

INTRODUCTION TO ANALYSIS
MATH 3230/8235

1.0 Course Objectives

- 1.1 Overview of Content and Purpose** (3 hours) 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, integration.
- 1.2 For Whom Intended:** Students majoring in mathematics or desiring a knowledge of the theoretical foundation for the concepts of elementary calculus.
- 1.3 Prerequisites:** MATH 1960 and MATH 2230
- 1.4 Unusual Circumstances:** None

2.0 Objectives

- 2.1 Performance Objectives for the Student:** to provide students with theoretical foundation for the concepts of elementary calculus and to provide the background for more advanced courses in analysis.

3.0 Content and Organization

- 3.1 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.

- I. Sets and Functions
- II. 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
- III. 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
- IV. Limits
 - a. Sequences
 - b. Functions of one variable
 - c. Continuity
 - d. Properties of continuous functions
- V. 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.
- IV. Functions of One Variable- Integration
 - a. definition of the Riemann integral
 - b. An existence proof for the Riemann integral.

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4.0 Teaching Methodology

- 4.1 Methods to be Used:** The class will be presented primarily in lecture form with student questions and discussion encouraged.

5.0 Evaluation

- 5.1 Basis for Evaluating Student Performances:** The grade will be determined primarily from examinations and problem assignments as determined by the instructor. Graduate students may be required to complete assignments not required of undergraduate students.

6.0 Resource Material

- 6.1 Textbook(s) or Other Required Readings:** Lay, *Analysis, with an Introduction of Proof*, Prentice Hall, publisher. ISBN-0-13-1481011-0

- 6.2 Current Bibliography Of resources:** Apostol, T.M., *Mathematical Analysis*, Addison-Wesley.
Bartle, R.G., *The Elements of Real Analysis*, John Wiley & Sons
Olmsted, J.M.H., *Real Variables*, Appleton-Century-Crofts, Inc.
Rudin, W., *Principles of Mathematical Analysis*, 2nd addition, McGraw Hill
Taylor, A.E., and Mann, W.R., *Advanced Calculus*, Xerox.