SUNY OLD WESTBURY

DEPARTMENT OF MATHEMATICS AND COMPUTER & INFORMATION SCIENCE

TRANSITION TO ADVANCED MATHEMATICS MA3520

Departmental Syllabus

TEXTBOOK: **Mathematical Proofs**: A Transition to Advanced Mathematics, Third Edition, by Chartrand, Polimeni, Zhang, Pearson Publication, 2013, ISBN: 9780321797094

Prerequisite: Grade of C or higher in Calculus II (MA2320) and Discrete Mathematics (MA3030)

COURSE DESCRIPTION: An introduction to concepts commonly used in advanced mathematics with an emphasis on writing proofs. Topics include logic, set theory, relations, functions, and cardinality as well as selected topics from other areas of advanced mathematics such as number theory, abstract algebra, topology, and real analysis.

GOALS & OBJECTIVES: The main goal of this course is to prepare students for higher level courses in mathematics. This is done by engaging students in problem solving techniques and mathematical reasoning that presage higher level topics. Through examples and exercises, students will develop their mathematical reasoning ability – the ability to read and write proofs. The mathematical reasoning is practiced on fundamental topics that are needed for success in advanced mathematics courses. These topics include sets, relations, functions, properties of numbers, and cardinalities of sets. After successful completion of the course students should be able to demonstrate the ability to write mathematical proofs that are convincing, readable, notational consistent, and grammatically correct.

COURSE EVALUATION & GRADING: Course grade will be based on midterm exams, quizzes, assignments, and Final Exam. The Final exam is **cumulative** and it counts at least **30**% of the course grade. The grading scale is as follows:

A = [94, 100]	**B** $^{+}$ = [87, 89]	**C** $^{+}$ = [77, 79]	**D** $^{+}$ = [67, 69]	**F** = [0, 59]
A^{-} = [90, 93]	**B** = [84, 86]	**C** = [74, 76]	**D** = [64, 66]	
	B $^{-}$ = [80, 83]	**C** $^{-}$ = [70, 73]	**D** $^{-}$ = [60, 63]	

TUTORIAL: Drop-in tutorial is available in the Mathematics Learning Center.

TOPICS TO BE COVERED

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Review of Proof Methods

- Mathematical Induction

Equivalence Relations

- Relations
- Properties of Relations
- Equivalence Relations
- Properties of Equivalence Classes
- Congruence Modulo *n*
- The Integers Modulo *n*

Functions

- The Definition of Function
- One-to-one and Onto Functions
- Bijective Functions
- Composition of Functions
- Inverse Functions
- Permutations

Cardinalities of Sets

- Numerically Equivalent Sets
- Denumerable Sets
- Uncountable Sets
- Comparing Cardinalities of Sets
- The Schröder-Bernstein Theorem

Number Theory

- Divisibility Properties of Integers
- The Division Algorithm
- Greatest Common Divisors
- The Euclidean Algorithm
- Relatively Prime Integers
- The Fundamental Theorem of Arithmetic

Group Theory

- Binary Operations
- Groups
- Permutation Groups
- Fundamental Properties of Groups
- Subgroups
- Isomorphic Groups

Calculus

- Limits of Sequences
- Infinite Series
- Limits of Functions
- Fundamental Properties of Limits of Functions
- Continuity
- Differentiability

Topology (*Time permitting*)

- Metric Spaces
- Open Sets in Metric Spaces
- Continuity in Metric Spaces
- Topological Spaces
- Continuity in Topological Spaces