Bachelor of Science in Mathematics (4 Years, 240 ECTS)

A rigorous mathematics program emphasizing proof, abstraction, and modeling, with strong computational training to apply mathematics in science, finance, technology, and policy.

Program Overview

- **Award:** B.Sc. in Mathematics

- **Duration:** 8 Semesters (4 academic years)

- **Total Credits:** 240 ECTS

- **Delivery:** Lectures (L), Tutorials (T), Computing Labs (CL), Studio/Project (S), Seminar (SE)

- **Workload:** 1 ECTS ≈ 25–30 hours

- **Program Pillars:** Calculus & Analysis • Linear Algebra • Discrete Mathematics & Logic • Probability & Statistics • Differential Equations • Numerical & Computational Mathematics • Optimization & Modeling • Mathematical Communication • Ethics in Applied Math

- **Signature Experiences:** proof-writing workshops, modeling studio, and an optional research assistantship.

Graduate Learning Outcomes

Graduates will be able to:

1 **Mathematical Foundations.** Construct clear proofs and apply core ideas from algebra, analysis, geometry, and discrete mathematics.

2 **Modeling.** Translate real-world systems into mathematical models and evaluate assumptions and limitations.

3 **Computation.** Implement numerical methods and algorithms to approximate, simulate, and optimize complex problems.

4 **Data Reasoning.** Use probability and statistical inference to analyze uncertainty and draw defensible conclusions.

5 **Problem Solving.** Select and combine techniques across subfields to solve unfamiliar, multi-step problems.

6. **Communication.** Explain mathematical ideas in written and oral form using precise notation and narrative clarity.

7. **Professional Practice.** Work effectively in teams, follow ethical standards, and document reproducible computational work.

8. **Applications.** Apply mathematics to challenges in engineering, economics, cryptography, and the natural sciences.

Curriculum Structure

Structured across 8 semesters (30 ECTS each). Most courses are 6 ECTS unless otherwise noted.

Year 1

Semester 1 (30 ECTS)
- Calculus I (Limits, Derivatives, Integration) - 6 ECTS
- Linear Algebra I (Vectors & Matrices) - 6 ECTS
- Discrete Mathematics I (Logic & Proof) - 6 ECTS
- Programming for Mathematicians (Python) - 6 ECTS
- Scientific Writing & Communication - 6 ECTS

Semester 2 (30 ECTS)
- Calculus II (Sequences & Series) - 6 ECTS
- Linear Algebra II (Eigenvalues & Applications) - 6 ECTS
- Discrete Mathematics II (Combinatorics & Graphs) - 6 ECTS
- Probability I (Random Variables) - 6 ECTS
- Mathematics Ethics & Academic Integrity - 6 ECTS

Year 2

Semester 3 (30 ECTS)
- Real Analysis I (Continuity & Differentiation) - 6 ECTS
- Abstract Algebra I (Groups) - 6 ECTS
- Differential Equations I - 6 ECTS
- Numerical Methods I - 6 ECTS
- Technical Elective I - 6 ECTS

Semester 4 (30 ECTS)
- Real Analysis II (Integration) - 6 ECTS
- Abstract Algebra II (Rings & Fields) - 6 ECTS
- Probability II (Limit Theorems) - 6 ECTS
- Mathematical Modeling Studio - 6 ECTS
- Technical Elective II - 6 ECTS

Year 3

Semester 5 (30 ECTS)
- Complex Analysis - 6 ECTS
- Topology Fundamentals - 6 ECTS
- Mathematical Statistics - 6 ECTS
- Optimization I (Linear & Convex) - 6 ECTS
- Technical Elective III - 6 ECTS

Semester 6 (30 ECTS)
- Numerical Linear Algebra - 6 ECTS
- Stochastic Processes - 6 ECTS
- Partial Differential Equations - 6 ECTS
- Technical Elective IV - 6 ECTS
- Summer Internship or Research Assistantship - 6 ECTS

Curriculum Structure

Structured across 8 semesters (30 ECTS each). Most courses are 6 ECTS unless otherwise noted.

Year 4

Semester 7 (30 ECTS)	• Measure & Probability (Advanced) - 6 ECTS • Applied Modeling (Networks & Dynamical Systems) - 6 ECTS • Computational Mathematics (Scientific Computing) - 6 ECTS • Technical Elective V - 6 ECTS • Capstone Research I (Planning & Literature) - 6 ECTS
Semester 8 (30 ECTS)	• Capstone Research II (Implementation & Write-up) - 12 ECTS • Cryptography & Information Theory - 6 ECTS • Mathematics in Industry Seminar - 6 ECTS • Advanced Topics Elective - 6 ECTS

Technical Elective Tracks

Choose at least 5 electives; focus on one track for specialization.

Track A — Pure Mathematics

- Algebraic Number Theory
- Differential Geometry
- Set Theory & Logic
- Functional Analysis

Track B — Applied Modeling

- Nonlinear Dynamics
- Operations Research
- Mathematical Biology
- Network Science

Track C — Statistics & Data

- Bayesian Statistics
- Time Series Analysis

- Causal Inference
- Experimental Design

Track D — Finance & Risk

- Stochastic Calculus
- Financial Mathematics
- Actuarial Models
- Risk Analytics

Learning Resources & Facilities

Mathematics Computing Lab

Dedicated space for numerical computing, LaTeX typesetting, and reproducible research workflows.

Seminar Series

Weekly talks connecting students with researchers and industry practitioners in analytics, finance, and engineering.

Peer Tutoring Center

Structured drop-in support for core modules, proofs, and problem-set strategy.

Research & Reading Groups

Small groups for problem-solving, paper reading, and capstone idea incubation.

Capstone Project Examples

- **Epidemic Forecasting with Uncertainty**
  Build a compartmental model and quantify uncertainty via Bayesian inference and simulation.

- **Cryptographic Protocol Analysis**
  Analyze a protocol's security assumptions and implement a proof-of-concept in code.

- **Optimal Transport for Image Matching**
  Implement an optimal transport solver and evaluate its performance on real datasets.

- **Traffic Flow Optimization**
  Design and test an optimization model for signal timing and congestion reduction.