

Introduction to Complex Variables

Math 4322—001

Fall 2018

Time: Tuesday, Thursday 3:30 — 4:50 PM

Instructor: Prof. Barbara Shipman

Phone: (817) 272-2606

Office Hours: Monday 2:30—3:30, Thursday 2--3

Course Website: www.uta.edu/faculty/shipman at Student Center, Math 4322

Faculty Profile: <https://www.uta.edu/profiles/barbara-shipman>

Classroom: PKH 107

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Prerequisite: C or better in [MATH 2326](#) (Calculus III)

Required Textbook: Complex Variables and Applications, by J.W. Brown and R.V. Churchill, 9th Edition.
ISBN: 978-0-07-305194-9.

Active Learning Course: This class is designed to be fun, creative, interactive, and challenging. You will learn how to think at a new level that will help in your future studies and career. You will be thinking with each other about problems in class, contributing to discussions, and sometimes presenting your work and reasoning at the board. Come ready to make every class a highlight of your day ☺

Course Description: An introduction to functions of a complex variable and their geometric presentation as mappings of the complex plane; also an introduction contour integration, residue theory, conformal mappings, and applications of these concepts. We will study selected topics from Chapters 1 – 10 of the textbook and complementary topics not covered in the textbook.

Learning Outcomes: On successful completion of this course, students will be able to

- conceptualize the geometry and algebra of the complex number system and contrast it with the system of real numbers,
- represent complex functions of a complex variable as mappings from the complex plane to itself and explain the geometric meaning of the functional formulas,
- explain and illustrate multi-valuedness of complex functions of a complex variable,
- explain the meaning of and demonstrate calculations of path integration in complex variables, including residues and poles,
- prove statements involving complex variables, at the level of the course,
- present and discuss applications of complex variables as studied in the course,
- read and analyze mathematical writing on complex variables at the level of the textbook,
- give clear explanations of solutions to problems in the course, both theoretical and applied, and both orally and in writing,
- and be confident about the correctness of their explanations and solutions.

Expectations of the Student:

- **Attendance:** Every class requires your active participation and learning. For your full benefit and enjoyment, attend every class, arrive on time, and remain in class and actively engaged for the whole period.
- **No Electronics during class:** All electronics, including cell phones, tablets, and laptops must be put away and out of sight during class.
- **Participation:** Bring the assigned study problems well prepared to every class and participate fully in presentations and class activities.
- **Study time:** Set aside about 9 hours per week outside of class to study for this course.
- **Course notebook:** Keep a current and organized folder with correct solutions to all problems assigned or discussed in class.
- **MavMail and Announcements:** Keep an activated MavMail account and check it regularly. You are responsible for all information that I send to your MavMail account and all announcements made in class or on the course website.
- **Asking for help when needed.** Ask for help on material that you may not be grasping fully. You may work with your classmates, come to office hours, or send me an e-mail with questions.

- **Personal responsibility.** This class is set up to be engaging and enjoyable and to help you to put in your best hard work for great learning. Make your success in this class a priority!

Grading: Your work will be graded on correctness, completeness, and clarity.

Attendance and Participation (every day counts):	15%
Quiz Average (excluding two lowest quiz scores):	45%
Final Exam:	40%

Course average	100%

Your course average determines your final grade. A: 90—100%. B: 80—89%. C: 70—79%. D: 60—69%. F: 0—59%. Students are expected to keep track of their performance throughout the semester and seek guidance from available sources (including the instructor) if their performance drops below satisfactory levels.

Attendance and Participation Points:

For every class and every lab, you will receive a score of 2, 1, or 0. For 2/2, you must be in class on time, present for the entire period with good participation and never using any electronic device. The score reduces to 1 or 0 if you are late to class, disrupt class, or use an electronic device during class. The score is 0 for missing class for any reason.

Quizzes: A quiz will be given each week on Thursday; these will take the place of longer midterm exams to provide you with frequent feedback on your progress. Questions may be on any study problems, material, or readings assigned or discussed up to the end of the previous week. A missed quiz cannot be made up. Two lowest quiz scores will be dropped. Here are some tips on preparing for the quizzes:

Final Exam: There will be a comprehensive final exam on Tuesday, December 11 from 2—4:30 PM, in the same room as the class. This is a written exam where you can show your best creative work in solving problems and explaining your reasoning.

Electronics Policy: Students may not use electronics of any kind during class or lab meetings. This includes (but is not limited to) cell phones, tablets, and laptop computers.

Attendance Policy: At The University of Texas at Arlington, taking attendance is not required but attendance is a critical indicator in student success. Each faculty member is free to develop his or her own methods of evaluating students' academic performance, which includes establishing course-specific policies on attendance. *As the instructor of this section, I count attendance and participation in every class in every lab towards the course grade as described in this syllabus.* However, while UT Arlington does not require instructors to take attendance in their courses, the U.S. Department of Education requires that the University have a mechanism in place to mark when Federal Student Aid recipients “begin attendance in a course.” UT Arlington instructors will report when students begin attendance in a course as part of the final grading process. Specifically, when assigning a student a grade of F, faculty report the last date a student attended their class based on evidence such as a test or participation in a class project or presentation. This date is reported to the Department of Education for federal financial aid recipients.

