上海交通大學
SHANGHAI JIAO TONG UNIVERSITY

Shanghai Jiao Tong University

MA396 Complex Analysis

Instructor Information:	TBD		
Term:	December 16, 2019 - January 7, 2020	**Credits:**	4 units
Class Hours:	Monday through Friday, 160 mins per teaching day		
Discussion Sessions:	2 hours each week, conducted by teaching assistant(s)		
Total Contact Hours:	64 contact hours (1 contact hour = 45 mins, 2880 mins in total)		
Required Texts (with ISBN):	N/A		
Prerequisite:	Students are expected to pass one of Real Analysis and Accelerated Mathematics 2, and any other second year level subject from the Department of Mathematics and Statistics.		

Course Overview

Complex analysis is a core subject in pure and applied mathematics, as well as the physical and engineering sciences. While it is true that physical phenomena are given in terms of real numbers and real variables, it is often too difficult and sometimes not possible, to solve the algebraic and differential equations used to model these phenomena without introducing complex numbers and complex variables and applying the powerful techniques of complex analysis.

Topics include: the topology of the complex plane; convergence of complex sequences and series; holomorphic functions, the Cauchy-Riemann equations, harmonic functions and applications; contour integrals and the Cauchy Integral Theorem; singularities, Laurent series, the Residue Theorem, evaluation of integrals using contour integration, conformal mapping; and aspects of the gamma function.

Course Goals

On completion of this subject students should

1. Apply the Cauchy-Riemann equations;
2. Use the complex exponential and logarithm;
3. Apply Cauchy's theorems concerning contour integrals;
4. Apply the residue theorem in a variety of contexts;
5. Understand theoretical implications of Cauchy's theorems such as the maximum modulus principle, Liouville's Theorem and the fundamental theorem of algebra.

General Skills

In addition to learning specific skills that will assist students in their future careers in science, they will have the opportunity to develop generic skills that will assist them in any future career path. These include

1. Problem-solving skills: the ability to engage with unfamiliar problems and identify relevant solution strategies;
2. Analytical skills: the ability to construct and express logical arguments and to work in abstract or general terms to increase the clarity and efficiency of analysis;
3. Collaborative skills: the ability to work in a team;
4. Time management skills: the ability to meet regular deadlines while balancing competing commitments.

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Grading Policy

Assignments	20%
Participation	10%
Midterm Exam	35%
Final Exam	35%

Grading Scale

Number grade	Letter grade	GPA
90-100	A	4.0
85-89	A-	3.7
80-84	B+	3.3
75-79	B	3.0
70-74	B-	2.7
67-69	C+	2.3
65-66	C	2.0
62-64	C-	1.7
60-61	D	1.0
≤59	F (Failure)	0

Class Schedule

Date	Lecture
Day 1	Introduction to the Complex Numbers and the Complex Plane & Elementary Topology of the Complex Plane
Day 2	Complex Sequences, Complex Limits and Complex Continuity, Introduction to Holomorphic Functions & Curves and integrals in the Complex Plane
Day 3	Antiderivatives, Contours and Contour Integrals, A miraculous Proof-Cauchy's Theorem & Holomorphic functions are magnificently behaved
Day 4	Zeros of holomorphic functions and the maximum modulus theorem, An introduction to entire functions & Isolated singularities
Day 5	Our "working versions" of the main theorems & A discussion/revision of improper Riemann integrals and real infinite series
Day 6	Parallelogram contours (including rectangles), Semicircular contours & Jordan's Lemma and indented contour problems (Assignment 1 due)
Day 7	Meromorphic functions: counting poles and zeros & Branch point singularities: complex logarithms and fractional powers
Day 8	**Midterm Exam**
Day 9	Contour integrals in the cut plane & Functions defined by sequences: uniform convergence
Day 10	Complex series in general and power series in particular & Series representation of elementary functions. Aspect of analytic continuation
Day 11	More on analytic continuation, Dirichlet series and the Riemann zeta function & Functions defined by integrals
Day 12	More about the gamma function, The digamma function and Stirling's formula & More about the Riemann zeta function (Assignment 2 due)
Day 13	Transformation of, and evaluation of, infinite series, The Laplace transform, The inverse Laplace transform & Conjugate harmonic functions
Day 14	Conformal mappings, Conformal automorphisms, Mobius transformation & Elliptic Functions
Day 15	**Final Exam**