Department of Mathematical Sciences

Curtis Church, Chair
KOM 223D

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The purpose of the Department of Mathematical Sciences is to provide students education in the mathematical sciences necessary to function and succeed in an increasingly complex, technological world.

Courses offered by the department are designed to prepare students who plan to enter graduate schools or professional schools of medicine or engineering; to teach in elementary schools, secondary schools, or community colleges; to major in mathematics, in computer science, in the natural or physical sciences, or in other areas with mathematics requirements; or to enter careers in business, industry, or government. Courses also are provided to meet cultural and General Education requirements.

Programs in the department lead to the Bachelor of Science degree with a major in Mathematics. Students choose one of the following concentrations: Professional Mathematics, Mathematics Education, Applications of Mathematics, or Actuarial Science. Minors are offered in Mathematics; in Mathematics for Managerial, Social, and Life Sciences; and in Statistics.

The following specialized courses do not count toward a Mathematics major or minor: MATH 1010, 1410, 1420, 1530, 1630, 1710, 1720, 1730, 1810, 1820, 2090, 2130, and 4010. However, MATH 1530, 1630, 1710, 1720, 1730, 1810, 1820, and 2130 may count toward a minor in Mathematics for Managerial, Social, and Life Sciences.

Curricular listings include General Education requirements in Communication, History, Humanities and/or Fine Arts, Mathematics, Natural Sciences, and Social/Behavioral Sciences categories as outlined on pages 60–63.

Major in Mathematics

A major in Mathematics requires the mathematics core of 21 hours plus 15 hours of specified upper-level courses in the department and at least 12 hours of supporting coursework (either in or out of the department). The supporting coursework must complement the student's program and be approved by the mathematics advisor. A single minor outside the department is required.

Every Mathematics major is required to declare a concentration. Concentrations include Professional Mathematics, Mathematics Education, Applications of Mathematics, and Actuarial Science.

Every Mathematics major is required to complete the Seminar in Mathematics, MATH 4990. All courses in the Mathematics major or minor must be completed with a grade of C or better. All courses transferred from other institutions for credit in the Mathematics major or minor must carry a grade of C or better and be approved by the department chair.

Mathematics Core

Each student majoring in the department must complete the following core (21 hours):
MATH 1910 (Calculus I), 4 hours
MATH 1920 (Calculus II), 4 hours
MATH 3110 (Calculus III), 4 hours
MATH 2010 (Elements of Linear Algebra), 3 hours
MATH 3460 (Foundations of Higher Mathematics), 3 hours
MATH 2050 (Probability and Statistics), 3 hours* OR
    STAT 3150 (Mathematical Statistics I), 3 hours

Students in the Mathematics Education concentration must concurrently enroll in MATH 2110 (Data Analysis, 1 hour).
Students with a concentration in Actuarial Science may substitute MATH 1810, 1820, 3020, and 3030 for MATH 1910, 1920, and 3110; STAT 3150 for MATH 2010; and ACSI 4200 for MATH 3460.

Concentration: Professional Mathematics

Students opting to study the discipline of mathematics will choose between tracks in general mathematics and advanced mathematics. In addition to the mathematics core, they will take 9 additional upper-level courses in the department chosen with the approval of the mathematics advisor. A single minor outside of the department and CSCI 1170 are required.

Advanced Mathematics Track

Students interested in preparing for a graduate degree in mathematics should pursue this track. In addition to the mathematics core, they must take MATH 3120, 4250, 4510; two courses from MATH 3260, 4230, 4270, 4420, 4530, 4700; and 12 hours of approved supporting coursework chosen from among upper-level courses in the department and CSCI 3080. The program must include at least one sequence in either algebra (4420/4510), analysis (4230-4250), or differential equations (3120-3260). Six hours of a foreign language are recommended.

Students should consult their advisors each semester to plan their schedules.

Curriculum Requirements and Recommended Sequence for Professional Mathematics-Advanced

FRESHMAN		SOPHOMORE	
ENGL 1010, 1020 (Comm)	6	COMM 2200 (Comm)	3
MATH 1910 (Math)	4	MATH 2010, 3110, 3460	10
MATH 1920	4	CSCI/MATH upper-division	
MATH 2050	3	elective	3
Natural Sciences	4	Natural Sciences	4
CSCI 1170	4	HIST 2010, 2020, or 2030	6
Minor	3	Minor	3
Humanities and/or Fine Arts	3		**29**
	31		

JUNIOR		SENIOR	
MATH 3120, 4510	6	MATH 4250, 4990	6
Math electives	6	CSCI/MATH electives	6
Minor	6	Minor	6
Social/Behavioral Sciences		Electives	12
(2 prefixes)	6		**30**
Humanities and/or Fine Arts	3		
ENGL 2020 or 2030 or			
HUM 2610 (Hum/FA)	3		
	30		

General Mathematics Track

Students desiring a broad general background in mathematics should pursue this track. In addition to the mathematics core, they must take MATH 3120, 4510; three additional courses from MATH 3260, 3400, 4230, 4250, 4270, 4310, 4320, 4420, 4530, 4700, STAT 3150, 4190; and 12 hours of approved supporting coursework chosen from among upper-level courses in the department and CSCI 3080.

