Cendara University

Department of Mathematics and Statistics

Course Catalog 2024–2025

Undergraduate Programs

B.Sc. in Mathematics Pathways:
- Pure Mathematics
- Applied Mathematics
- Data Science

Course Listing

MAT 101: Calculus I

- **Credits:** 4
- **Description:**
  Introduction to the differential and integral calculus of one variable, focusing on limits, derivatives, applications of derivatives, and the Fundamental Theorem of Calculus. Emphasis on problem-solving and conceptual foundations.
- **Prerequisites:**
  Secondary school mathematics (pre-calculus) or equivalent.

MAT 102: Calculus II

- **Credits:** 4
- **Description:**
  Continuation of Calculus I, including integration techniques, applications of the integral, sequences, series, and an introduction to differential equations.
- **Prerequisites:**
  MAT 101: Calculus I

MAT 110: Introduction to Data Science

- **Credits:** 3

- **Description:**
  Foundations of data science, covering data wrangling, introductory statistics, data visualization, and the basics of data analysis using modern software tools.
- **Prerequisites:**
  None

MAT 120: Linear Algebra I

- **Credits:** 3
- **Description:**
  Systems of linear equations, matrix operations, determinants, vector spaces, eigenvalues, and eigenvectors with applications in science and engineering.
- **Prerequisites:**
  MAT 101: Calculus I

MAT 130: Discrete Mathematics

- **Credits:** 3
- **Description:**
  Logic, set theory, combinatorics, graph theory, functions, relations, and mathematical induction, with emphasis on applications in computer science and mathematics.
- **Prerequisites:**
  None

MAT 211: Calculus III (Multivariable Calculus)

- **Credits:** 4
- **Description:**
  Calculus of functions of several variables, including partial derivatives, multiple integration, vector calculus, and applications.
- **Prerequisites:**
  MAT 102: Calculus II

MAT 220: Linear Algebra II

- **Credits:** 3

- **Description:**
  Advanced topics in linear algebra including inner product spaces, diagonalization, Jordan forms, and applications to differential equations and data science.
- **Prerequisites:**
  MAT 120: Linear Algebra I

MAT 225: Introduction to Mathematical Proof

- **Credits:** 3
- **Description:**
  Principles of rigorous mathematical reasoning and proof methods including direct, contrapositive, contradiction, and induction. Critical for transition to higher mathematics.
- **Prerequisites:**
  MAT 130: Discrete Mathematics

MAT 240: Probability and Statistics I

- **Credits:** 3
- **Description:**
  Probability theory, random variables, distribution functions, expectation, variance, and introduction to statistical inference.
- **Prerequisites:**
  MAT 102: Calculus II

MAT 250: Differential Equations

- **Credits:** 3
- **Description:**
  First and second order differential equations, systems of equations, qualitative analysis, and applications to physical, biological, and social sciences.
- **Prerequisites:**
  MAT 102: Calculus II

MAT 305: Abstract Algebra I

- **Credits:** 3
- **Description:**
  Fundamentals of group theory, including cyclic groups, permutation

groups, subgroups, quotient groups, and homomorphisms. Applications in symmetry and cryptography.
- **Prerequisites:**
  MAT 225: Introduction to Mathematical Proof

MAT 310: Real Analysis I

- **Credits:** 3
- **Description:**
  Rigorous development of real numbers, sequences, series, limits, continuity, and differentiability. Focuses on precise definitions and logic.
- **Prerequisites:**
  MAT 102: Calculus II
  MAT 225: Introduction to Mathematical Proof

MAT 325: Combinatorics

- **Credits:** 3
- **Description:**
  Counting principles, permutations, combinations, inclusion-exclusion, recurrence relations, generating functions, and basic graph theory.
- **Prerequisites:**
  MAT 130: Discrete Mathematics

MAT 340: Probability and Statistics II

- **Credits:** 3
- **Description:**
  Advanced probability distributions, limit theorems, statistical estimation, confidence intervals, hypothesis testing, and regression analysis.
- **Prerequisites:**
  MAT 240: Probability and Statistics I

MAT 360: Mathematical Modeling

- **Credits:** 3
- **Description:**
  Construction and analysis of deterministic and stochastic models for problems in natural and social sciences, including dimensional analysis and simulation.

