Students may select mathematics as their major for the following degree programs:

- Bachelor of Science (BS)
- Bachelor of Science in Education (BSEd)

In addition to satisfying general University requirements, all students majoring in mathematics must complete the following core courses:

<table>
<thead>
<tr>
<th>COURSE</th>
<th>TITLE</th>
<th>S.H.</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 1571</td>
<td>Calculus 1</td>
<td>4</td>
</tr>
<tr>
<td>MATH 1572</td>
<td>Calculus 2</td>
<td>4</td>
</tr>
<tr>
<td>MATH 2673</td>
<td>Calculus 3</td>
<td>4</td>
</tr>
<tr>
<td>MATH 3715</td>
<td>Discrete Mathematics</td>
<td>3</td>
</tr>
<tr>
<td>MATH 3720</td>
<td>Linear Algebra and Matrix Theory</td>
<td>3</td>
</tr>
<tr>
<td>MATH 3721</td>
<td>Abstract Algebra 1</td>
<td>4</td>
</tr>
<tr>
<td>MATH 3751</td>
<td>Real Analysis 1</td>
<td>4</td>
</tr>
<tr>
<td>STAT 3743</td>
<td>Probability and Statistics</td>
<td>4</td>
</tr>
<tr>
<td>CSIS 2610</td>
<td>Programming and Problem-Solving</td>
<td>4</td>
</tr>
</tbody>
</table>

Intermediate-level (2600) proficiency in a foreign language

Select one of the following:

- MATH 4896 Senior Undergraduate Research Project
- MATH 4897H Thesis
- STEM 4890 STEM Internship

In addition, students must complete 12 additional semester hours in mathematics at the 3700-level or above, with at least two courses chosen from the 4800-level. The total number of hours of mathematics is 40 semester hours.

In selecting appropriate courses, the student should consult a department advisor, since certain courses are recommended according to whether the student plans for graduate study in mathematics or statistics, secondary school teaching, or a career in business, industry, or government. The following courses are recommended based upon the student’s interest and career goals:

**Traditional Mathematics**: In addition to the core, students seeking classical training in mathematics are recommended to take MATH 4822, MATH 4880, and MATH 5852 and one additional 4800-level course in mathematics. The minor course of study may be any discipline. Suggested minors include biology, chemistry, computer science, economics, geology, physics, psychology, one engineering specialty (from chemical, civil, electrical, industrial, mechanical), or statistics. Students will study the nature of mathematics in fields such as algebra, real analysis, complex analysis, and topology. Connections to, and generalizations of, earlier formulations of mathematical concepts will constantly occur. Generally, new results in mathematics are developed and proven by those with a Ph.D. in mathematics. Students planning to pursue a Ph.D. will be well prepared for graduate school with these courses and should also study at least one of the languages French, Russian, or German.

**Applied Mathematics**: Applied mathematics courses emphasize areas of mathematics used in government and industry: Students learn mathematical models for the study of physical and computational processes. Mathematical techniques are also used to study uncertainty, scheduling, and decision theory. Many graduates find employment in consulting firms and large corporations where computing and mathematical problem solving skills are valued. Students are also prepared to pursue a master’s degree in applied mathematics.

In addition to the core, students interested in applied mathematics are recommended to take MATH 3705, 3745, 3760, MATH 4855, MATH 5825, MATH 5835, MATH 5845, MATH 5861, or MATH 6942, and complete a recognized minor in any discipline. Suggested minors include statistics, computer science, engineering, physics, geology, chemistry, biology, logistics, economics, or geoscience.

**Statistics**: Statistical techniques are utilized in many fields of research such as medicine, biology, business, and sociology. Statisticians learn proper methodology for collecting, summarizing, and interpreting data subject to sampling variability. The increase in affordable computing and the ease of statistical software have placed statistical expertise in demand. Generally, students interested in statistics pursue further study at the graduate level, but positions are available for students upon completion of a bachelor’s degree.

In addition to the core, students interested in statistics are recommended fulfill their upper-level course requirements with statistics courses and complete a minor in statistics.

**Actuarial Mathematics**: Students interested in using mathematics and statistics to quantify risk and develop models to better predict and study risk should consider actuarial mathematics. Actuaries work for insurance companies, investment and consulting firms, as well as the government and seek to find ways to manage risk and avoid potential exposure to excessive risk. Actuaries assess pension plans, mortality rates, and accident rates. Students will study the mathematical and statistical foundations of actuarial models as they prepare for the examination sequence to become a licensed actuary.

