

Mathematics

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The major purposes of the Mathematics Department are to help students increase their knowledge and understanding of mathematical concepts, develop their reasoning ability and problem-solving skills, and improve their ability to apply mathematics in a variety of areas. The department prepares students to become data scientists, teachers of mathematics; to enter careers in actuarial science, business, industry, and government; and to pursue graduate study in mathematics and related areas.

The student expecting to major in Mathematics should have four years of high school mathematics, including two years of high school algebra, geometry, trigonometry and preferably calculus. In the freshman year, students planning to major in mathematics and those preparing for scientific work, including engineering, should be qualified to begin with MAT 151 Calculus I or MAT 230 Calculus II. The department offers four majors: Data Science; Mathematics; Mathematics Education; and Mathematics–Interdisciplinary.

Students interested in actuarial science should consider the Actuarial Science certificate and majoring in Mathematics–Interdisciplinary with a major or minor in Accounting or Finance. They should take MAT 352, MAT 382, and FIN 361 as preparation for the first two actuarial exams. Students can also receive VEE credit (Validation by Educational Experience) from the Society of Actuaries with grades of B- or higher in ECO 201, ECO 202, FIN 361, and MAT 382. See the guidelines from the Society of Actuaries webpage for further details.

Each semester, the Mathematics Department offers at least four sanctioned events such as special lectures or colloquiums. All majors are required to attend at least 15 sanctioned events for graduation and at least 12 sanctioned events before taking the MAT 493 course.

Data Science (BS)

The Bachelor of Science degree with a major in Data Science requires a minimum of 65-67 hours and attendance at 15 sanctioned events. *All major courses, including concentration courses, must be completed with a grade of C- or better and are included in the major GPA.*

Computer Science Core Requirements

COS 120	4	Introduction to Computational Problem Solving
COS 121	4	Foundations of Computer Science
COS 143	3	Interactive Webpage Development
COS 265	4	Data Structures and Algorithms
COS 280	3	Introduction to Artificial Intelligence
COS 326	3	Data Visualization
COS 343	3	Database Systems
SYS 411	4	Machine Learning I

Mathematics Core Requirements

MAT 180	3	Problem Solving
MAT 230	4	Calculus II
MAT 240	4	Calculus III
MAT 255	3	Justifications in Mathematics
MAT 311	3	Introduction to Data Science
MAT 345	4	Linear Algebra
MAT 352	4	Mathematical Statistics
MAT 382	3	Advanced Statistical Methods
MAT 392	1	Mathematics Seminar
MAT 393	3	Practicum
MAT 493	3	Senior Capstone

Select one course from the following:

BIO 306	3	Introduction to Bioinformatics
CHE 301	4	Analytical Chemistry I
COS 380	3	Natural Language Processing
MAT 385	3	Mathematics of Finance
MAT 401	3	Operations Research
PHY 310	3	Modern Physics
POS 245	3	Research in Political Studies
PSY 272	3	Research Methods in Psychology
SMA 210	3	Introduction to Sport Technology and Analytics
SYS 412	4	Machine Learning II

Data Science Minor

A Data Science minor requires a minimum of 31-32 hours. *All minor courses must be completed with a grade of C- or better and are included in the minor GPA.*

Minor Requirements

COS 121	4	Foundations of Computer Science
COS 143	3	Interactive Webpage Development
COS 326	3	Data Visualization
MAT 151	4	Calculus I
MAT 311	3	Introduction to Data Science
MAT 382	3	Advanced Statistical Methods

Select one course from the following:

MAT 210	4	Introductory Statistics
MAT 352	4	Mathematical Statistics

Select one course from the following:

COS 120	4	Introduction to Computational Problem Solving
SYS 120	4	Introduction to Problem Solving

Select one course from the following:

COS 265	4	Data Structures and Algorithms
COS 343	3	Database Systems
SYS 411	4	Machine Learning I

Mathematics (BA)

The Bachelor of Arts degree with a major in Mathematics requires two years of one foreign language and 46-47 hours (42-43 math hours), attendance at 15 sanctioned events, and is designed for students planning to attend graduate school. *All major courses must be completed with a grade of C- or better and are included in the major GPA.*

