

MODULE SPECIFICATION

Module Title	Mathematical Reasoning
Module Code	MTH 351
Module Credits	4
Pre-requisites (including Year 1)	Analytic Geometry and Calculus III

Description

Course Overview
This course provides a foundational exploration of mathematical reasoning and the techniques required to construct and write mathematical proofs. Students will develop essential skills for rigorous mathematical thinking, focusing on topics such as logical reasoning, set theory, functions, and mathematical induction. The course emphasizes clear mathematical communication and structured argumentation, preparing students for advanced study in mathematics and related disciplines.
Method of Teaching and Learning
This module will be taught using a combination of lectures, tutorials and consultation hours. Learning will also be reinforced by appropriate readings from the course text.
Syllabus
<p>Modules</p> <p>Module 1: Introduction to Writing Proofs in Mathematics</p> <ul style="list-style-type: none"> • What is a Proof? • Constructing Direct Proofs <p>Module 2: Logical Reasoning</p> <ul style="list-style-type: none"> • Logical Statements and Connectives • Truth Tables • Logical Equivalence • Quantifiers and Negations <p>Module 3: Constructing and Writing Proofs in Mathematics</p> <ul style="list-style-type: none"> • Direct Proofs • Proof by Contrapositive • Proof by Contradiction • Proof by Cases • Proofs Involving Sets • Writing Mathematical Proofs <p>Midterm Exam 1</p>

Module 4: Mathematical Induction

- Principle of Mathematical Induction
- Strong Induction
- Induction in Other Contexts

Module 5: Set Theory

- Basic Definitions and Notation
- Subsets and Power Sets
- Set Operations
- Cartesian Products
- Indexed Families of Sets

Midterm Exam 2**Module 6: Functions**

- Definitions and Examples
- Domain and Range
- Injective, Surjective, and Bijective Functions
- Composition of Functions
- Inverse Functions
- Functions Defined on Sets
- Divisibility and the Division Algorithm
- Greatest Common Divisors and the Euclidean Algorithm
- The Fundamental Theorem of Arithmetic

Module 7: Finite and Infinite Sets

- Finite Sets and Cardinality
- Countable and Uncountable Sets
- Comparing Sizes of Infinite Sets

Final Exam**Assessment**

Assessment Type	% of Final Mark
Midterm Exam 1	25%
Midterm Exam 2	25%
Final Exam	30%
Homework and Quizzes	10%
Course Participation	10%

<i>Range</i>	<i>Letter Grade</i>
90% - 100%	A
80% – 89%	B

70% - 79%	C
60% - 69%	D
< 60%	U

Textbooks

Mandatory Textbooks

Title	Editor/Author	ISBN/Publisher
Mathematical Reasoning: Writing and Proof	Ted Sundstrom	

Optional Textbooks

Title	Author	ISBN/Publisher
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Reference Textbooks

Title	Author	ISBN/Publisher
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