

8-26-14

**MATH 4200
FOUNDATIONS OF ANALYSIS
SYLLABUS**

Instructor: Robert Heal, Professor
Department of Mathematics and Statistics
435-760-5771 bob@math.usu.edu

Objectives: This course serves as a transition from the intuitive development of calculus to the more rigorous advanced calculus and analysis courses. After reviewing elementary logic and set theory, students will construct the real number system and then focus on the theory of limits and continuity. Emphasis is placed on understanding, constructing, and writing proofs. A historical perspective is also provided by considering some of the famous proofs, problems, and personalities in the history of mathematics.

Prerequisites: Math 2210, 2250; or 2210, 2270, 2280 (3F, Sp)

Textbook: *Introduction to Analysis 5th Edition*, Edward D. Gaughan, American Mathematical Society 2009. ISBN-978-0-8218-4787-9

Office Hours: 2:30 - 3:30 PM; T, Th in AnSci 306

Examinations:	Test 1	100 points
	Test 2	100 points
	Final	200 points (comprehensive)

Quizzes: Five quizzes will be given, each worth 20 points.

Assignments: Written assignments will be collected and a portion of each will be graded. Their total will be worth 100 points. Late assignments will not be accepted.

Grading Policy: Grades will be based on the 600 points indicated above. The following is an approximate grade distribution.

A: 30% B: 45% C: 20% D,F: 5%

Topics Covered:

1. Language and Proofs
Quantifiers and logical statements, negations, introduction to proofs, counting principles
2. Sets and Numbers
Notation and terminology about sets, set operations

3. Functions
Definitions and terminology, sequences, graphs, bijections, composition
4. Mathematical Induction
Axioms for the natural numbers, equivalent induction axioms, induction proofs, Fibonacci numbers
5. Counting and Cardinality
Finite and infinite sets, countable and uncountable sets
6. Divisibility
Division algorithm, prime factorization theorem
7. Rational Numbers
Equivalence relations, constructing the rationals, irrational numbers
8. Counting Principles and Recurrence Relations
Binomial coefficients, pigeon hole principle,
9. Real Numbers
Completeness axiom, the Archimedean property, limits of sequences, monotone convergence theorem, decimal expansions, uncountability of \mathbb{R}
10. Sequences and Series
Cauchy sequences, squeeze theorem, Bolzano-Weierstrass Theorem, harmonic series, tests for convergence
11. Continuity
Characterization of continuity, Intermediate Value Theorem, uniform continuity
12. Differentiation
Linear approximation theorem, derivative rules, Chain Rule, Mean Value Theorem
13. Integration
Definition of the integral, Fundamental Theorem of Calculus

Mathematics is the nuclear furnace of science. It is the crucible in which the fundamental ideas and concepts of science are created. It is for this reason that mathematics has been crowned the queen of the sciences ... It is difficult to define mathematics and one knows something about it only by doing it. Its enjoyment can only be experienced. It has many virtues. It enjoys the precision of science as well as the creative freedom of art. And if one listens carefully, one can hear its music as well.

M. Ram Murty, Professor of Mathematics, McGill University