Math 106 - Complex Analysis

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Office hours: Room 382D, Monday 3-5pm (this will most likely change).

Course Assistant: Penka Georgieva, penkag@math.you-know-where.edu, Room 381H.

Textbook: James Brown and Ruel Churchill - Complex Variables and Applications.

Unfortunatelly, the Bookstore sells the textbook for a lot of money!!! There are two copies of the textbook on reserve in the Math library, they circulate for a couple of hours. You can also buy cheaper copies from the internet (check the usual websites).

Lectures: Tuesday, Thursday (11am-12:15pm, 381T).

Webpage: http://math.stanford.edu/~oprea/106.html.

Goals: This course provides an introduction to complex analysis. We will cover complex numbers, holomorphic functions and examples, Cauchy's integral formula, Taylor expansions, meromorphic functions, Laurent expansions, residues and applications.

Prerequisites: Familiarity with multivariable calculus at the level of Math 52 will be assumed.

Exams: There will be two midterms and a final (December 13). The first midterm is in class (Oct 19) and will be graded before the drop deadline. The second midterm is a take-home, to be distributed Nov 14, due back Nov 17. It will be graded before the withdrawal deadline. There are no make up midterms.

I am open to having only one in class midterm which could happen on Nov 9 (N.B. After the drop deadline!)

Problem Sets: There will be weekly problem sets, usually due on Tuesday. The problem sets will be posted online. Group work is encouraged, but you have to hand in your own write up of the homework problems. Late problem sets will not be accepted.

Final Grades: Problem sets (20 percent), Midterms (40 percent, 20 percent each), Final Exam (40 percent).

Important dates: Drop deadline: Oct 22. Withdrawal deadline: Nov 19. Thanksgiving break: Nov 20-24. Last day of classes: December 7.

Tentative Syllabus

1. Complex numbers.

Tuesday, Sept 26: Introduction. Complex numbers.
Thursday, Sept 28: Exponential form. Roots of complex numbers.

2. Holomorphic functions.

Tuesday, Oct 3: Open sets, closed sets. Functions of a complex variable.
Problem Set 1 due.
Thursday, Oct 5: Continuity, derivatives, holomorphic functions.
Tuesday, Oct 10: Holomorphic functions. Cauchy-Riemann equations.
Problem Set 2 due.
Thursday Oct 12: Examples: exponential, logarithmic, trigonometric functions.
Tuesday Oct 17: Harmonic functions. Harmonic conjugates.
Problem Set 3 due.
Thursday Oct 19: **Midterm exam.**

3. Complex integration.

Tuesday Oct 24: Countour integrals.
Thursday Oct 26: Cauchy-Goursat theorem. Simply connected regions.
Tuesday Oct 31: Cauchy integral formula.
Problem Set 4 due.
Thursday Nov 2: Cauchy integral formula and derivatives.
Tuesday Nov 7: Liouville's theorem. Maximum modulus principle.
Problem Set 5 due.

4. Series and Taylor expansions.

Thursday Nov 9: Power series. Radius of convergence. Examples.
Differentiation and integration of power series.
Tuesday Nov 14: Taylor expansion of holomorphic functions.
Problem Set 6 due.
Take home midterm. Distributed Tuesday Nov 14 in class.
Due back Saturday Nov 17 at noon.

5. Meromorphic functions, residues.

Thursday, Nov 16: Singularities. Poles. Meromorphic functions.
Tuesday, Nov 28: Laurent expansions. Residues.
Thursday, Nov 30: The residue theorem.
Problem Set 7 due.
Tuesday, Dec 5: Applications of the residue theorem.
Thursday, Dec 7: The argument principle. Rouche's theorem.
The fundamental theorem of algebra.
Wednesday, Dec 13: **Final Exam.**

Homework 1.

Due Tuesday, Oct 3 in class. Solve the following questions from the textbook.

(1) Page 7, Problem 1.
(2) Page 11, Problem $1(a)$ and Problem 4.
(3) Page 13, Problem $2(a)$.
(4) Page 14, Problem 14.
(5) Page 21, Problem 1 and 5.
(6) Page 28, Problem 2 and 7.