Overview: While most of science is based on inductive reasoning, mathematics is based on deductive reasoning. This means that new results are formed from logical combinations of hypothesis and statements accepted as true. Every result and technique learned in calculus (and other mathematics courses) is logically consistent and can be derived in a rigorous manner. In this course students begin to study some basic properties used to develop the fundamental calculus results including convergence of sequences, limit of a function, continuity (point-wise and uniform), derivative of a function, Rolle’s theorem and the mean value theorem, L’Hôpital’s rule, inverse function theorem, Riemann integrals, Fundamental Theorem of Calculus, and derivatives of integrals. To be able to understand these results, and their proofs, it is necessary to develop a solid foundation in the real number system. It is also necessary to develop the ability to read, understand and write mathematical proofs. One of the most important steps in the creation of a mathematical proof is a solid understanding of the basic definitions. Unlike most previous courses you have taken, it is essential to pay attention to the details and technicalities. While this may be slightly unnatural, it is a skill that can be acquired through practice and patience.

Instructional Objectives: Students will become knowledgeable about and will master concepts of real analysis. Students will improve their ability to write and read mathematical proofs, particularly those related to the least upper bound axiom, compactness, sequences, continuity, uniform continuity, differentiation, Riemann integration, and the Fundamental Theorem of Calculus.

Text: Carol S. Schumacher, Closer and Closer. Introducing Real Analysis, Jones and Barlett.

Prerequisite: C or better in MATH 300 and at least one of MATH 511, 520, 534, 550, or 552, or consent of the Undergraduate Director.
**Grading:** Your grade in this course will be based on your performance on quizzes, on your final exam and your attendance, according to the formula:

$$\left[\left(\text{Sum of the scores in your quizzes including the three quizzes of the final exam but excluding your lowest quiz which will be dropped}\right) \div \left(\text{the total number of quizzes given in class } - \left(\text{the number of quizzes that you missed because of excused absences}\right) - 1\right)\right] - \left(\text{Attendance penalty if you have more than 3 absences whether excused or unexcused}\right).$$

The cut-off points are: $A =[9,10]$, $B+=[8.5,9)$, $B = [8,8.5)$, $C+ = [7.5,8)$, $C = [7,7.5)$, $D+ = [6.5,7)$, $D = [6,6.5)$, $F= [0,6)$.

**Quizzes:** The students are supposed to read by themselves the assigned materials (usually the next one or two sections) and solve the assigned set of problems (usually all the exercises of the assigned sections). In fact the author of our textbook wrote our textbook in such a way that the students will be able to read it by themselves and solve the problems by themselves! My role will be mainly to moderate classroom discussions, and to grade quizzes. A quiz will be given during every class period and it will be related to the materials that were assigned to the students to study at the end of the previous class period. The quiz will contain approximately 2 questions and it will take approximately 15 minutes. Your notes and your book has to be kept closed during the quiz. Your lowest quiz score will be dropped (this could be for instance an unexcused absence, or one of the three quizzes of the final exam).

**Excused absences:** If you miss a quiz because of a documented reason of illness or family emergency or participation in a University sponsored event, and you inform me before the quiz, as well as provide me with the appropriate documentation on your first day of your return to school, then you will be excused from the missed quiz.

**Attendance penalty:** According to the undergraduate academic regulations, "Absence from more than 10 percent of the scheduled class sessions, whether excused or unexcused, is excessive and the instructor may choose to exact a grade penalty for such absences." Note that 3 absences from class lectures constitutes more than 10 percent of the scheduled class sessions. If you have more than 3 absences from the class sessions, whether excused or unexcused, an attendance
penalty will be applied to your grade.

**Final Exam:** The final exam will be on Tuesday, May 7 at 12:30 p.m. and will be composed from three quizzes.

**Presentation points:** During every class session students will be given the opportunity to present problems on the board. Every presentation will be awarded 1, 2 or 3 points depending on its quality and the difficulty of the problem (each quiz will be graded in the scale 0-10). You are allowed to have your notes with you when you present, but not to copy your notebook on the board. When you are presenting you are supposed to write complete sentences on the board, to make sure that your classmates understand, and to make eye-contact with them, (you do not need to make eye-contact with me!). Your classmates are encouraged to ask you questions when you are presenting. When a student asks a presenter a question, not only the student who asks benefits but the whole class!

**703I:** The students who take graduate credit from the class will need to make at least 7 presentations.

**Cell phones, computers and newspapers:** Turn off cell phones during classes. You are not permitted to use computers or read a newspaper inside the classroom, because this distracts the rest of the students and me.