MATHEMATICS (MTH)

MTH-1030 Dealing With Data (4 semester hours)
By incorporating algebraic thinking, students will develop the ability to use data and observations to make informed decisions by interpreting and analyzing data. Topics include ratios, proportionality, data sources and sampling, concepts of experimental design, descriptive measures, graphical representations, measures of center and variability, and use of spreadsheet software. The effective use of evidence, methods, and models in real world applications will be highlighted.

MTH-1100 College Algebra (4 semester hours)
This course addresses the fundamentals of algebra for students of all majors. It prepares the student mathematically for such courses as MTH-1310, MTH-2320, CSC-1700, ECN-2030 and CHM-1310. Topics include equations and systems of linear equations, inequalities, graphs, and functions, including polynomial, rational, inverse, exponential, and logarithmic functions.

MTH-1210 Mathematics for Elementary Teachers I (4 semester hours)
This course is the first of a three-course sequence (MTH-1210, MTH-1220, NSM-2500) for those majoring in elementary education. Topics include problem solving, sets and set operations, numeration systems, whole number operations, estimation, integer operations, number theory concepts, rational numbers and proportional reasoning.

MTH-1220 Mathematics for Elementary Teachers II (4 semester hours)
This course is a continuation of MTH-1210. Topics include decimals, percents, operations with decimals, probability, statistics and statistical analysis, fundamentals of geometry, congruence and similarity, geometric constructions, motion geometry, the Pythagorean Theorem, measurement, area and volume.
Prerequisite(s): MTH-1210.

MTH-1310 Precalculus (4 semester hours)
This course is a preparation for calculus beyond college algebra. Topics include a brief review of functions and graphs, trigonometric functions, analytic trigonometry, vector arithmetic, and analytic geometry in two and three dimensions.
Prerequisite(s): Placement in MTH-1310 is based on SAT or ACT mathematics sub-score or MTH-1100 with a grade of "C" or better or its equivalent as demonstrated on the AU Mathematics Competency Examination.

MTH-1810-9 Selected Topics in Mathematics (Variable semester hours)
This course will address a specific area of study in Mathematics not already covered by other course offerings. Prerequisites vary by topic.

MTH-2100 Statistics (4 semester hours)
This course is designed to educate the student in the foundational principles of descriptive and inferential statistics. Topics will include data and sampling, data visualization, measures of central tendency and variation, probability, probability distributions (including binomial, normal and student's t distributions), confidence intervals, hypothesis testing, correlation and linear regression analysis. This course will instill a working knowledge of statistics through applications in areas such as biostatistics and business analytics.
Prerequisite(s): Placement in MTH-2100 is based on SAT or ACT mathematics sub-score or MTH-1030 or MTH-1100 or MTH-1310 or MTH-2210 or the equivalent as demonstrated on the AU Mathematics Competency Examination.

MTH-2210 Calculus and Analytic Geometry I (4 semester hours)
This is the first of three courses covering the fundamentals of calculus and its applications. Topics include limits, continuity, derivatives, implicit differentiation, applications of differentiation, indefinite integral, the definite integral, numerical integration, logarithmic and exponential functions, and inverse functions. Numerical techniques and modeling applications of content will be explored.
Prerequisite(s): Placement in MTH-2210 is based on SAT or ACT mathematics sub-score or MTH-1310 with a grade of "C" or better or its equivalent as demonstrated on the AU Mathematics Competency Examination.

MTH-2220 Calculus and Analytic Geometry II (4 semester hours)
This course is a continuation of MTH-2210. Topics include application of integration, area, volume of revolution, arc length, techniques of integration, L'Hopital's rule, improper integrals, sequences, infinite series, power series, conics, parametric equations, polar, cylindrical and spherical coordinates. Numerical techniques and modeling applications of content will be explored.
Prerequisite(s): MTH-2210.

MTH-2230 Calculus and Analytic Geometry III (4 semester hours)
This course is a continuation of MTH-2220. This is a multivariable calculus course. Topics include vectors, vector functions and their derivatives, partial derivatives, multiple integrals, vector analysis, and infinite series. Numerical techniques and modeling applications of content will be explored.
Prerequisite(s): MTH-2220.

MTH-2500 Problem Solving, Modeling, and Design (4 semester hours)
Students in this course develop an understanding of problem solving, modeling, and design by developing ideas and solutions to relevant real-world opportunities. With team building, project management skills, and coursework fundamentals, students apply their knowledge to work within constraints using available tools. Professional and ethical responsibilities are considered.
Prerequisite(s): MTH-2210.

