MATHEMATICS (MATH)

MATH 100A Intermediate Algebra
Prerequisites: Appropriate score on the Math Placement Exam.
Notes: Credit earned in MATH 100A will not count toward degree requirements.
Description: Review of the topics in a second-year high school algebra course taught at the college level. Includes: real numbers, 1st and 2nd degree equations and inequalities, linear systems, polynomials and rational expressions, exponents and radicals. Heavy emphasis on problem solving strategies and techniques.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Prerequisite for: MATH 100A; MATH 101; MATH 103
Groups: Introductory Mathematics

MATH 101 College Algebra
Prerequisites: Appropriate score on the Math Placement Exam; or grade of P, C, or better in MATH 100A.
Notes: Credit for both MATH 101 and 103 is not allowed.
Description: Real numbers, exponents, factoring, linear and quadratic equations, absolute value, inequalities, functions, graphing, polynomial and rational functions, exponential and logarithmic functions, system of equations.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Prerequisite for: CHEM 105; CRIM 300; MATH 102; MATH 104; METR 100; METR 140; MSYM 109; PHYS 260; PHYS 261
Groups: Introductory Mathematics

MATH 102 Trigonometry
Prerequisites: Appropriate score on the Math Placement Exam; or grade of P, C, or better in MATH 101.
Notes: Credit toward the degree may be earned in only one of MATH 102 or 103.
Description: Trigonometric functions, identities, trigonometric equations, solution of triangles, inverse trigonometric functions and graphs.
Credit Hours: 2
Max credits per semester: 2
Max credits per degree: 2
Format: LEC
Prerequisite for: AGRO 361, GEOL 361, NRES 361, SOIL 361, WATS 361; ASCI 340; CHEM 109; CSCE 155A; CSCE 155E; CSCE 155H; CSCE 155N; CSCE 155T; GEOL 400; GEOL 400; MATH 104; MATH 106; METR 100; METR 140; MSYM 109; PHYS 141; PHYS 141H; PHYS 151; PHYS 260; PHYS 261
Groups: Introductory Mathematics

MATH 103 College Algebra and Trigonometry
Prerequisites: Appropriate score on the Math Placement Exam; or grade of P, C, or better in MATH 100A.
Notes: For students with previous college math courses, permission is also required. Credit for both MATH 101 and 103 is not allowed; credit for both MATH 102 and MATH 103 is not allowed.
Description: First and second degree equations and inequalities, absolute value, functions, polynomial and rational functions, exponential and logarithmic functions, trigonometric functions and identities, laws of sines and cosines, applications, polar coordinates, systems of equations, graphing, conic sections.
Credit Hours: 5
Max credits per semester: 5
Max credits per degree: 5
Format: LEC
Prerequisite for: AGRO 361, GEOL 361, NRES 361, SOIL 361, WATS 361; ASCI 340; CHEM 109; CSCE 155A; CSCE 155E; CSCE 155H; CSCE 155N; CSCE 155T; MATH 104; MATH 106; MSYM 109; PHYS 141; PHYS 141H; PHYS 151; PHYS 260; PHYS 261; SOFT 160; SOFT 160H
Groups: Introductory Mathematics

MATH 104 Applied Calculus
Prerequisites: Appropriate score on the Math Placement Exam; or grade of P, C, or better in MATH 101, MATH 102 or MATH 103.
Notes: Credit for both MATH 104 and 106 is not allowed.
Description: Rudiments of differential and integral calculus with applications to problems from business, economics, and social sciences.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Prerequisite for: ABUS 341, MRKT 341; ACCT 200; ACCT 308; ACCT 309; ACCT 313; AGRO 361, GEOL 361, NRES 361, SOIL 361, WATS 361; AGRO 472, AGRO 872; NRES 472; NRES 872; SOIL 472; WATS 472; ASCI 340; BLAW 371; BLAW 371H; BLAW 372; BSEN 355; CSCE 155A; CSCE 155E; CSCE 155H; CSCE 155N; CSCE 155T; ECON 215; ECON 215H; ECON 311; FINA 361; FINA 361H; MATH 104; METR 100; METR 140; MNGT 301; MNGT 301H; MRKT 341H; RAIA 341H; MSYM 109; PHYS 141; PHYS 141H; PHYS 151; PHYS 260; PHYS 261; SCMA 331; SCMA 335; SCMA 350; SCMA 350H
ACE: ACE 3 Math/Stat/Reasoning
Groups: Introductory Mathematics
MATH 106 Calculus I
Prerequisites: Appropriate score on the Math Placement Exam; or grade of P,C, or better in MATH 102 or MATH 103
Notes: Credit for both MATH 104 and Math 106 is not allowed. Math Placement Policy applies.
Description: Functions of one variable, limits, differentiation, exponential, trigonometric and inverse trigonometric functions, maximum-minimum, and basic integration theory (Riemann sums) with some applications.
Credit Hours: 4
Max credits per semester: 5
Max credits per degree: 5
Format: LEC
Prerequisite for: MATH 107

