SUFFOLK COUNTY COMMUNITY COLLEGE
COLLEGE-WIDE COURSE SYLLABUS
MAT200

I. COURSE TITLE:

Language, Logic, and Proof

II. CATALOG DESCRIPTION:

A basic course in the logic of mathematics, the construction of proofs and writing proofs. The mathematical content is primarily set theory, logic, number theory, introduction to basic analysis, and Euclidean Geometry. There is considerable focus on writing proofs. A / 3 cr. hrs.

III. COURSE GOALS:

A. Provide students with the language necessary for communicating upper level mathematics.
B. Formulate, write, and read proofs in mathematics.
C. This course satisfies the SUNY general education requirement for mathematics.

IV. Learning Outcomes: *(Main concepts, principles, and skills you want students to learn from this course)*

Upon completion of this course, students will be able to:

a. use logical language, operations, and rules to create and interpret mathematical proofs.
b. use the definition of sets and maps between them to create and interpret proofs about sets.
c. use concepts from number theory and elementary Euclidean geometry to create and interpret proofs from those topics.
d. prove elementary facts about functions and relations.
e. read and critique proofs, and recognize basic errors in reasoning.
f. construct and write mathematical proofs by using methods, such as mathematical induction, proof by contradiction, direct proof, and proof by contraposition.

V. Major Topics Required:

Required Topics	**Approximate Time (Including Examinations)**
A. Introduction: A more rigorous approach to the familiar (revisit topics from algebra, real numbers, and calculus with an emphasis on understanding "why?" rather than "how") Selections can be chosen from the list below or from other proofs found in earlier mathematics courses:	$1\frac{1}{2}$ weeks

1. Proving the quadratic formula both algebraically and geometrically. 2. Deriving a formula for solving a system of 2 simultaneous linear equations in 2 unknowns. 3. Proving $\sqrt{2}$ is irrational. 4. Precise definition of limit and proving $\lim_{x \to a} f(x) = L$ for linear functions. 5. The Binomial Theorem and proofs of the power, product and quotient rules for differentiation. 6. Showing that differentiable at a point implies continuous at a point. 7. Finding counterexamples.	
B. Logic 1. Statement, compound statements and truth values 2. Truth tables, logical equivalence, tautologies and contradictions 3. Conditional statements and their negation 4. Converse, inverse and contrapositive of conditional statements 5. Valid argument forms (rules of inference) 6. Proving arguments valid using truth tables 7. Proving arguments valid using the rules of inference 8. Brief introduction to universal and existential quantifiers and learning how to negate these quantifiers	$3\frac{1}{2}$ weeks
C. Elementary Number Theory 1. Natural numbers, integers, rational numbers, irrational numbers and real numbers 2. Formal definition of even, odd, prime, composite, and "a divides b" 3. Quotient-Remainder Theorem 4. Euclidean Algorithm 5. Methods of proof illustrated by intuitive number theory results (direct proofs, proof by contradiction, proof by contraposition, proof by division into cases, uniqueness and existence proofs) 6. Mathematical induction	$3\frac{1}{2}$ weeks
D. Set Theory 1. Basic definitions (set, set equality, operation on sets, empty set, partitions of sets, power sets, Cartesian product) 2. Basic set identities and their proofs 3. Disproving set properties 4. Proving that a set is an empty set	2 weeks
E. Functions (Provide an understanding of what a function is and prove basic results) 1. Definition of a function and connections with set theory 2. Notion of well-defined 3. One-to-one, onto and inverse functions 4. Composition of functions	2 weeks
F. Relations 1. Relations on sets 2. Reflexivity, symmetry and transitivity 3. Equivalence relations	$2\frac{1}{2}$ weeks

4. Relation induced by a partition 5. Equivalence classes 6. Showing every equivalence relation induces a Partition 7. Connection between functions and relations	
G. Optional Topic 1. Introduction to Euclidean Geometry a. Introduction to axiomatic systems b. Proofs by construction involving circles, lines and triangles 2. Properties of continuous function	

VI. EVALUATION OF STUDENT PERFORMANCE:

To be determined by the instructor

VII. PROGRAMS THAT REQUIRE THIS COURSE: *(List or indicate none.)*

Liberal Arts and Sciences: Mathematics Emphasis (LAMA-AA)

VIII. COURSE(S) THAT REQUIRE THIS COURSE AS A PREREQUISITE:
(List courses or indicate none)

NONE

IX. SUPPORTING INFORMATION: *(Examples – newspapers, journals, Internet resources, CD-ROMS, Videos, other teaching materials, textbooks, etc.)*

Mathematics tutoring services, as well as video and computer aids, are provided for all students through the Math Learning Center (Ammerman Campus, Riverhead 235), the Center for Academic Excellence (Grant Campus, Health, Sports and Education Center 129), and the Academic Skills Center (Eastern Campus, Montaukett 224).