

ACTUARIAL SCIENCE, B.S.

Program Description

The B.S. in Actuarial Science is designed to prepare students for the actuarial profession. Actuaries utilize tools from mathematics, statistics, and business to measure and manage risk in industries such as insurance, banking, investments, energy, and e-commerce. The program's curriculum prepares students to take two actuarial society exams while enrolled and to obtain actuarial society credit in all three Validation by Educational Experience (VEE) areas. Students who ultimately choose not to pursue the actuarial profession can apply the problem-solving and technical skills gained as analysts in industries such as those mentioned above.

Why Take This Major?

As is the case for the mathematics major, a major in Actuarial Science helps one to think logically, to formulate complex problems in a well-defined manner, to critically analyze data, and to determine optimal solutions to real-world problems. In addition, the Actuarial Science major provides students with a well-rounded background in areas of Economics, Business, and Finance to better prepare them for careers in the field.

Degree Earned

Bachelor of Science (B.S.)

Required for Graduation

- Courses
 - Major: 18
- Credits
 - Major: 59
 - Total: 120
- GPA
 - Major: 2.0
 - Cumulative: 2.0

Student Learning Outcomes

Upon completion of the program, students will be able to:

- demonstrate competency in the areas that comprise the core of the mathematics major
- be able to use appropriate technologies to solve mathematical problems
- be able to construct appropriate mathematical models to solve a variety of practical problems
- demonstrate competency in the areas of Probability and Statistics
- demonstrate competency in the area of Financial Mathematics

Progress Chart

Level One - Core Courses

12 courses and 2 modules required.

Major Requirements

Major requirements include 4 Level Two ILO requirements, *fulfilled through the major*.

Code	Title	Credits
Level One - Core Courses		
<i>Universal Required Courses</i>		
Students must complete the following 4 courses.		
ILO 8.1: Written Communication (https://catalog.lasalle.edu/undergraduate/ilo/)		
ENG 110	College Writing I: Persuasion	3
ILO 5.1: Information Literacy (https://catalog.lasalle.edu/undergraduate/ilo/)		
ENG 210	College Writing II: Research	3
ILO 1.1: Understanding Diverse Perspectives (https://catalog.lasalle.edu/undergraduate/ilo/)		
FYS 130	First-Year Academic Seminar ¹	3
ILO 2.1: Reflective Thinking and Valuing (https://catalog.lasalle.edu/undergraduate/ilo/)		
REL 100	Religion Matters	3
<i>Elective Core Courses</i>		
Students must complete 1 course in each of the following 4 ILOs.		
ILO 3.1a: Scientific Reasoning (https://catalog.lasalle.edu/undergraduate/ilo/)		
Choose course within ILO (https://catalog.lasalle.edu/undergraduate/ilo/)		4
ILO 3.1b: Quantitative Reasoning (https://catalog.lasalle.edu/undergraduate/ilo/)		
MTH 120	Calculus I	4
ILO 6.1: Technological Competency (https://catalog.lasalle.edu/undergraduate/ilo/)		
Choose course within ILO (https://catalog.lasalle.edu/undergraduate/ilo/)		
ILO 8.1a/12.1: Oral Communication/Collaborative Engagement (https://catalog.lasalle.edu/undergraduate/ilo/)		
Choose course within ILO (https://catalog.lasalle.edu/undergraduate/ilo/)		3
<i>Distinct Discipline Core Courses</i>		
Students must complete 1 course in each of the following 4 ILOs. Each course must be from a different discipline. (A "discipline" is represented by the 3- or 4-letter prefix attached to each course.)		
ILO 4.1: Critical Analysis and Reasoning (https://catalog.lasalle.edu/undergraduate/ilo/)		
Choose course within ILO (https://catalog.lasalle.edu/undergraduate/ilo/)		3
ILO 9.1: Creative and Artistic Expression (https://catalog.lasalle.edu/undergraduate/ilo/)		
Choose course within ILO (https://catalog.lasalle.edu/undergraduate/ilo/)		3
ILO 10.1: Ethical Understanding and Reasoning (https://catalog.lasalle.edu/undergraduate/ilo/)		
Choose course within ILO (https://catalog.lasalle.edu/undergraduate/ilo/)		3
ILO 11.1: Cultural and Global Awareness and Sensitivity (https://catalog.lasalle.edu/undergraduate/ilo/)		
Choose course within ILO (https://catalog.lasalle.edu/undergraduate/ilo/)		3
<i>Universal Required Modules</i>		
Students must complete the following 2 non-credit modules.		

