

# MATH 5341 – Real Analysis

## Fall 2008

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**Course Blackboard Names and Access Codes:**

2008-FALL-MATH-5341.001 - Real Analysis      Access Code: 5341.001

**Required Text:** Real Analysis by H. L. Royden, 3rd edition, ISBN 0024041513

### Description of Course

Topics include set theory, the real number system, Lebesgue measure, the Lebesgue integral, differentiation and integration, classical Banach spaces.

### Prerequisites

Equivalent of MATH 4341 – Real Analysis II

### Grades

Your grade will be based on exams and homework. The exams will constitute 70% of your grade and the homework 30%. Some of your homework grade will come from in-class presentations. There will be two or three midterm exams (40%) and a comprehensive final exam (30%).

### Homework

We learn by doing, so I will regularly assign and collect homework assignments. Student collaboration on the homework is allowed and encouraged, but don't cross the line into plagiarism!

### Disability Statement

If you have a disability, including a learning disability, for which you request disability support services/accommodation(s), please contact Ida MacDonald in the Disability Support Services office so that the appropriate arrangements may be made. In accordance with federal law, a student requesting disability support services/accommodation(s) must provide appropriate documentation of his/her disability to the Disability Support Services counselor. In order to assure approved services the first week of class, diagnostic, prognostic, and prescriptive information should be received 30 days prior to the beginning of the semester services are requested. For more information, call or visit the Student Services Center located in the University Center, Room 282. The telephone number is 566-7079 (TDD 565-5579). Additional information may also be obtained at the following UT Tyler Web address: <http://www.uttyler.edu/disabilityservices>.

### Social Security Statement

It is the policy of The University of Texas at Tyler to protect the confidential nature of social security numbers. The University has changed its computer programming so that all students have an identification number.

### Note Regarding Student Absence due to Religious Observance

Students who anticipate being absent from class due to a religious observance are requested to inform the instructor by the second class meeting of such absences.

## **Grade Replacement**

If you are repeating this course for a grade replacement, you must file an intent to receive grade forgiveness with the registrar by the 12th day of class. Failure to file an intent to use grade forgiveness will result in both the original and repeated grade being used to calculate your overall grade point average. A student will receive grade forgiveness (grade replacement) for only three (undergraduate student) or two (graduate student) course repeats during his/her career at UT Tyler. (2008-2010 Catalog, p. 26)

## **Student Learning Outcomes**

By the end of this course, the student will be able to do the following:

- Describe the differences and similarities between undergraduate real analysis and graduate real analysis with an eye toward describing the advantages of the more advanced theory.
- Prove classical theorems concerning real analysis
- Solve new problems in real analysis

## Course Outline

1. Foundations Review
  - (a) Functions
  - (b) Algebra of sets
  - (c) Axiom of Choice
  - (d) Countable sets
  - (e) Relations and equivalences
  - (f) Partial orderings and the Maximal Principle
  - (g) Well orderings and the countable ordinals
2. The Real Number System
  - (a) Axioms of  $\mathbb{R}$
  - (b)  $\mathbb{N}$  and  $\mathbb{Q}$
  - (c) The extended real numbers
  - (d) Sequences
  - (e) Open and closed sets
  - (f) Continuous functions
  - (g) Borel Sets
3. Lebesgue Measure
  - (a) Outer measure
  - (b) Measurable sets and Lebesgue measure
  - (c) A nonmeasurable set
  - (d) Measurable functions
4. The Lebesgue Integral
  - (a) The Riemann integral
  - (b) The Lebesgue integral with boundedness conditions
  - (c) The integral of a nonnegative function
  - (d) The general Lebesgue integral
5. Differentiation and Integration
  - (a) Differentiation of monotone functions
  - (b) Functions of bounded variation
  - (c) Differentiation of an integral
  - (d) Absolute continuity
  - (e) Convex Functions
6. The Classical Banach Spaces
  - (a) The  $L^p$  spaces
  - (b) The Minkowski and Hölder inequalities
  - (c) Convergence and completeness
  - (d) Approximation in  $L^p$
  - (e) Bounded linear functionals on the  $L^p$  spaces