MTH 210-COMMUNICATING IN MATHEMATICS SHARED GOALS
REVISED September 22, 2016

1. OVERALL GOALS:

- Students will demonstrate logical thinking skills and the ability to think abstractly in a proof oriented setting.
- Students will demonstrate the ability to construct and write mathematical proofs using standard methods of mathematical proof including direct proofs, proof by contradiction, mathematical induction, and case analysis.
- Students will demonstrate the ability to read and understand written mathematical proofs by being able to assess the validity of a proof and generate examples that follow the methodology of the proof.
- Students will develop creative thinking skills and strategies for problem solving including learning to look for patterns and constructing examples and counterexamples to better understand a definition, theorem, or problem.
- Students will learn to experiment with mathematical ideas and conjectures and not be afraid to make mistakes and learn from their from mistakes. This includes developing the ability to construct conjectures based on experimentation.
- Students will improve their quality of communication in mathematics. This includes improving writing techniques, reading comprehension, and oral communication in mathematics as detailed in the approved 'Guidelines for Writing Mathematical Proofs' file: http://bit.ly/1vqWWMn.
- Students will develop a view of mathematics as a living discipline whose practice includes precision in communication.
- Students will be able to typeset mathematics using LaTeX, writelatex.com, or using MS Word and its equation editor. (Instructors are encouraged to teach their students to use LaTeX.)

2. SPECIFIC CONTENT GOALS

- **Logic**. Statements and logical operators; conditional statements; logically equivalent statements; predicates, sets, and quantifiers; negations of quantified statements.
- **Methods of Proof.** Direct proof, proof using the contrapositive and other logical equivalencies, proof by contradiction, proof using cases, choose an element method, constructive proofs, and proofs using mathematical induction.
- **Elementary Number Theory**. Even and odd integers; the 'divides' relation; the Division Algorithm; congruence and congruence arithmetic; rational and irrational numbers.
- **Elementary Set Theory**. Set notation; operations on sets (intersection, union, set difference, complement); properties of set operations; Cartesian products (optional).
- **Functions**. Definition and function notation; injections, surjections, and bijections; composition of functions; inverses of functions.
- **Equivalence Relations**. Relations and properties of relations; equivalence relations; equivalence classes.

3. CONTENT GOALS TO SUPPORT FOLLOWING COURSES:

- Proof-writing skills and methods of proof (315, 331, 350, 408, 409, 450, 431, 441, 495).
- Equivalence relations (MTH 315, 350, 450).
- Logical operators, logically equivalent statement, using quantifiers (315, 331, 355, 408, 409, 450, 431, 441, 495).