Lecture: Monday-Wednesday-Thursday, 1:35pm–2:40pm, Kariotis Hall 104.

Instructor: Evan Dummit, Lake Hall 571, edummit@northeastern.edu.

Office Hours: Wednesday noon–1:00pm + 3pm–4:00pm, or by appointment, online via Zoom.

Course Webpage: https://web.northeastern.edu/dummit/teaching_fa22_4555.html.

Course Textbook: The instructor will write lecture notes for the course (in lieu of an official textbook) as the semester progresses. The course will roughly follow the presentation in Lang's "Complex Analysis" and Saff/Snider's "Fundamentals of Complex Analysis", but it is **not** necessary to purchase the textbooks for this course.

Prerequisites: Math 2321 (Calculus 3) or instructor's permission.

Course Philosophy: The goal of this course is to give an introduction to complex analysis, which studies the behavior of functions of a complex variable $z = x + iy$ from both a computational and theoretical perspective.

Complex analysis is a natural extension of the methods of real analysis and multivariable calculus to functions defined on the complex plane, and many of the underlying ideas and questions are very similar (e.g., studying derivatives, integrals, series expansions, and convergence). However, in contrast with the wide variety of unusual behaviors and pathological examples typically encountered in real analysis, complex-differentiable functions behave far more nicely than mere real-differentiable functions, resulting in a much cleaner theory overall.

Since this is an advanced undergraduate-level class, much of the learning, and many of the secondary topics, are developed through the homework assignments. The lectures will primarily focus on discussing the results and giving applications. The homework is an integral component of the course and, as such, it is expected that all students will work on it every week: the purpose is to require complex problem solving and combining multiple ideas together in novel ways as a way of solidifying the foundation created during the lectures. Proof is a central theme in this course, and the homework assignments and exams will emphasize proofs and problem-solving in addition to performing computations.

Grades: Your course grade consists of **40% homework**, **25% midterm**, and **35% final exam**.

The homework score consists of the average of the written assignment scores, with the lowest score dropped.

There will be two in-class exams. The midterm is tentatively scheduled for Monday, October 31st and the final exam is scheduled during the final exam week.

An overall raw score of 92% will be **at least** an A, 89% will be **at least** an A-, 86% will be **at least** a B+, 82% will be **at least** a B, 79% will be **at least** a B-, 76% will be **at least** a C+, 72% will be **at least** a C, and 69% will be **at least** a C-.

If you feel that an assignment or exam has been misgraded, please talk to the instructor directly. Requests for regrading will not be considered more than two days past the date the assignment or exam was returned.

Homework Assignments: Written assignments will be assigned weekly and due via Canvas, typically on Wednesdays.

It is highly recommended to start work on the assignments early: many problems will require substantial thought and effort to solve, even if the solution is ultimately fairly short. Do not fall into the trap of only starting the assignment the evening before it is due!

The lowest assignment grade is dropped, to provide you a cushion if an emergency arises and you cannot complete an assignment. Assignments may be submitted late, but late submissions may be penalized at the grader's discretion.

Written assignments should be organized carefully, neatly, and in complete sentences, with concise well-reasoned logical arguments. Cite any external resources used, and clearly label all problems. All electronic submissions are expected to be easily readable. **Failure to adhere to any of these guidelines may result in point deductions, at the grader's discretion.**

Course Schedule: The course and lecture notes are tentatively organized into five chapters, as follows:

Weeks 1-3: Chapter 1 $\sim$ Complex Differentiation: Complex arithmetic, polar and exponential forms, topology of $\mathbb{C}$, limits, complex derivatives, the Cauchy-Riemann equations, angle-preserving maps.

Weeks 3-5: Chapter 2 $\sim$ Complex Series: formal power series, convergence of sequences and series, properties of power and Taylor series, the complex exponential and logarithm, trigonometric functions.

Weeks 5-7: Chapter 3 $\sim$ Complex Integration: Contours, line integrals, path independence, Cauchy's integral theorem, zeroes and poles, Cauchy's integral formula, Liouville's theorem and growth estimates.

Weeks 8-11: Chapter 4 $\sim$ Applications of Integration: Zeroes and poles, Laurent series, residue calculus, evaluation of contour integrals, Rouché's theorem, the fundamental theorem of algebra.

Weeks 11-14: Chapter 5 $\sim$ Geometry of Holomorphic Functions: Functions on the unit disc, conformal mapping, fractional linear transformations and Möbius transformations, harmonic functions, boundary value problems.

Collaboration Policy: Mathematics is fundamentally a collaborative endeavor, and discussing the course material with others is an excellent way to solidify your own understanding. However, it is critical not to outsource your learning! You cannot expect to retain knowledge if you do not solve your homework problems yourself, whether because you relied on other people to explain to you how to do the problems, or because you relied too heavily on technological assistance.

On written assignments, you may work together with other people, but you must write up your work independently. If you use **any** external resources (e.g., wikipedia, stackexchange, other books beyond the course text or notes, other people, etc.) you must say **what results you are citing and where they are from**. If you happen to find a solution to an assigned problem online or elsewhere, it is academically dishonest to copy the solution and present it as your own work.

Attendance Policy: It is expected that you will attend every class. This course moves very fast, and it is quite possible to fall behind even if you only miss one day. If you miss class for any reason, it is highly advisable to consult the course lecture notes and to watch the recording of the lecture you missed. It is your responsibility to be aware of all information announced in class, including modifications to the course syllabus or schedule, even if you are absent.

If you will be absent from a class activity due to a religious observance or practice, or for participation in a university-sanctioned event (e.g., university athletics), it is your responsibility to inform the instructor during the first week of class and provide appropriate documentation if required.

Statement on Academic Integrity: A commitment to the principles of academic integrity is essential to the mission of Northeastern University. Academic dishonesty violates the most fundamental values of an intellectual community and undermines the achievements of the entire University. Violations of academic integrity include (but are not limited to) cheating on assignments or exams, fabrication or misrepresentation of data or other work, plagiarism, unauthorized collaboration, and facilitation of others' dishonesty. Possible sanctions include (but are not limited to) warnings, grade penalties, course failure, suspension, and expulsion.

Statement on Accommodations: Any student with a disability is encouraged to meet with or otherwise contact the instructor during the first week of classes to discuss accommodations. The student must bring a current Memorandum of Accommodations from the Office of Student Disability Services.

Statement on Classroom Behavior: Disruptive classroom behavior will not be tolerated. In general, any behavior that impedes the ability of your fellow students to learn will be viewed as disruptive.

Statement on Inclusivity: Faculty are encouraged to address students by their preferred name and gender pronoun. If you would like to be addressed using a specific name or pronoun, please let your instructor know.

Statement on Evaluations: Students are requested to complete the TRACE evaluations at the end of the course.

Miscellaneous Disclaimer: The instructor reserves the right to change course policies, including the evaluation scheme of the course. Notice will be given in the event of any substantial changes.