Functions of a Complex Variable

Math 4417, FALL 2017

Instructor: Dr. Nicolae R. Pascu
Office: D205, Phone: (470) 578-4989
E-mail: npascu@kennesaw.edu

TEXTBOOK: *Complex Variables and Applications* 8th Edition by Brown & Churchill (McGraw Hill)

MEETING TIMES/LOCATION: TuTh 9:30 am - 10:45 am / D113

Goals: Upon successfully completing this course, students will be able to:

1. Use properties of elementary functions (trigonometric, exponential, etc.) of a complex variable.
2. Determine if a given function of a complex variable is continuous/ analytic/ integrable.
3. Differentiate and integrate functions of a complex variable. Use the Cauchy's Theorem, Cauchy's integral formula, and the Residue Theorem to evaluate elementary contour integrals. Prove related elementary theorems.
4. Perform elementary calculations with Taylor and Laurent series.
5. Apply the techniques of complex analysis to solve certain applied problems (e.g. compute certain Riemann integrals, determine certain conformal maps or harmonic functions with given boundary values).

OFFICE HOURS: MW 11:00 – 12:00, or by appointment.

PREREQUISITE: MATH 2203 (Calculus III) - Minimum Grade of C.

COURSE DESCRIPTION This course is an introduction to the basic concepts of complex analysis, its beautiful theory and powerful applications. Topics covered will include: the algebra and geometry of the complex plane, properties of elementary functions of a complex variable, analytic and harmonic functions, conformal mappings, continuity, differentiation, integration (Cauchy integral theory), singularities, Taylor and Laurent series, residues and, time permitting, their applications.

CLASS ATTENDANCE: I strongly suggest the attendance to class. If you miss a class, it is your responsibility to find make up the material and make sure your homework is turned in on time..

HOMEWORK: For each section, there will be a minimum number of problems, which I strongly suggest to be done by the next class meeting. There will be about ten homework assignments; the lowest grade will be dropped. Late homework will not be accepted under any circumstances.

COURSE POLICY: There will three in-class tests tentatively scheduled for September 7th, October 5th and November 2nd respectively. The final exam is cumulative (the date/time will be announced later in class).

There will be NO MAKE-UP quizzes, exams. Should there be a special circumstance giving you a valid reason for a makeup exam (such as a medical emergency), let me know in advance of this situation by sending me an email (npascu@spsu.edu) BEFORE the exam takes place.

Evaluation: There will be 3 regular exams, each worth 20% of your grade. A comprehensive final exam will be woth 20%. Homework will be 20%. The scale for converting your score to letter grades is the usual one (90% or more is an A, 80-89% is a B, 70-79% is a C, 60 - 69% is a D, below 60% is a F).

EPECTATIONS: I expect you to read the textbook (solved examples, especially). The only way to get through this course is to work constantly. This includes doing your homework exercises and going over the notes, and textbook. The only way to know math is to practice. This is the only "secret".

IMPORTANT DATES: Labor Day Holiday September 2nd - 4th / The last day to withdraw from class with a grade of "W" is October 4th/ Thanksgiving Holiday November 20th - 26th/ Last day of classes December 4th.

STUDENTS WITH DISABILITIES: Students with disabilities who believe that they may need accommodations in this class are encouraged to contact the counselor working with disabilities at (678) 915-7244 as soon as possible to better ensure that such accommodations are implemented in a timely fashion. Written verification from the KSU Student Disability Services (http://www.kennesaw.edu/stu_dev/dsss/welcome.html) is required.

HONESTY: KSU has an Honor Code and a procedure for handling cases when academic misconduct is alleged. All students should be aware of them. Information about the Honor Code and the misconduct procedure may be found at https://web.kennesaw.edu/scai/content/ksu-student-code-conduct.

NOTE: The pace may vary, so the following is a weekly rather than daily outline.

MATH 4417 Complex Variables

TENTATIVE COURSE COVERAGE

WEEK	SECTIONS/TOPICS	HW	DUE
Aug 15th -Aug 17th	Sums and Products Basic Algebraic Properties Further Properties Moduli Complex Conjugates Exponential Form	p. 5: 1-5, 10 p 8: 1,2,4	Aug 24
Aug 22nd -Aug 24th	Exponential Form Products and Quotients in Exponential Form Roots of Complex Numbers Examples Regions in the Complex Plane	p. 22: 1, 2, 4, 6, 10 p. 29: 1, 2b, 3b, 6, 7 p. 33: 1	Aug 31
Aug 29th -Aug 31st	Functions of a Complex Variable Mappings Mappings by the Exponential Function	p. 31: 4, 5 p 37: 1, 3, 4 p. 44: 1, 3, 4, 7	Sep 8
Sep 5th -Sep 7th *Labor Day September 2-4*	Limits Theorems on Limits Limits Involving the Point at Infinity Continuity **Exam 1**	p. 55: 1ab, 3b, 5, 10, 11	Sep 14
Sep 11th -Sep 14th	Derivatives Differentiation Formulas Cauchy-Riemann Equations Sufficient Conditions for Differentiability	p. 62: 1, 3, 8 p. 71: 1cd, 2ab, 3 abc, 4b, 5	Sep 21

	Polar Coordinates		
Sep 19th -Sep 21st	Analytic Functions Examples Harmonic Functions Uniquely Determined Analytic Functions Reflection Principle	p. 77: 1ad, 2abc, 4c, 7 p. 81: 3,4 p. 87: 3,4	Sep 28
Sep 26th -Sep 28th	The Exponential Function The Logarithmic Function Branches and Derivatives of Logarithms Some Identities Involving Logarithms	p. 92: 1, 2, 4, 5, 7 p. 97: 1, 2, 3	Oct 5
Oct 3rd -Oct 5th	Complex Exponents Trigonometric Functions **Exam 2**	p. 104: 1 p. 108: 1, 3	Oct 12
Oct 10th -Oct 12th	Derivatives of Functions Definite Integrals of Functions Contours Contour Integrals Examples Upper Bounds for Moduli of Contour Integrals	p. 121: 2, 4 p. 135: 1, 2, 4 p. 140: 2, 3, 5	Oct 19
Oct 17th -Oct 19th	Antiderivatives Cauchy-Goursat Theorem Simply and Multiply Connected Domains Cauchy Integral Formula Liouville's Theorem and the Fundamental Theorem of Algebra Maximum Modulus Principle	p. 153: 1aef, 2ac, 3, 6, 7 p. 171: 1ab, 2	Oct 26
Oct 24th - Oct 26th	Convergence of Sequences Convergence of Series Taylor Series Examples Laurent Series	p. 188: 1,3 p. 196: 2b, 3, 6	Nov 2
Oct 31st -Nov 2nd	Residues Cauchy's Residue Theorem Using a Single Residue The Three Types of Isolated Singular Points Residues at Poles **Exam 3**	p. 239: 1ae, 2, 4 p. 243 1a, 3 p. 248: 1, 2	Nov 9
Nov 7th -Nov 9th	Evaluation of Improper Integrals	p. 267: 1, 2	Nov 16
Nov 14th – Nov 16th	Linear Transformations The Transformation w = liz Mappings by 1/z Linear Fractional Transformations An Implicit Form Mappings of the Upper Half Plane	p. 313: 1, 2 p. 317: 2,4	Nov 23
Nov 28nd – Nov 30th *Thanksgiving Nov 20th – Nov 26th*	**Review for Final Examination/ FINAL EXAM**		