MATH G287: INTRODUCTION TO ABSTRACT MATHEMATICS

Item	Value
Curriculum Committee Approval Date	02/06/2024
Top Code	170100 - Mathematics, General
Units	4 Total Units
Hours	72 Total Hours (Lecture Hours 72)
Total Outside of Class Hours	0
Course Credit Status	Credit: Degree Applicable (D)
Material Fee	No
Basic Skills	Not Basic Skills (N)
Repeatable	No
Grading Policy	Standard Letter (S), • Pass/No Pass (B)

Course Description

This course is an introduction to proof writing and mathematical reasoning. Topics include propositional logic, concepts and methods of mathematical proofs, mathematical induction, functions, number theory, relations and partitions, and set theory. The course will provide students with the foundational knowledge necessary to initiate a bachelor's degree in mathematics. PREREQUISITE: MATH G185. Transfer Credit: CSU; UC.

Course Level Student Learning Outcome(s)

1. Course Outcomes
2. Prove the set of integers contain an infinite amount of primes.
3. Use Euclidean Algorithm to find the greatest common divisor of two integers.
4. Prove number theoretic statements through the use of mathematical induction.

Course Objectives

- 1. Determine if a propositional statement represents a contradiction or tautology.
- 2. Explain the relationship between a mathematical definition, conjecture, theorem, and proof.
- 3. Prove a mathematical statement through induction.
- 4. Prove a mathematical statement through methods of direct proof, proof by contrapositive, or proof by contradiction.
- 5. Use the Euclidean Algorithm to prove number theoretic statements.
- 6. Calculate the greatest common divisor using the Euclidean Algorithm.
- 7. Determine the cardinality of a set.
- 8. Perform mathematical operations on sets.
- 9. Organize a set into its various equivalence classes.

Lecture Content

Introduction Proof Definition Theorem and conjecture Planning and writing a proof Logic and Basis of Proofs Propositions Expressions and tautologies Propositional functions and quantifiers Methods of proof Direct Contrapositive Contradiction Sets Set notation Definition Subsets Operations on sets Indexed families An axiomatic approach to sets Functions Functions as relations Functions viewed globally Permutations Functions and partitions Real-valued functions Images and inverse images of sets Functions of indexed families Divisibility and Euclidean Algorithm Remainders and congruence Greatest common divisor Euclidean Algorithm Mathematical Induction Recursion Proof by induction Induction and recursion Principle of mathematical induction Strong induction Set Theory Cartesian products Power sets Indexed collections of sets Relations and Partitions Relations Equivalence relations Partitions and identifications Congruence Composition of relations Types of orders Cardinality of Sets Finite and infinite sets Schroeder-Bernstein Theorem Well-ordering principle Countable sets Uncountable sets

Method(s) of Instruction

- Lecture (02)
- DE Live Online Lecture (02S)
- DE Online Lecture (02X)

Reading Assignments

Textbook and instructor handouts.

Writing Assignments

Students will solve number theoretic problems and write mathematical proofs.

Out-of-class Assignments

Homework and projects.

Demonstration of Critical Thinking

Students will demonstrate critical thinking and problem-solving skills by using logic, in conjunction with past mathematical solving techniques, to solve and interpret a variety of applications not previously seen through writing mathematical proofs. Demonstrations will be shown by completing assignments, participating in discussions, and completing required assessments.

Required Writing, Problem Solving, Skills Demonstration

Students will demonstrate problem solving skills when they write their own solutions to homework and assessment problems.

Eligible Disciplines

Mathematics: Masters degree in mathematics or applied mathematics OR bachelors degree in either of the above AND masters degree in statistics, physics, or mathematics education OR the equivalent. Masters degree required.

Textbooks Resources

1. Required Hammack, Richard. Book of Proof, 3rd ed. (OER) (latest), 2018 Rationale: . 2. Required Fletcher, Peter Patty, Wayne. Foundations of Higher Mathematics, 3rd ed. Cengage (latest), 1995 Rationale: . 3. Required Sundstrom, Ted. Mathematical Reasoning, 2nd ed. Pearson (latest), 2006 Rationale: .