MATHEMATICS 321/322

ADVANCED CALCULUS I & II

I. Introduction

A. Catalog description

This course is an introduction to advanced analysis. Topics of study include set theory, the topology of Euclidean spaces, functions, continuity, differentiability of functions and mappings, integration, series, uniform convergence, transformation of multiple integrals, differential geometry of curves and surfaces, and vector calculus. Satisfies the proof-based requirement in major contracts. *Prerequisites: MATH 280 and 290 or equivalents, MATH 321 for 322.* MATH 321 offered Fall term only; MATH 322 offered Spring term only.

B. Objectives

The primary goal for students in this sequence is to understand the language, fundamental concepts, and standard theorems of analysis so that they will be prepared to read and appreciate appropriate mathematical literature. An additional goal for students in the course is to develop the ability to construct and write proofs that are logically clear and precise.

C. Prerequisites

Math 321: Math 280 and 290 or equivalents.

Math 322: Math 321.

II. Required Topics (Math 321 and 322)

A. Real numbers and Euclidean space

1. Axioms or construction of the real numbers
2. Euclidean space and the inner product
3. Open, compact, and connected sets in Euclidean space
4. Functions and mappings

B. Sequences and series

1. Sequences and series of numbers and functions
2. Convergence and uniform convergence
3. Limits
4. Continuity and uniform continuity

C. Differentiation

1. Derivatives for functions and mappings
2. Taylor’s Theorem
3. Mean Value Theorems
4. Inverse and Implicit Function Theorems

II. Required Topics (cont.)

D. Integration

1. Integrable functions and integrability criteria
2. Fundamental Theorems of Calculus
3. Fubini's Theorem

III. Optional Topics

A. Numerical methods

B. Point set topology

C. Improper integrals

D. Lebesgue integrals

E. Differentiable manifolds

F. Differential geometry

G. Vector calculus

IV. Bibliography

T. Apostol, **Mathematical Analysis**

R. Buck, **Advanced Calculus**

P. Fitzpatrick, **Advanced Calculus**

P. Franklin, **A treatise on Advanced Calculus**

W. Fulks, **Advanced Calculus**

L. Loomis & S. Sternberg, **Advanced Calculus**

J. Lewin & M. Lewin, **An Introduction to Mathematical Analysis**

R. Strichartz, **The Way of Analysis**