MATH 107 Calculus II
Prerequisites: A grade of P or better in MATH 106
Description: Integration theory, techniques of integration; applications of definite integrals; series, Taylor series, vectors, cross and dot products, lines and planes, space curves.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Format: LEC
Prerequisite for: MATH 107

MATH 107H Honors: Calculus II
Prerequisites: Good standing in the University Honors Program by invitation; and a grade of "B" or better in MATH 106 or equivalent
Description: For course description, see MATH 107.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Format: LEC
Prerequisite for: MATH 107

MATH 107R Analytic Geometry and Calculus II
Prerequisites: A grade of P; C or better in MATH 106
Notes: Open only to students who previously completed the 5 credit hour Math 107 at UNL and wish to improve their grade.
Description: Integration theory, techniques of integration, applications of definite integrals, series, Taylor series, vectors, cross and dot products, lines and planes, space curves.
Credit Hours: 5
Max credits per semester: 5
Max credits per degree: 5
Format: LEC
Prerequisite for: MATH 107

MATH 189H University Honors Seminar
Prerequisites: Good standing in the University Honors Program or by invitation; placement score on the Math Placement Examination (MPE) at the MATH 104-level or above.
Notes: Topics vary. A University Honors Seminar 189H is required of all students in the University Honors Program.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Prerequisite for: MATH 107, MATH 108H

Groups: Introductory Mathematics
MATH 198 Freshman Seminar
Credit Hours: 1-3
Min credits per semester: 1
Max credits per semester: 3
Max credits per degree: 24
Format: LEC
Prerequisite for: METR 100; METR 140; PHYS 141; PHYS 141H; PHYS 260; PHYS 261
Groups: Seminars, Ind Study, Topics

MATH 198H Honors: Freshman Seminar
Prerequisites: Good standing in the University Honors Program or by invitation.
Credit Hours: 1-3
Min credits per semester: 1
Max credits per semester: 3
Max credits per degree: 24
Format: LEC
Prerequisite for: METR 100; METR 140; PHYS 141; PHYS 141H; PHYS 260; PHYS 261
Groups: Seminars, Ind Study, Topics

MATH 203 Contemporary Mathematics
Notes: Not open to students with credit or concurrent enrollment in MATH 106 or MATH 203J.
Description: Applications of quantitative reasoning and methods to problems and decision making in the areas of management, statistics, and social choice. Includes networks, critical paths, linear programming, sampling, central tendency, inference, voting methods, power index, game theory, and fair division problems.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
ACE: ACE 3 Math/Stat/Reasoning
Groups: Introductory Mathematics

MATH 203J Contemporary Math
Prerequisites: Must be admitted to the College of Journalism
Notes: Not open to students with credit or concurrent enrollment in MATH 106 or MATH 203.
Description: Applications of quantitative reasoning and methods to problems and decisions making in areas of particular relevance to College of Journalism and Mass Communication, such as governance, finance, statistics, social choice, and graphical presentation of data. Financial mathematics, statistics and probability (sampling, central tendency, and inference), voting methods, power index, and fair division problems.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
ACE: ACE 3 Math/Stat/Reasoning
Groups: Introductory Mathematics

MATH 208 Calculus III
Prerequisites: A grade of P, C or better in MATH 107
Description: Vectors and surfaces, parametric equations and motion, functions of several variables, partial differentiation, maximum-minimum, Lagrange multipliers, multiple integration, vector fields, path integrals, Green's Theorem, and applications.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Format: LEC
Prerequisite for: ABUS 341, MRKT 341; ACTS 401; BLAW 371; BLAW 371H; BLAW 372; CSCE 155A; CSCE 155E; CSCE 155H; CSCE 155N; CSCE 155T; ECEN 215; ECEN 306; ECON 328; ECON 329; FINA 361; FINA 361H; MATH 208; MATH 221H; MATH 310; MATH 310H; MATH 314H; MATH 325; MECH 318; MECH 321; MECH 325H; MECH 373; MECH 373H; MECH 421, MECH 821; MNGT 301; MNGT 301H; MRKT 341H, RAIK 341H; PHYS 213; PHYS 213H; SCMA 331; SCMA 335; SCMA 350; SCMA 350H; STAT 462
ACE: ACE 3 Math/Stat/Reasoning
Groups: Introductory Mathematics

