ISBN #	ISBN-13: 978-0521534291; ISBN-10: 0521534291

Recommended Text: Stein, Complex Analysis (Princeton University Press).

University-wide Withdrawal Date: The last day to withdraw with a **W** is **Monday, April 7, 2025**. It will be strictly enforced.

COURSE GOALS

Course Objectives:

- Students gain a clear and deep understanding of the wide-ranging properties of analytic functions of a complex variable.
- Students learn and understand key theorems applicable to analytic functions, particularly the Integral Theorems, their corollaries and applications.
- Students learn key applications of the Cauchy Residue Theorem, including its use in calculating certain definite integrals, as well as Fourier and Laplace Transform theory.
- Students gain practical knowledge of how complex analysis can be used in a range of applied mathematics and physics problems.

Course Outcomes:

- Students will be able to use and apply results from complex analysis to a range of problems in applied mathematics.
- Students will be prepared for the complex analysis portion of Part B of the written Qualifying Exam.
- Students will gain an understanding of the theory of functions of a complex variable.
- Students will be prepared for the next level of study in complex analysis and other areas of mathematics.

Course Assessment:

The assessment of objectives will be achieved through homework assignments and examinations testing the specific outcomes listed above.

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	20%
Midterm Exam	30%
Final Exam	50%

Your final letter grade will be based on the following chart. These cutoff grades may be adjusted slightly downwards - they will never be made more strict - slightly, at the discretion of the professor, and only after the course has concluded.

A +	99-100	**A**	93-98

A-	90-93	**B+**	87-89
B	83-86	**B-**	80-82
C+	75-79	C	70-74
C-	60-69	D	55-59
F	0-54		

Attendance: Attendance in class is mandatory. A couple of missed lectures over the course of the semester will not impact your grade, but please don't miss class if you don't have to. You should inform your instructor in case you have to miss a class.

Religious Observance: NJIT is committed to supporting students observing religious holidays. Students must notify their instructors in writing of any conflicts between course requirements and religious observances, ideally by the end of the second week of classes and no later than two weeks before the anticipated absence.

Email and Canvas: Regularly check your NJIT email account and the course information posted on Canvas for class assignments and announcements from your instructor.

Homework: Homework assignments, as well as their due dates, will be posted on Canvas. Your work will be submitted on Gradescope (NOT email). NO late submission will be accepted (rare exceptions may be made if there is good reason, but that must be approved by the instructor before the due date. No post-deadline exceptions will be allowed).

Exams: The midterm exam will be held at the regular class time as indicated in the detailed schedule below, proctored by the instructor.

Midterm Exam	March 14, 2025
Final Exam Period	May 10 - May 16, 2025

The final exam will test your knowledge of all the course material taught in the entire course. Make sure you read and fully 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. In the event 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

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 are in need of accommodations due to a disability please If you need an accommodation due to a disability please contact the Office of Accessibility Resources and Services at oars@njit.edu. The office is located in Kupfrian Hall, Room 201. A Letter of Accommodation Eligibility from the Office of Accessibility Resources and Services office authorizing your accommodations will be 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: Spring 2025 Academic Calendar, Registrar)

Date	Day	Event
January 21, 2025	Tuesday	First Day of Classes
January 27, 2025	Monday	Last Day to Add/Drop Classes
March 16, 2025	Sunday	Spring Recess Begins
March 22, 2025	Saturday	Spring Recess Ends
April 3, 2025	Thursday	Wellness day
April 7, 2025	Monday	Last Day to Withdraw
April 18, 2025	Friday	Good Friday - No Classes
April 20, 2025	Sunday	Easter Sunday - No Classes Scheduled
May 6, 2025	Tuesday	Thursday Classes Meet
May 7, 2025	Wednesday	Friday Classes Meet
May 7, 2025	Wednesday	Last Day of Classes
May 8, 2025	Thursday	Reading Day 1
May 9, 2025	Friday	Reading Day 2
May 10 - May 16, 2025	Friday to Thursday	Final Exam Period

Outline

Below is an estimated week-by-week outline. Independently, I will publish a “live” class-by-class summary in this

spreadsheet after each week has concluded.

Week 1: Review of complex numbers, topology of the plane, intro to limits

Week 2: Limits and continuity of complex functions, holomorphic functions and the Cauchy Riemann equations

Week 3: Multi-valued functions and branch cuts, the complex roots and complex log

Week 4: Contour integrals and Cauchy Integral Formula

Week 5: Morea, Liouville, and Maximum Theorems. Convergence of functions

Week 6: Taylor and Laurant Series

Week 7: Laurant series and meromorphic functions

Week 8: Applications to initial value problems, Midterm

Week 9: Cauchy Residue Theorem

Week 10: More Residue Theorem and applications

Week 11: Argument and Rouche Theorem

Week 12: Fourier and Laplace Transforms (maybe other transforms too?)

Week 13: Conformal Maps

Week 14: Mobius Transformations