Upper-Level Courses (continued)

MTH 360 Actuarial Science: Insurance companies are the primary employers of actuaries. An undergraduate degree in mathematics is often all that is required for an initial hire. A sequence of exams must be passed for full qualification. This course prepares students for the first actuarial exam.

MTH 370 Operations Research: Many decision-making problems can be modeled as linear optimization problems with constraints. Symplex method is used to find optimal solutions for these problems. Transportation problem is discussed as well.

MTH 410, 411 Mathematical Statistics: Statistics is the science of obtaining, analyzing, and drawing inference from quantitative data. This course explores the mathematical concepts behind the numbers.

MTH 415 Mathematical Biology: This course involves the growing interaction between mathematics and the biological sciences and provides a practical context for the mathematical description.

MTH 416 Mathematics of Finance: Mathematical techniques for solving problems arising in finance and financial markets are covered. Students will develop financial models and apply mathematical methods to concrete problems.

MTH 430 Partial Differential Equations: Topics covered include first-order equations and the method of characteristics, canonical forms of second-order equations and the analysis of prototype hyperbolic, parabolic, elliptic equations with applications to mathematical physics and engineering.

MTH 431 Complex Analysis: The complex numbers extend the real numbers in magical ways. This course introduces the student to functions that depend on a complex variable and take values in the complex plane.

MTH 435 Nonlinear Dynamics and Chaos: Why is the weather forecast accurate only once every few days? Is tossing a coin really random? Techniques used to address these and similar questions are introduced with concrete examples in physics, biology and engineering.

MTH 437 Mathematical Modeling: This course explores the essential components of constructing a mathematical model, from problem identification and variable selection to model analysis and refinement. The aim is to provide experience in the process of building useful models in a variety of real world settings.

MTH 440 Foundations of Math: Is every true statement provable? Mathematical logic, the study of truth and provability, shows that axioms can be true in different ways, in different models. Fuzzy logic allows for bizarre intermediate truth values between true and false.

MTH 441 Topology: Topology involves the study of geometrical properties using analytical and algebraic tools. This course introduces the basic framework.

Upper-Level Courses (continued)

MTH 442 Abstract Algebra: Rings, integral domains, fields. Introduction to Galois theory.

MTH 445 Differential Geometry: A course focused in the study of curves and surfaces in three dimensional spaces.

Math Department Faculty

The faculty at CSI consists of approximately twenty-five professors working in a wide range of research areas.

Louis Blois, *Number Theory*
Abhijit Champanerkar, *Hyperbolic 3-Manifolds*
Jane Coffee, *Algebra*
Chris Conidis, *Mathematical Logic and Computability*
Jean-Claude Derderian, *Lattice Theory, Semigroups*
Antonia Foldes, *Probability*
Deborah Franzblau, *Combinatorics*
Gunter Fuchs, *Set Theory, Logic*
Joel David Hamkins, *Logic, Set Theory*
Sherman Heller, *Applied Mathematics*
Zheng Huang, *Differential Geometry*
Ilya Kofman, *Knot Theory, Topology*
Carlo Lancellotti, *Mathematical Physics*
Marcello Lucia, *Nonlinear Analysis*
Joseph Maher, *Topology*
Prabudh Misra, *Topology, Semi-group Theory*
Calandra Moore, *Applied Statistics*
Kevin O'Bryant, *Number Theory*
Andrew Poje, *Fluid Dynamics*
Wladimir Pribitkin, *Number Theory*
Arundhati Raychaudhuri, *Graph Theory*
Jay Rosen, *Probability*
Tobias Schaefer, *Mathematical Physics*
Mohammad Talafha, *Graph Theory*
Allen Tesdall, *Applied Mathematics*
John Verzani, *Probability*
Jesenko Vukadinovic, *Fluid and Polymer Dynamics*
Stephen Wollman, *Applied Mathematics*

Staff

Colleen Biagini, *College Assistant*
Lewis Carbonaro, *Technical Coordinator*
Richard Kotula, *College Assistant*
Dorothy Manganel, *Remedial Coordinator*
Susan Massara, *Administrative Assistant*
Mary Grace Swift, *Administrative Assistant*

4/2014

The Department of Mathematics at CSI

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The Math Major at CSI

Majoring in mathematics is a gateway to many desirable professions both in the public and private sectors. Research teams at nearly all large corporations and government agencies recruit math majors. The analytical and problem-solving skills cultivated by students majoring in mathematics are both versatile and highly valued in industry, government, and education.