ILO 7.1a (<https://catalog.lasalle.edu/undergraduate/ilo/>)

Health Literacy Module

ILO 7.1b (<https://catalog.lasalle.edu/undergraduate/ilo/>)

Financial Literacy Module

Major Requirements*Level Two*

Students must complete 1 course/learning experience in each of the 4 commitments.

ILO 2.2: Broader Identity (Capstone Course/Experience) (<https://catalog.lasalle.edu/undergraduate/ilo/>)

MTH 322 Differential Equations 4

Select one ILO from 3.2a, 3.2b, 4.2, 5.2, 6.2, 7.2a, or 7.2b: Expanded Literacies (<https://catalog.lasalle.edu/undergraduate/ilo/>)

MTH 240 Linear Algebra (ILO 3.2b) 4

ILO 8.2b: Effective Expression (Writing-Intensive Course) (<https://catalog.lasalle.edu/undergraduate/ilo/>)

MTH 261 Discrete Structures II 3
or MTH 302 Foundations of Mathematics

Select one ILO from 10.2, 11.2, or 12.2: Active Responsibility (<https://catalog.lasalle.edu/undergraduate/ilo/>)

MTH 410 Probability 3

All Other Required Courses

MTH 120 Calculus I 4

MTH 121 Calculus II 4

MTH 222 Calculus III 4

MTH 240 Linear Algebra 4

MTH 260 Discrete Structures I 3

MTH 322 Differential Equations 4

MTH 410 Probability 3

MTH 411 Mathematical Statistics 3

MTH 415 Financial Mathematics 3

Two MTH Electives 300-level or higher 6

ECN 150 Introductory Macroeconomics: The U.S. in the Global Economy I 3

ECN 201 Introductory Microeconomics: Business Firm and Market Analysis I 3

BUS 101 Introduction to Financial Accounting 3

BUS 206 Financial Markets and Institutions: Principles and Applications 3

BUS 208 Fundamentals of Financial Management 3

FIN 304 Financial Decision-Making 3

Free Electives

In addition to the requirements listed above, students must take enough courses to the fulfill graduation credit requirements for their School and major.

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NOTE. The following students use Level 2 Capstone Experience in Major instead of FYS 130 First-Year Academic Seminar: Honors, BUSCA, Core-to-Core, Transfer, and Non-Traditional/Evening.

2

The Modules are **not** required for Transfer Students, Core-to-Core Students, or BUSCA Students. BUSCA students are required to take modules if/when they pursue a bachelor's degree.

Recommended Course Sequence

The following is a sample course sequence for the required major-level courses. It is possible that the order in which you take the courses will vary due to when certain courses are offered. The typical student should take five courses each semester, filling out the remaining slots with Core courses and/or free electives (which may possibly be used to complete a minor or second major).

Course	Title	Credits
First Year		
First Semester		
MTH 120	Calculus I	4
BUS 101	Introduction to Financial Accounting	3
Credits		7
Second Semester		
MTH 121	Calculus II	4
ECN 150	Introductory Macroeconomics: The U.S. in the Global Economy I	3
Credits		7
Second Year		
First Semester		
MTH 222	Calculus III	4
MTH 240	Linear Algebra	4
MTH 260	Discrete Structures I	3
Credits		11
Second Semester		
MTH 302 or MTH 261	Foundations of Mathematics or Discrete Structures II	3
ECN 201	Introductory Microeconomics: Business Firm and Market Analysis I	3
BUS 206	Financial Markets and Institutions: Principles and Applications	3
Credits		9
Third Year		
First Semester		
MTH 410	Probability	3
BUS 208	Fundamentals of Financial Management	2-3
Credits		5-6
Second Semester		
MTH 322	Differential Equations	4
MTH 411	Mathematical Statistics	3
FIN 304	Financial Decision-Making	3
Credits		10
Fourth Year		
First Semester		
MTH 415	Financial Mathematics	3
MTH 300+ elective		3
Credits		6
Second Semester		
MTH 300+ elective		3
Credits		3
Total Credits		58-59