Major Requirements

MAT 180	3	Problem Solving
MAT 230	4	Calculus II
MAT 240	4	Calculus III
MAT 255	3	Justifications in Mathematics
MAT 340	4	Advanced Calculus
MAT 345	4	Linear Algebra
MAT 352	4	Mathematical Statistics
MAT 392	1	Mathematics Seminar
MAT 455	3	Abstract Algebra
MAT 457	3	Topology
MAT 493	3	Senior Capstone

Select one course from the following:

MAT 251	4	Differential Equations
MAT 311	3	Introduction to Data Science
MAT 382	3	Advanced Statistical Methods
MAT 385	3	Mathematics of Finance
MAT 401	3	Operations Research

Electives

Select 3 hours of mathematics electives—MAT 216 or higher, excluding MAT 301, 302, 309

Additional Major Requirements

Select one course from the following:

COS 120	4	Introduction to Computational Problem Solving
SYS 120	4	Introduction to Problem Solving

Select one course in biology, chemistry, or physics from:

BIO 203	4	Principles of Genetics
CHE 201	4	General, Organic, and Biochemistry I
CHE 211	4	College Chemistry I
PHY 211	4	University Physics I

Mathematics—Interdisciplinary (BS)

The Bachelor of Science degree with a major in Mathematics—Interdisciplinary requires a minimum of 51-55 hours, attendance at 15 sanctioned events, and the completion of a minor (or major) in any area outside of the Mathematics Department not including the Scripture Engagement minor. Recommended areas include Accounting, Biology, Chemistry, Computer Engineering, Computer Science, Cybersecurity, Economics, Engineering, Environmental Science, Finance, Information Systems, Political Science, or Physics. Minor (or major) requirements are listed under the offering department. The practicum may be in a supporting area (major or minor) instead of mathematics. *All major courses must be completed with a grade of C- or better and are included in the major GPA; additional courses from other major (or minor) are not included in this major GPA unless also required for this major.*

Major Requirements

MAT 180	3	Problem Solving
MAT 230	4	Calculus II
MAT 240	4	Calculus III
MAT 251	4	Differential Equations
MAT 255	3	Justifications in Mathematics
MAT 311	3	Introduction to Data Science
MAT 345	4	Linear Algebra
MAT 352	4	Mathematical Statistics
MAT 382	3	Advanced Statistical Methods
MAT 392	1	Mathematics Seminar
MAT 393	2-4	Practicum
MAT 493	3	Senior Capstone

Select one course from the following:

MAT 340	4	Advanced Calculus
MAT 455	3	Abstract Algebra
MAT 457	3	Topology

Additional Major Requirements

Select one course from the following:

COS 120	4	Introduction to Computational Problem Solving
COS 130	3	Computational Problem Solving for Engineers
SYS 120	4	Introduction to Problem Solving

Electives

Select 3 hours of mathematics electives—MAT 216 or higher, excluding MAT 301, 302, 309

Select one of the following biology, chemistry, or physics courses:

BIO 203	4	Principles of Genetics
CHE 201	4	General, Organic, and Biochemistry I
CHE 211	4	College Chemistry I
PHY 211	4	University Physics I

Mathematics Education (BA/BS)

The Bachelor of Science degree in Mathematics Education requires 50-51 hours in addition to education courses and attendance at 15 sanctioned events. Optional concentrations are available in SpEd Mild-Moderate P-12 Licensure, SpEd Intense P-12 Licensure, and TESOL P-12 Licensure. The Bachelor of Arts degree requires two years of one foreign language. *All major courses, including education curriculum courses, must be completed with a grade of C- or better and are included in the major GPA.*

Mathematics Requirements

MAT 180	3	Problem Solving
MAT 230	4	Calculus II
MAT 240	4	Calculus III
MAT 255	3	Justifications in Mathematics
MAT 280	3	Mathematics in the Junior High/Middle School
MAT 312	4	College Geometry
MAT 340	4	Advanced Calculus
MAT 345	4	Linear Algebra
MAT 352	4	Mathematical Statistics
MAT 392	1	Mathematics Seminar
MAT 455	3	Abstract Algebra
MAT 493	3	Senior Capstone

Additional Major Requirements

Select one course from the following:

COS 120	4	Introduction to Computational Problem Solving
MAT 251	4	Differential Equations
MAT 285	3	Technology for Mathematics Education
MAT 311	3	Introduction to Data Science
MAT 382	3	Advanced Statistical Methods
MAT 401	3	Operations Research
SYS 120	4	Introduction to Problem Solving