Students should consult their advisors each semester to plan their schedules.

Concentration: Mathematics Education

Students preparing to teach mathematics at the secondary level (grades 7-12) must complete the major in Mathematics with a concentration in Mathematics Education. In addition to the mathematics core, they must take as upper-division coursework MATH 3070, 4510, 4620, 4990, and one upper-division elective in the department. Supporting coursework consists of MATH 3320, 3330, 4540, and CSCI 1170. A minor in secondary education is required. (See Department of Educational Leadership for a complete description.) Students seeking state licensure must also pass all applicable portions of the Praxis Series Exams, developed and administered by the Educational Testing Service. For the latest information regarding these exams contact the Office of Testing Services (KUC 327, 898-2863)**. To complete their programs of study in a timely manner, students must consult their major and minor advisors each semester.**

Curriculum Requirements and Recommended Sequence for Mathematics Education

FRESHMAN		SOPHOMORE	
MATH 1910 (Math)	4	MATH 2010, 3110, 3460,	
MATH 1920, 2050, 2110	8	3070	13
ENGL 1010, 1020 (Comm)	6	CSCI elective	3
Humanities and/or Fine Arts	3	COMM 2200 (Comm)	3
Natural Sciences (2 prefixes)	8	HIST 2010, 2020, or 2030	6
FOED 1110§	3	ENGL 2020 or 2030 or	
	32	HUM 2610 (Hum/FA)	3
		FOED 2110§	3
			31

JUNIOR		**SENIOR**	
MATH 3320, 3330, 4510,		MATH 4620, 4990	6
4540	12	Secondary Education minor§	15
MATH elective*	3	Humanities and/or Fine Arts	3
Social/Behavioral Sciences		Elective	3
(2 prefixes)	6		**27**
Secondary Education minor§	9		
	30		

*Approved by advisor
§The Secondary Education minor has been revised. Please see page 193 and contact the Educational Leadership Department for information.

Concentration: Applications of Mathematics

Students desiring to study applications of mathematics and statistics in business, government, and industry may choose between tracks in statistics, business, or industrial mathematics. All three tracks blend theory and practice to provide students with background for employment or graduate studies.

Statistics Track

The statistics track offers students a program of study in one of the broadest areas of applied mathematics. Statistical methods are used in many fields, including agriculture, business, communications, government, health, industry, public policy, sports, and science. Courses provide students the opportunity to learn data analysis and to develop skills in statistical methods of wide application. Emphasizing a blend of theory and practice, the program is designed to provide students with the necessary background for employment as a statistician in the public or private sector and to provide a solid foundation for those students interested in graduate studies.

In addition to the mathematics core, students pursuing this track must take STAT 3150 and 4190; MATH 4990; and two courses from STAT 4200, 4320, 4360, 4370, 4380. One minor outside the department is required. Students also complete supporting coursework of 12 hours that complement the student's program chosen with approval of the statistics advisor. These courses include computing, information systems, and other relevant courses.

Students should consult their advisors each semester to plan their schedules.

Curriculum Requirements and Recommended Sequence for Applied Mathematics-Statistics

FRESHMAN		**SOPHOMORE**	
ENGL 1010, 1020 (Comm)	6	COMM 2200 (Comm)	3
MATH 1910 (Math)	4	MATH 3110, 2010, 2050	10
MATH 1920	4	Minor	6
Natural Sciences	4	Natural Sciences	4
Support course*	6	HIST 2010, 2020, or 2030	6
Humanities and/or Fine Arts	3		**29**
Social/Behavioral Sciences	3		
	30		

JUNIOR		**SENIOR**	
MATH 3460	3	STAT elective**	3
STAT 3150, 4190	6	MATH 4990	3
STAT elective**	3	Support course*	3
Support course*	3	Minor	6
Minor	6	Humanities and/or Fine Arts	3
Social/Behavioral Sciences	3	Electives	13
ENGL 2020 or 2030 or			**31**
HUM 2610 (Hum/FA)	3		
Elective	3		
	30		

*Approved by advisor
**STAT 4200, 4320, 4360, 4370, 4380

Business Track

This track is appropriate for students who seek a broad background from such diverse but mutually supportive areas as mathematics, statistics, computer science, and business. The program prepares students for the job market or for further study in the more specialized areas of actuarial science, operations research, statistics, computer science, or finance.