In addition to the core, students interested in actuarial mathematics are recommended to take STAT 5800, STAT 4804, STAT 4844, STAT 4888, and STAT 5802 and complete a minor in actuarial science.

**Accelerated 4+1 Program**: Undergraduate students can apply for admission into the accelerated program for the MS in Mathematics after completing 78 undergraduate semester hours with a GPA of 3.3 or higher. After being admitted to the accelerated MS program, students can take a maximum of nine semester hours of graduate coursework that can count toward both a bachelor’s and master’s degree from the Department of Mathematics and Statistics. The courses chosen to count for both undergraduate and graduate coursework must be approved by the Graduate Executive Committee within the Department upon admission into the program. An additional six hours of graduate coursework can be completed as an undergraduate and used exclusively for graduate credit. This allows the student to graduate with a master’s degree with one year of additional full-time study beyond the bachelor’s degree.

**Chair**
- Thomas P. Wakefield, Ph.D., Professor, Chair
- Professor
- Alexis Byers, Ph.D., Assistant Professor
- Guang-Hwa (Andy) Chang, Ph.D., Professor
- Neil Flowers, Ph.D., Assistant Professor
- Richard G. Goldthwait, Ph.D., Assistant Professor
- Jozsi Z. Jalics, Ph.D., Associate Professor
- G. Jay Kerns, Ph.D., Professor
- Lucy Xiaojing Kerns, Ph.D., Assistant Professor
Thomas L. Madsen, Ph.D., Assistant Professor
Nguyet Thi Nguyen, Ph.D., Assistant Professor
Anita C. O’Mellan, Ph.D., Professor
David H. Pollack, Ph.D., Associate Professor
Alicia Prieto Langarica, Ph.D., Associate Professor
Stephen Rodabaugh, Ph.D., Professor
Thomas Smotzer, Ph.D., Professor
Jamal K. Tartir, Ph.D., Professor
Padraic (“Paddy”) W. Taylor, Ph.D., Associate Professor
Eric J. Wingler, Ph.D., Professor
George Yates, Ph.D., Professor
Lecturer
Lori A. Carlson, M.S., Senior Lecturer
Emily Dolsak, M.S., Lecturer
Sepideh Khavari, M.S., Lecturer
Alayne Leone, M.S., Lecturer

Majors
- BS in Mathematics (http://catalog.ysu.edu/undergraduate/colleges-programs/college-science-technology-engineering-mathematics-department-mathematics-statistics-bs-mathematics-traditional-mathematics-track)

Minors

Mathematics

MATH 1505 Intermediate Algebra with Applications 5 s.h.
This course is intended to prepare STEM students for their college-level mathematics requirement. Topics include linear and nonlinear equations and inequalities; problem solving; relations of function types that include linear, polynomial, radical, rational, exponential, and logarithmic; applications. Math Placement Level 10 or higher. Does not count toward a degree.

MATH 1507 Intermediate Algebra 3 s.h.
Topics include functions of the following: linear, polynomial, rational, exponential, and logarithmic. Emphasis on function relations and graphing by algebraic techniques and technology. Solving linear, nonlinear equations and inequalities. Does not count toward a degree.
Prereq.: MATH 1501 or Level 20 on Math Placement Test.

MATH 1510 College Algebra 4 s.h.
This course is primarily intended to prepare STEM students (along with MATH 1511) for MATH 1570 or 1571 and business students for MATH 1552. Topics include real numbers, equations and inequalities, linear, quadratic, polynomial, exponential, and logarithmic functions, graphing techniques, systems of equations, and applications. The course fulfills the general education requirements for mathematics.
Prereq.: MATH 1505 or MATH 1507 with a “C” or better or Math Placement Level 35 or higher and concurrent enrollment in MATH 1510C.
Gen Ed: Mathematics.

MATH 1511 Trigonometry 3 s.h.
This course, along with MATH 1510 is primarily intended to prepare STEM students for MATH 1570 or MATH 1571. Topics include algebraic structure and graphs of trigonometric functions and inverse trigonometric functions, angle measurements, similar triangles, trigonometric identities, vectors, complex numbers, polar coordinates and solving trigonometric equations with applications.
Prereq.: Concurrent enrollment in MATH 1510.