All students majoring in mathematics must satisfy the general education requirements for a **Bachelor of Science** degree. Only specific science sequences are acceptable for math majors. Pre-major requirements include a calculus sequence, calculus laboratory, and either an introductory computer class or a statistics course. The major requirements include Probability Theory, Applied Mathematical Analysis I or Differential Equations, Linear Algebra, Applied Algebra, and Advanced Calculus I plus four additional mathematics courses at the 300 or 400 level. Please consult the *Undergraduate Catalog* for more details.

Students majoring in mathematics at CSI may arrange their course work according to their interests. There are three major emphases for the B.S. degree in mathematics:

Applied Mathematics, ***Pure Mathematics*** and ***Secondary Education***. A student may also earn a B.S. through the joint ***Computer Science-Math Major***.

An emphasis in either pure or applied mathematics is required for further study in mathematics at the graduate level. An emphasis in Secondary Education is designed for those students interested in teaching high school level mathematics.

Recommended courses for students majoring in mathematics with an Applied Mathematics emphasis include Applied Combinatorics and Graph Theory, Mathematical Biology, Mathematical Modeling, Mathematical Statistics, Nonlinear Dynamics, Numerical Analysis, Operations Research, Mathematical Finance and Partial Differential Equations. An emphasis in ***Pure Mathematics*** is designed for those students primarily interested in mathematical concepts and who excel at abstract and analytical thinking.

Recommended courses for students majoring in mathematics with a pure emphasis include Abstract Algebra, Advanced Calculus II, Complex Analysis, Number Theory, Topology, Geometry and Logic.

Students majoring in mathematics who are interested in certification to teach mathematics at a secondary level must include the courses Geometry and History of Mathematics in their curriculum. Such students must also complete a sequence of Education courses.

The ***Joint Computer Science-Math Major*** is offered through the Computer Science and Mathematics Departments at CSI. This is an excellent option for those students interested in both fields. The interface between mathematics and computer science is an extremely rich and growing area of research. Many problems involve a synthesis of ideas from both fields and students choosing this option are at an advantage with broader opportunities. Please consult the undergraduate catalog for the requirements for this degree.

Upper-Level Courses

MTH 306 History of Math: Learn about mathematics by studying the development of mathematical ideas and techniques from antiquity through the eighteenth century. Topics involve arithmetic, algebra, trigonometry, and analytic geometry and will be drawn from Babylonian, Egyptian, Greek, Chinese, Hindu, Arabian and European mathematics.

MTH 311 Probability Theory: Probabilistic models are used in a variety of fields and applications including randomized algorithms, analysis of financial markets and quantum mechanics.This course provides the fundamental framework through illustrative and practical examples.

MTH 329 Geometry: Fundamental concepts in Euclidean geometry in two and three dimensions and non-Euclidean geometry are covered with applications to image processing and map-making. Topics include classical axiomatic geometry, classification of polygons and polyhedra, and representation of curves and surfaces.

MTH 330, 331, 334 Differential Equations: The language of rates allows one to model the physical systems arising from real-world phenomena. These courses introduce the student to the analytical methods and techniques used in solving systems of differential equations.

MTH 335 Numerical Analysis: Since the advent of the computers, algorithms have been developed to approximate numerical solutions to large-scale systems. This course introduces the student to the primary algorithms and tackles issues concerning computational efficiency, stability and error analysis.

MTH 337 Combinatorics and Graph Theory: Many problems of a discrete nature, such as finding optimal postal routes and frequency assignments, are analyzed with graphtheory. This course introduces the basic framework and shows how different problems can be solved within this.

MTH 338 Linear Algebra: Systems of linear equations and their solutions are studied in depth in this course. Concepts are taught at both a hands-on and abstract level with applications to problems in physics, engineering, economics and the social sciences.

MTH 339/442 Applied Algebra: Group theory and ring theory allow one to analyze a variety of problems in mathematics and computer science from the viewpoints of abstraction and application. For example, students may prove basic results in group theory and apply these results to codes that are used on computers.

MTH 341, 342 Advanced Calculus: These courses provide the theoretical basis of modern analysis by taking a more general look at the key concepts of calculus including continuous functions, differentiable functions and integration theory.

MTH 347 Number Theory: Problems from many branches of mathematics often reduce to the investigation of properties of a particular set of numbers; for example, the set of integer solutions to a certain equation. This course covers many elegant results from number theory, including some applications to cryptography.

MTH 349 Introduction to Cryptology: Cryptology is the mathematical aspect of information security, and in particular of ciphers. In this course, you will learn the mathematics behind the insecurity of historical ciphers, and the reasons why modern ciphers don't have the same weakness.

MTH 350 Logic: What is an algorithm? When is a function computable? When is a question decidable? Computability theory, a part of logic, shows that some functions are not computable and some questions are not decidable.