

## Official Syllabus

# Math 223: Logic and Mathematical Reasoning

(Adopted Fall 2009; Committee: Drs. A. Neath, A. Weyhaupt, Course objectives added October 2014 by Department consent)

**Catalog Description:** Concepts and techniques essential to advanced mathematics: logic, methods of proof, sets, relations, induction, functions, cardinality, combinatorics and graph theory. Prerequisite: MATH 150. (2 Lecture hrs. plus 2 hr. lab).

**Textbook:** Smith, Eggen, St. Andre, *A Transition to Advanced Mathematics*, 7<sup>th</sup> Edition, Thomson Brooks Cole.

Chapter	Sections	Class Periods
1. Logic and Proof	1. Propositions and Connectives 2. Conditionals and Biconditionals 3. Quantifiers 4. Basic Proof Methods I 5. Basic Proof Methods II 6. Proofs Involving Quantifiers 7. Additional Examples of Proofs	6
2. Set Theory	1. Basic Concepts of Set Theory 2. Set Operations 3. Extended Set Operations and Index Families of Sets 4. Induction 6. Principles of Counting (Previously, 4 lectures were devoted to counting and combinatorial proofs. We have developed a short supplement for this material to augment <i>Transition</i> .)	9
3. Relations	1. Cartesian Products and Relations 2. Equivalence Relations 3. Partitions 5. Graphs ( <i>Transition</i> does not discuss Hamiltonian cycles, Euler cycles, or the adjacency matrix. We have developed a short supplement for this material.)	6
4. Functions	1. Functions as Relations 2. Constructions of Functions 3. Functions That Are Onto; One-to-One Functions 4. Images of Sets	4
5. Cardinality	1. Equivalent Sets; Finite Sets 2. Infinite Sets	2

Schedule has 3 days for exams or optional material. Schedule assumes two 110-minute class periods per week. Approximately 75 minutes of a class period should be devoted to lecture with the remaining 35 minutes a problem solving session.

**Course objectives:**

At the conclusion of this course, students should be able to:

- 1)perform computations involving logic, sets, functions, and graphs
- 2)construct proofs using the following techniques: direct, contrapositive, contradiction, induction, and combinatorial
- 3)construct proofs involving basic number theory (divisibility, gcd, parity, rational numbers), sets, relations and partitions, functions (including injective and surjective properties), cardinality, and basic graph theory
- 4)use counting techniques to count sets of moderate complexity

Any instructor should cover all of the material specified; additional sections are optional.