MATH 208H Honors: Calculus III
Prerequisites: Good standing in the University Honors Program and a grade of P, C, or better in MATH 107 or MATH 107H
Description: Vectors and surfaces, parametric equations and motion, functions of several variables, partial differentiation, maximum-minimum, Lagrange multipliers, multiple integration, vector fields, path integrals, Green's Theorem, and applications.
Credit Hours: 4
Max credits per semester: 4
Max credits per degree: 4
Format: LEC
Prerequisite for: ABUS 341, MRKT 341; ACTS 401; BLAW 371; BLAW 371H; BLAW 372; CSCE 155A; CSCE 155E; CSCE 155H; CSCE 155N; CSCE 155T; ECEN 215; ECEN 306; ECON 328; ECON 329; FINA 361; FINA 361H; MATH 208; MATH 221H; MATH 310; MATH 310H; MATH 314H; MATH 325; MECH 318; MECH 321; MECH 325H; MECH 373; MECH 373H; MECH 421, MECH 821; MNGT 301; MNGT 301H; MRKT 341H, RAIK 341H; PHYS 213; PHYS 213H; SCMA 331; SCMA 335; SCMA 350; SCMA 350H; STAT 462
ACE: ACE 3 Math/Stat/Reasoning
Groups: Introductory Mathematics
MATH 221 Differential Equations
Crosslisted with: MATH 821
Prerequisites: A grade of P, C, or better in MATH 208 or MATH 208H
Notes: Not open to MA or MS students in mathematics or statistics.
Description: First- and second-order methods for ordinary differential equations including: separable, linear, Laplace transforms, linear systems, and some applications.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Prerequisite for: AGEN 303, BSEN 303; AGEN 344, BSEN 344; AGEN 350, BSEN 350; AGEN 957, BSEN 957, CIVE 957, GEOL 957; BSEN 260, AGEN 260; BSEN 311; BSEN 317; BSEN 326, CIVE 326; BSEN 326H, CIVE 326H; BSEN 363; BSEN 954, CHME 312; CHME 815; CHME 825; CIVE 310; CIVE 310H; ECEN 213; ECEN 216; ECEN 304; ECEN 306; ECEN 328; MATH 430; MATH 435; MATH 442; MECH 310, MECH 310H, MECH 318; MECH 925; MECH 933; MECH 936; MECH 938; METR 312; PHYS 311; PHYS 422, PHYS 822, ECEN 422, ECEN 822
ACE: ACE 3 Math/Stat/Reasoning
Groups: Advanced Mathematics Courses

MATH 221H Honors:Differential Equations
Prerequisites: A grade of P, C, or better in MATH 208 or MATH 208H
Description: For course description, see MATH 221/821.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Prerequisite for: AGEN 303, BSEN 303; AGEN 344, BSEN 344; AGEN 350, BSEN 350; AGEN 957, BSEN 957, CIVE 957, GEOL 957; BSEN 260, AGEN 260; BSEN 311; BSEN 317; BSEN 326, CIVE 326; BSEN 326H, CIVE 326H; CHME 312; CIVE 310; CIVE 310H; ECEN 213; ECEN 216; ECEN 304; ECEN 306; ECEN 328; MATH 430; MATH 435; MATH 442; MECH 310, MECH 310H, MECH 318; MECH 925; MECH 933; MECH 936; MECH 938; METR 312; PHYS 311; PHYS 422, PHYS 822, ECEN 422, ECEN 822
ACE: ACE 3 Math/Stat/Reasoning
Groups: Advanced Mathematics Courses

MATH 300 Mathematics Matters
Prerequisites: TEAC 308 or TEAC 416D or parallel.
Notes: Credit toward the degree may be earned in only one of: MATH 300 or MATH 300M. MATH 300 is designed for elementary education majors with mathematics as an area of concentration.
Description: Numbers and operations. Develop an understanding of mathematics taught in the elementary school.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Prerequisite for: MATH 301; TEAC 297E; TEAC 308
Groups: Introductory Mathematics

MATH 300M Mathematics as a Second Language
Prerequisites: Must be degree seeking in the College of Education & Human Sciences.
Notes: MATH 300M is open only to a middle grades teaching endorsement program student. Credit towards degree may be earned in only one of: MATH 300, or MATH 300M. MATH 300M is designed to strengthen the mathematics knowledge of the middle-level mathematics teacher.
Description: Develop a deeper understanding of "number and operations". The importance of careful reasoning, problem solving, and communicating mathematics, both orally and in writing. Connections with other areas of mathematics and the need for developing the "habits of mind of a mathematical thinker".
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Groups: Introductory Mathematics