Select 3 hours of mathematics electives—MAT 216 or higher, excluding MAT 301, 302, 309

Select one of the following biology, chemistry, or physics courses:

BIO 203	4	Principles of Genetics
CHE 201	4	General, Organic, and Biochemistry I
CHE 211	4	College Chemistry I
PHY 211	4	University Physics I

Mathematics Education requirements continued on next page

Professional Education

EDU 150	3	Education in America
EDU 222	2	Literacy in the Content Area for Secondary Teachers
EDU 260	3	Educational Psychology
EDU 307	2	Discipline and Classroom Management for Secondary Teachers
EDU 309	1	Methods of Instruction and Assessment in Secondary Education
EDU 332	2	The Junior High/Middle School
EDU 384	2	Perspectives on Diversity
EDU 431	17	Supervised Internship in Secondary Schools
MAT 309	2	Teaching Math in Secondary Schools
SED 220	3	Exceptional Children

Select one course from the following:

EDU 344	1	Educational Technology in Secondary Education
MAT 285	3	Technology for Mathematics Education

Additional Education Requirements

PSY 340	3	Adolescent Psychology
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Select one course from the following:

CAC 160	3	Integrative Communication
COM 210	3	Public Speaking

Select one course from the following:

ENG 110	3	College Composition
ENG 111	4	College Composition with Support

Mathematics Minor

A Mathematics minor requires a minimum of 23-25 hours. All minor courses must be completed with a grade of C- or better and are included in the minor GPA.

Minor Requirements

MAT 230	4	Calculus II
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Select one option from the following:

MAT 151	4	Calculus I
MAT 145 [†]	3	Introduction to Functions and Calculus
and		
MAT 146 [†]	3	Functions and Calculus

[†]MAT 145 & 146 count as one option

Select an additional 15 hours of mathematics electives above MAT 151—MAT 205, 301, 302, and 309 do not count toward the minor. PHY 341 may also count as an elective.

Certificate in Actuarial Science

The department awards a certificate in Actuarial Science to students in any baccalaureate major. Students are required to complete 37 hours and pass at least one actuary exam. Students must complete an application and demonstrate passing a Society of Actuaries Exam no less than 30 days prior to graduation. Work in progress will be accepted. This certificate is awarded by the department and does not include a transcript entry.

Certificate Requirements

ACC 241	3	Accounting Principles I
ACC 242	3	Accounting Principles II
ECO 201	3	Principles of Microeconomics
ECO 202	3	Principles of Macroeconomics
FIN 361	3	Corporate Finance
MAT 151	4	Calculus I
MAT 230	4	Calculus II
MAT 240	4	Calculus III
MAT 352	4	Mathematical Statistics
MAT 382	3	Advanced Statistical Methods
MAT 385	3	Mathematics of Finance

Recommended Courses

MAT 353	1	Actuarial Exam Preparation (PI)
MAT 386	1	Actuarial Exam Preparation (FM1)

Mathematics Courses

MAT 100 1 hour

Mathematics Fundamentals

A study of the basic arithmetic operations, exponents, ratios, linear and quadratic equations, graphs, and story problems. This course is specifically designed to assist those students who need help for the mathematics proficiency examination. Pass/fail only. Does not count toward a mathematics major or minor.

NOTE: MAT 100 or proficiency by an approved exam is a prerequisite to all other Mathematics courses.

MAT 110 3 hours

Finite Mathematics

A study of selected topics from set theory, matrices, systems of linear equations and inequalities, linear programming, counting and probability, statistics, and mathematics of finance. Intended for Business Department majors only. Does not count toward a mathematics major or minor. Meets foundational core mathematics requirement. Prerequisite: A good understanding of algebra.

MAT 120 3 hours

Investigations in Mathematics

A course designed to engage students in relevant college-level mathematics and its connection to the Christian faith and everyday life. Students will experience interesting questions and real-life applications of mathematics from a variety of contexts while using appropriate technology. Emphasis will be on thinking, reasoning, and exploring patterns as well as communicating mathematical ideas. Topics will be chosen from data analysis, modeling, probability, statistics, mathematics of finance, logic, infinity, geometric applications, and fundamentals of problem solving. Does not count toward a mathematics major or minor. Meets foundational core mathematics requirement.