MTH-2810-9 Selected Topics in Mathematics (Variable semester hours)
This course will address a specific area of study in Mathematics not already covered by other course offerings. Prerequisites vary by topic.

MTH-3100 Financial Engineering (4 semester hours)
This course gives a comprehensive overview of the theory of interest and its application to a wide variety of financial instruments. Topics include rates of interest, present and future value, effective and nominal rates, annuities, loans, bonds, rate of return, stocks, fixed income investment, cash flow duration, immunization, and financial derivatives.
Co/prerequisite(s): MTH-2220.

MTH-3240 Probability and Statistics I (4 semester hours)
This course provides students with the fundamentals of statistical methods, probability and data analysis. It includes descriptive measures for data characterization (statistics), graphical representations and organization of data, random variables, expectation, distribution functions, central limit theorem, and an introduction to statistical inference. The theories of probability and statistics and their relational value to applied real-world problem solving are studied.
Prerequisite(s): MTH-2210.

MTH-3250 Linear Algebra (4 semester hours)
Topics in this course include systems of linear equations, matrices, determinants, vector spaces, subspaces, bases, dimension, eigenvalues and eigenvectors, inner products, linear transformations and matrices of linear transformations. Mathematical proofs of theorems and properties are also introduced in the course.
Prerequisite(s): MTH-2220.

MTH-3260 Probability and Statistics II (4 semester hours)
This course serves as a continuation of MTH-3240, Probability and Statistics I. Topics include continuous random variables, continuous distributions, bivariate and multivariate distributions, covariance, correlation, moment-generating functions, and the Central Limit Theorem.
Prerequisite(s): MTH-2230; MTH-3240.

MTH-3270 Discrete Mathematics (4 semester hours)
This course will provide students with the fundamentals of mathematical proof. Different proof techniques, such as direct proof and induction, will be introduced. Logic, graph theory, set theory, Boolean algebra, theory of automata, computability, Turing machines, and formal language theory will also be presented.
Prerequisite(s): MTH-1100.

MTH-3300 Differential Equations and Numerical Analysis (4 semester hours)
Topics include mathematical modeling, graphical solutions, techniques for solving first order differential equations, Euler's method, homogeneous constant coefficient linear equations, nonhomogeneous linear equations and their solutions, Laplace transformations, and numerical methods.
Prerequisite(s): MTH-2230.

MTH-3320 Applied Geometry (4 semester hours)
This is a course in Euclidean and non-Euclidean geometry in two and three dimensions via the axiomatic approach. Topics include Euclid's geometry, axiomatic systems and the nature of proof, the parallel axiom, non-Euclidean geometries, projective geometry, and transformation geometry. Applications of calculus and linear algebra to the geometry of curves and surfaces in space.
Prerequisite(s): MTH-2230.

MTH-3505 Data Analytics I: Predictive Analytics and Data Analysis (4 semester hours)
This is a course in predictive analytics, including theoretical background, tools, and techniques used to obtain insight into the properties of datasets. Regression, multiple regression, design of experiments, and time series analyses will be discussed in detail, including analysis of real data. Students will learn to visualize, explore, and interpret datasets as well as to apply and evaluate models using statistical software.
Prerequisite(s): MTH-3240.

MTH-3810-9 Selected Topics in Mathematics (Variable semester hours)
This course will address a specific area of study in Mathematics not already covered by other course offerings. Prerequisites vary by topic.

MTH-3820 Secondary Methods in Mathematics and Computer Science (4 semester hours)
This course presents techniques that are effective in teaching in the content areas. The course includes lesson planning, classroom arrangement, curriculum design, alternative teaching strategies and evaluation. In addition to the classroom hours there is a simultaneous practicum. This is usually the last course the student takes prior to student teaching. Placement applications for the practicum are due to the School of Education placement coordinator the January before the academic year of the practicum or for transfer students upon acceptance into the School of Education.
Prerequisite(s): Passing an FBI national fingerprint screening that encompasses passing a criminal background/sex offender check; passing a TB test; EDU-2100; EDU-2260; EDU-3620; EDU-3720.

MTH-3830 Directed Study in Mathematics (0.5-17 semester hours)
This is a course in which a student or students study on campus under the close supervision of an Aurora University faculty member. This is not "field experience," does not cover material in the regular curriculum, and is not as research and/ or independently oriented in its instructional methodology as an independent study. Descriptions of directed studies are contained in the petition by which the learning experience was approved. Students should file the Directed Study Petition prior to registration. This petition must be signed/approved by the Instructor, Department chair, and Academic Dean. Regular tuition is charged, and additional fees may apply.