In addition to the mathematics core, students pursuing this track must take STAT 4190, ACSI 4200, and either STAT 4200 or 4360. The supporting coursework consists of 12 hours of computer science or information systems courses. The student must complete a minor in the Jennings A. Jones College of Business as well as ACTG 2110 and 2120 or 3000 and ECON 2410, 2420.

Students should consult their advisors each semester to plan their schedules.

Curriculum Requirements and Recommended Sequence for Applied Mathematics-Business

FRESHMAN		**SOPHOMORE**	
ENGL 1010, 1020 (Comm)	6	COMM 2200 (Comm)	3
MATH 1910 (Math)	4	MATH 2010, 3110, 3460	10
MATH 1920	4	ECON 2410 (Soc/Beh Sci)	3
Computing courses	6	ECON 2420	3
Natural Sciences	4	HIST 2010, 2020, or 2030	6
Humanities and/or Fine Arts	3	Natural Sciences	4
Social/Behavioral Sciences	3	Elective	3
	30		**32**

JUNIOR		**SENIOR**	
STAT 3150, 4190	6	STAT 4360 or 4200	3
ACSI/MATH 4200	3	ACSI/STAT electives	6
Computing courses	6	MATH 4990	3
ACTG 2110 and 2120		Humanities and/or Fine Arts	3
or ACTG 3000	3-6	Minor	12
Minor	6	Electives	1-4
ENGL 2020 or 2030 or			**28-31**
HUM 2610 (Hum/FA)	3		
	27-30		

Industrial Mathematics Track

The industrial mathematics track offers students a program of study that incorporates the areas of mathematics that contribute to business and industry. Coursework is designed to produce graduates who have strong qualifications that make them competitive for positions in industry and provides a solid foundation for students interested in pursuing graduate study in the area. The minor must be chosen from Computer Science, Physics, Chemistry, Biology, Aerospace, or Industrial Technology.

In addition to the mathematics core, students pursuing this track must take MATH 3120, 3260, 4250, and 4310. Required supporting coursework includes CSCI 1170 and 2170. Nine additional hours of supporting coursework must be chosen with the approval of the mathematics advisor from MATH 4601, 4230, 4270, 4320, 4700 and STAT 4190.

Students should consult their advisors each semester to plan their schedules.

Curriculum Requirements and Recommended Sequence for Applied Mathematics-Industrial Mathematics

FRESHMAN		SOPHOMORE	
ENGL 1010, 1020 (Comm)	6	ENGL 2020 or 2030 or	
MATH 1910 (Math)	4	HUM 2610 (Hum/FA)	3
MATH 1920	4	MATH 3110, 3460	7
CSCI 1170, 2170	8	PHYS 2110/2111 (Nat Sci)	4
Natural Sciences	4	PHYS 2120/2121	4
COMM 2200 (Comm)	3	Social/Behavioral Sciences	3
HIST 2010, 2020, or 2030	3	Humanities and/or Fine Arts	3
	32	Minor	6
			30

JUNIOR		SENIOR	
MATH 2010, 4250	6	MATH 4310	3
STAT 3150 or MATH 2050	3	MATH 4990	3
MATH 3120, 3260	6	MATH/STAT electives	9
Social/Behavioral Sciences	3	Minor	6
Minor	6	Humanities and/or Fine Arts	3
MATH elective*	3	Electives	4
HIST 2010, 2020, or 2030	3		**28**
	30		

*Approved by advisor

Concentration: Actuarial Science

The Actuarial Science concentration is designed for students who have a strong mathematical ability with an interest in applying their mathematical knowledge to insurance, finance, risk management, investments, and other areas of business. The program is classified by the Society of Actuaries (SOA) as an Advanced Undergraduate Actuarial Science program and is in complete compliance with the requirements set forth by the Society of Actuaries and the Casualty Actuarial Society (CAS) in the Year 2000 Syllabus and beyond. Therefore, the student can choose coursework necessary to prepare for the SOA/CAS Course/Exams 1 through 4 and SOA Course 6.

Mathematics majors preparing for the actuarial examination series and an actuarial science career should complete this professional program in Actuarial Science. The program requires that the student complete the mathematics core; upper-division actuarial science courses consisting of ACSI 4140, 4220, 4230, 4330, and two elective courses chosen from ACSI 4240, 4340, 4630, 4640; STAT 4200; and supporting coursework consisting of STAT 4190 and 4320 and MATH 4990. The student is required to complete ACTG 3000, ECON 2410, 2420, and FIN 3610. A minor from the Jennings A. Jones College of Business is required. A minor in Insurance is strongly suggested. A Computer Science or Information Systems elective and CSCI 1170 are required.

Students should consult their advisors each semester to plan their schedules.