Course Descriptions

Mathematics

MTH 120 Calculus I

Topics in this course include functions of various types: rational, trigonometric, exponential, logarithmic; limits and continuity; the derivative of a function and its interpretation; applications of derivatives, including finding maxima and minima and curve sketching; antiderivatives, the definite integral and approximations; the fundamental theorem of calculus; and integration using substitution. A TI graphing calculator is required. Prerequisite(s): MTH 119 or its equivalent

MTH 121 Calculus II

This course addresses differentiation and integration of inverse trigonometric and hyperbolic functions; applications of integration, including area, volume, and arc length; techniques of integration, including integration by parts, partial fraction decomposition, and trigonometric substitution; L'Hopital's Rule; improper integrals; infinite series and convergence tests; Taylor series; parametric equations; polar coordinates; and conic sections. A TI graphing calculator is required. Prerequisite(s): MTH 120

MTH 221 Calculus & Anal Geom II

This course addresses differentiation and integration of inverse trigonometric and hyperbolic functions; applications of integration, including area, volume, and arc length; techniques of integration, including integration by parts, partial fraction decomposition, and trigonometric substitution; L'Hopital's Rule; improper integrals; infinite series and convergence tests; Taylor series; parametric equations; polar coordinates; and conic sections. A TI graphing calculator is required. Prerequisite: MTH 120.

MTH 222 Calculus III

This course addresses three-dimensional geometry, including equations of lines and planes in space, and vectors. It offers an introduction to multi-variable calculus including vector-valued functions, partial differentiation, optimization, and multiple integration. Applications of partial differentiation and multiple integration. A TI-89 graphing calculator is required. Prerequisite(s): MTH 121

MTH 240 Linear Algebra

This course includes vectors and matrices, systems of linear equations, determinants, real vector spaces, spanning and linear independence, basis and dimension, linear transformations, eigenvalues and eigenvectors, and orthogonality. Applications in mathematics, computer science, the natural sciences, and economics are included. Prerequisite(s): MTH 120

MTH 260 Discrete Structures I

This course is the first half of a two-semester course in discrete mathematics. Topics in the course include logic, sets, functions, numeric bases, matrix arithmetic, divisibility, modular arithmetic, elementary combinatorics, probability, graphs, and trees. There will be an emphasis on applications of mathematics. Prerequisite(s): MTH 101 or a Mathematics Placement of 102M

MTH 261 Discrete Structures II

This course is the second half of a two-semester course in discrete mathematics. Topics in the course include rules of inference, proof methods, sequences and summation, growth of functions, complexity of algorithms, prime numbers and their application to cryptography, proof by induction, recursion, recurrence relations, and properties of relations. There will be an emphasis on applications. Prerequisite(s): MTH 260

MTH 302 Foundations of Mathematics

Topics in this course include propositional logic, methods of proof, sets, fundamental properties of integers, elementary number theory, functions and relations, cardinality, and the structure of the real numbers. Prerequisite(s): MTH 120 Corequisite(s): MTH 121

MTH 321 Real Analysis

This is a course that emphasizes the theory behind calculus topics such as continuity, differentiation, integration, and sequences and series (both of numbers and of functions); basic topology, Fourier Series. Prerequisites: MTH 222 and either MTH 302 OR a B- or better in MTH 261

