INTRODUCTION TO ANALYSIS

MATH 3230/8235

Course Description:

Provides a theoretical foundation for the concepts of elementary calculus. Topics include the real number system, topology of the real line, limits, functions of one variable, continuity, differentiation, and integration. **3 credits**

Prerequisites:

MATH 1960 and MATH 2230

Overview of content and purpose of the course:

This course provides students with a theoretical foundation for the concepts of elementary calculus and to provide the background for more advanced courses in analysis.

Anticipated audience/demand:

Students majoring in mathematics or desiring a knowledge of the theoretical foundation for the concepts of elementary calculus.

Major topics:

This list of topics is similar to those found in any elementary calculus text. In this course, however, emphasis is to be placed on the theoretical foundation for these concepts. Students will be expected to understand definitions and to be able to prove for themselves theorems selected by the instructor.

1) Sets and Functions

2) The Real Number System
- **a.** Development of the Real Numbers
- **b.** Real Numbers as a Field, Some Proofs Using Axioms
- **c.** Inequalities and Absolute Values
- **d.** Least Upper Bounds and Greatest Lower Bounds

3) Topology of the Real Line
- **a.** Open and Closed Sets, Neighborhoods, Limit Points
- **b.** Compact and Connected Sets
- **c.** Bolzano-Weierstrass Theorem
- **d.** Heine-Borel Theorem

4) Limits

a. Sequences
b. Functions of One Variable
c. Continuity
d. Properties of Continuous Functions

5) Functions of One Variable - Differentiation

a. Definition of the Derivative
b. Statement and Proof of Some Theorems on the Derivative which commonly appear in Elementary Calculus.

6) Functions of One Variable - Integration

a. Definition of the Riemann Integral
b. An Existence Proof for the Riemann Integral

Methods:

The class will be presented primarily in lecture form with student questions and discussion encouraged.

Textbook:

Dangello, Frank, and Michael Seyfried. *Introductory Real Analysis*. Boston: Houghton Mifflin, 2000.

February 2016