Curriculum Requirements and Recommended Sequence for Actuarial Science

FRESHMAN		SOPHOMORE	
ENGL 1010, 1020 (Comm)	6	COMM 2200 (Comm)	3
MATH 1810 (Math)	3	MATH 3020, 3030	6
MATH 1820	3	ENGL 2020 or 2030 or	
CSCI 1170	4	HUM 2610 (Hum/FA)	3
Natural Sciences (2 prefixes)	8	ECON 2410 (Soc/Beh Sci)	3
Social/Behavioral Sciences	3	ECON 2420	3
Humanities and/or Fine Arts	3	HIST 2010, 2020, or 2030	6
	30	ACTG 3000	3
		Elective	3
			30

JUNIOR		SENIOR	
STAT 3150 (or MATH 2010),		ACSI 4330, 4230	6
4190, 4320	9	STAT/ACSI electives	6
ACSI 4140, 4200, 4220	9	MATH 4990	3
FIN 3610	3	Minor	9
Minor	6	Humanities and/or Fine Arts	3
CSCI/INFS elective*	3	Elective	3
	30		**30**

*Approved by advisor

Minor in Mathematics

A minor in Mathematics consists of 18 semester hours including MATH 1910 and 1920. The remaining 10 hours of electives must be selected with the approval of the Mathematics minor advisor from the mathematics courses for majors and minors.

Minor in Mathematics for Managerial, Social, and Life Sciences

A minor in Mathematics for Managerial, Social, and Life Sciences consists of 18 semester hours including MATH 1810 and 1820 with the remaining 12 hours as approved by the minor advisor. The remaining courses must be selected from a list of approved courses; see the minor advisor for details. Note that a student may count Q M 2610 and 3620 as one 3-hour course and may count CSCI 1160 or 1170 as one 3-hour course.

Minor in Statistics

A minor in Statistics requires 18 semester hours and consists of STAT 3150, 4190, 4360, 4370, 4380 and one course to be selected from MATH 3190, 3120, 3260, 4310, 4320, or CSCI 3180. With advisor approval, MATH 2050 may be substituted for either STAT 4190, 4360, 4370, or 4380. Additionally, with advisor approval, one semester of calculus may be counted as the elective course.

Courses in Mathematics [MATH]

1010 Mathematics for General Studies. Three credits. Prerequisites: Two years of high school algebra and a MATH Enhanced ACT of at least 19 or DSPM 0850 or COMPASS placement. Course satisfies the General Education Mathematics requirement and is also part of the mathematics sequence for students preparing to become elementary school teachers. Topics include logic, sets, algebraic reasoning, probability, statistics, and consumer mathematics.

1410 Concepts and Structure of Elementary School Mathematics. Three credits. Prerequisites: Two years of high school algebra and a Math Enhanced ACT of at least 19 or DSPM 0850 or COMPASS placement. Algebra-based study of school mathematics in keeping with the recommendations of the National Council of Teachers of Mathematics. Tools for problem solving, set theory, functions, number theory, and examinations of number systems from counting numbers to irrational numbers.

1420 Informal Geometry. Three credits. Prerequisite: A grade of C or better in MATH 1410. Geometry-based study of school mathematics in keeping with the recommendations of the National Council of Teachers of Mathematics. Studies of plane, solid, coordinate, and motion geometry as well as constructions, congruence, similarity, and concepts of measurement. A variety of instructional technology tools investigated.

1530 Applied Statistics. Three credits. Prerequisites: Two years of high school algebra and a mathematics Enhanced ACT 19 or greater or equivalent. Descriptive statistics, probability, and statistical inference. The inference unit covers means, proportions, and variances for one and two samples, and topics from one-way ANOVA, regression and correlation analysis, chi-square analysis, and nonparametrics.

1630 College Mathematics for Managerial, Social, and Life Sciences. Three credits. Prerequisites: Two years of high school algebra and a Math Enhanced ACT greater than 25 or MATH 1710. Topics include solving systems of linear equations, Leontief models, linear programming, mathematics of finance, set theory, and probability theory.

1710 College Algebra. Three credits. Prerequisite: DSPM 0850 or two years of high school algebra; a Math Enhanced ACT 19 or greater or COMPASS placement. Course satisfies the General Education Mathematics requirement. Topics include functions—linear, quadratic, exponential, and logarithmic; analysis of graphs; linear systems; inequalities; counting principles; and probability. Graphing calculator required. Course may be taken by correspondence. Not open to those who have had MATH 1730.

1720 Plane Trigonometry. Three credits. Prerequisite: Strong background in algebra recommended. Trigonometric functions of the acute and general angle, circular functions, graphs of trigonometric and inverse functions, identities, solutions of right and general triangles, equations, complex numbers, and vectors. Not open to those who have had MATH 1730. Graphing calculator required.

1730 Algebra and Trigonometry. Four credits. Prerequisite: MATH 1710 or successful completion of high school precalculus course. An integrated and rigorous study of the algebra and trigonometry needed to successfully attempt calculus. Emphasis on functions, their analysis and their applications. Level of algebraic sophistication developed above that found in MATH 1710. Topics included exponentials and logarithms, analysis of graphs, and word problems. Graphing calculator required.