MATH 1511C Corequisite Support for Trigonometry 1-3 s.h.
This course is intended to provide corequisite support for students requiring remediation in mathematics while they are concurrently enrolled in MATH 1510 (College Algebra). Emphasis will be placed on prerequisite skills needed for college algebra as well as just in time review through the use of appropriate technology. Does not count toward a degree.
Prereq.: Concurrent enrollment in MATH 1511.

MATH 1513 Algebra and Transcendental Function 5 s.h.
Function concepts including trigonometric, exponential, and logarithmic functions. Application problems and graphing. Supplemental topics.
Prereq.: Math Placement Level 45 or higher.
Gen Ed: Mathematics.

MATH 1552 Applied Mathematics for Management 4 s.h.
Apply functions, linear systems, linear programming to business including use of technology; mathematics of finance and an introduction to limits, derivatives and integrals with business applications. No credit for students who have completed MATH 1570 or MATH 1571.
Prereq.: MATH 1510 with grade of “C” or better or at least Level 45 on the Mathematics Placement Test.
Gen Ed: Mathematics.

MATH 1552C Corequisite Support for Applied Math for Management 1-3 s.h.
This course is intended to provide corequisite support for students requiring remediation in mathematics while they are concurrently enrolled in MATH 1552 (Applied Math for Management). Emphasis will be placed on prerequisite skills needed for business calculus as well as just in time review through the use of appropriate technology. Does not count toward a degree.
Prereq.: Concurrent enrollment in MATH 1552.

MATH 1564 Foundations of Middle School Mathematics 4 s.h.
Conceptual foundations of topics from number theory, operations, functions, algebra, geometry, measurement, probability, and data analysis. Emphasis on multiple approaches and representations, problem solving, and communication of mathematical reasoning. Includes inquiry-based laboratory experiences with manipulatives and computer technology.
Prereq.: At least Level 40 on the Mathematics Placement Test or concurrent registration in MATH 1507 (for both).
**MATH 1570 Applied Calculus 1** 4 s.h.
The elements of differential and integral calculus, with emphasis on applications. Analytical geometry, differentiation and integration techniques and series representations. Introduction to differential equations, transform calculus, and Fourier analysis. This is a basic methods course particularly adapted for those who require applied topics in mathematics. Not applicable toward the Mathematics major. Credit will not be given for both MATH 1549 and MATH 1570.
Prereq.: MATH 1513, or MATH 1510 and MATH 1511 grade of "C" or better, or at least Level 50 on the Mathematics Placement Test.
Gen Ed: Mathematics.

**MATH 1571 Calculus 1** 4 s.h.
A sequence of integrated courses in analytic geometry and calculus. A detailed study of limits, derivatives, and integrals of functions of one and several variables with applications.
Prereq.: MATH 1513, minimum grade of "C", or MATH 1510 and MATH 1511, minimum grade of "C" in both courses, or at least Level 70 on the Mathematics Placement Test.
Gen Ed: Mathematics.

**MATH 1571H Honors Calculus 1** 4 s.h.
A sequence of integrated courses in analytic geometry and calculus. A detailed study of limits, derivatives, and integrals of functions of one and several variables with applications.
Prereq.: MATH 1513, minimum grade of "C", or MATH 1510 and MATH 1511, minimum grade of "C" in both courses, or at least Level 70 on the Mathematics Placement Test.
Gen Ed: Mathematics.

**MATH 1572 Calculus 2** 4 s.h.
A sequence of integrated courses in analytic geometry and calculus. A detailed study of limits, derivatives, and integrals of functions of one and several variables with applications.
Prereq.: C or better in MATH 1571.
Gen Ed: Mathematics.

**MATH 1572H Honors Calculus 2** 4 s.h.
A sequence of integrated courses in analytic geometry and calculus. A detailed study of limits, derivatives, and integrals of functions of one and several variables with applications.
Prereq.: MATH 1571 OR MATH 1581H grade of "C" or better.
Gen Ed: Mathematics.

**MATH 1580H Honors Biomathematics 1** 2 s.h.
Counting techniques, probability, matrices and linear systems. Emphasis on the role of mathematical models in explaining and predicting phenomena in life sciences.
Prereq.: Admission to NEOMED-USY program.

**MATH 1581H Honors Biomathematics 2** 4 s.h.
Limits, derivatives, integrals; emphasizes theory, proofs, nonlinear epistemology, medical/health applications. Rigorously develops logarithmic/exponential functions. Major projects applying differential equations to medicine. Credit can be given for both MATH 1571 and MATH 1581H if taken in that order; MATH 1581H can be prerequisite for MATH 1572.
Prereq.: Admission to YSU-BaccMed program.
Gen Ed: Mathematics.