MTH 322 Differential Equations

This course focuses on analytical, graphical, and numerical techniques for first and higher order differential equations; Laplace transform methods; systems of coupled linear differential equations; phase portraits and stability; applications in the natural and social sciences. (offered in alternate years) Prerequisite(s): MTH 121

MTH 330 Modern Geometries

Topics from Euclidean geometry including: planar and spatial motions and similarities, collinearity and concurrence theorems for triangles, the nine-point circle and Euler line of a triangle, cyclic quadrilaterals, compass and straightedge constructions. In addition, finite geometries and the classical non-Euclidean geometries are introduced. (offered in alternate years) Prerequisite(s): MTH 240 or MTH 302 or a B- or better in MTH 261

MTH 335 Graph Theory

This course introduces students to the field of graph theory and leads them through an exploration of the major branches of this subject, incorporating both theoretical results and current applications for each area studied. From a theoretical perspective, students re-derive well-known existing results and construct proofs related to new topics which have been introduced. From an applied standpoint, members of the class learn to formulate graph models to solve problems in computer science, the natural sciences, engineering, psychology, sociology, and other fields. We also consider some open problems and pose new questions of our own. In addition to fundamental definitions and concepts in graph theory, some specific topics that will be introduced are the following: Eulerian, Hamiltonian, planar, and directed graphs; trees, connectivity, matching, decomposition, coloring, covering, and independent sets and cliques; techniques and algorithms on graphs; and optimization problems and network flows. Prerequisite(s): Junior/senior mathematics standing or permission of the department chair

MTH 341 Abstract Algebra

Sets and mappings; groups, rings, fields, and integral domains; substructures and quotient structures; homomorphisms and isomorphisms; abelian and cyclic groups; symmetric and alternating groups; polynomial rings are topics of discussion in this course. (offered in alternate years) Prerequisite(s): MTH 302 or a B- or better in MTH 261

MTH 345 Combinatorics

This course addresses permutations and combinations, generating functions, recurrence relations and difference equations, inclusion/exclusion principle, derangements, and other counting techniques, including cycle indexing and Polya's method of enumeration. Prerequisite(s): MTH 120

MTH 370 Selected Topics in Mathematics

This is an introductory course to specialized areas of mathematics. The subject matter will vary from term to term. Restriction(s): junior or senior standing

MTH 405 History of Mathematics

This course is an in-depth historical study of the development of arithmetic, algebra, geometry, trigonometry, and calculus in Western mathematics (Europe and the Near East) from ancient times up through the 19th century, including highlights from the mathematical works of such figures as Euclid, Archimedes, Diophantus, Fibonacci, Cardano, Napier, Descartes, Fermat, Pascal, Newton, Leibniz, Euler, and Gauss. A term paper on some aspect of the history of mathematics is required. (offered in alternate years) Prerequisite(s): MTH 302 or a B- or better in MTH 261

MTH 410 Probability

Topics in this course include sample spaces and probability measures, descriptive statistics, combinatorics, conditional probability, independence, random variables, joint densities and distributions, conditional distributions, functions of a random variable, expected value, variance, various continuous and discrete distribution functions, and the Central Limit Theorem. (offered in alternate years) Prerequisite(s): MTH 222

MTH 411 Mathematical Statistics

Topics in this course include measures of central tendency and variability, random sampling from normal and non-normal populations, estimation of parameters, properties of estimators, maximum likelihood and method of moments estimators, confidence intervals, hypothesis testing, a variety of standard statistical distributions (normal, chi-square, Student's t, and F), analysis of variance, randomized block design, correlation, regression, goodness of fit, and contingency tables. (offered in alternate years) Prerequisite(s): MTH 410

MTH 415 Financial Mathematics

This course introduces students to the fundamental concepts of financial mathematics and provides opportunities to apply those concepts to real-world problems. Students will gain an understanding of concepts behind present and future values for various streams of cash flows and will work with reserving, valuation, pricing, asset and liability management, investment income, budgeting, and contingencies. Pre-requisite(s): Math 120 or permission of Chair.

