NJIT New Jersey's Science & Technology University

THE COLLEGE OF SCIENCE AND LIBERAL ARTS

THE DEPARTMENT OF MATHEMATICAL SCIENCES

MATH 656-002: Complex Variables I
Spring 2020 Graduate 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.

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 D. Blackmore

Office Hours for All Math Instructors: Spring 2020 Office Hours and Emails

Required Textbooks:

Title	*Complex Variables*
Author	Ablowitz, Fokas
Edition	---
Publisher	Cambridge University Press
ISBN #	978-0521534291

University-wide Withdrawal Date:The last day to withdraw with a **W** is **Monday, April 6, 2020**. It will be strictly enforced.

COURSE GOALS

Course Objectives

- Gain deep understanding of the wide-ranging properties of analytic functions of a complex variable.
- Learn key theorems applicable to analytic functions, in particular the Integral Theorems and their corollaries.
- Learn key applications of the Cauchy Residue Theorem, in particular its use in calculating certain definite integrals.
- Learn how to apply the knowledge of analytic functions to problems in fluid flow and electrostatics.

Course Outcomes

- Students gain deeper knowledge of the theory of a function of complex variable.
- Students are prepared for further study in more advanced applied mathematics courses.
- Students are prepared for the Complex Analysis part of the Ph.D. Qualifying Examination at NJIT and other Ph.D.-granting Universities.
- Students can apply the theory of analytic functions to solve problems in applied mathematics, fluid dynamics and electrodynamics.

Course Assessment:

- The assessment of objectives is achieved through homework assignments, and the in-class 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	15%
Midterm Exam	35%
Final Exam	50%

Your final letter grade will be based on the following tentative curve.

A	88 - 100	**C**	62 - 67
B+	82 - 87	**D**	55 - 61
B	75 - 81	**F**	0 - 54
C+	68 - 74		

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.

Exams: There will be one midterm exam held in class during the semester and one comprehensive final exam. Exams are held on the following days:

Midterm Exam	March 13, 2020
Final Exam Period	May 8 - 14, 2020

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: To properly report your absence from a midterm or final exam, please review and follow the required steps under the DMS Examination Policy found here:

- http://math.njit.edu/students/policies_exam.php

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

ADDITIONAL RESOURCES

Accommodation of Disabilities: Disability Support Services (DSS) 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 contact Chantonette Lyles, Associate Director of Disability Support Services at 973-596-5417 or via email at lyles@njit.edu. The office is located in Kupfrian Hall, Room 201. A Letter of Accommodation Eligibility from the Disability Support 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 Disability Support Services (DSS) website at:

- https://www.njit.edu/studentsuccess/accessibility/

Important Dates (See: Spring 2020 Academic Calendar, Registrar)

Date	Day	Event
January 21, 2020	T	First Day of Classes
January 31, 2020	F	Last Day to Add/Drop Classes
March 15 - 22, 2020	Su-Su	Spring Recess: No Classes/ University Open
April 6, 2020	M	Last Day to Withdraw
April 10, 2020	F	Good Friday - University Closed
May 5, 2020	T	Friday Classes Meet - Last Day of Classes
May 6 & 7, 2020	W & R	Reading Days
May 8 - 14, 2020	F - R	Final Exam Period

Course Outline

Date	Sections	Topics	Assignment
1/21	1.1, 1.2	Complex Numbers and Functions	Selected Probs.
1/24	1.2, 1.3	Complex Functions and Derivatives	Selected Probs.
1/28	2.1, 2.2	Analytic Functions and Integration	Selected Probs.
1/31	2.3, 2.4	Analytic Functions and Integration	Selected Probs.
2/4	2.5, 2.6	Complex Integration: Cauchy's Theorem and Formulas	Selected Probs.
2/7	2.6	Liouville, Morera and Maximum Modulus Theorems	Selected Probs.
2/11	3.1, 3.2	Series and Singularities for Complex Functions	Selected Probs.
2/14	3.2, 3.3	Taylor and Laurent Series	Selected Probs.
2/18	3.3, 3.4	Laurent Series and Singularities	Selected Probs.
2/21	3.4, 3.5	Singularities and Continuation	Selected Probs.
2/25	3.5, 3.7	Singularities and Painlevé Equations	Selected Probs.

2/28	3.7, 3.8	Computations and Applications for Singularities	Selected Probs.
3/3	3.8 + Notes	Complex Functions: Representations	Selected Probs.
3/6	Notes	More on Complex Functions	Selected Probs.
3/10	-------	*Review for Midterm*	----------
3/13	-------	**MIDTERM EXAM**	----------
3/15 - 3/22	-------	SPRING BREAK	----------
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3/24	4.1	Residue Calculus: Cauchy's Theorem	Selected Probs.
3/27	4.2, 4.3	Applications of Residue Theory: Definite Integrals	Selected Probs.
3/31	4.4	Applications of Residue Theory: Argument Principle	Selected Probs.
4/3	4.4	Applications of Residue Theory: Rouché's Theorem	Selected Probs
4/7	4.4, 4.5	More Applications: Fourier and Laplace Transforms	Selected Probs..
4/10	-------	Good Friday	----------
4/14	4.1 – 4.6	Overview of Residue Theory and Applications	Selected Probs.
4/17	5.1, 5.2	Conformal Maps and Their Inverses	Selected Probs.
4/21	5.3, 5.4	Conformal Maps and Their Applications	Selected Probs.
4/24	5.5, 5.6	Riemann Mapping and Schwarz—Christoffel Theorems	Selected Probs.
4/28	5.1 - 5.6	Overview of Conformal Maps	Selected Probs.
5/1	Notes	More Conformal Maps- Riemann Mapping Theorem	Selected Probs.
5/5	-------	***REVIEW FOR FINAL EXAM***	----------