**MATH 1585H Accelerated Honors Calculus 1** 5 s.h.
A sequence of honors courses in analytical geometry and calculus which cover essentially the same material as MATH 1571, 1572, 2673, in two semesters instead of three. A detailed study of limits, derivatives, and integrals of functions of one and several variables and their applications. This sequence will be offered at most once during each academic year.
Prereq.: ACT math subscore of 32, AP Calculus score of 4 or higher, or at least one unit of high school calculus with a score of 28 or higher on placement exam or instructor permission.
Gen Ed: Mathematics.
MATH 2670  Applied Calculus 2  5 s.h.
The elements of differential and integral calculus, with emphasis on applications. Analytical geometry, differentiation and integration techniques and series representations. Introduction to differential equations, transform calculus, and Fourier analysis. This is a basic methods course particularly adapted for those who require applied topics in mathematics. Not applicable toward the Mathematics major. Credit will not be given for both MATH 1549 and MATH 1570.
Prereq.: MATH 1570 grade of "C" or better.
Gen Ed: Mathematics.

MATH 2673  Calculus 3  4 s.h.
A sequence of integrated courses in analytic geometry and calculus. A detailed study of limits, derivatives, and integrals of functions of one and several variables with applications.
Prereq.: MATH 1572 with a "C" or better.

MATH 2673H  Honors Calculus 3  4 s.h.
A sequence of integrated courses in analytic geometry and calculus. A detailed study of limits, derivatives, and integrals of functions of one and several variables with applications.
Prereq.: MATH 1572 with a "C" or better.

MATH 2686H  Accelerated Honors Calculus 2  5 s.h.
A sequence of honors courses in analytical geometry and calculus which cover essentially the same material as MATH 1571, 1572, 2673, in two semesters instead of three. A detailed study of limits, derivatives, and integrals of functions of one and several variables and their applications. This sequence will be offered at most once during each academic year.
Prereq.: MATH 1585H.
Gen Ed: Mathematics.

MATH 2687H  Honors Calculus Laboratory 2  1 s.h.
Introduction to mathematical modeling of topics covered in calculus. Emphasizes the use of technology such as computer algebra systems, technical document processing, and graphics software for solving problems and reporting solutions.
Prereq.: MATH 1572 or concurrent with MATH 1572H or 1586H.

MATH 3701  Biomathematics Seminar 1 s.h.
Introduction to interdisciplinary research in biology and mathematics. Topics include current research by faculty and students, cross disciplinary communication, report writing, technical presentations, literature reading, laboratory techniques and safety. May be repeated once. Listed also as BIOL 3701.
Prereq.: MATH 1571 or MATH 1585H or BIOL 2601 or BIOL 2602.

MATH 3702  Problem Solving Seminar for Secondary Mathematics 3 s.h.
Approaches to and practice with problem solving with examples from a broad spectrum of mathematics. Emphasizes problems at the level of the Praxis II examination for mathematics and problems suitable for high school contests such as the American Mathematics Competition 10 and 12.
Prereq.: MATH 1572 or MATH 1585H or consent of instructor.

MATH 3705  Differential Equations 3 s.h.
Prereq.: C or better in MATH 2673.

MATH 3705H  Honors Differential Equations 3 s.h.
Prereq.: MATH 2673 grade of "C" or better.

MATH 3715  Discrete Mathematics 3 s.h.
A course in discrete mathematical structures to prepare students for advanced courses. Topics include set theory, functions and relations, logic and quantifiers, truth tables and Boolean expressions, induction and other techniques of proof, and graphs. Credit will not be given for both CSCI 3710 and MATH 3715.
Prereq.: MATH 1572 or MATH 1585H.

MATH 3720  Linear Algebra and Matrix Theory 3 s.h.
Matrices; matrix operations; linear transformations; applications.
Prereq.: MATH 1572 or MATH 1585H.

MATH 3721  Abstract Algebra 1  4 s.h.
Introduction to abstract algebra investigating fundamental concepts in group and ring theory. Topics include groups, subgroups, cyclic groups, permutation groups, cosets, direct products, homomorphisms, factor groups, rings, integral domains and polynomial rings.
Prereq.: MATH 3715 and MATH 3720.

