University of Texas at Dallas

Course Syllabus

Math 3379: Complex Variable

Fall 2016

Time and Location:	Tues & Thurs 10:00pm-11:15pm	JO 4.708
Instructor:	Zalman Balanov	
Contact Information:		
	• Office:	FO 2.408E
	• Phone:	972-883-6591
	• Email:	balanov@utdallas.edu
	• Office hours:	Tues & Thurs 4:15 pm - 5:15 pm or by appointment.

Course Description:

MATH 3379 - Complex Variables (3 semester credit hours) Geometry and algebra of complex numbers, functions of a complex variable, power series, integration, calculus of residues, conformal mapping. Prerequisites: MATH 2451 and MATH 3310. (3-0) S

References:

- **Main Textbook:** James W. Brown, Ruel V. Churchill, *Complex Variables and Applications*, McGraw Hill, **any edition**.
- **Problem Book:** L. Volkovysky, G. Lunts, I. Armanovich, *Problems in the theory of functions of a complex variable*, Mir Publishers, Moscow (book is out of print, so check out this link http://lib.freescienceengineering.org/view.php?id=293959).

Homework Assignments:

There will be about 6-8 mandatory graded assignments. Assignments will contribute 20% to your final grade. The homework assignments will be published at our website and you will be given approximately 7 days to complete your solutions. You will be required to hand your homework to your instructor in class on the due-dates. There will be NO late homework accepted.

Grading Policy:

•	Homework assignments:	20%
•	Midterm Exam 1:	25%
•	Midterm Exam 2:	25%
•	Final Exam:	30%
•	Total:	100%

Midterm Exams:

	Date	Time	Location
Midterm Exam 1:	October 6, 2016	10:00am–11:15am	JO 4.708
Midterm Exam 2:	November 3, 2016	10:00am–11:15 am	JO 4.708
Final Exam:	Available at Galaxy	after September 7	

Exams Rules: Textbooks, notes, mobile phones, iPhones, scientific calculators or other electronic devises won't be allowed during examination. Rules governing the proper academic conduct and student's integrity will be strictly observed. Cheating and plagiarism won't be tolerated.

Student Learning Objectives:

- Students will learn: algebraic properties of complex numbers, their different representations and geometric properties, complex roots, elementary functions of complex variable and their properties (exponential function, logarithm, trigonometric functions, hyperbolic functions, complex exponents, inverse trigonometric and hyperbolic functions), complex differentiation and its relation to the real differentiation, Cauchy-Riemann equations and their connection to Clifford Analysis (if time permits), complex analytic functions, properties of derivatives, contours in complex domains, contour integrals of complex-valued functions, relations to line integrals, properties of complex integrals, Cauchy-Goursat theorem, Cauchy Integral Formula, derivatives of analytic functions, Liouville's Theorem, Fundamental Theorem of Algebra, Rouche's Theorem, Maximum Modulus Principle, Taylor series, Laurent series, entire and meromorphic functions and their singularities, residues, Cauchy Residue Theorem and its connection to winding number of a vector field (if time permits), linear fractional transformations, conformal mappings (if possible, other selected topics).

- Students will show ability to express complex numbers, complex functions in different forms, to determine analyticity of complex functions, to apply definition and properties of contour integrals to compute concrete integrals, to expand standard analytic functions into Taylor and Laurent series, to determine the type of singularity and the value of the residue for given analytic functions, to apply the residue method for computations of real improper integrals, and to construct conformal mappings between specific domains.

- Students will learn several proofs of classical theorems in complex variable and will apply their knowledge to solve standard problems involving functions of complex variable.

Detailed Description of the Course

1. Definition of complex numbers and geometric interpretation. Conjugate numbers and various forms of complex numbers: vector, polar, standard, trigonometric, exponential, matrix. Properties of complex numbers, argument function, modulus function, DeMoivre formula, complex roots (geometric interpretation).

2. Domains and regions in complex plain, point at infinity, functions of complex variable, a concept of a multivalued function and its branches, complex elementary functions (exponential function, logarithmic function, trigonometric functions, hyperbolic functions, complex exponents, inverse trigonometric and hyperbolic functions), review of concepts of continuity and differentiability, complex differentiation and Cauchy-Riemann Equations and their connection to Clifford Analysis (if time permits), analytic functions and analyticity of elementary functions. Properties of complex differentiation.

3. Review of line integrals, contours and definition of complex contour integral, examples and properties of complex line integrals, antiderivatives and formula for evaluation of complex contour integrals, existence of antiderivative of analytic functions, examples of finding antiderivatives of elementary functions, construction of an antiderivative, Cauchy-Goursat theorem, homotopy property of complex line integral, Cauchy Integral Formula, derivatives of analytic function, Liouville's theorem, Maximum Modulus Theorem.

4. Sequences and series, Taylor series, Laurent series, examples of finding Taylor and Laurent series, convergence of functional series (absolute, uniform), integration and differentiation of functional series, local representation of an analytic function by a Taylor or Laurent series, multiplication and division of power series.

5. Isolated singular points and their classification, entire and meromorphic function, residues and their connection to winding number of a vector field (if time permits), Cauchy Residue Theorem and its connection to winding number of a vector field (if time permits), computational formulae for residues, applications of residues to trigonometric and improper real integrals, examples.

6. Linear fractional transformations and construction of such transformations, conformal mappings and their properties, examples.

UT Dallas Syllabus Policies and Procedures

The information contained in the following link constitutes the University's policies and procedures segment of the course syllabus. Please go to

$$\texttt{http}://\texttt{go.utdallas.edu}/\texttt{syllabus}-\texttt{policies}$$

for these policies.

The descriptions and timelines contained in this syllabus are subject to change at the discretion of the Professor.