MATH 305/573 – Complex Calculus
Fall 2021 Instructor: Gökhan Göğüş

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Mathematics is the language of physicists and is shared by scientists and engineers working in several branches; it provides a framework for making precise models of the real world and opens the road to making far-reaching predictions and applications of such models. The approach to teaching and learning of mathematics for beginners falls into two broad categories. One approach is to go through a rigorous cycle of learning definitions, theorems proofs, and their analysis by means of examples and counterexamples. The other approach, advocated by many scientists and engineers, often reduces to learning only the recipes and using them to solve problems encountered in the real world. The path followed in the course attempts to take the best of these two approaches.

Lectures

Monday 15:40-17:30 FASS 1008-1010, Wednesday 11:40-12:30 FENS G032, 17:40-18:30 (online problem session).

Course teaching assistant. Umutcan Erdur (umutcanerdur@sabanciuniv.edu)

Textbook

Zill D., Shanahan P. A first course in complex analysis with applications (2003)(517 pages) (look at SuCourse for more info!). We will use this book for more exercises.

We will cover majority of the chapters 1 -- 6.

Recommended Reading

Fundamentals of complex analysis: with applications to engineering and science, 3rd Edition, E. B. Saff and A. D. Snider, Pearson, 2003.

Basic Complex Analysis, J. E. Marsden and M. J. Hoffman, W. H. Freeman, New York.

Complex Variables, S. D. Fisher, Dover, New York, 1999.

Course Outline

Analytic functions, Cauchy's theorem and the Cauchy integral formula. Taylor series. Singularities of analytic functions, Laurent series and the calculus of residues. Residue theorem. Asymptotic expansion. Conformal mappings.

Homework. During the semester I will announce problems for homework. All homework should be done separately. Your solutions of homework will be collected and **randomly they will be graded.** There is no make up for homework. However, the best 4 homework out of 5 will count as your homework grade; overall homework is 40% of your total grade.

Tests/Grading

There will be one midterm, five homework.

Best 4 Homework		40%
Midterm		60%

The grading scale subject to change: 93-100 A, 97-92 A-, 83-86 B+, 79-82 B, 75-78 B-, 71-74 C+, 65-70 C, 61-64 C-, 57-60 D+, 50-56 D, and below 50 F.

Attendance: Students are strongly advised to attend all the lectures.

Makeup Policy

If you miss the exam, you **must** contact me and explain your excuse as soon as possible. If it is a health problem you must bring your doctor's report, which is given or checked by SU Health Center, as well. In case you are unable to visit me, you, a friend or a relative should somehow (e-mail, phone, etc.) let me know about the situation.

There will be a make-up for the midterm for those who have a valid excuse for not taking this exam. The time of the makeup will be announced towards the end of semester.

Academic Honesty

We expect you to follow common-sense practices during the exams and all course activities. **Cheating will not be tolerated.** The action against such violations could range from getting a zero on the particular exam to explaining your case in front of the Disciplinary Committee.
http://mysu.sabanciuniv.edu/yonerge/Akademik_durustluk/E-Investigation.html

Goals. By the end of this course, students should be able to:
(a) Operate with complex numbers,
(b) Differentiate and integrate complex valued functions,
(c) Distinguish analyticity from differentiability by real variables (Cauchy-Riemann equation),
(d) Understand how analytic and harmonic functions are connected,
(e) Formulate Cauchy Theorem and Cauchy Formula and apply them consciously for integration,
(f) Identify Taylor and Laurent expansions and distinguish isolated singularities,
(g) Apply Cauchy Residue Theorem to calculations of definite integrals,
(h) Find conformal mappings between simple domains (disks, half-planes, strips, half strips, sectors etc.),
(i) Apply conformal mappings to solution of Dirichlet Problem for Laplace equation in some simplest domains.

If you need extra help:
Always keep in mind that it is very natural and all right if you do not understand a concept or some thing in the lecture. I am available to help. Ask questions. Benefit office hours.

Suggestions

- Regular study habits are sufficient to get a decent grade.
- **Attend the classes regularly.**
- Studying out of class for this course should become a routine. Key to success in mathematics is practice. **Solve many problems** related to each concept. You must try to reproduce the results derived in class and apply the computational techniques to other problems on your own. You must spend an average of six hours per week on studying the material covered in class and on doing the suggested exercises.
- **You are responsible from every announcement made in class or in SUCourse.** Not attending the class or not following SUCourse regularly is not an excuse, in case you miss something.
- **I am available to help.** Feel free to ask me a question in and out of class. If you cannot make it to our office hours, you should e-mail me ahead of time and make an appointment.

Web sites of interest
http://en.wikipedia.org/wiki/Complex_analysis
Lots of references and external links.

GOOD LUCK!

Course Schedule:

Dates	Section Readings (weekly)	Homework (HW)
Sep 27	1.1-1.5 Algebra of complex numbers	
Oct 4	2.1-2.6 Elementary functions	
Oct 11	3.1-3.2 Analytic functions	
Oct 18	3.3, 4.1 CR-equations	**HW1**
Oct 25	4.2-4.3 Complex powers	
Nov 1	5.1-5.2 Complex integrals	
Nov 8	5.3-5.4 Cauchy-Goursat theorem	**HW2**
Nov 15	5.4-5.6 Cauchy integral formula	
Nov 22	6.1-6.2 Taylor series	**HW3**
Nov 29	6.3-6.4 Laurent series	
Dec 6	6.5 Residue theorem	**HW4**
Dec 13	6.6 More on residues	
Dec 20	6.7 Applications	**Midterm**
Dec 27	Overall Review	**HW5**

Add-drop period: 5-6 October 2021.

My weekly schedule

	Mon	Tue	Wed	Thu	Fri
8.40-9.30					
9.40-10.30	Math 505				
10.40-11.30	Math 505				
11.40-12.30	Office hrs		Math 305/573		
12.40-13.30					
13.40-14.30					
14.40-15.30					
15.40-16.30	Math 305/573				
16.40-17.30	Math 305/573		Math 505		
17.40-18.30			Recitation		
18.40-19.30					