MATH 3745  Topics in Mathematical Modeling 3 s.h.
This course exposes students to methods of mathematical modeling through applications. Tools used to develop, refine, test, and present mathematical models will be discussed. Topics covered and projects undertaken may vary with each course offering and are designed to expose students to the types of problems modeled by applied mathematicians working in business, government, industry, or research. Course may be repeated depending on projects or topics presented.
Prereq.: MATH 2673 or MATH 2686H or permission of the instructor.

MATH 3745H  Honors Topics in Mathematical Modeling 3 s.h.
This course exposes students to methods of mathematical modeling through applications. Tools used to develop, refine, test, and present mathematical models will be discussed. Topics covered and projects undertaken may vary with each course offering and are designed to expose students to the types of problems modeled by applied mathematicians working in business, government, industry, or research. Course may be repeated depending on projects or topics presented.
Prereq.: MATH 2673 or MATH 2686H or permission of the instructor.

MATH 3750  History of Mathematics 3 s.h.
A survey of the historical development of mathematics.
Prereq.: MATH 3715.

MATH 3751  Real Analysis 1  4 s.h.
Introduction to the properties of the real number system and metrics and metric properties, with critical analysis of limits, continuity, differentiability, integration, and other fundamental concepts underlying the calculus.
Prereq.: MATH 3715 and one of MATH 2673 or MATH 2686H.

MATH 3767  Algebra/Geometry for Middle School Teachers 1  4 s.h.
An integrated, conceptual, and function-centered approach to the foundations of algebra, geometry, and trigonometry for preservice middle childhood mathematics specialists. Emphasis on multiple approaches and representations, problem solving, and communication of mathematical reasoning. Includes inquiry-based laboratory experiences. Not applicable to the mathematics major.
Prereq.: MATH 1564 and either 40 on the Mathematics Placement test or MATH 1507.
MATH 3768  Algebra/Geometry for Middle School Teachers  2  4 s.h.
An integrated, conceptual, and function-centered approach to the
foundations of algebra, geometry, and trigonometry for future middle
school mathematics specialists. Emphasis on multiple approaches and
representations, problem solving, and career preparation. Inclusions inquiry-based laboratory experiences. Not applicable to
the mathematics major.
Prereq.: MATH 2665 and either 40 on the Mathematics Placement test or
MATH 1507.

MATH 3785  Numerical Methods  3 s.h.
Matrices, matrix operations, and the application of numerical methods. Not
applicable to the Mathematics major.
Prereq.: MATH 2670 and ENTC 1505, or equivalent.

MATH 3795  Topics in Mathematics 2-3 s.h.
The study of a mathematical topic or the development of a special area of
mathematics. May be repeated once.
Prereq.: MATH 1570 or MATH 1571 or MATH 2623 or MATH 2651.

MATH 4822  Abstract Algebra 2  3 s.h.
A continuation of MATH 3721 with special emphasis on fields. Additional
topics in pure or applied algebra.
Prereq.: MATH 3721 or equivalent.

MATH 4823  Abstract Algebra 3  3 s.h.
This course introduces advanced topics in field theory. Topics may include
principal ideal domains, irreducibility, quotient rings, algebraic extensions,
finite fields, splitting fields, and the Galois group.
Prereq.: MATH 4822.

MATH 4830  Foundations of Geometry  3 s.h.
The development of Euclidean and non-Euclidean geometries from postulate
systems.
Prereq.: MATH 3715.

MATH 4832  Euclidean Transformations 3 s.h.
General properties of functions and transformations; isometries and
transformations of the Euclidean plane; the complex plane, its geometry and
subfields; transformational, analytical, and vector approaches to Euclidean
geometry; connections to other branches of mathematics and applications.
Prereq.: MATH 3720 and MATH 4830.

MATH 4855  Ordinary Differential Equations  3 s.h.
A second course in differential equations with emphasis on nonlinear
problems and qualitative methods or on boundary value problems. Topics are
chosen from: proofs of fundamental theorems, phase plane analysis, limit
cycles and the Poincare-Bendixon theorem, biological models, stability via
Liapunov functions, asymptotic methods, and boundary value problems.
Prereq.: MATH 3705 and MATH 3720.

MATH 4857  Partial Differential Equations  3 s.h.
Introduction to partial differential equations (PDE) including solution
techniques and applications. Classification of the basic types of PDE’s
(hyperbolic, parabolic and elliptic) and dependence on boundary and initial
conditions. Topics include Fourier series, integral transforms (Fourier, Laplace),
and applications in vibrations, electricity, heat transfer, fluids or other selected
topics.
Prereq.: MATH 3705 and MATH 3720.