MAT 130 4 hours

Strategies for Calculus

Topics include rational, exponential, logarithmic, and trigonometric functions. Study of these functions include algebraic manipulation, graphing, applications, and trigonometric identities. Function concepts such as asymptotes, zeroes, domain, range, continuity, and function composition are also studied. This course is only intended for students who need further preparation before taking MAT 151 Calculus I. Does not count toward a mathematics major or minor. Does not meet a foundational core requirement. Prerequisite: MAT 100 or equivalent proficiency. Online only.

MAT 140 3 hours

Fundamental Calculus for Applications

An introductory study of derivatives, series, and integrals with a wide range of applications, including maximum and minimum problems. Prerequisite: A good understanding of algebra. Does not count toward a mathematics major or minor. Meets foundational core mathematics requirement.

MAT 145 3 hours

Introduction to Functions and Calculus

The MAT 145-146 sequence aims to provide a deep understanding of topics from precalculus and calculus as well as a strong sense of their usefulness. Fundamental ideas of calculus, specifically rates of change, are introduced early and used to provide a framework for the study of mathematical modeling involving algebraic, exponential, and logarithmic functions. Applications to business, economics, and science are emphasized. Meets foundational core mathematics requirement. MAT 145-146 may be taken as a two-semester substitute for MAT 151.

MAT 146 **3 hours**
Functions and Calculus
 MAT 146 is the second of a two-course sequence which begins with MAT 145, and continues the investigation of functions, including trigonometric functions, and their rate of change. Students are introduced to integrals and methods of integrations with applications. Further topics, such as infinite series and differential equations are included. *Prerequisite: MAT 145. MAT 145-146 may be taken as a two-semester substitute for MAT 151.*

MAT 151 **4 hours**
Calculus I
 A study of functions, including algebraic and trigonometric functions. An introduction to the algebraic, numerical, and graphical approaches to calculus, including limits, continuity, derivatives, integrals, and applications. *Prerequisite: A good understanding of algebra and trigonometry. Meets foundational core mathematics requirement. MAT 145 and MAT 146 may be taken as a two-semester substitute for MAT 151.*

MAT 169 **1-4 hours**
Independent Study
 An individualized, 100-200 level directed study involving a specified topic. *May be repeated with different topics for a maximum of 12 credits of independent study.*

MAT 170 **1-4 hours**
Selected Topics
 A course offered on a subject of interest but not listed as a regular course offering.

MAT 180 **3 hours**
Problem Solving
 An introduction to the mathematical sciences through the study of problem solving. An overview of various methods of problem solving to discover patterns, construct and modify conjectures and develop proofs of those conjectures. There will be an emphasis on developing creativity, confidence, and concentration. Content areas studied will include algebra, combinatorics, number theory and calculus, all from a problem-solving point of view. *Prerequisite: MAT 151 or one semester of high school calculus. Meets foundational core mathematics requirement.*

MAT 205 **3 hours**
Explorations in Elementary School Mathematics
 An introductory math course for elementary education majors that focuses on helping prospective teachers develop an understanding of the topics of algebra, probability, and data analysis as they relate to the elementary school curriculum. *Two hours of lecture and one hour of lab.*

MAT 210 **4 hours**
Introductory Statistics
 A study of basic statistical methods with a focus on applied data analysis in a group setting using statistical software. Develops proficiency in the use of descriptive methods, sampling, linear regression and correlation, probability theory and distributions, statistical inference techniques for estimation and hypothesis testing and experimental design. *Meets foundational core mathematics requirement.*

MAT 215 **3 hours**
Discrete Mathematics for Computer Science
 Discrete mathematics concepts are studied that are foundational for further study in computer science. Topics include propositional logic and quantifiers, proofs with emphasis on induction, relations and functions on sets, graph theory, solution of certain classes of recurrence and equivalence relations, combinatorics, and discrete probability. *Prerequisites: COS 120 or COS 130 or SYS 120; and MAT 146 or MAT 151.*

MAT 230 **4 hours**
Calculus II
 A study of analytic geometry, functions, limits and derivatives, differentiation and integration of algebraic functions and elementary transcendental functions, applications of the integral, the definite integral, sequences, series, Taylor's formula, and special techniques of integration. *Prerequisite: MAT 146 or MAT 151.*