MATH 301 Geometry Matters
Prerequisites: MATH 300, with a grade of C or Pass or better.
Notes: Credit towards the degree may be earned in only one of: MATH 301. Designed for elementary education majors with mathematics as an area of concentration.
Description: Geometry and measurement. Develop an understanding of geometry as taught in the elementary school.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Groups: Introductory Mathematics

MATH 302 Math Modeling
Notes: Math 300 is a strongly recommended prerequisite. Math 302 is intended for middle grades teaching endorsement majors with a mathematics emphasis and/or to elementary education majors who want a mathematics concentration.
Description: Using mathematics to model solutions or relationships for realistic problems taken from the middle school curriculum. The mathematics for these models are a mix of algebra, geometry, sequences (dynamical systems, queuing theory), functions (linear, exponential, logarithmic), and logic. Mathematical terminology, concepts and principles. Calculator based lab devices, graphing calculators, and computers as tools to collect data, to focus on concepts and ideas, and to make the mathematics more accessible.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Groups: Introductory Mathematics
MATH 304 Experimentation, Conjecture, and Reasoning
Prerequisites: Must be degree seeking in the College of Education & Human Sciences.
Description: How to express mathematical solutions and ideas logically and coherently in both written and oral forms in the context of problem solving. Inductive and deductive logical reasoning skills through problem solving. Present and critique logical arguments in verbal and written forms. Problem topics taken from topics nationally recommended for middle school mathematics.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Groups: Introductory Mathematics

MATH 306 Number Theory and Cryptology for Middle Level Teachers
Prerequisites: Must be degree seeking in the College of Education & Human Sciences.
Description: Basic number theory results which are needed to understand the number theoretic RSA cryptography algorithm. Primes, properties of congruences, divisibility tests, linear Diophantine equations, linear congruences, Chinese Remainder Theorem, Wilson's Theorem, Fermat's Little Theorem, Euler's Theorem, and Euler's phi function. Integers with connections to the middle school curriculum and mathematical reasoning.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Groups: Introductory Mathematics

MATH 310 Introduction to Modern Algebra
Prerequisites: A grade of P, C, or better in MATH 208 or MATH 208H
Description: Elementary number theory, including induction, the Fundamental Theorem of Arithmetic, and modular arithmetic. Introduction to rings and fields as natural extension of the integers. Particular emphasis on the study of polynomials with coefficients in the rational, real, or complex numbers.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Groups: Advanced Mathematics Courses

MATH 310H Honors: Introduction to Modern Algebra
Prerequisites: Good Standing in the University Honors Program and a grade of P, C, or better in MATH 208 or MATH 208H
Description: For course description, see MATH 310.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Groups: Advanced Mathematics Courses

MATH 314 Linear Algebra
Crosslisted with: MATH 814
Prerequisites: A grade of P, C, or better in MATH 208 or MATH 208H
Notes: Not open to MA or MS students in mathematics or statistics
Description: Fundamental concepts of linear algebra, including properties of matrix arithmetic, systems of linear equations, vector spaces, inner products, determinants, eigenvalues and eigenvectors, and diagonalization.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Prerequisite for: CSCE 970; CSCE 973; MATH 405; MATH 435; MATH 442; MATH 471; MATH 809, MATH 409; MECH 350; MECH 888
ACE: ACE 3 Math/Stat/Reasoning
Groups: Advanced Mathematics Courses

MATH 314H Honors: Applied Linear Algebra (Matrix Theory)
Prerequisites: Good Standing in the University Honors Program and a grade of P, C, or better in MATH 208 or MATH 208H
Description: For course description, see MATH 314.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Prerequisite for: CSCE 970; MATH 405; MATH 435; MATH 442; MATH 471; MATH 809, MATH 409; MECH 350
ACE: ACE 3 Math/Stat/Reasoning
Groups: Advanced Mathematics Courses

MATH 316 Case Studies in Theoretical Ecology
Crosslisted with: BIOS 316, NRES 316
Prerequisites: Permission.
Notes: Case studies are structured around preparation for subsequent independent research (BIOS 498 or MATH 496).
Description: Introduction to biological literature, applied mathematics, computer programming, and/or statistical techniques relevant to field questions in ecology, evolution, and behavior. Typical mathematical topics include discrete dynamics, systems of differential equations, matrix algebra, or statistical inference and probability.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Prerequisite for: CSCE 970; MATH 405; MATH 435; MATH 442; MATH 471; MATH 809, MATH 409; MECH 350
ACE: ACE 3 Math/Stat/Reasoning
Groups: Advanced Mathematics Courses