MATH 4869  Functions, Calculus, and Applications for Middle School
Teachers  3 s.h.
Polynomial and exponential functions, limits, derivatives, integrals, and
applications. Interpretation of slope and area in graphs of functions from
applied settings. Applications of limits to the derivations of geometric
formulas. Relations between tables, graphs, and the symbolic representation
of functions.
Prereq.: MATH 3767 or consent of instructor.

MATH 4870  Mathematics Seminar for Middle School Teachers  3 s.h.
Problem solving from a broad spectrum of mathematics topics (Number
Sense and Operations; Algebra, Functions, and Calculus; Measurement and
Geometry; Statistics, Probability, and Discrete Mathematics) designed to
prepare future middle school mathematics teachers to address Common Core
Standards. May be repeated 2 times.
Prereq.: MATH 3767, MATH 3768, MATH 4869, and either STAT 2601 or
STAT 2625.

MATH 4875  Complex Variables  3 s.h.
Complex numbers and their geometric representation, analytic functions of a
complex variable, contour integration, Taylor and Laurent series, residues and
poles, conformal mapping.
Prereq.: MATH 3751 or equivalent.

MATH 4880  Introduction to Topology  3 s.h.
An introduction to the basic concepts of general topology: compactness,
connectedness, and continuity in topological spaces.
Prereq.: MATH 3721 and MATH 3751.

MATH 4882  Biomathematics Research  1-2 s.h.
Interdisciplinary and individualized study of a topic in biology and
mathematics. Student project mentored jointly by faculty in biology and
mathematics. May be repeated once. Grading is Traditional/PR. Listed also as
BIOL 4882.
Prereq.: MATH 3701, BIOL 3701, senior status and permission of the
department chairperson.

MATH 4884  Mathematical Logic  3 s.h.
An introduction to the study of theories in formalized languages and to the
theory of models.
Prereq.: MATH 3721 or PHIL 3719.

MATH 4896  Senior Undergraduate Research Project  2 s.h.
Individualized study of a topic in mathematics culminating in a written report
and an oral presentation at a national or regional meeting or a local seminar.
May be repeated once.
Prereq.: 24 s.h. of mathematics applicable to the mathematics major
including either MATH 3721 or MATH 3751 and permission of the
department chairperson.

MATH 4897H  Thesis 2 s.h.
Individualized study of a topic in mathematics culminating in a written report
and an oral presentation at a national or regional meeting or a local seminar.
May be repeated once.
Prereq.: 24 s.h. of mathematics applicable to the mathematics major
including both MATH 3721 and MATH 3751 and permission of the department
chairperson.

MATH 4980  Introduction to Topology  3 s.h.
An introduction to the basic concepts of general topology: compactness,
connectedness, and continuity in topological spaces.
Prereq.: MATH 3721 or PHIL 3719.

MATH 5821  Topics in Abstract Algebra  4 s.h.
A course in abstract algebra aimed at developing a broad understanding of
the subject. Credit will not be given for both MATH 3721 and MATH 5821.
Prereq.: MATH 3715 and MATH 3720.

MATH 5825  Advanced Linear Algebra  3 s.h.
A study of abstract vector spaces, linear transformations, duality, canonical
forms, the spectral theorem, and inner product spaces.
Prereq.: MATH 3721.
MATH 5845 Operations Research 3 s.h.
An introduction to operations research with emphasis on mathematical methods. Topics may include: linear programming, sensitivity analysis, duality theory, transportation problems, assignment problems, transshipment problems, and network problems.
Prereq.: MATH 3715 and MATH 3720.

MATH 5851 Topics in Analysis 4 s.h.
A course in analysis aimed at developing a broad understanding of the subject. Credit will not be given for both MATH 3751 and MATH 5851.
Prereq.: MATH 2673 or MATH 2686H and MATH 3720 and MATH 3715.

MATH 5852 Real Analysis 2 3 s.h.
Uniform convergence of sequences of functions and some consequences; functions on n-space: derivatives in vector spaces, mean value theorem, Taylor's formula, inverse mapping theorem, implicit mapping theorem.
Prereq.: MATH 3720 and MATH 3751 or equivalent.

MATH 5860 Topics in Numerical Analysis 3 s.h.
A course in numerical analysis aimed at developing a broad understanding of the subject. Credit will not be given for both MATH 3760 and MATH 5860.
Prereq.: MATH 3720 and CSIS 2610.

