Mathematics 4331 – Analysis

**Student Learning Outcomes**

1. **The students will demonstrate an understanding of factual knowledge including the mathematical notation and terminology used in this course.** Students will read, interpret, and use the vocabulary, symbolism, and basic definitions used in set theory, function theory, and single variable calculus.
2. **The students will describe the fundamental principles including the mathematical rules and theorems arising from the concepts covered in this course.** Students will identify and apply the results of major theorems including theorems involving least upper bounds and greatest lower bounds, convergence of sequences, properties of continuous functions, differentiation, and integration.
3. **The students will apply course material using with techniques and procedures covered in this course to solve problems.** Students will utilize the facts, concepts, and techniques learned in this course to provide mathematical justification for basic theorems and related examples that form the foundations of calculus.

**4. The students will develop specific skills, competencies, and thought processes sufficient to support further study, or work in this field or related fields.** Students will acquire a level of proficiency in basic concepts and techniques necessary for further study in mathematics or for work in occupational fields requiring the application of logical inquiry or mathematical reasoning.

# Course Content

Textbook: *Foundations of Analysis,* 2nd. ed., by David Belding and Kevin Mitchell. Content consists of the following topics, listed according to the corresponding chapters in the text.

**Chapter 1: The Real Number System.** Introduction, Irrational Numbers, Constructing the Real Numbers, An Axiom System for the Real Numbers, The Heine-Borel and Nested Interval Theorems.

**Chapter 2: Functions, Limits, and Continuity.**  Introduction, Functions, Limits, Limit Theory, Other Types of Limits, Continuity, Continuity on Closed Intervals.

**Chapter 3: Differentiation and Integration.** Introduction, The Derivative, Elementary Laws of Differentiation, The Mean Value Theorem, Integration.

**Chapter 4: Sequences and Series.** Introduction, Infinite Sequences, Monotone and Cauchy Sequences.

**Additional topics as time allows:** Properties of the Integral, The Fundamental Theorems of Calculus, Taylor Polynomials, Infinite Series.