- **Prerequisites:**
  MAT 211: Calculus III
  MAT 250: Differential Equations

MAT 370: Numerical Analysis

- **Credits:** 3
- **Description:**
  Numerical methods for solving equations, interpolation, numerical integration and differentiation, and applications to computational mathematics.
- **Prerequisites:**
  MAT 211: Calculus III
  MAT 220: Linear Algebra II

MAT 398: Undergraduate Seminar in Mathematics

- **Credits:** 1
- **Description:**
  Student presentations and discussions of current topics and research in mathematics. Emphasis on communication skills and critical thinking.
- **Prerequisites:**
  Junior standing in Mathematics

Advanced Undergraduate and Graduate Level

MAT 410: Abstract Algebra II

- **Credits:** 3
- **Description:**
  In-depth study of rings and fields, including polynomial rings, field extensions, Galois theory, and applications to coding theory.
- **Prerequisites:**
  MAT 305: Abstract Algebra I

MAT 420: Real Analysis II

- **Credits:** 3
- **Description:**
  Metric spaces, sequences and series of functions, uniform convergence, and introduction to measure theory.

- **Prerequisites:**
  MAT 310: Real Analysis I

MAT 431: Topology

- **Credits:** 3
- **Description:**
  Basic concepts of general topology, including open and closed sets, continuity, compactness, connectedness, and fundamental groups.
- **Prerequisites:**
  MAT 310: Real Analysis I
  MAT 225: Introduction to Mathematical Proof

MAT 445: Stochastic Processes

- **Credits:** 3
- **Description:**
  Markov chains, Poisson processes, Brownian motion, martingales, and applications in finance and queueing theory.
- **Prerequisites:**
  MAT 340: Probability and Statistics II

MAT 450: Data Mining and Statistical Learning

- **Credits:** 3
- **Description:**
  Algorithms and theory behind data mining, supervised and unsupervised learning, clustering, classification, and validation methods.

- **Prerequisites:**
  MAT 340: Probability and Statistics II
  MAT 110: Introduction to Data Science

MAT 480: Mathematical Modeling Seminar

- **Credits:** 2
- **Description:**
  Collaborative research experience involving real-world modeling projects with faculty mentorship, proposal development, and solution presentation.
- **Prerequisites:**
  Senior standing in Mathematics or instructor approval

Graduate Program

M.Sc. in Mathematics Specializations:
- Algebra
- Combinatorics
- Mathematical Modeling

MAT 501: Graduate Algebra

- **Credits:** 4
- **Description:**
  Comprehensive study of group theory, ring theory, and module theory, with emphasis on structural theorems and modern algebraic techniques.
- **Prerequisites:**
  MAT 410: Abstract Algebra II or equivalent

MAT 510: Graduate Analysis

- **Credits:** 4
- **Description:**
  Lebesgue integration, convergence theorems, function spaces, and Hilbert spaces, with applications to mathematical modeling.
- **Prerequisites:**
  MAT 420: Real Analysis II or equivalent

MAT 525: Algebraic Combinatorics

- **Credits:** 3
- **Description:**
  Topics in enumeration, graph theory, designs, and coding theory, including connections to algebraic structures.
- **Prerequisites:**
  MAT 325: Combinatorics
  MAT 305: Abstract Algebra I

MAT 540: Advanced Probability and Stochastic Processes

- **Credits:** 3

- **Description:**
  Measure-theoretic foundations of probability, advanced stochastic processes, martingales, and applications in finance and biology.
- **Prerequisites:**
  MAT 445: Stochastic Processes or equivalent

MAT 561: Mathematical Modeling and Simulation

- **Credits:** 3
- **Description:**
  Development and analysis of mathematical models for complex real-world systems; simulation techniques; connection to industrial and academic research.
- **Prerequisites:**
  MAT 360: Mathematical Modeling or instructor approval

MAT 599: Thesis Research

- **Credits:** 6
- **Description:**
  Original research project under faculty supervision, culminating in a written thesis and oral defense.

- **Prerequisites:**
  Completion of 24 graduate credits and recommendation of faculty advisor

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Notes

- Not all courses are offered every semester; check current timetable for scheduling.
- Prerequisites may be waived with instructor approval under exceptional circumstances.
- For questions about course selection and program pathways, contact the Department of Mathematics and Statistics, Cendara University (mathstat@cendara.edu).