MATH 5861 Numerical Analysis 2 3 s.h.
Numerical methods of initial-value problems, eigenvalue problems, iterative methods for linear and nonlinear systems of equations, and methods involving least squares, orthogonal polynomials, and fast Fourier transforms.
Prereq.: MATH 2673 or MATH 2686H and MATH 3760 or equivalent.

MATH 5875 Complex Variables 3 s.h.
Complex numbers and their geometric representation, analytic functions of a complex variable, contour integration, Taylor and Laurent series, residues and poles, conformal mapping.
Prereq.: MATH 3751 or equivalent.

MATH 5895 Selected Topics in Mathematics 2-3 s.h.
The study of a special area of mathematics. May be repeated twice.
Prereq.: 24 s.h. of mathematics applicable to the mathematics major including either MATH 3721 or MATH 3751.

Statistics
STAT 2601 Introductory Statistics 3 s.h.
Designed for students from different disciplines who desire an introduction to statistical reasoning. Topics include collecting and summarizing data, concepts of randomness and sampling, statistical inference and reasoning, correlation and regression. Credit will not be given for both STAT 2601 and STAT 2625.
Prereq.: level 35 or higher on the Math Placement Test.
Gen Ed: Mathematics.

STAT 2625 Stat Lit and Crit Reasoning 4 s.h.
An introduction to statistics and its applications. Topics include descriptive statistics, experimental design, probability sampling distribution, statistical inference, correlation and regression. Emphasis on applications, critical reasoning, and data analysis using statistical software. Credit will not be given for both MATH 2623 and STAT 2625.
Prereq.: at least Level 20 on the Mathematics Placement Test or Level 10 on the Mathematics Placement Test and concurrent enrollment in STAT 2625C.

STAT 2625C Corequisite Support for Statistical Literacy and Critical Reasoning 1-3 s.h.
This course is intended to provide corequisite support for students requiring remediation in mathematics while they are concurrently enrolled in STAT 2625 (Statistical Literacy and Critical Reasoning). Emphasis will be placed on prerequisite skills needed for statistics as well as just in time review through the use of appropriate technology. Does not count toward a degree. 1 - 3 s.h.
Prereq.: Concurrent enrollment in STAT 2625.

STAT 3717 Statistical Methods 4 s.h.
Probability and statistics designed for students majoring in the natural sciences. Topics include descriptive statistics, probability, estimation, testing hypotheses, analysis of variance, regression and nonparametric statistics. Use of personal computers with computer software will be required. Credit will not be given for both STAT 3717 and STAT 3743.
Prereq.: MATH 1552 or MATH 1570 or MATH 1571 or MATH 1585H or equivalent.

STAT 3717H Honors Statistical Methods 4 s.h.
Probability and statistics designed for students majoring in the natural sciences. Topics include descriptive statistics, probability, estimation, testing hypotheses, analysis of variance, regression and nonparametric statistics. Use of personal computers with computer software will be required. Credit will not be given for both STAT 3717 and STAT 3743.
Prereq.: MATH 1549 or MATH 1570 or MATH 1571 or MATH 1585H or equivalent.

STAT 3743 Probability and Statistics 4 s.h.
A calculus-based probability and statistics course. Topics include descriptive statistics, probability models and related concepts and applications, statistical estimation, and hypothesis testing. Credit will not be given for both STAT 3717 and STAT 3743.
Prereq.: MATH 1572 or MATH 1585H.

STAT 3781H Honors Biostatistics 3 s.h.
Descriptive statistics, testing hypotheses, analysis of count data, correlation, regression, nonparametric statistics, and analysis of variance with applications relating to biological and health sciences.
Prereq.: MATH 1580H and MATH 1581H, or equivalent.

STAT 4804 Actuarial Models 1 3 s.h.
The statistical foundation of actuarial contingency models including the study of survival and severity distributions. Other topics selected from life insurance and annuities, benefit premiums, reserves, and applications.
Prereq.: STAT 3743 or consent of department chairperson.

STAT 4805 Actuarial Models 2 3 s.h.
The statistical foundation of actuarial contingency models including the analysis of benefit reserves. Other topics selected from multiple life functions and decrement models, insurance models, and applications.
Prereq.: STAT 3743 or consent of department chairperson.

STAT 4812 Statistical Analysis System for Data and Analytics 3 s.h.
An introduction to SAS programming for data and analytics. Topics include using SAS for data processing, manipulation, visualization, reporting, and statistical analysis. The objective is for students to develop statistical computing skills for problem solving and decision making.
Prereq.: STAT 3717 or STAT 3743 or equivalent.