1810 Applied Calculus I. Three credits. Prerequisite: Eligibility to take MATH 1710. First of a four-course sequence. Introduces mathematical modeling applied to real-world problems. Sets, functions, inverse models, limits, continuity, first and second order model building, single variable differentiation, implicit differentiation, inverse problems (exponential and log models). First and second derivatives used to study the behavior of real-world applications.

1820 Applied Calculus II. Three credits. Prerequisite: MATH 1810. Second of a four-course sequence. Riemann Sum, indefinite and definite integrals, modeling using substitution, differential equations with initial conditions, modeling real-world problems using functions of two or more variables, level curves, feasible regions, linear objective functions, system of linear equations, annuities, partial derivatives, least squares, matrix multiplication and addition, inverse matrix, and matrix equations.

1910 Calculus I. Four credits. Prerequisite: MATH 1730 or equivalent. An introduction to calculus with an emphasis on analysis of functions, multidisciplinary applications of calculus, and theoretical understanding of differentiation and integration. Topics include the definition of the derivative, differentiation techniques, and applications of the derivative. Calculus topics related to trigonometric, exponential, and logarithmic functions also included. Course concludes with the fundamental theorem of calculus; the definition of antidifferentiation and the definite integral; basic applications of integrations; and introductory techniques of integration. Graphing calculator required.

1920 Calculus II. Four credits. Prerequisite: MATH 1910. A topics course providing a wide view of different techniques and applications of calculus in the plane. Techniques of integration and applications of integration fully developed. Power series and Taylor series included. Emphasis on multidisciplinary applications includes Taylor series approximation; applications of integration to physics, biology, and business; and geometric and power series applications. Graphing calculator required.

2010 Elements of Linear Algebra. Three credits. Prerequisite: MATH 1910. Vectors and vector spaces, matrices and systems of linear equations, geometry of vector spaces and linear transformations in a vector space.

2050 Probability and Statistics. Three credits. Prerequisite: Calculus I. Data analysis, probability, and statistical inference. The inference material covers means, proportions, and variances for one and two samples, one-way ANOVA, regression and correlation, and chi-square analysis.

2090 Mathematics for Health Professions. Two credits. Enables students in the health professions to apply mathematical concepts to interpret and solve drug dosage calculation problems encountered in fields such as nursing. Includes basic math review, solid and liquid doses of medications for adults and children, solutions, and IV administration. Also includes conversions from metric to household and apothecary measurements. Course may be taken by correspondence. Not open to Mathematics majors or minors.

2110 Data Analysis. One credit. Grouping and classifying technical data. Curve fitting by statistical and nonstatistical methods. Graphing of scientific data. Secondary education in mathematics students should take concurrent or subsequent to MATH 2050.

2130 Mathematics of Finance. Three credits. Prerequisites: Two years of high school algebra and a Math Enhanced ACT 19 or greater or DSPM 0850. Investment finance, including general annuities, evaluation of bonds, and life annuities.

3020 Applied Calculus III. Three credits. Prerequisites: MATH 1810 and 1820. In-depth study of continuity of single variable functions; inverses of functions; differentiation and integration of various functions including trigonometric functions, logarithmic

functions, exponential functions, power functions, and piece-wise functions; methods of integration; the Riemann Sum, extensive applications of the fundamental theorem of calculus, and arc length of a curve. Emphasis on real-world applications.

3030 Applied Calculus IV. Three credits. (Same as ACSI 3030.) Prerequisite: MATH 3020. In-depth study of L'Hopital's Rule, improper integrals, sequences, convergence and divergence of series, Taylor and Maclaurin series, approximations for single-variable functions, two- and three-dimensional vector spaces, vector-valued functions, polar coordinates, and partial differentiation and integration of multivariate functions. Emphasis on blending these topics with real-world applications.

3070 College Geometry. Three credits. Prerequisite: MATH 3460. Advanced treatment of standard topics in Euclidean geometry using informal and axiomatic approaches. Includes proofmaking techniques, traditional and transformational geometry, finite geometries, and a brief introduction to other geometries.

3080 Discrete Structures. Three credits. (Same as CSCI 3080.) Prerequisites: CSCI 1160 or 1170 and MATH 1910 or consent of instructor. Topics include formal logic, proof techniques, matrices, graphs, formal grammars, finite state machines, Turing machines, and binary coding schemes.

3110 Calculus III. Four credits. Prerequisite: MATH 1920. Adjusts calculus techniques developed in the plane (Calculus I and II) to make them applicable in three-dimensional space. Introductory study of the nature of three-dimensional space and definition of the algebraic calculations in three-dimensional space. Differential and integral calculus definitions and techniques revised to appropriately transfer into this new space. Topics include multivariate functions, partial differentiation, partial integration, multiple integration, and multidisciplinary applications.

