Math 370 Real Analysis I Spring 2006

Text: *Introduction to Analysis,* 3rd Edition, by William R. Wade (published by Prentice Hall).

Lecture: MWF 10:10-11:00am **Room:** TH 326

Instructor: Joseph Gubeladze

Office: TH 941

Phone: (415) 338 7722

Contact – e-mail: soso@math.sfsu.edu

Office Hours: We 1:00 – 3:00pm

Prerequisites: Standard calculus courses (culminating with Math 228) and Exploration and Proof (Math 301) with letter grade "C" or better. It is very important that you have taken a course requiring rigorous mathematical proofs. If you have not taken Math 301 please see me.

Grading:

Two midterms – 20% each

Final – 30%

Homework (assigned each week on Fridays) – 25%

Attendance – 5%

Course Plan:

Sections to be covered before the 1st Midterm: §§1.1, 1.2, 1.3, 1.4, 2.1, 2.2, 2.3, 2.4

Review before the 1st Midterm Exam – March 3

1st Midterm – **March 6**

Sections to be covered before the 2nd Midterm: §§3.1, 3.2, 3.3, 4.1, 4.2, 4.3

Review before the 2nd Midterm – April 14

2nd Midterm – **April 17**

Sections to be covered before the Final Exam: §§4.4, 5.1, 5.2, 5.3

Final Exam – **May 26**

Make-up exams will be given for *serious* documented reasons, by prior arrangement.

Course Description:

Real Analysis 1 is the course where the rigorous proofs of all theorems of Calculus 1 are found.

More systematically, the principal aim of Real Analysis 1 is for students to learn how to carry out a rigorous analysis of calculus of functions of a real variable. Students are expected to learn how to write, in a logical manner, important theorems and properties of continuous, differentiable, and integrable functions. Students learn to solve problems using the concepts of analysis. They will be able to devise, organize and present brief (half-page) solutions based on definitions and theorems of analysis.

Students who successfully complete this course will be capable of applying the Completeness Axiom. They will also be able to prove and apply the Bolzano-Weierstrass Theorem, the Intermediate Value Theorem, the Mean Value Theorem, the Inverse Function Theorem and the Fundamental Theorem of Calculus. They will be able to define uniform continuity and be able to prove that continuous functions defined on closed bounded intervals are uniformly continuous. Students will also demonstrate that rational, trigonometric, exponential, and logarithmic functions are differentiable. They will be able to construct differentiable functions that are not continuously differentiable. Students will be able to determine if a function has a continuous or differentiable inverse. Students will be able to prove that continuous functions are Riemann integrable.

Topics to be covered:

Chapter 1: The Real Number System: ordered field axioms, the Well-Ordering Principle, the Completeness Axiom, countability.

Chapter 2: Sequences in $\mathbb{R}$: limit theorems, Bolzano-Weiertrass Theorem, Cauchy sequences.

Chapter 3: Continuity on $\mathbb{R}$: two and one-sided limits of functions, limits of functions at infinity, continuity, uniform continuity.

Chapter 4: Differentiability on $\mathbb{R}$: the derivative, differentiability theorems, the Mean Value Theorem, LHôpitals Rule, monotone functions, the Inverse Function Theorem.

Chapter 5: The Riemann integral: Riemann sums, The Fundamental Theorem of Calculus.

Homework Policy:

• Homeworks will be assigned weekly on Fridays and will be due on next Fridays. I will collect them in class.

• Don't turn in work copied off the Internet: such a student won't learn anything so won't pass the exams, and this is easily detectable.

• If you cannot solve a problem completely, then you can turn in a partial answer that is correct as far as it goes.

• Don't turn in wrong answers: a wrong answer tells me that not only were the student unable to solve the problem but he/she couldn't even tell if an answer was correct. A good rule is: if one is not sure an answer is correct, then it is probably wrong.

• Recognize the two principal steps of problem solving: understanding the problem and finding the solution.

• You are encouraged to work in groups up to three, although the homework writeups must be individual.

• No late homework will be accepted.

Classroom Policy:

• Please be punctual, not be late in class;

• Cell phones must be turned off during classes.

• If a schedule conflict does not allow you to come to my office hours please feel free to e-mail me and make an appointment.

• All up-to-date information (homework assignments, solutions, announcements) will be posted on the course page:

http://math.sfsu.edu/gubeladze/classes/spring2006/370/370.html