

## Mathematics (MATH)

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### MATH 035 ELEMENTARY ALGEBRA (4)

Real numbers, linear equations and inequalities, quadratic equations, polynomial operations, radical and exponential expressions. Prerequisite: placement based on ELM examination taken within the past two years. Course credit is not applicable toward graduation.

### MATH 045 INTERMEDIATE ALGEBRA (4)

Linear, quadratic, radical, rational, exponential, and logarithmic functions and their graphs. Conic sections. Prerequisite: MATH 35 or equivalent, or placement based on ELM examination taken within the past two years. Course credit is not applicable toward graduation.

### MATH 103 ETHNOMATHEMATICS (3)

This course examines the mathematics of many indigenous cultures, especially those of North and South America, Africa, and Oceania. It will examine the use of mathematics in commerce, land measure and surveying, games, kinship, measurement of time, navigation, data storage, and other topics. The mathematics involved includes number bases, probability, geometry, number theory, lattice theory, and many other topics of interest in modern mathematics. This class is recommended for liberal arts students who are interested in studying other cultures. Satisfies the Area B4 GE requirement for mathematics. Prerequisite: satisfaction of ELM requirement.

### MATH 104 INTRODUCTION TO MODERN MATHEMATICS (3)

A class designed to explore the beauty and relevance of mathematics. Topics may include puzzles, paradoxes, and logic; axiomatic systems; biographies; infinity of the counting numbers and higher infinities; historical crises and breakthroughs in mathematics; and uncertainty. This class is recommended for liberal arts students. Satisfies the GE Area B4 requirement for mathematics. Prerequisite: satisfaction of ELM requirement.

### MATH 105 MATHEMATICS AND POLITICS (3)

This course will explore mathematical achievements in the theory of politics. Topics may include: escalation, conflict, yes-no voting, political power, and social choice. This course has an enormous cultural content, while at the same time dealing with important mathematical ideas. This class is especially suitable for social science students. Satisfies the GE Area B4 requirement for mathematics. Prerequisite: satisfaction of ELM requirement.

### MATH 111 SYMMETRY IN THE ARTS AND SCIENCES (3)

This class explores the symmetries that exist in art as well as the natural world around us, and how symmetry can be described in terms of mathematics. A central theme is the contribution of mathematics to other fields, such as architecture and decorative art, engineering of mechanical devices, music and dance, evolution and anatomy, crystallography, chemical bonding and atomic structure, philosophy, and mathematical proofs. Satisfies the GE Area B4 requirement for mathematics. Prerequisite: satisfaction of ELM requirement.

### MATH 131 INTRODUCTION TO FINITE MATHEMATICS (3)

Designed to give students an understanding of finite mathematics applied in the modern world to social sciences, economic analysis, statistical analysis, and decision making. Topics include linear models, linear programming, financial mathematics, sets, combinatorics, probability, and statistics. Recommended for students with interests in the social sciences and management. Satisfies the GE Area B4 requirement for mathematics. Prerequisite: satisfaction of ELM requirement.

### MATH 141 STUDIES IN... (3)

Topics and approaches may vary. Please consult the current Schedule of Classes for details. Satisfies the GE Area B4 requirement for mathematics. Prerequisite: satisfaction of ELM requirement.

### MATH 142 DISCRETE STRUCTURES I (3)

A study of discrete structures that have applications in computer science. Topics may include logic, introduction to number theory, methods of proof, mathematical induction, set theory, relations, functions, directed graphs, Boolean algebras, and combinatorics. Prerequisite: MATH 160, or consent of instructor.

### MATH 142E DISCRETE MATHEMATICS FOR ENGINEERING (2)

The first portion of MATH 142: a study of discrete structures needed for electronics and communications engineering. Topics may include logic, proofs, mathematical induction, set theory, Boolean algebra, and combinatorics.

### MATH 150 MODERN GEOMETRY (3)

A study of Euclidean geometry. It will cover topics such as compass and straightedge constructions, proofs, parallel and perpendicular lines, triangles, circles, polygons, measurement, solids, transformations, tessellations, and the use of geometry software. Satisfies the GE Area B4 requirement for mathematics. Prerequisite: satisfaction of ELM requirement.