MATH 322 Advanced Calculus
Crosslisted with: MATH 822
Description: Uniform convergence of sequences and series of functions, Green's theorem, Stoke's theorem, divergence theorem, line integrals, implicit and inverse function theorems, and general coordinate transformations.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Prerequisite for: METR 965
Groups: Advanced Mathematics Courses
MATH 325 Elementary Analysis
Prerequisites: A grade of P, C, or better in MATH 208 or MATH 208H
Description: An introduction to mathematical reasoning, construction of proofs, and careful mathematical writing in the context of continuous mathematics and calculus. Topics may include the real number system, limits and continuity, the derivative, integration, and compactness in terms of the real number system.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Prerequisite for: MATH 425; MATH 430; MATH 450; MATH 452; MATH 471
ACE: ACE 3 Math/Stat/Reasoning
Groups: Advanced Mathematics Courses

MATH 350 Geometry for High School Teaching
Prerequisites: A grade of P, C, or better in MATH 310 or MATH 310H
Notes: NOT open to MATH majors EXCEPT those under degree option "E" who are seeking a secondary mathematics teaching endorsement.
Description: Modern elementary geometry, plane transformations and applications, the axiomatic approach, Euclidean constructions. Additional topics vary.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Prerequisite for: MATH 408
Groups: Introductory Mathematics

MATH 380 Statistics and Applications
Crosslisted with: MATH 380H, STAT 380, STAT 380H, RAIK 270H
Prerequisites: A grade of P, C, or higher in MATH 107 or MATH 107H.
Notes: Credit toward the degree can not be earned in STAT 218 if taken after or taken in parallel with STAT/MATH 380.
Description: Probability calculus; random variables, their probability distributions and expected values; t, F and chi-square sampling distributions; estimation; testing of hypothesis; and regression analysis with applications.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Prerequisite for: ABUS 341, MRKT 341; BLAW 371; BLAW 371H; BLAW 372; BSAD 371H, RAIK 371H; CSCE 970; ECEN 325, ECEN 850; ECEN 450; ECON 311; FINA 361; FINA 361H; MATH 435; MATH 809, MATH 409; MECH 343; MNGT 301; MNGT 301H; MRKT 345; MKRT 350; MKRT 446; SCMA 331; SCMA 335; SCMA 350; SCMA 350H; SCMA 350L
ACE: ACE 3 Math/Stat/Reasoning
Groups: Advanced Mathematics Courses

MATH 380H Statistics and Applications
Crosslisted with: MATH 380, STAT 380, STAT 380H, RAIK 270H
Prerequisites: A grade of P, C, or higher in MATH 107 or MATH 107H.
Notes: Credit toward the degree can not be earned in STAT 218 if taken after or taken in parallel with STAT/MATH 380.
Description: Probability calculus; random variables, their probability distributions and expected values; t, F and chi-square sampling distributions; estimation; testing of hypothesis; and regression analysis with applications.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Prerequisite for: ABUS 341, MRKT 341; BLAW 371; BLAW 371H; BLAW 372; BSAD 371H, RAIK 371H; CSCE 970; ECEN 325, ECEN 850; ECEN 450; ECON 311; FINA 361; FINA 361H; MATH 435; MATH 809, MATH 409; MECH 343; MNGT 301; MNGT 301H; MRKT 345; MKRT 350; MKRT 446; SCMA 331; SCMA 335; SCMA 350; SCMA 350H; SCMA 350L
ACE: ACE 3 Math/Stat/Reasoning
Groups: Advanced Mathematics Courses
MATH 407 Mathematics for High School Teaching I
Prerequisites: MATH 208 and 310
Notes: NOT open to MATH majors EXCEPT those under degree option "E" who are seeking a secondary mathematics teaching endorsement.
Description: Analysis of the connections between college mathematics and high school algebra and precalculus.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Groups: Advanced Mathematics Courses

MATH 408 Mathematics for High School Teaching II
Prerequisites: MATH 310 and 350
Notes: NOT open to MATH majors EXCEPT those under degree option "E" who are seeking a secondary mathematics teaching endorsement.
Description: Analysis of the connections between college mathematics and high school algebra and geometry.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC

