

GENERAL INFORMATION

Course Title: Fundamentals of Mathematics, MATH 2305

Field: Mathematics

Credit Weight: 3

Semester and Year: Spring 2024

Pre-requisites: MATH 2015 Introduction to Calculus II, MATH 2025 Introduction to Linear Algebra

Course Description

This introductory course in the foundations of mathematics explores the fundamental principles that underlie advanced mathematical reasoning. Emphasizing the development of rigorous proofs, set theory, and logical structures, students will delve into the core concepts essential for higher-level mathematical studies. The course covers topics including propositional and predicate logic, various proof techniques, set theory, paradoxes, axiomatic set theory, and the cardinality of sets. Through both theoretical exploration and practical exercises, students will gain a solid foundation in the principles of mathematical reasoning.

Learning Objectives

By the end of this course, students will be able to do the following:

- Understand the fundamental concepts of set theory and their applications.
- Gain familiarity with propositional and predicate logic.
- Understand the principles of axiomatic set theory and the encoding of mathematics.
- Learn various proof techniques and apply them to solve mathematical problems.
- Gain knowledge of cardinality and different sizes of sets.
- Explore paradoxes and their implications in mathematics.
- Study the Axiom of Choice and Zorn's Lemma.
- Develop proficiency in constructing and presenting mathematical proofs.

Required Text/Readings:

Rene Cori, Daniel Lascar, Donald H. Pelletier, (2001). *Mathematical Logic: A Course with Exercises*. Oxford University Press.

Accessibility Services (Accommodations)

Students with documented academic, medical, emotional, and/or physical disabilities, who require accommodation, must provide current documentation attesting to the specific nature of their disability to Academic Accommodations Coordinator and Associate Registrar. Students are responsible for submitting the appropriate documents and forms in a timely manner. A meeting to review documentation and discuss accommodations is strongly recommended.

Academic Honesty

Please read the relevant section of the College's policy on academic honesty in the student Code of Conduct. Briefly academic dishonesty includes: cheating, fabrication, and plagiarism. Please ask me if you have any questions about whether something constitutes academic dishonesty. Academic dishonesty will not be tolerated and will result in failure of the course. Institutional penalties may also apply.

Attendance Policy & Class Participation

You are expected to complete all assignments and exams on time, attend class regularly, and come to class prepared to participate actively. Please have readily available the assigned readings and texts. They will be a valuable resource for our discussions and will assist you in following lectures.

Evaluation of Performance

Final grades will be determined as follow:

Participation	10%
Problem Sets	15%
Quizzes	30%
Midterm Exam	15%
Final Exam	30%
Total	100%

Grades will be assigned as follows:

Grade		Grade	
A	(93- 100%)	C	(73-76%)
A-	(90-92%)	C-	(70-72%)
B+	(87-89%)	D+	(67-69%)
B	(83-86%)	D	(64-66%)
B-	(80-82%)	D-	(60-63%)
C+	(77-79%)	F	(<60%)

Course Content (Subject to Change)

Module Topics	Materials	Tasks
Introduction to Proofs: Basics of mathematical proofs Proof techniques: direct, by contradiction, by cases, constructive and non-constructive, induction	Chapter 4	Problem Set 1 Quiz 1
Propositional and Predicate Logic: Syntax and semantics of propositional logic Introduction to predicate logic and quantifiers Axiomatic theories	Chapter 1, 3	Problem Set 2 Quiz 2
Set Theory: Informal set theory: sets, functions, equivalence relations, order relations Paradoxes in set theory	Chapter 7	Midterm Exam
Axiomatic Set Theory: Introduction to axiomatic set theory Encoding of mathematics Axiom of Choice and Zorn's Lemma	Chapter 7	Problem Set 3 Quiz 3

Cardinality of Sets: Countable and uncountable sets Cardinal numbers and sizes of sets	Chapter 7	Final Exam
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This syllabus is subject to change. Keep aware of the changes that might occur. There will be announcement if that happens.