MAT 240 **4 hours**
Calculus III
 This is the final course in the three-course sequence that is the standard complete introduction to the concepts and methods of calculus. The emphasis is on concepts and solving problems rather than on theory and proof. The course presents the concepts of calculus from three points of view: geometric, numeric, and algebraic. Topics typically include multivariable functions; contour diagrams and cross-sections; vectors; the dot product and the cross product; vector projection; partial derivatives; the gradient; directional derivatives; local linearity; local extrema and critical points; double integrals in Cartesian and polar coordinates; triple integrals in Cartesian, cylindrical, and spherical coordinates; parametric curves; vector fields; line integrals; gradient fields, path-independence, and the Fundamental Theorem of Calculus for Line Integrals; Green's Theorem; flux integrals; and the Divergence Theorem and Stokes' Theorem. *Prerequisite: MAT 230.*

MAT 251 **4 hours**
Differential Equations
 This course is about analytic, graphical, and numerical techniques for solving ordinary differential equations and systems of ordinary differential equations. Students will also study "real world" phenomena using ordinary differential equations. Topics typically include separation of variables; slope fields; linear first-order equations and the method of integrating factors; Euler's method for both first- and second-order autonomous equations; phase lines; methods for solving second-order linear equations with constant coefficients having exponential, polynomial, or sinusoidal forcing functions, including the method of undetermined coefficients, the method of integrating factors, and the method of finding series solutions; spring-mass systems; linear systems of equations of the form $x' = Ax$; the trace-determinant plane; Laplace transforms; and existence and uniqueness theorems for various families of equations. *Prerequisite: MAT 240. Offered Fall and Spring semesters.*

MAT 255 **3 hours**
Justifications in Mathematics
 The purpose of this course is for students to acquire the ability to create and express mathematical arguments through the exploration of mathematical ideas. In addition to gaining an understanding and appreciation for important and interesting mathematics, students will develop an ability to think creatively, to analyze critically, and to communicate clearly and correctly using mathematical reasoning and argumentation. Students are introduced to logic, number theory, sets, functions, infinity, graph theory, and abstract algebra, with an emphasis on proof techniques throughout. *Prerequisite: MAT 151. Offered Fall semester.*

MAT 261 **1 hour**
Special Problems
 Selected topics in mathematics. *Prerequisite: Consent of the department chair.*

MAT 270 **1-4 hours**
Selected Topics
 A course offered on a subject of interest but not listed as a regular course offering.

MAT 280 **3 hours**
Mathematics in the Junior High/Middle School
 An integrated content-methods course for middle school and introductory high school preparation. This course includes the mathematical strands of reasoning and algebra, rational numbers, geometry/measurement, and data analysis and probability, interwoven with the connections to appropriate pedagogical strategies for middle grades' teaching and learning. Should be taken with an education course with a field-based teaching lab component (e.g. JuMP, EDU 222, EDU 332). *Mathematics and elementary education majors only or permission of the instructor. Offered Spring semester of even years.*

MAT 285 **3 hours**
Technology for Mathematics Education
 The course will cover effective use of technology in a mathematics classroom and the inextricable connection between technology, pedagogy, and content knowledge. Students will also explore and think critically about how technology use relates to their faith. The course will focus on free, web-based technologies and pedagogical principles that are relevant regardless of the technology used. All student artifacts (e.g., homework, lesson plans, and personal statement of technology) will be collected into a digital portfolio for future use. *Meets foundation core computation requirement. Prerequisites: MAT 151 and EDU 150; or permission of instructor.*

MAT 301 **3 hours**
Number Concepts for Elementary Teachers
 A junior-level integrated content-methods course for elementary teacher preparation. The course includes a study of number systems and operations with emphasis on current standards and research-based pedagogical practices which focus on communication, reasoning, and representation standards. Each student will also participate in corresponding field experience (JuMP practicum). *Prerequisite: Approval into the teacher education program. Does not count toward a mathematics major or minor. Open to majors in elementary education. The MAT 301-302 sequence meets the mathematics foundational core requirement.*