3120 Differential Equations I. Three credits. Corequisite: MATH 3110. The solution and application of ordinary differential equations with emphasis on first order equations, second order linear equations, Laplace Transform method, systems of differential equations, and numerical methods.

3180 Introduction to Numerical Analysis. Three credits. (Same as CSCI 3180.) Prerequisites: MATH 1920 and CSCI 1160 or 1170. Topics include series approximation, finite differences, interpolation, summation, numerical differentiation and integration, iteration, curve fitting, systems of equations and matrices, and error analysis.

3190 Deterministic and Probabilistic Models. Three credits. Corequisite: MATH 2050. Linear programming, network analysis, queuing theory, dynamic programming.

3260 Differential Equations II. Three credits. Prerequisite: MATH 3120. A continuation of MATH 3120 with emphasis on series solutions, method of Frobenius, orthogonal functions, equations of Bessel, Legendre, Gauss, Chebyshev; introduction to partial differential equations.

3320 Teaching Mathematics in Grades 5-8. Three credits. Prerequisite: Admission to the teacher education program. Required of all Mathematics majors seeking a license to teach mathematics in grades 7-12. Strongly encouraged for elementary education majors with a 5-8 emphasis. Topics from number relationships, mental computation and estimation strategies, patterns and functions, algebra, statistics, probability, geometry, and measurement. Must be taken prior to student teaching.

3330 Teaching Mathematics in Grades 9-12. Three credits. Prerequisites: Admission to teacher education, completion of the mathematics core, and MATH 3320. Required of all Mathematics majors seeking a license to teach mathematics in grades 7-12. In-depth study of mathematics learning and teaching strategies in secondary school mathematics. Selected topics from junior and senior high school curricula provide a foundation for student investigations into the conceptual nature of mathematics and applications in the secondary school curriculum. Must be taken prior to student teaching.

3400 Symbolic Logic. Three credits. (Same as PHIL 3400.) The elements of propositional calculus—propositional connectives and their truth functions, validity, proof, and an introduction to quantification theory. Where appropriate and natural, parallels from elementary set theory are introduced. May count for credit in Philosophy.

3460 Foundation of Higher Mathematics. Three credits. Prerequisite: MATH 1920. The language of mathematics, set theory and proof, relations and functions, number systems, mathematical structures. Focuses on the transition from lower-division study to upper-division study by actively engaging the student in problem solving, mathematical reasoning, and both informal and technical writing.

4010 Selected Topics in Elementary Mathematics. Three credits. Prerequisites: MATH 1410, 1420, and 1010. Required of students who are preparing to teach grades 5-8. Examines in greater depth topics to which the student has prior exposure; emphasizes the relevance and implications of these topics to the middle school classroom.

4200 Introduction to Mathematics of Investment. Three credits. (Same as ACSI 4200.)

4210 Advanced Calculus I. Three credits. Prerequisites: MATH 3110 and 3460. Theory and application of continuity, differentiation, and integration.

4220 Advanced Calculus II. Three credits. Prerequisite: MATH 4210. A continuation of MATH 4210 including theory and application of convergence.

4230 Vector Analysis. Three credits. Prerequisite: MATH 3110. A review of vector algebra and vector differentiation with emphasis on aspects of these topics not covered in previous calculus courses. Stress on line and surface integrals; Divergence Theorem and Stokes' theorem with generalizations and related topics.

4250 Theory of Calculus. Three credits. Prerequisites: MATH 3110 and 3460. Theoretical development of limits, continuity, differentiation, and integration in one dimension.

4270 Introduction to Topology. Three credits. Prerequisites: MATH 3110 and 3460. Fundamental concepts of topology including continuity, compactness, connectedness, separation axioms, and metric spaces.

4310 Numerical Analysis I. Three credits. Prerequisites: CSCI 1170 and MATH 2010 or consent of instructor. Application of computer-oriented numerical algorithms to algebraic equations, differential and integral equations, and linear algebra. Rigorous mathematical treatment of error included.

4320 Numerical Analysis II. Three credits. Prerequisite: MATH 4310. A continuation of MATH 4310.

4420 Number Theory. Three credits. Prerequisite: MATH 3460. Divisibility, congruences, quadratic residues, Diophantine equations, quadratic forms, and continued fractions.

4470 Introduction to Modern Algebra. Three credits. Prerequisite: MATH 3460. A treatment of sets, relations, operations, and the construction of number systems in algebra.

4510 Abstract Algebra I. Three credits. Prerequisite: MATH 3460. An introduction to groups, with a brief introduction to rings, integral domains, and fields.

4530 Abstract Algebra II. Three credits. Prerequisite: MATH 4510/5510. The theory of rings, fields, integral domains, and vector spaces.

