

## MATH 3160-001, TWF 1:00 - 2:20 IN LCB 215

### 1. INSTRUCTOR

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Office hours: TWF 11AM - 1PM, except on July 04 and 24, holidays.

### 2. SYLLABUS

This is an introduction to Complex Analysis. The textbook is *Complex Variables and Applications* by Brown and Churchill (7-th edition). Unfortunately, since every edition adds about 30 pages, this book has grown into a 450 page monster. In particular, it is impossible to specify precisely sections that we will cover. A prominent theme in complex analysis is contour integrals. Our first goal is to review some properties of complex numbers and get to contour integrals by the end of June. The first major theorem is Cauchy-Goursat. It says that an integral of a holomorphic function over a closed contour is zero. (A function on a complex domain is holomorphic (or analytic or regular) if it is differentiable once on the domain.) A consequence of this theorem is that any holomorphic function can be expanded into a power series. Thus, if a complex function is differentiable once on a domain, it is differentiable infinitely many times! This property illustrates a stark difference between real and complex functions. This is, in short, the first half of the course and it corresponds to a sparse subset of the first 5 chapters in the book. (Sparse only in volume, not in substance. Think of the book as an overblown balloon of helium.)

### 3. GRADING

The grade will be based on three components: Homework 30%, two in-class exams 40% and the final, comprehensive, exam 30%. Each exam will be preceded by a sample exam, which should give you a very good idea about the topics and types of problems appearing on the exam. Homework and exams are given according to the following “every other week” schedule:

Homework: Due on Tuesdays: July 03, July 17, July 31.

Exams: Fridays: July 06, July 20 and FINAL EXAM on Aug 03, 12:30 - 2:30 in our classroom.

## 4. HOMEWORK PROBLEMS

The homework problems are from the book. For example, 1 (a) [7] means problem number 1, part (a) from the page 7. I will update problems as we go and will let you know when a set of problems is complete. The following is roughly one half of the first HW set, so please get going.

First HW: 1 (a) (c) [7]; 4 [11]; 6 (c) (d) [21]; 1 (a) (b) (c) (d) [31] ; 1, 3 [42]; 1 [59]; 8 (b) [60]; 1 (a) (c) (d), 2 (c) [68]; 1, 2 [129]; 1 (a) (b) (c) [153]. End of the first HW.

Second HW: 2 [153]; 1 (a) (b) (c), 2 [162-163]; 6 [172]; 3, 5, 7, 13 [189-190]; 5 [198]; 3 [213]. End of the second HW.

Third HW: 1 [218]; 1 (a) (b), 3 (a) (b) [230]; 1, 4 (a) [245]; 2, 6 [257]; 1, 6, 7, 8 [285-286]. End of the third HW.

## 5. COURSE LOG

06/22 Complex numbers, polar coordinates, domains.

06/26 Domains, mappings, differentiability.

06/27 Differentiability, Cauchy - Riemann equations, contour integrals.

06/29 Contour integrals, Cauchy-Goursat Theorem.

07/03 Review.

07/06 Exam.

07/10 Cauchy's formula. Maximum modulus principle.

07/11 Fundamental Theorem of Algebra. Power series.

07/13 Louville's Theorem. Laurent series.

07/17 Residues and Poles.

07/18 Review.

07/20 Exam.

In the last part of the term we cover sections 64, 69, 71, 72, 79 and 80.