MAT 302 **3 hours**
Geometry and Measurement for Elementary Teachers
 A junior-level integrated content-methods course for elementary teacher preparation. The course utilizes a problem-solving approach to the study of geometry and measurement with emphasis on current standards and research-based pedagogical practices which focus on communication, reasoning, and representation. Each student will also participate in a corresponding field experience (JuMP practicum). *Prerequisite: approval into the teacher education program and MAT 301. Does not count toward a mathematics major or minor. Open to majors in elementary education. The MAT 301-302 sequence meets the mathematics foundational core requirement.*

MAT 306 **3 hours**
Introduction to Bioinformatics
 This course is designed to introduce students to concepts of bioinformatics, as well as basic bioinformatics skills, using the R programming language. The course will explore methods and datasets spanning from the level of DNA (genomics) up to the organismal and ecosystem level. Bioinformatics is an interdisciplinary field combining concepts of biology, computer science, and statistics to analyze and interpret biological datasets and solve complex questions. *Two hours of lecture and one hour of one hour of coding/data analysis in a computer lab per week. Prerequisites: BIO 203 or instructor permission. Offered Fall semester of even years.*

MAT 309 2 hours**Teaching Math in Secondary Schools**

This course is designed to assist teacher candidates in developing their pedagogical content knowledge in the area of mathematics. It addresses such topics as lesson planning, higher-order thinking, professional development, content-appropriate teaching strategies, standards-based instruction, assessment of student learning, educational technology, motivational techniques, and instructional resources. National and state math standards are examined as a basis for reflective teaching and best practices. Should be taken with an education course that has a field-based teaching lab component (e.g., EDU 222 or EDU 332). *Prerequisites:* EDU 150 and EDU 260. *Offered Spring semester of odd years.*

MAT 310 3 hours**Mathematical Modeling with Numerical Analysis**

An introduction to modeling and the methods, techniques, and pitfalls in scientific computing and numerical analysis. The course will emphasize projects, writing, technology, and applications. Topics include iterative and algorithmic processes, error analysis, numerical integration and differentiation, curve fitting, and numerical solutions to different equations. *Prerequisites:* COS 120 or COS 130 or SYS 120; and MAT 240. *Offered Fall semester of even years.*

MAT 311 3 hours**Introduction to Data Science**

Provides a practical foundation to data science through the data analysis cycle of data acquisition, cleaning, transforming, modeling, and interpretation. An introduction to data wrangling and management with real world applications. The statistical program R will be introduced. *Prerequisites:* MAT 210 or MAT 240; COS 120 or SYS 120.

MAT 312 4 hours**College Geometry**

Advanced Euclidean plane geometry with a brief survey of some of the non-Euclidean geometries and vector and transformational geometry. *Prerequisites:* MAT 180 or MAT 345. *Offered Spring semester of odd years.*

MAT 322 4 hours**Ways of Knowing**

Topics studied include number, logic, Euclidean and non-Euclidean geometry, algebraic structures, dimension, and infinity. A study is made of the deductive method in mathematics and its relationship to ways of knowing in other areas. There is an emphasis on the beauty of mathematics and the relationship of mathematics to science and other forms of culture including the arts and religion. *Course is offered within the Honors Guild. Meets foundational core mathematics requirement. Offered Spring semester of odd years.*

MAT 340 4 hours**Advanced Calculus**

An introduction to a rigorous development of the fundamental concepts of calculus. The real numbers and their standard topology, sequences, series, limits, differentiation, and integration are developed rigorously. *Prerequisites:* MAT 240; MAT 180 or MAT 255. *Offered Spring semester of even years.*

MAT 345 4 hours**Linear Algebra**

A course on matrix theory, linear equations and linear dependence, vector spaces and linear transformations, characteristic equation, quadratic forms, and the singular value decomposition. *Prerequisite:* MAT 240. *Offered Spring semester.*

MAT 352 4 hours**Mathematical Statistics**

A theoretical, as well as applied, study of counting outcomes, probability, probability distributions, sampling distributions, confidence intervals, tests of hypotheses, linear regression, and correlation. *Prerequisite:* MAT 240. *Offered Fall semester.*

MAT 353 1 hour**Actuarial Exam Preparation (PI)**

The focus of the course is to prepare students to take the Society of Actuaries Exam P in probability. Topics include applications of calculus, probability, and statistics to risk management. Sitting for the Society of Actuaries Exam P is required for successful completion of the course. *Prerequisite:* MAT 352 or equivalent.