Drop Policy: Students may drop or swap (adding and dropping a class concurrently) classes through self-service in MyMav from the beginning of the registration period through the late registration period. After the late registration period, students must see their academic advisor to drop a class or withdraw. Undeclared students must see an advisor in the University Advising Center. Drops can continue through a point two-thirds of the way through the term or session. It is the student's responsibility to officially withdraw if they do not plan to attend after registering. **Students will not be automatically dropped for non-attendance.** Repayment of certain types of financial aid administered through the University may be required as the result of dropping classes or withdrawing. For more information, contact the Office of Financial Aid and Scholarships (<http://www.uta.edu/aao/fao/>).

Disability Accommodations: UT Arlington is on record as being committed to both the spirit and letter of all federal equal opportunity legislation, including *The Americans with Disabilities Act (ADA)*, *The Americans with Disabilities Amendments Act (ADAAA)*, and *Section 504 of the Rehabilitation Act*. All instructors at UT Arlington are required by law to provide “reasonable accommodations” to students with disabilities, so as not to discriminate on the basis of disability. Students are responsible for providing the instructor with official

notification in the form of a **letter certified** by the Office for Students with Disabilities (OSD). Only those students who have officially documented a need for an accommodation will have their request honored. Students experiencing a range of conditions (Physical, Learning, Chronic Health, Mental Health, and Sensory) that may cause diminished academic performance or other barriers to learning may seek services and/or accommodations by contacting: **The Office for Students with Disabilities, (OSD)** <http://www.uta.edu/disability/> or calling 817-272-3364. Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at www.uta.edu/disability.

Counseling and Psychological Services (CAPS) www.uta.edu/caps/ or calling 817-272-3671 is also available to all students to help increase their understanding of personal issues, address mental and behavioral health problems and make positive changes in their lives.

Non-Discrimination Policy: The University of Texas at Arlington does not discriminate on the basis of race, color, national origin, religion, age, gender, sexual orientation, disabilities, genetic information, and/or veteran status in its educational programs or activities it operates. For more information, visit uta.edu/eos.

Title IX Policy: The University of Texas at Arlington ("University") is committed to maintaining a learning and working environment that is free from discrimination based on sex in accordance with Title IX of the Higher Education Amendments of 1972 (Title IX), which prohibits discrimination on the basis of sex in educational programs or activities; Title VII of the Civil Rights Act of 1964 (Title VII), which prohibits sex discrimination in employment; and the Campus Sexual Violence Elimination Act (SaVE Act). Sexual misconduct is a form of sex discrimination and will not be tolerated. *For information regarding Title IX, visit www.uta.edu/titleIX or contact Ms. Michelle Willbanks, Title IX Coordinator at (817) 272-4585 or titleix@uta.edu*

Academic Integrity: Students enrolled all UT Arlington courses are expected to adhere to the UT Arlington Honor Code:

I pledge, on my honor, to uphold UT Arlington's tradition of academic integrity, a tradition that values hard work and honest effort in the pursuit of academic excellence.

I promise that I will submit only work that I personally create or contribute to group collaborations, and I will appropriately reference any work from other sources. I will follow the highest standards of integrity and uphold the spirit of the Honor Code.

UT Arlington faculty members may employ the Honor Code in their courses by having students acknowledge the honor code as part of an examination or requiring students to incorporate the honor code into any work submitted. Per UT System *Regents' Rule* 50101, §2.2, suspected violations of university's standards for academic integrity (including the Honor Code) will be referred to the Office of Student Conduct. Violators will be disciplined in accordance with University policy, which may result in the student's suspension or expulsion from the University. Additional information is available at <https://www.uta.edu/conduct/>. See the following library tutorials: <http://libguides.uta.edu/copyright/plagiarism> and <http://library.uta.edu/plagiarism/> .

Electronic Communication: UT Arlington has adopted MavMail as its official means to communicate with students about important deadlines and events, as well as to transact university-related business regarding financial aid, tuition, grades, graduation, etc. All students are assigned a MavMail account and are responsible for checking the inbox regularly. There is no additional charge to students for using this account, which remains active even after graduation. Information about activating and using MavMail is available at <http://www.uta.edu/oit/cs/email/mavmail.php>.