MATH 409 Math for High School Teachers II, Using Math to Understand Our World
Crosslisted with: MATH 809
Prerequisites: Math 310, Math 314, Math 380/Stat 380
Notes: Not open to MA or MS students in Mathematics. This course is for students seeking a mathematics major under the Education Option and for students in CEHS who are seeking their secondary mathematics teaching certificate.
Description: Designed around a series of projects in which students create mathematical models to examine the mathematics underlying several socially-relevant questions.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Groups: Advanced Mathematics Courses

MATH 415 Theory of Linear Transformations
Crosslisted with: MATH 815
Prerequisites: Math 314/814 and either Math 325 or Math 310
Description: Topics fundamental to the study of linear transformations on finite and infinite dimensional vector spaces over the real and complex number fields including: subspaces, direct sums, quotient spaces, dual spaces, matrix of a transformation, adjoint map, invariant subspaces, triangularization and diagonalization. Additional topics may include: Riesz Representation theorem, projections, normal operators, spectral theorem, polar decomposition, singular value decomposition, determinant as an n-linear functional, Cayley-Hamilton theorem, nilpotent operators, and Jordan canonical form.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Groups: Advanced Mathematics Courses

MATH 417 Group Theory
Prerequisites: A grade of P, C, or better in MATH 310 or MATH 310H
Description: Elementary group theory, including cyclic, dihedral, and permutation groups; subgroups, cosets, normality, and quotient groups; fundamental isomorphism theorems; the theorems of Cayley, Lagrange, and Cauchy; and if time allows, Sylow's theorems.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
ACE: ACE 10 Integrated Product
Groups: Advanced Mathematics Courses

MATH 423 Complex Analysis
Crosslisted with: MATH 823
Prerequisites: A grade of P, C, or better in MATH 208 or MATH 208H
Description: Complex numbers, functions of complex variables, analytic functions, complex integration, Cauchy's integral formulas, Taylor and Laurent series, calculus of residues and contour integration, conformal mappings, harmonic functions. Applications of these concepts in engineering, physical sciences, and mathematics.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Groups: Advanced Mathematics Courses

MATH 424 Introduction to Partial Differential Equations
Crosslisted with: MATH 824
Prerequisites: A grade of P, C, or better in MATH 221 or MATH 221H
Notes: Not open to MA or MS students in mathematics or statistics.
Description: Derivation of the heat, wave, and potential equations; separation of variables method of solution; solutions of boundary value problems by use of Fourier series, Fourier transforms, eigenfunction expansions with emphasis on the Bessel and Legendre functions; interpretations of solutions in various physical settings.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Groups: Advanced Mathematics Courses

MATH 425 Mathematical Analysis
Prerequisites: A grade of P, C, or better in MATH 325
Description: Real number system, topology of Euclidean space and metric spaces, compactness, sequences, series, convergence and uniform convergence, and continuity and uniform continuity.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Groups: Advanced Mathematics Courses

MATH 427 Mathematical Methods in Engineering
Prerequisites: A grade of P, C, or better in MATH 310
Description: Introduction to the mathematical methods used in engineering, including linear algebra, ordinary differential equations, Laplace transforms, and Fourier series.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Groups: Advanced Mathematics Courses
MATH 427 Mathematical Methods in the Physical Sciences  
Crosslisted with: MATH 827  
Prerequisites: A grade of P, C, or better in MATH 221 or MATH 221H  
Notes: Not open to mathematics majors. Not open to MA or MS students in mathematics.  
Description: Matrix operations, transformations, inverses, orthogonal matrices, rotations in space. Eigenvalues and eigenvectors, diagonalization, applications of diagonalization. Curvilinear coordinate systems, differential operations in curvilinear coordinate systems, Jacobians, changes of variables in multiple integration. Scalar, vector and tensor fields, tensor operations, applications or tensors. Complex function theory, integration by residues, conformal mappings.  
Credit Hours: 3  
Max credits per semester: 3  
Max credits per degree: 3  
Format: LEC  
Groups: Advanced Mathematics Courses

MATH 428 Principles of Operations Research  
Crosslisted with: MATH 828  
Prerequisites: MATH 314; STAT 380 or MECH 321.  
Description: Introduction to techniques and applications of operations research. Includes linear programming, queueing theory, decision analysis, network analysis, and simulation.  
Credit Hours: 3  
Max credits per semester: 3  
Max credits per degree: 3  
Format: LEC  
ACE: ACE 10 Integrated Product  
Groups: Advanced Mathematics Courses