MAT 369 1-4 hours**Independent Study**

An individualized upper-division directed study involving a specified topic. *May be repeated with different topics for a maximum of 12 credits of independent study.*

MAT 370 1-4 hours**Selected Topics**

A course offered on a subject of interest but not listed as a regular course offering.

MAT 382 3 hours**Advanced Statistical Methods**

Introduction to a variety of topics including nonparametric statistical methods linear models, with simple linear regression, multiple regression, and analysis of variance as special cases of the linear model. The emphasis will be on translating applied questions into an appropriate statistical model, checking model assumptions, and interpreting analyses in applied contexts. A brief introduction to time series is included. *Prerequisites:* MAT 210 or MAT 352; and MAT 146 or MAT 151.

MAT 385 3 hours**Mathematics of Finance**

This course is an introduction to the mathematical models used in finance and economics with a focus on interest theory (discrete and continuous). The goal is to provide an understanding of the fundamental concepts of financial mathematics and how those concepts are applied in calculating present and accumulated values for various streams of cash flows. Topics include the mathematical foundations of interest theory, annuities, loans, stocks, financial markets, arbitrage, and financial derivatives. The course can be used as a foundation for the FM actuarial exam. *Prerequisite:* MAT 151. *Offered Fall semester of odd years.*

MAT 386 1 hour**Actuarial Exam Preparation (FMI)**

The focus of the course is to prepare students to take the Society of Actuaries Exam FM in Financial Mathematics. Topics include the fundamental concepts of financial mathematics, calculating present and accumulated values for various streams of cash flows. Sitting for the Society of Actuaries Exam FM is required for successful completion of the course. *Corequisite:* MAT 385 or equivalent.

MAT 392 1 hour**Mathematics Seminar**

Each student in the seminar researches a mathematical topic and makes a presentation to the entire group. *Prerequisite:* MAT 240. *Offered Fall semester.*

MAT 393 1-4 hours**Practicum**

Supervised learning involving a first-hand field experience or a project. Generally, one hour of credit is awarded for a minimum of 40 hours of practicum experience. *Offered primarily during the Summer.*

MAT 401 3 hours**Operations Research**

An introduction to operations research (management science), which is quantitative decision making. Emphasis is on linear programming and its application to financial decisions, distribution problems, project scheduling, and other network problems. Decision analysis with probabilities and multi-goal decisions are discussed as well. *Prerequisites:* COS 109 or SYS 101; COS 121 or COS 143; MAT 210 or MAT 352; MAT 151.

MAT 450 1-4 hours**Directed Research**

Investigative learning involving closely directed research and the use of such facilities as the library or laboratory.

MAT 455 3 hours**Abstract Algebra**

The development of the postulates of group theory, rings, integral domains, and fields. Applications to cryptography. *Prerequisites:* MAT 180 and MAT 240. *Offered Spring semester of odd years.*

MAT 456 3 hours**Advanced Algebra**

A continued study of Abstract and Linear Algebra. Topics include Galois Theory, cryptography, and field extensions. *Prerequisite:* MAT 455.

MAT 457 3 hours**Topology**

This is a proof-based course in which students explore the fundamentals of point-set topology. Topics include topological spaces, bases, subspaces, product spaces, separation properties, compactness, continuity, and connectedness. *Prerequisite:* MAT 255.

MAT 461 3 hours**Real Analysis**

A study of the Lebesgue integral and its consequences, including convergence theorems, function spaces, and introductions to measure theory and operator theory. Metric spaces, uniform convergence of functions, and topological approaches to continuity are also considered. *Prerequisite:* MAT 340. *Offered Fall semester of even years.*

MAT 480 1-4 hours**Seminar**

A limited-enrollment course designed especially for upper-class majors with emphasis on directed readings and discussion.

MAT 490 1-2 hours**Honors**

Individualized study or research of an advanced topic within a student's major. *Open to students with at least a 3.00 GPA in the major field.*

MAT 493 3 hours**Senior Capstone**

An overview of mathematics with an emphasis on the integration of all areas in undergraduate mathematics with an exploration of the relationship between mathematics and the Christian faith. *Open to senior status mathematics majors only. Meets foundational core speaking (SP) requirement. Offered during January interterm.*