

# MA556 – Real Analysis

*Dr. Stefan Ehrlich*

*Graduate Computer Science / Mathematics Department*  
Spring Semester, 2005

**Contact Info:**

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**Text:**

Advanced Calculus  
Witold Kosmala, 2004, second edition  
Prentice Hall

**Office Hours:**

Monday 4:30- 6:30, 9:00- 9:30  
Tuesday 1:30-2:30, 4:00- 5:00 PM  
Thursday 1:30-2:30, 4:00-5:30 PM

**Brief Course Description:**

Advanced Calculus ( Mathematical Analysis ) is designed to bridge the gap between the two or three semester basic calculus courses offered at the freshman/ sophomore level and the sophisticated analysis courses taken at the senior or graduate level. Through a rigorous approach to standard topics covered in your calculus courses – existence, limits, continuity, differentiation, integration, and the structure of the real axis - this course offers a deeper and fuller understanding of the many ideas encountered in the calculus.

**Course Objectives:**

This course has been designed with two important goals in mind:

the development of a rigorous foundation for the basic topics of analysis  
the less tangible acquisition of an accurate intuitive feeling for analysis

In the interest of these goals, considerable time is devoted to motivating and developing new concepts.

**Classroom Policies:**

Students are expected to attend and participate in all classes. Attendance is taken at the beginning of each period. Please notify the instructor in advance of any anticipated absence whenever possible. It is your responsibility to make up any material missed whenever you are absent.. Assignments are related to material covered in class. The homework problems are always covered in a timely fashion and questions about the problems should be raised at the next class meeting. The study of mathematics/computer science requires regular work and plenty of practice. Postponed homework usually results in poor comprehension and performance.

**Teaching Strategies:**

Lecture format, with numerous examples chosen to illustrate theoretical concepts. Lots of drill with emphasis on practice, practice, and more practice. Questions are encouraged and discussion of material stressed.

## **Course Requirements and Grading Policies:**

Students will be evaluated based on midterms and a final exam as follows:

Midterms - 60%      Final - 40%

All tests are closed book and the final is comprehensive. The results will be converted to a letter grade in keeping with grading policies of the college.

Graduate students will be assigned a term project. This will count as 10% of their grade with the final counting 30%. Each graduate student will be required to meet with the instructor throughout the semester to discuss his or her term project.

## **Material Covered:**

### 1. Real Axis

Proof Techniques, and Application of Derivatives to Graphing ( Review, as needed )  
Rational and Irrational Numbers  
Dedekind Cut and the Archimedean Order Property  
Countable and Uncountable Sets  
Structure of the Real Axis

### 2. Existence and Continuity

Limits of Functions ( Review, as needed ) in Single and Multi-dimensions  
Continuous and Discontinuous Functions  
Extreme Value, Intermediate Value, and the Fixed Value Theorems and their applications  
Uniform Continuity

### 3. Differentiation

Derivative of a Function  
Functions not Differentiable at a Point and Functions not Differentiable anywhere  
Relation between Existence, Continuity and Differentiability  
Rolle's Theorem, Mean Value Theorem, and the Location of Extremum of Functions

### 4. Integration

Riemann Integral  
Integrable and Nonintegrable Functions  
Fundamental Theorem of Integral Calculus and Mean Value Theorems for Integrals  
Relation between Existence, Continuity, Differentiability, and Integrability  
Improper Integrals