MATH 430 Ordinary Differential Equations  
Prerequisites: MATH 221 or 221H; MATH 310 or MATH 310H or MATH 325.  
Description: Qualitative behavior of solutions of systems of differential equations, including existence and uniqueness, extendibility, and periodic solutions. The Putzer algorithm, Floquet theory, matrix norms, linearization, stability theory, and period-doubling and chaos.  
Credit Hours: 3  
Max credits per semester: 3  
Max credits per degree: 3  
Format: LEC  
Groups: Advanced Mathematics Courses

MATH 432 Linear Optimization  
Crosslisted with: MATH 832  
Prerequisites: MATH 314 or 314H; MATH 310 or 310H or MATH 325  
Description: Mathematical theory of linear optimization, convex sets, simplex algorithm, duality, multiple objective linear programs, formulation of mathematical models.  
Credit Hours: 3  
Max credits per semester: 3  
Max credits per degree: 3  
Format: LEC  
Groups: Advanced Mathematics Courses

MATH 433 Nonlinear Optimization  
Crosslisted with: MATH 833  
Prerequisites: MATH 314/814 and MATH 310 or MATH 325  
Description: Mathematical theory of unconstrained and constrained optimization for nonlinear multivariate functions, particularly iterative methods, such as quasi-Newton methods, least squares optimization, and convex programming. Computer implementation of these methods.  
Credit Hours: 3  
Max credits per semester: 3  
Max credits per degree: 3  
Format: LEC  
Groups: Advanced Mathematics Courses

MATH 435 Math in the City  
Prerequisites: MATH 221 or 221H and MATH 314 or 314H; or MATH 221 or 221H and MATH 380; or MATH 314 or 314H and MATH 380.  
Description: A research experience modeling problems of current interest to the local community, businesses, or government.  
Credit Hours: 3  
Max credits per semester: 3  
Max credits per degree: 3  
Format: LEC  
ACE: ACE 10 Integrated Product

MATH 439 Mathematical Models in Biology  
Crosslisted with: MATH 839  
Prerequisites: A grade of P, C, or better in MATH 107 or MATH 107H  
Notes: MATH 439/839 has a small laboratory component.  
Description: Discrete and continuous models in ecology: population models, predation, food webs, the spread of infectious diseases, and life histories. Elementary biochemical reaction kinetics; random processes in nature. Use of software for computation and graphics.  
Credit Hours: 3  
Max credits per semester: 3  
Max credits per degree: 3  
Format: LEC  
Groups: Advanced Mathematics Courses

MATH 440 Numerical Analysis I  
Crosslisted with: CSCE 440, CSCE 840, MATH 840  
Prerequisites: CSCE 155A, CSCE 155E, CSCE 155H, CSCE 155N, CSCE 155T, or SOFT 160; Math 107.  
Notes: Credit toward the degree may be earned in only one of the following: CSCE/MATH 440/840 and MECH 480/880.  
Description: Principles of numerical computing and error analysis covering numerical error, root finding, systems of equations, interpolation, numerical differentiation and integration, and differential equations. Modeling real-world engineering problems on digital computers. Effects of floating point arithmetic.  
Credit Hours: 3  
Max credits per semester: 3  
Max credits per degree: 3  
Format: LEC  
Prerequisite for: CSCE 942, MATH 942
MATH 441 Approximation of Functions  
Crosslisted with: CSCE 441, CSCE 841, MATH 841  
Prerequisites: MATH 221/221H and MATH 314/314H  
Description: Polynomial interpolation, uniform approximation, orthogonal polynomials, least-first-power approximation, polynomial and spline interpolation, approximation and interpolation by rational functions.  
Credit Hours: 3  
Max credits per semester: 3  
Max credits per degree: 3  
Format: LEC  
Prerequisite for: CSCE 942, MATH 942  
Groups: Advanced Mathematics Courses

MATH 442 Methods of Applied Mathematics I  
Prerequisites: MATH 221 and 314, or their equivalents.  
Description: Derivation, analysis, and interpretation of mathematical models for problems in the physical and applied sciences. Scaling and dimensional analysis. Asymptotics, including regular and singular perturbation methods and asymptotic expansion of integrals. Calculus of variations.  
Credit Hours: 3  
Max credits per semester: 3  
Max credits per degree: 3  
Format: LEC  
Groups: Advanced Mathematics Courses

MATH 445 Number Theory  
Crosslisted with: MATH 845  
Prerequisites: MATH 310 or 310H  
Description: Fundamentals of number theory, including congruences, primality tests, factoring methods. Diophantine equations, quadratic reciprocity, continued fractions, and elliptic curves.  
Credit Hours: 3  
Max credits per semester: 3  
Max credits per degree: 3  
Format: LEC  
Groups: Advanced Mathematics Courses