MTH 421 Numerical Analysis

A survey of numerical methods commonly used in algebra and calculus with emphasis on both algorithms and error analysis. Topics include round-off error, numerical methods for solving equations in one variable, interpolation and polynomial approximation, and numerical differentiation and integration. Methods and techniques studied include Bisection, Fixed-Point Iteration, Newton's Method, M ller's Method, Lagrange Polynomials, Neville's Method, Divided Differences, Cubic Splines, Three-point and Five-point Numerical Differentiation Formulas, Newton-Cotes Formulas, Composite Numerical Integration, Adaptive Quadrature, Gaussian Quadrature. Prerequisite(s): MTH 121

MTH 424 Complex Variables

This course examines analytic functions; Cauchy-Riemann equations; Cauchy's integral theorem; power series; infinite series; calculus of residues; contour integration; conformal mapping. Prerequisite(s): MTH 222

MTH 425 Mathematical Modeling

This course addresses the uses of mathematical methods to model real-world situations, including energy management, assembly-line control, inventory problems, population growth, predator-prey models. Other topics include: least squares, optimization methods interpolation, interactive dynamic systems, and simulation modeling. Prerequisite(s): MTH 120

MTH 430 Topology

Topics in the course include topological spaces; subspaces; product spaces, quotient spaces; connectedness; compactness; metric spaces; applications to analysis. (offered in alternate years) Prerequisite(s): MTH 302 or a B- or better in MTH 261

MTH 444 Research in MTH I

This course provides the student with an opportunity to do research with a faculty member. The student and the faculty member agree on the research project before the student registers for the course.

MTH 460 Internship I**MTH 470 Selected Topics in Mathematics**

This course is an introduction to specialized research, concentrating on one particular aspect of mathematics. The subject matter will vary from term to term. Restriction(s): junior or senior standing

Economics

ECN 150 Introductory Macroeconomics: The U.S. in the Global Economy I
After introducing students to the what and how of economic thinking, the course explores the causes of national economic prosperity and economic problems such as unemployment and inflation. It also discusses the role of fiscal and monetary policies, economic growth, and international economic relations among the U.S. and other countries.

ECN 201 Introductory Microeconomics: Business Firm and Market Analysis I

This course explores many issues pertaining to the operation of businesses and the markets in which they operate. Among these are the behavior of consumers, the determinants of prices and production levels, and the efficiency of market outcomes. As time allows, the course applies economic thinking to issues like economic inequality, environmental concerns, international trade, and firms with monopoly power. Prerequisite(s): ECN 150

Business**BUS 101 Introduction to Financial Accounting**

The course introduces financial reporting by focusing on the fundamental principles of recording business transactions with emphasis on the presentation and interpretation of corporate financial information. Topics include an overview of financial reporting and the accounting cycle, as well as, accounting and reporting of operating, investing and financing activities of a business. Assignments employ both Excel and SAP.

BUS 206 Financial Markets and Institutions: Principles and Applications

An introduction to the basics of institutional finance. Financial instruments are generated and traded by participants in financial markets with financial intermediaries facilitating the process. Concepts, terminology, and current practices in each of these areas are examined, along with the impact they have on the economy. Students work on "mini cases" which employ actual data to help better understand the principles examined in the course. Prerequisite(s): BUS 101

BUS 208 Fundamentals of Financial Management

An introduction to the major concepts and techniques of financial management with an emphasis on time value of money, security valuation, cost of capital, capital budgeting, and financial statement analysis. Prerequisite(s): BUS 101, MTH 114, CSC 155

Finance

FIN 304 Financial Decision-Making

This course focuses on how managers can construct a decision-making process and manage the creation of shareholder value. As the majority of financial decisions require an estimate of future events, we will spend considerable time investigating how to achieve the above objectives, subject to the constraints of an uncertain future. Outside readings, case studies, and text material will be used to integrate current financial theory with pragmatic financial decision making. Prerequisite(s): BUS 202, 206, and 208

Program Contact Information

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