Campus Carry: Effective August 1, 2016, the Campus Carry law (Senate Bill 11) allows those licensed individuals to carry a concealed handgun in buildings on public university campuses, except in locations the University establishes as prohibited. Under the new law, openly carrying handguns is not allowed on college campuses. For more information, visit <http://www.uta.edu/news/info/campus-carry/>

Student Feedback Survey: At the end of each term, students enrolled in face-to-face and online classes categorized as "lecture," "seminar," or "laboratory" are directed to complete an online Student Feedback Survey (SFS). Instructions on how to access the SFS for this course will be sent directly to each student through MavMail approximately 10 days before the end of the term. Each student's feedback via the SFS database is aggregated with that of other students enrolled in the course. Students' anonymity will be protected to the extent that the law allows. UT Arlington's effort to solicit, gather, tabulate, and publish student feedback is required by state law and aggregate results are posted online. Data from SFS is also used for faculty and program evaluations. For more information, visit <http://www.uta.edu/sfs>.

Final Review Week: for semester-long courses, a period of five class days prior to the first day of final examinations in the long sessions shall be designated as Final Review Week. The purpose of this week is to allow students sufficient time to prepare for final examinations. During this week, there shall be no scheduled activities such as required field trips or performances; and no instructor shall assign any themes, research problems or exercises of similar scope that have a completion date during or following this week *unless specified in the class syllabus*. During Final Review Week, an instructor shall not give any examinations constituting 10% or more of the final grade, except makeup tests and laboratory examinations. In addition, no instructor shall give any portion of the final examination during Final Review Week. During this week, classes are held as scheduled. In addition, instructors are not required to limit content to topics that have been previously covered; they may introduce new concepts as appropriate.

Emergency Exit Procedures: Should we experience an emergency event that requires us to vacate the building, students should exit the room and move toward the nearest exit, which is located outside the classroom door on the left (facing the front) and out the doors to the left. When exiting the building during an emergency, one should never take an elevator but should use the stairwells. Faculty members and instructional staff will assist students in selecting the safest route for evacuation and will make arrangements to assist individuals with disabilities.

Student Support Services: UT Arlington provides a variety of resources and programs designed to help students develop academic skills, deal with personal situations, and better understand concepts and information related to their courses. Resources include [tutoring](#), [major-based learning centers](#), developmental education, [advising and mentoring](#), personal counseling, and [federally funded programs](#). For individualized referrals, students may visit the reception desk at University College (Ransom Hall), call the Maverick Resource Hotline at 817-272-6107, send a message to resources@uta.edu, or view the information at <http://www.uta.edu/universitycollege/resources/index.php>.

The IDEAS Center (2nd Floor of Central Library) offers **FREE tutoring** to all students with a focus on transfer students, sophomores, veterans and others undergoing a transition to UT Arlington. Students can drop in, or check the schedule of available peer tutors at www.uta.edu/IDEAS, or call (817) 272-6593.

Student Disruption: The University may impose disciplinary action for an infraction of University policies, including engagement in conduct, alone or with others, that obstructs, disrupts, or interferes with any function of class activities.

<p>Emergency Phone Numbers: In case of an on-campus emergency, call the UT Arlington Police Department at 817-272-3003 (non-campus phone), 2-3003 (campus phone). You may also dial 911.</p>

Course Schedule on next page!

Course Schedule: *This day-by-day outline is approximate; as the instructor of this course, This schedule may be adjusted in any way that better serves the educational needs of the students enrolled in this course.*

Week 1	Aug 23	The complex number system, algebraic and geometric properties
Week 2	Aug 28 Aug 30	More on properties of the complex number system, inverses and quotients, complex roots, the complex plane
Week 3	Sep 4 Sep 6	Functions of a complex variable: geometry as mappings of the complex plane, examples, limits
Week 4	Sep 11 Sep 13	More geometry of mappings of the complex plane Continuity and differentiation, the Cauchy-Riemann equations
Week 5	Sep 18 Sep 20	Analytic functions Harmonic functions, uniquely determined analytic functions
Week 6	Sep 25 Sep 27	The exponential and logarithmic functions, branches and derivatives Complex exponents, trigonometric and hyperbolic functions
Week 7	Oct 2 Oct 4	Applications involving complex eigenvalues, derivatives of complex functions of a real variable, definite integrals of complex functions of a real variable
Week 8	Oct 9 Oct 11	Contours and contour integrals, examples, examples with branch cuts
Week 9	Oct 16 Oct 18	The Cauchy-Goursat Theorem, simply connected and multiply connected domains
Week 10	Oct 23 Oct 25	The Cauchy Integral Formula Liouville's Theorem, Fundamental Theorem of Algebra
Week 11	Oct 30 Nov 1 Nov 2	Convergence of complex sequences and series Taylor and Laurent series Last day to drop a class
Week 12	Nov 6 Nov 8	Integration and differentiation of power series Residues, Cauchy Residue Theorem
Week 13	Nov 13 Nov 15	More results on residues and poles and applications of residue theory
Week 14	Nov 20 Nov 22	More geometry of mappings of the complex plane
Week 15	Nov 27 Nov 29	Conformal mappings and applications
Week 16	Dec 4	Sister geometry of the Lorentzian plane
Final	Dec 11	(Tuesday) Final Exam: 2 – 4:30 PM