MA 713 **SPRING 2006** **M. KON**

Prof. Mark Kon
Room 259, 111 Cummington St. (MCS Bldg.)
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OFFICE HOURS:

TUESDAY 12:30-2
THURSDAY 3:30-5
... And by appointment

This course is an introduction to complex analysis. This field is the completion of the study of the real numbers, and a domain in which pure real number results can be proved much more easily. "Imaginary" or complex numbers have been used in as diverse a set of applications as the study of fluid flow, to the first proof of the prime number theorem 100 years ago, in which the density of the prime numbers in all natural numbers was first established as being inverse logarithmic.

Text: The text is "Complex Analysis", by Lars Ahlfors, third edition.

Homework: Homework assignments will be given out each Thursday, and collected on Thursday of the following week. Homework will determine 30% of the final grade. There will be a midterm and a final, which will determine 25% and 35% of the final grade, respectively. An additional 10% of the grade is for coming to and participating in class - one of the most important aspects of the course.

Given the diffuculty of some of the material, it is strongly recommended that the homwork be given careful attention, even aside from its importance in terms of the course grade. Solutions to assigned problems will be made available. Please note that full reasoning should be given in all problem solutions. Please staple homework. Late homework will not be accepted. Note that missing any homeworks can harm one's grade. If you have not finished all of the problems, then please turn in what you have completed.

In a course like this, it is natural to emphasize the notion of rigorous exposition. This is reflected in the need for rigor and care in written problem solutions. I will emphasize the need for good written communication of ideas in the homework assignments, and the ability to formalize intuitive mathematical notions clearly. This will include the requirement of well written and thought-out problem solutions. Feel free to consult with me on what will be expected of you here.

Topics to be covered:

1. **Basics:**
   Complex numbers and their algebra

Geometry of complex numbers: the complex plane

2. **Functions of a complex variable**
   Analytic functions
   Power series representations
   Other power series representations: exponential and trigonometric functions

3. **Geometry of analytic functions**
   Point set topology (brief treatment)
   Conformal transformations
   Linear fractional transformations
   Geometry of conformal maps
   Riemann surfaces

4. **Complex integration**
   Fundamentals
   The Cauchy integral formula
   Analytic functions: local properties
   Cauchy's theorem
   Residue calculus: evaluation of contour integrals
   Harmonic functions

5. **Series and products**
   Power series
   Partial fractions expansions and factorization
   Entire functions
   Normal families of functions

6. **Conformal mapping**
   Riemann mapping theorem
   Applications to fluid flow
   Conformal mapping of polygons - Schwarz-Christoffel transformation