STAT 4817 Applied Statistics 3 s.h.
Application of regression, survey sampling, analysis of variance, design and analysis of experiments, and related topics.
Prereq.: STAT 3717 or STAT 3743 or equivalent.

STAT 4843 Theory of Probability 3 s.h.
The mathematical foundation of probability theory including the study of discrete and continuous distributions. Other topics selected from limit theorems, generating functions, stochastic processes, and applications. Listed also as MATH 4843. Credit for STAT 4843 will not be given to students with MATH 4843.
Prereq.: STAT 3743 and one of MATH 2673 or MATH 2686H or consent of department chairperson.

STAT 4844 Theory of Statistics 3 s.h.
The mathematical theory of statistical inferences including likelihood principle, sufficient statistics, theory of statistical estimation, hypothesis testing and related topics.
Prereq.: STAT 4843.
STAT 4845  Stochastic Process Models  3 s.h.
Introduction to the mathematical foundations of the theory and application of stochastic processes. Topics include Markov processes, Poisson processes, queueing theory, and simulation. Other topics selected from limit theorems, Brownian Motion, and stationary processes.
Prereq.:  STAT 4843.

STAT 4848  Applied Regression Time Series  3 s.h.
Statistical methods for regression and time series analysis. Topics include applied linear regression with model fitting and diagnostics, data analysis, and forecasting with time series models.
Prereq.:  STAT 3717 or STAT 3743.

STAT 4849  Design of Experiments  3 s.h.
The objective of this course is to learn how to plan, design and conduct experiments efficiently, and apply statistical techniques on resulting data to obtain conclusions. Topics include introduction of experiments, complete randomized designs, blocking designs, factorial designs, nested designs, and random effects models.
Prereq.:  STAT 4817 or STAT 6940 or equivalent.

STAT 4888  Actuarial Models in Financial Economics  3 s.h.
An introduction to actuarial models in financial economics. Topics include the Black-Scholes framework for pricing derivatives, the binomial pricing model, and interest rate models.
Prereq.:  STAT 4843.

STAT 4896  Statistical Project  2 s.h.
Individualized study of a topic in statistics culminating in a written report and an oral presentation. May be repeated once.
Prereq.:  STAT 4817 and permission of chairperson.
Gen Ed:  Capstone.

STAT 5800  Mathematical Foundations of Actuarial Science  3 s.h.
A survey of probability theory and an introduction to risk management. Emphasis of the course will be on problem solving with applications in actuarial science.
Prereq.:  STAT 4843 or consent of instructor.

STAT 5802  Theory of Interest  3 s.h.
Mathematical theory and techniques in analysis of interest. Topics include measurement of interest, force of interest, annuities, amortization, pricing of investment products, and applications to actuarial sciences.
Prereq.:  MATH 1572 and any 3700 level MATH, STAT, ECON, or FIN course.

STAT 5806  Seminar in Actuarial Science  2-3 s.h.
Approaches to and practice with problem solving in actuarial science. Topics may include financial mathematics, financial economics, or actuarial modeling. May be repeated once. Not applicable to the mathematics major.
Prereq.:  STAT 4843 or consent of the instructor.

STAT 5811  SAS Programming for Data Analytics  3 s.h.
An introduction to SAS programming for data analytics. Topics include using SAS for data processing, manipulation, visualization, reporting and statistical analysis. The objective is for students to develop statistical computing skills for problem solving and decision making. Also listed as ECON 5861.
Prereq.:  STAT 3717 or STAT 3743 or STAT 2601 or ECON 3790 or equivalent.

STAT 5814  Statistical Data Mining  3 s.h.
A systematic introduction to data mining with emphasis on various data mining problems and their solutions. Topics include data mining processes and issues, exploratory data analysis, supervised and unsupervised learning, classification, and prediction methods.
Prereq.:  STAT 3717 or STAT 3743, or consent of department chairperson.

STAT 5819  Bayesian Statistics  3 s.h.
An introduction to the Bayesian approach to statistical inference for data analysis in a variety of applications. Data analysis using statistical software will be emphasized. Topics include: comparison of Bayesian and frequentist methods, Bayesian model specification, prior specification, basics of decision theory, Markov chain Monte Carlo, Bayes factor, empirical Bayes, Bayesian linear regression and generalized linear models, hierarchical models.
Prereq.:  STAT 3717 or STAT 3743 or STAT 4817 or STAT 6940 or equivalent.