4540 Topics in Secondary School Mathematics. Three credits. Prerequisites: Admission to teacher education, completion of the mathematics core, MATH 3070 and 4510. Required of all Mathematics majors seeking a license to teach mathematics in grades 7-12. Examines in greater depth topics to which the student has prior exposure; emphasizes the relevance and applications of these topics to the pre-college level classroom.

4600 Problems in Contemporary Mathematics. One to six credits. Pass/Fail grading in specified sections.

4601 Problems in Contemporary Mathematics—Complex Variables. Three credits. Prerequisite: MATH 3460. Fundamental principles and applications of complex variables.

4620 History and Philosophy of Mathematics. Three credits. Prerequisite: MATH 3460. Background in geometry and number theory helpful. The character of mathematical thought by way of mathematical problems that have occupied the outstanding mathematicians of Babylon, Egypt, Greece, China, the Renaissance, and modern times paralleled with a study of three schools of mathematical philosophy: intuitionism, logicism, and formalism.

4630 Mathematics of Risk Management. Three credits. (Same as ACSI 4630.)

4640 Mathematics of Options, Futures, and Other Derivatives. Three credits. (Same as ASCI 4640.)

4700 Combinatorics and Graph Theory. Three credits. Prerequisites: MATH 2010 and 3460. Selected topics in combinatorics and graph theory emphasizing combinatorial problem solving and algorithmic proof.

4800 Seminar in Mathematics with Technology. Three credits. Prerequisite: 18 semester hours in mathematics including calculus or consent of instructor. Examine and utilize the technological tools available for doing mathematics. Emphasis on non-numerical tools such as theorem provers and algebraic manipulation systems.

4990 Seminar in Mathematics. Three credits. Open only to Mathematics majors; normally taken during last regular semester of coursework. Required of all Mathematics majors with the exception of those completing ACSI 4000. Offers graduating Mathematics majors a broad perspective of mathematics, mathematical activity, and problem solving in various areas of application; offers preparation for professional examinations; acquaints students with job possibilities and aids in career decisions; acquaints students with the nature of graduate study in mathematics. Pass/fail.

Courses in Statistics [STAT]

3150 Mathematical Statistics I. Three credits. Prerequisite: Two semesters of calculus. Probability theory including basic probability laws, properties of distributions, mathematical expectation, special discrete and continuous distributions, functions of random variables, and selected applications.

4190 Mathematical Statistics II. Three credits. Prerequisite: STAT 3150 or equivalent. Theory of statistical inference. Topics include sampling distributions, decision theory, estimation, test of hypothesis, regression analysis, analysis of variance, and selected applications.

4200 Statistical Methods for Forecasting. Three credits. Prerequisite: STAT 4190. Topics include application of regression models in forecasting and exponential smoothing methods to forecast nonseasonal time-series, seasonal series, and globally constant seasonal models; stochastic time series models; and forecast evaluation.

4320 Probability and Stochastic Processes. Three credits. Prerequisites: Two semesters of calculus and STAT 3150 (or MATH 2050) or consent of instructor. Theoretical basis for stochastic processes and their use as models of real-world phenomena. Topics include Markov chains, Poisson processes, Brownian motion and stationary processes. Applications include Gambler's Ruin, birth and death models, hitting times, stock option pricing, and the Black-Scholes model.

4360 (436) Regression Analysis. Three credits. Prerequisite: MATH 2050 or Q M 3620. Theory and application of regression models. Approaches to model building and data analysis. Computation and interpretation of results facilitated through the use of statistical software packages.

4370 Nonparametric Statistics. Three credits. Prerequisite: MATH 2050 or equivalent. Statistical tests that require no assertions about parameters or about the form of the population from which the samples are drawn. A wide range of practical problems studied.

4380 Experimental Design. Three credits. Prerequisite: MATH 2050 or Q M 3620. Topics include one-way analysis of variances, multiple comparison, multifactor analysis of variance, and various practical issues in experimental design. Computation and interpretation of results facilitated through the use of statistical software packages.

4600 Problems in Statistics. One to six credits. Prerequisites: Senior standing and consent of instructor. Students wishing to enroll must submit a written course/topic proposal to the department prior to the semester in which STAT 4600 is taken. Proposal must be approved prior to taking the course. At the conclusion, each enrollee must submit a written report to the department.

Courses in Actuarial Science [ACSI]

4140 Mathematical Foundations of Actuarial Science. Three credits. Prerequisites: ACSI/MATH 3020 (or MATH 3110) and STAT 3150; or consent of instructor. Integrates calculus, probability, and risk management topics into fundamental tools for assessing risk in an actuarial environment. Calculus and probability topics include derivatives, integrals, partials, random variables, distributions, and conditional probability. Risk topics include frequency and severity. Insurance concepts such as retention, deductible, coinsurance, and risk premiums. For students in Actuarial Science, a preparatory course for the Society of Actuaries/Casualty Actuarial Society Course/Exam 1.

