University of Nicosia, Cyprus

Course Code	**Course Title**	**Credits (ECTS)**
MATH-185	Foundation of Mathematics	8
Department	**Semester**	**Prerequisites**
Mathematics	Fall	None
Type of Course	**Field**	**Language of Instruction**
Required	Mathematics	English
Level of Course	**Year of Study**	**Lecturer**
1st Cycle	1st	Dr George Chailos
Mode of Delivery	**Work Placement**	**Co-requisites**
Face-to-face	N/A	None

Objectives of the Course:

The main objectives of the course are to:

1. Enable students to develop a basic understanding of a new (to the student) rigorous approach to concepts previously encountered and to put them in the right perspective.
2. Develop the student's idea of what constitutes a rigorous proof, via an axiomatic system as well as the abstract thinking.
3. Provide students with the necessary skills in order to be capable of using the various proving techniques developed through the course.
4. Cover the method of Mathematical induction in detail.
5. Provide the fundamental theory of Naive set theory and to introduce students to Axiomatic Set Theory.
6. Provide the proofs of fundamental theorems in Set Theory, such as Schroeder-Bernstein Theorem using the axiomatic method.
7. Offer the fundamental concepts and the elementary theory of propositional and first order predicate logic

Learning Outcomes:

After completion of the course students are expected to:

1. Apply the mathematical concepts and notions developed throughout the course.
2. Solve mathematical problems using the fundamental concepts of Naive and Axiomatic Set Theory.
3. Implement the basic theory of Propositional and First Order Logic.
4. Use Mathematical Induction to prove basic theorems and formulas.
5. Prove theorems via axiomatic and systematic process.
6. Handle infinite sets and to be able to apply the Axiom of Choice and Zorn's Lemma in various Mathematical Subjects (such as Analysis and Algebra)

Course Contents:

1. Set theory
    - Operations on Sets
    - Functions
    - Relations and Cartesian Products
    - Countable and Uncountable Sets
    - Cardinal Numbers (introduction)
    - Schroeder-Bernstein Theorem
    - Well-Ordered Sets and the Maximum Principle
2. Real Number System
    - Peano's Axiomatic natural Numbers System
    - Well ordering of Natural numbers
    - Definition of the Integers
    - Axiomatic construction of Real Numbers *(If time permits)*
3. Proving Techniques
    - Methods of Proof
    - The Principle of Mathematical Induction
    - Extensions of Mathematical Induction
4. Propositional Logic
    - Truth tables and trees
    - Boolean Functions
    - Evaluating Arguments
5. First Order Logic
    - The Principles of Inference
    - Truth Trees for Predicate logic
6. Elements of Axiomatic Set Theory
    - The Axioms of Set Theory
    - The Axiom of Choice
    - Equivalences of Axiom of Choice-Zorn's Lemma *(If time permits)*

Teaching Methods:

Lectures, Handouts and Assignments

Assessment Methods:

2 Mid-Term Exam; Final Exam; Class Participation.

Required Textbook:

Authors	Title	Publisher	Year	ISBN
D.L.Johnson	Elements of Logic via Numbers and Sets	Springer	2001	978-3540761235

Recommended Textbooks/Reading:

Authors	Title	Publisher	Year	ISBN
Yiannis Moschovakis	Notes on Set Theory	Springer 2nd Edition	2005	978-0387287225
Thomas Sibley	The Foundation of Mathematics	Wiley, 1st Edition	2008	978-0470085011