MATH 248 Methods of Proof in Mathematics

1. Catalog Description

MATH 248 Methods of Proof in Mathematics **4 units**

Prerequisite: MATH 143.

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.

2. Required Background or Experience

Math 143.

3. Learning Objectives

The student should:

a. 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. Suggested texts include:

- Schumacher, Carol, Chapter Zero
- Schwartz, Diane Driscoll, Conjecture and Proofs
- Smith, Douglas, et al., A Transition to Advanced Mathematics

5. Minimum Student Materials

Paper, pencils, and notebook.

6. Minimum University Facilities

Classroom with ample chalkboard space for class use.

7. Content and Method

Lectures

a. **Logic and Proofs** 5
Propositions, connectives, truth tables, conditionals and biconditionals, tautologies, quantifiers, negations, methods of proof

b. **Set Theory and Induction** 8
Basic notions, set operations, power sets, indexed families of sets, proving theorems about sets, mathematical induction

c. **Relations and Functions** 8
Cartesian products, relations, equivalence relations, partitions, basic notions of functions, composition, injections, surjections, bijections, inverse functions, proving theorems about functions

d. **Cardinality**
Finite, countable and uncountable sets 4

e. **Topics in Analysis** 8
Sequences, limits of sequences and functions, continuity, monotonic sequences, integration
or
Topics in Algebra
Groups, homomorphisms, subgroups, cyclic groups, Lagrange's theorem, quotient groups

Total 33

8. Methods of Assessment

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