MTH-4240 Probability and Statistics II (4 semester hours)
This course serves as a continuation of MTH 3240 Probability and Statistics I. Topics of study include multivariate continuous distributions, transformations of variables, moment generating functions, covariance, and statistical inference.
Prerequisite(s): MTH-2230; MTH-3240.

MTH-4260 Number Theory (4 semester hours)
This course addresses the theory of mathematical induction, divisibility theory, prime numbers and their distribution, theory of congruences and modular arithmetic, Fermat's theorem, and number theoretic functions and their applications.
Prerequisite(s): MTH-3270.

MTH-4300 Introduction to Real Analysis (4 semester hours)
This course introduces students to the theory of the calculus of functions of one variable. Introduction to advanced proof techniques is an emphasis of this course. Topics in this course could include, but are not limited to, functions, limits, continuity, differentiability and integrability for functions of one variable.
Prerequisite(s): MTH-2230.

MTH-4450 Abstract Algebra (4 semester hours)
This course is an introduction to abstract algebra. Algebraic structures and properties will be studied. Structures, substructures, and quotients with examples from groups, rings, and fields. Particular attention will be paid to examples from modular arithmetic on the integers and polynomials. Emphasis is placed on both the writing of clear and logically correct proofs as well as demonstration of computational proficiency.
Prerequisite(s): MTH-2230.

MTH-4505 Data Analytics II: Modeling, Optimization and Statistical Programming (4 semester hours)

This course will expand on the content in Data Analytics I. Students will explore and implement advanced modeling strategies and optimization techniques. Topics may include advanced model selection, logistic regression, decision trees, neural networks, optimization, and clustering. **Prerequisite(s):** MTH-3505; CSC-1700.

MTH-4810-9 Selected Topics in Mathematics (Variable semester hours)

This course will address a specific area of study in Mathematics not already covered by other course offerings. Prerequisites vary by topic.

MTH-4830 Directed Study in Mathematics (0.5-17 semester hours)

This is a course in which a student or students study on campus under the close supervision of an Aurora University faculty member. This is not "field experience," does not cover material in the regular curriculum, and is not as research and/ or independently oriented in its instructional methodology as an independent study. Descriptions of directed studies are contained in the petition by which the learning experience was approved. Students should file the Directed Study Petition prior to registration. This petition must be signed/approved by the Instructor, Department chair, and Academic Dean. Regular tuition is charged, and additional fees may apply.

MTH-4940 Internship in Actuary Science (4 semester hours)

An advanced academic internship experience for credit requires the student to be at least a junior in standing, although individual programs may require senior standing. The academic internship experience requires a faculty sponsor, educational criteria, and a current executed affiliation agreement and Schedule A on file. Internships can be designated as either credit/no credit or letter grade, depending on the school or program. Regular tuition is charged, and additional fees may apply. **Prerequisite(s):** Instructor Permission.

MTH-4970 Research in Mathematics (1-4 semester hours)

This course is designed to provide students with the opportunity to do mathematical research that has the potential to be published in a peer-reviewed scientific journal and/or presented at a scientific meeting. Students will accomplish these goals by performing a supervised research project and attending weekly seminars with their supervising instructor on how to conduct scientific research. Permission of the Instructor or Department Chair required.

MTH-4980 Independent Study in Mathematics (0.5-17 semester hours)

Descriptions of independent studies are contained in the petition by which the learning experience was approved. Prior to registration, students must file the Independent Study Petition. This petition requires the signature/approval of the Instructor, Department Chair, and Academic Dean. Regular tuition is charged. In most cases, Independent Study should be within the field of the student's major and should be something that cannot be pursued through established courses. These are pursued on campus under the direct supervision of an Aurora University faculty member. Regular tuition is charged, and additional fees may apply.

MTH-4990 Senior Capstone in the Mathematical Sciences (4 semester hours)

This course is the culmination of the mathematics and actuarial science major's academic experience. Students engage in independent research on a chosen topic or question under the direction of a faculty member. Guest lectures by various faculty members will expose students to content suitable for independent research. The course will also prepare students for entry into the job market or graduate school. Permission of the instructor/department.

Prerequisite(s): Senior standing, permission of the Instructor/Department Chair.