



September 2011

## **MATH 248 Methods of Proof in Mathematics**

### 1. Catalog Description

#### **MATH 248 Methods of Proof in Mathematics (4)**

Methods of proof (direct, contradiction, conditional, contraposition); valid and invalid arguments. Examples from set theory. Quantified statements and their negations. Functions, indexed sets, set functions. Proofs in number theory, algebra, geometry and analysis. Proof by induction. Equivalence and well-defined operations and functions. The axiomatic method. 4 lectures. Prerequisite: MATH 143 or consent of the instructor.

### 2. Required Background or Experience

Math 143.

### 3. Learning Objectives

The student should be able to read and write proofs of elementary propositions in set theory, number theory, geometry, analysis, and algebra.

### 4. Text and References

The course supervisor has several possible texts and supplemental texts for the course. Some of the most appropriate ones (in alphabetical order) are:

1. Schumacher, Carol, Chapter Zero, 2nd ed., Addison-Wesley, 2000.
2. Schwartz, Diane Driscoll, Conjecture and Proofs, Brooks/Cole, 1996.
3. Smith, Douglas, et al., A Transition to Advanced Mathematics, 6th ed., Brooks/Cole, 2006.

### 5. Minimum Student Materials

Paper, pencils, and notebook.

### 6. Minimum University Facilities

Classroom with ample chalkboard space for class use.

7. Content and Method

<u>Content</u>	<u>Lectures</u>
a. <b>Logic and Proofs</b> Propositions, connectives, truth tables, conditionals and biconditionals, tautologies, quantifiers, negations, methods of proof	5
b. <b>Set Theory and Induction</b> Basic notions, set operations, power sets, indexed families of sets, proving theorems about sets, mathematical induction	8
c. <b>Relations and Functions</b> Cartesian products, relations, equivalence relations, partitions, basic notions of functions, composition, injections, surjections, bijections, inverse functions, proving theorems about functions	8
d. <b>Cardinality</b> Finite, countable and uncountable sets	4
e. <b>Topics in Analysis</b> Sequences, limits of sequences and functions, continuity, monotonic sequences, integration <i>or</i> <b>Topics in Algebra</b> Groups, homomorphisms, subgroups, cyclic groups, Lagrange's theorem, quotient groups	8
Total	<u>33</u>

8. Methods of Assessment

Comprehensive final exam, mid-term exams or quizzes, homework.