### MATH 160 PRECALCULUS MATHEMATICS (4)

Covers a brief review of college algebra; functional notation, composition, and decomposition of functions and inverse functions; behavior of families of functions such as polynomial, rational, exponential, and logarithmic; trigonometric functions, equations, and identities and some mathematical modeling. Emphasis on problem solving. Satisfies the GE Area B4 requirement for mathematics. Prerequisite: satisfaction of ELM requirement.

### MATH 160W PRECALCULUS (1)

A workshop designed to be taken with MATH 160. Exploration of precalculus concepts through problem solving in a group setting. Cr/NC only. Corequisite: MATH 160.

### MATH 161 DIFFERENTIAL AND INTEGRAL CALCULUS I (4)

Calculus I includes limits, continuity, the concept of the derivative, differentiation rules, and applications of the derivative, including curve sketching, extremum problems, L'Hopital's rule, implicit differentiation, related rates, Mean Value Theorem, introduction to integration, fundamental theorem of calculus, and substitution. Satisfies the GE Area B4 requirement for mathematics. Prerequisite: Precalculus mastery.

### MATH 161W CALCULUS I WORKSHOP (1)

A workshop designed to be taken with MATH 161. Exploration of first-semester calculus concepts through problem solving in a group setting. Cr/NC only. Corequisite: MATH 161.

### MATH 161X DIFFERENTIAL AND INTEGRAL CALCULUS 1 EXTENDED (6)

A 6-unit version of Math 161 for students who feel that they need to refresh their algebra skills. Satisfies the GE Area B4 requirement for mathematics. Prerequisite: Satisfaction of ELM requirement.

### MATH 165 ELEMENTARY APPLIED STATISTICS (4)

This course is a technology-intensive introduction to elementary statistics. Topics include: elementary descriptive and inferential statistics and their application to the behavioral, natural, and social sciences; sampling; special distributions; central limit theorem; estimation; tests of hypothesis; analysis of variance; linear regression; and correlation. Satisfies the GE Area B4 requirement for mathematics. Prerequisite: satisfaction of ELM requirement.

### MATH 165X ELEMENTARY APPLIED STATISTICS EXTENDED (6)

A 6-unit version of Math 165 for first-time freshmen with an ELM score of 44, 46 or 48. Students who pass this class will receive credit for Math 165 and will also satisfy their developmental mathematics requirement, without taking Math 45. Satisfies the GE Area B4 requirement for mathematics. Prerequisite: A score of 44, 46, or 48 on the ELM and first-time freshman status. The course will not be open to students who have satisfied the ELM requirement.

**MATH 175 MATHEMATICS COLLOQUIUM (1)**

A student taking this course will be required to attend all presentations in the M\*A\*T\*T\*H Colloquium series during the semester and, in addition, keep a journal. May be taken three times for credit. Cr/NC only. Prerequisite: consent of instructor.

**MATH 180 COMPUTING FOR MATHEMATICS AND SCIENCE (2)**

This course will utilize a software system, such as Mathematica, to implement numerical, symbolic, and graphical computations useful in mathematics and science. It will also introduce students to procedural programming in that system. Prerequisite: Grade of C or better in MATH 161 or 161X or consent of instructor.

**MATH 185 SELECTED TOPICS IN MATH (1-5)**

Subject matter to be determined by instructor and may differ from semester to semester. This course may be repeated with different subject matter for up to 12 units. The course title will appear on the student's transcript. Prerequisite: consent of instructor.

**MATH 195 SPECIAL STUDIES (1-4)**

Special Studies may be arranged to cover an area of interest not covered in the lower-division courses offered by the department. Prerequisites: a college-level math course and consent of instructor.

**MATH 200 DISCRETE MATHEMATICS (3)**

Designed for elementary and middle school teachers, this course is a study of discrete mathematics with emphasis on its use in other areas of mathematics and in real world problems. Topics include selections from logic, proof, coding and cryptography, set theory, sequences, mathematical induction, combinatorics, graphs, and others as selected by the instructor. Prerequisite: Grade of C or better in a GE mathematics class or consent of the instructor.