MATH 447 Numerical Linear Algebra  
Crosslisted with: CSCE 447, CSCE 847, MATH 847  
Prerequisites: MATH 314  
Description: Mathematics and algorithms for numerically stable matrix and linear algebra computations, including solution of linear systems, computation of eigenvalues and eigenvectors, singular value decomposition, and QR decomposition.  
Credit Hours: 3  
Max credits per semester: 3  
Max credits per degree: 3  
Format: LEC  
Prerequisite for: CSCE 942, MATH 942  
Groups: Advanced Mathematics Courses

MATH 450 Combinatorics  
Prerequisites: MATH 310 or 310H or 325.  
Description: Theory of enumeration and/or existence of arrangements of objects: Pigeonhole principle, inclusion-exclusion, recurrence relations, generating functions, systems of distinct representatives, combinatorial designs and other applications.  
Credit Hours: 3  
Max credits per semester: 3  
Max credits per degree: 3  
Format: LEC  
Groups: Advanced Mathematics Courses

MATH 452 Graph Theory  
Prerequisites: MATH 310 or MATH 325  
Notes: Selected applications.  
Description: Theory of directed and undirected graphs. Trees, circuits, subgraphs, matrix representations, coloring problems, and planar graphs. Methods which can be implemented by computer algorithms.  
Credit Hours: 3  
Max credits per semester: 3  
Max credits per degree: 3  
Format: LEC  
Groups: Advanced Mathematics Courses

MATH 456 Differential Geometry I  
Prerequisites: MATH 221 or 221H; MATH 314 or 314H; and MATH 322.  
Description: Introduction to a selection of topics in modern differential manifolds, vector bundles, vector fields, tensors, differential forms, Stoke's theorem, Riemannian and semi-Riemannian metrics, Lie Groups, connections, singularities. Includes gauge field theory, catastrophe theory, general relativity, fluid flow.  
Credit Hours: 3  
Max credits per semester: 3  
Max credits per degree: 3  
Format: LEC  
Groups: Advanced Mathematics Courses

MATH 465 Introduction to Mathematical Logic  
Crosslisted with: MATH 865  
Description: Semantical and syntactical developments of propositional logic, discussion of several propositional calculi, application of Boolean algebra and related topics, semantics and syntax of first order predicate logic including Godel's completeness theorem, the compactness theorem.  
Credit Hours: 3  
Max credits per semester: 3  
Max credits per degree: 3  
Format: LEC  
Groups: Advanced Mathematics Courses

MATH 471 Introduction to Topology  
Prerequisites: Math 314 and either Math 325 or 310  
Description: Elementary point-set and geometric topology. Point-set topics include topological spaces, continuous functions, homeomorphisms, connectedness, compactness, quotient spaces. Geometric topology topics include Euler characteristic, classification of surfaces, and other applications.  
Credit Hours: 3  
Max credits per semester: 3  
Max credits per degree: 3  
Format: LEC  
Prerequisite for: MATH 856
MATH 487 Probability Theory
Crosslisted with: MATH 887
Prerequisites: Math 314 and Math 325
Description: Probability, conditional probability, Bayes' theorem, independence, discrete and continuous random variables, density and distribution functions, multivariate distributions, probability and moment generating functions, the central limit theorem, convergence of sequences of random variables, random walks, Poisson processes and applications.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
Groups: Advanced Mathematics Courses

MATH 489 Stochastic Processes
Crosslisted with: MATH 889
Prerequisites: MATH 314 and STAT/MATH 380 (or STAT 880)
Description: Markov chains, continuous-time Markov processes, the Poisson process, Brownian motion, introduction to stochastic calculus.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Format: LEC
ACE: ACE 10 Integrated Product
Groups: Advanced Mathematics Courses

MATH 495 Seminar
Prerequisites: MATH 208 or 208H; and permission.
Credit Hours: 1-3
Min credits per semester: 1
Max credits per semester: 3
Max credits per degree: 6
Format: LEC
Groups: Seminars, Ind Study, Topics

MATH 496 Seminar in Mathematics
Crosslisted with: MATH 896
Prerequisites: Permission.
Credit Hours: 1-3
Min credits per semester: 1
Max credits per semester: 3
Max credits per degree: 6
Format: LEC
Groups: Seminars, Ind Study, Topics

MATH 497 Reading Course
Prerequisites: Permission.
Credit Hours: 1-4
Min credits per semester: 1
Max credits per semester: 4
Max credits per degree: 4
Format: IND
Groups: Seminars, Ind Study, Topics