MATH 4322: Introduction to Complex Variables
Section 001 – Fall 2015

Time: Tue. Thur 3:30—4:50 PM   **Classroom:** Pickard Hall 107
Instructor: Prof. Barbara Shipman   **Office:** Pickard Hall 437
Phone: (817) 272-2606   **E-mail:** bshipman@uta.edu
Office Hours: Tue,Thur 10:30—11:30 AM
Website: www.uta.edu/faculty/shipman at Student Center, Math 4322

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. A copy of the textbook is on reserve in the Central Library (2-hour loan).

Course Content: 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:** At The University of Texas at Arlington, taking attendance is not required. Rather, 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 determined by the instructor of this section, attendance is mandatory and counts towards the course grade as described below. You are expected to attend every class, arrive on time, and remain in class for the whole period.
- **Participation:** Bring all assigned study problems well prepared to every class and to participate fully in oral presentations and class activities.
- **12 hours per week outside of class.** Spend at least 12 hours per week outside of class studying and (re-)working problems for this course.
- **Course notebook.** Keep a neat, up-to-date, and organized binder 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 specific questions.

- **Personal responsibility.** You carry the ultimate responsibility for your learning. The onus is on you to attend every class, keep up daily with the assignments, put in the expected hours, keep your course notebook up-to-date, and ask for help when needed.

Study Problems and Oral Participation: Study problems will be assigned daily as posted on the course website. At every class, be prepared to explain orally, and in writing, your solution to any study problem assigned so far in the course. You may also be asked to explain your reasoning to questions that arise during class discussions. You are expected to work out correct solutions to all study problems, resolve any questions that you have on them, keep your correct solutions organized in your class binder, and bring these solutions to every class. Study problems are to be prepared as follows:
- For each problem, write out the complete question above the solution.
- Explain all your answers and justify all your claims in your arguments and proofs.
- Number each study problem as given in the assignment.

Scoring for Prepared Attendance with Oral Participation: At every class, you will receive an attendance and participation score according the following scheme. Every class counts in the final grade, and no attendance/participation score is dropped.
- 2, for being present during the entire period with good participation and preparation.
- 0—1, if you are not present during the entire period, are inadequately prepared, or do not fully participate. If you arrive late, your score will be recorded as 0; if you would like consideration for raising this to 1, please inform me *after class on the same day*.
- 0, for missing class for any reason. This records that the in-class active learning experience for that day of the course was missed.

Quizzes: Zero to two short quizzes will be given each week; these will take the place of longer midterm exams and will provide you with frequent feedback on your progress. Quizzes are cumulative and may cover any study problems, material, or readings assigned or discussed up to that point. Come to every class prepared for a possible quiz; the dates of the quizzes will be unannounced. A missed quiz cannot be made up. Three lowest quiz scores will be dropped. Here are some tips on preparing for the quizzes:
- Regularly review all class notes and study problems.
- Re-work study problems and problems discussed in class without resorting to notes. Consult notes only after good effort to re-work the problems on your own.
- Set aside ample time to work out all study problems carefully before the next class.
- Form study groups with classmates and work on coursework together.
- Pinpoint the specific question if you "get stuck" on a problem. Often in seeking to identify the question, one will see how to solve it.
- Meet with the instructor to settle remaining questions that you may have.

Final Exam: There will be a comprehensive final exam on Thursday, December 17 from 2—4:30 PM, in the same room as the class. A missed final exam cannot be made up.

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

Prepared Attendance with Oral Participation (every day counts):	15%
Quiz Average (excluding three lowest quiz scores):	45%
Final Exam:	40%
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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.

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

Week 1	Aug 27	The complex number system, algebraic and geometric properties
Week 2	Sep 1 Sep 3	More on properties of the complex number system, inverses and quotients, complex roots, the complex plane, Julia and Mandelbrot sets
Week 3	Sep 8 Sep 10	Functions of a complex variable: geometry as mappings of the complex plane, examples, limits
Week 4	Sep 15 Sep 17	More geometry of mappings of the complex plane Continuity and differentiation, the Cauchy-Riemann equations
Week 5	Sep 22 Sep 24	Analytic functions Harmonic functions, uniquely determined analytic functions
Week 6	Sep 29 Oct 1	The exponential and logarithmic functions, branches and derivatives Complex exponents, trigonometric and hyperbolic functions
Week 7	Oct 6 Oct 8	Applications involving complex eigenvalues, derivatives of complex functions of a real variable, definite integrals of complex functions of a real variable
Week 8	Oct 13 Oct 15	Contours and contour integrals, examples, examples with branch cuts
Week 9	Oct 20 Oct 22	The Cauchy-Goursat Theorem, simply connected and multiply connected domains
Week 10	Oct 27 Oct 29	The Cauchy Integral Formula Liouville's Theorem, Fundamental Theorem of Algebra
Week 11	Nov 3 Nov 5	Convergence of complex sequences and series Wed., Nov. 4: Last day to drop a class (by 4 PM) Taylor and Laurent series
Week 12	Nov 10 Nov 12	Integration and differentiation of power series Residues, Cauchy Residue Theorem
Week 13	Nov 17 Nov 19	More results on residues and poles and applications of residue theory
Week 14	Nov 24	More geometry of mappings of the complex plane
Week 15	Dec 1 Dec 3	Conformal mappings and applications
Week 16	Dec 8	Introduction to Riemann surfaces
Final	**Dec 17**	**Final Exam 2 – 4:30 PM (Thursday)**

Policies of the University of Texas at Arlington:

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 withdaw. 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://wweb.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).** 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) www.uta.edu/disability or calling 817-272-3364.
Counseling and Psychological Services, (CAPS) www.uta.edu/caps/ or calling 817-272-3671.

Only those students who have officially documented a need for an accommodation will have their request honored. Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at www.uta.edu/disability or by calling the Office for Students with Disabilities at (817) 272-3364.

Title IX: 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. For information regarding Title IX, visit www.uta.edu/titleIX.

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.*
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> *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 as they see fit in their courses, including (but not limited to) 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. The student will receive a score of 0 toward the course grade on any assignment, quiz, or exam that violates the Academic Integrity Policy.

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.
Student Feedback Survey: At the end of each term, students enrolled in classes categorized as "lecture," "seminar," or "laboratory" shall be 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 enters the SFS database anonymously and is aggregated with that of other students enrolled in the course. UT Arlington's effort to solicit, gather, tabulate, and publish student feedback is required by state law; students are strongly urged to participate. For more information, visit http://www.uta.edu/sfs.

Final Review Week: 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 just outside of the classroom door on the left (facing the front of the room); after exiting the classroom, go through the glass doors to the left, and exit the building. 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

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.

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.