4200 Introduction to Mathematics of Investment. Three credits. (Same as MATH 4200.) Prerequisites: MATH 1910 or ACSI 2020, 2030, and one semester of probability/statistics; or consent of instructor. Calculus and probability/statistics used to model and analyze investments in bonds, treasury bills, stocks, and other derivatives. Topics include obtaining the price of a bond as a function of interest rate, developing formulas for duration and convexity to study the sensitivity of price to interest rate, and mathematical modeling of investor preference and attitude toward risk.

4220 Mathematics of Pricing Theory. Three credits. Prerequisites: ACSI/MATH 4200 and ECON 2410, 2420; or consent of instructor. Applies calculus and theory of interest tools to intermediate topics in microeconomics. Topics include mathematics of supply, demand, and equilibrium; prices, costs, and the gains from trade; consumer behavior; elasticities; competition; monopoly; market power, collusion, and oligopoly; the mathematics of risk and uncertainty; and surplus economics. For students in Actuarial Science, a preparatory course for the Society of Actuaries/Casualty Actuarial Society Course/Exam 2.

4230 Mathematics of Compound Interest. Three credits. Prerequisite: ACSI 4200 or consent of instructor. For students in Actuarial Science, offers preparation for the Society of Actuaries/Casualty Actuarial Society Exam 2. Topics include measurement of interest (including accumulated and present value factors), annuities certain, yield rates, amortization schedules, sinking funds, and bonds and related securities.

4240 Mathematics of Interest Theory, Economics and Finance. Three credits. Prerequisite: ACSI 4230 or consent of instructor. Applies calculus and theory of interest tools to intermediate topics in microeconomics and macroeconomics and topics in finance. Topics include pricing activities, the simplified Keynesian model, interest and discount rates, valuation of payment streams, yield rates, amortization, cash flows and internal rate of return, stock and bond valuation, portfolio risks, the Capital Asset Pricing Model (CAPM), efficient markets, capital structure, leverage, financial performance measurement, and basic option pricing and the Black-Scholes model. For students in Actuarial Science, a preparatory course for the Society of Actuaries/Casualty Actuarial Society Course/Exam 2.

4330 Actuarial Mathematics I. Three credits. Prerequisites: ACSI 4230 and STAT 4190; or consent of instructor. First of a two-semester sequence; offers preparation for the Society of Actuaries/Casualty Actuarial Society Course/Exam 3. Topics include survival distributions and life tables, life insurance, life annuities, and net premiums.

4340 Actuarial Mathematics II. Three credits. Prerequisite: ACSI 4330. Second of a two-semester sequence; offers preparation for the Society of Actuaries/Casualty Actuarial Society Course/Exam 3. Topics chosen from net premium reserves, multiple life functions, multiple decrement models, valuation theory and pension plans, and insurance models (including expenses and nonforfeiture benefits and dividends).

4600 Problems in Actuarial Science. One to six credits. Prerequisites: Senior standing and consent of instructor. Students wishing to enroll must submit a written course/topic proposal to the department prior to the semester in which ACSI 4600 is taken. Proposal must be approved prior to taking the course. At the conclusion, each enrollee must submit a written report to the department.

4630 Mathematics of Risk Management. Three credits. (Same as MATH 4630.) Prerequisite: ACSI/MATH 4200. For students in Actuarial Science, offers preparation for the Society of Actuaries/Casualty Actuarial Society Course 6. Topics include mathematical modeling of volatility; pricing of bonds, stocks, and other derivatives with uncertainty; benchmark portfolios; asset/liability management for property/casualty insurers; liability associated with a financially distressed company. Heath-Jarrow-Morton and Cox-Ingersoll-Ross models.

4640 Mathematics of Options, Futures, and Other Derivatives. Three credits. (Same as MATH 4640.) Prerequisites: ACSI/MATH 4630 and 4200. For students in Actuarial Science, offers preparation for the Society of Actuaries/Casualty Actuarial Society Course 6. Topics include risk management using options, interest rate swaps, interest rate caps, Black-Scholes analysis, Taylor series expansion to obtain hedge parameters, portfolio insurance, numerical procedures, interest rate derivatives, and use of Black's model.

Honors College
Mathematics 1730, 1710, and 1010 are offered periodically for students in the MTSU Honors College who are not Mathematics majors. Mathematics 4600 is offered periodically for students in MTSU Honors who are Mathematics majors.

Cooperative Education
MATH 2930, 2940, 3970, 3980. Cooperative Education Experience I, II, III, IV. One to three credits each. Experiences must be taken in sequence. Pass/Fail.

Graduate Study
The Master of Science and Master of Science in Teaching degrees are offered in mathematics. A minor in Mathematics is offered for masters and Doctor of Arts degrees. Requirements for these degrees and a list of the courses offered for graduate credit are in the Graduate Catalog.