**MATH 210 INTRODUCTION TO PROOF (1)**

Introduction to propositional logic and methods of proof, including direct proof, indirect proof, proof by "pick-a-point," and proof by mathematical induction. Students construct and analyze conjectures and counterexamples, and analyze and write proofs. Topics will include basic set theory, function theory, and equivalence relations, and may include examples from elementary number theory, algebra, and geometry. Does not count toward the Mathematics major, but satisfies the MATH 220 prerequisite for certain upper-division mathematics courses. Cr/NC only. Prerequisites: GE math and consent of instructor.

**MATH 211 DIFFERENTIAL AND INTEGRAL CALCULUS II (4)**

Calculus II includes the calculus of exponential and logarithmic functions, trigonometric and inverse trigonometric functions, numerical integration, techniques of integration, introduction to applications of integration including volumes and probability distributions, differential equations, Taylor polynomials, L'Hopital's rules, improper integrals, series, and introduction to partial derivatives. Prerequisite: Grade of C or better in MATH 161 or 161X or consent of instructor.

**MATH 211S CALCULUS II-S (2)**

First half of MATH 211. Prerequisites: Grade of C or better in MATH 161 or 161X or consent of instructor. Open only to students enrolled in programs that require MATH 211S.

**MATH 211SW CALCULUS II-S WORKSHOP (1)**

First half of MATH 211W. A workshop designed to be taken with MATH 211S. Exploration of second-semester calculus concepts through problem solving in a group setting. Cr/NC only. Corequisite: MATH 211S.

**MATH 211W CALCULUS II WORKSHOP (1)**

A workshop designed to be taken with MATH 211. Exploration of second semester calculus concepts through problem solving in a group setting. Cr/NC only. Corequisite: MATH 211.

**MATH 220 REASONING AND PROOF (4)**

This course will teach students to analyze and evaluate scientific and rhetorical reasoning, with emphasis on the reasoning used in Mathematical proofs. Students will identify and evaluate unstated assumptions in statistical tables and charts from real-world media, submit coherent and original proofs of theorems, and develop verbal and non-verbal skills for making persuasive oral arguments and presentations on mathematical topics. Satisfies GE area A3. Prerequisite: Grade of C or better in (MATH 161 or 161X and a Math/Stats course numbered 200 or above) or CS 242, or consent of instructor. Not repeatable for credit.

**MATH 222 ELEMENTARY APPLIED LINEAR ALGEBRA (3)**

A course in vector and matrix algebra applied to science and computing. Topics include systems of linear equations, determinants, Euclidean and general vector spaces, eigenvalues and eigenvectors, linear transformations. Prerequisite: Grade of C or better in MATH 160 or consent of instructor.

**MATH 241 LINEAR ALGEBRA WITH APPLICATIONS IN DIFFERENTIAL EQUATIONS (4)**

A course in vector and matrix algebra applied to the study of differential equations. Topics include vectors and matrices, linear independence, spanning, bases, linear transformations, first order differential equations and linear systems, phase planes, geometric and numerical methods. Prerequisite: Grade of C or better in MATH 211 or equivalent, or consent of instructor. Not repeatable for credit.

**MATH 250 PROBABILITY AND STATISTICS FOR FUTURE TEACHERS (2)**

A study of elementary probability and statistics and their real-world contexts. Topics include the binomial distribution, conditional probability, expected value, data collection and sampling, measures of location and variability, estimation and simple hypothesis testing. The course is designed for teachers and may not be substituted for MATH 165. Prerequisite: Grade of C or better in Math 300B or Math 161 or Math 161X or consent of instructor. Not repeatable for credit.

**MATH 261 MULTIVARIABLE CALCULUS (4)**

Multivariable calculus includes partial derivatives, multiple integrals, alternative coordinate systems, vector functions and their derivatives, line integrals, Green's Theorem, Stokes' Theorem, and Divergence Theorem. Prerequisite: Grade of C or better in MATH 241 or equivalent, or MATH 211, or consent of instructor.

**MATH 265 INTERMEDIATE APPLIED STATISTICS WITH SPSS (4)**

This course is a technology-intensive examination of the application of statistical techniques to the real world using SPSS. The course extends the concepts learned in an elementary statistic course and introduces new topics; it is suitable for students with an interest in applying statistics to their field of interest. Topics selected from: theory of estimation, ANOVA (analysis of variance), multiple regression, principles of experimental design, sampling theory, time series analysis, non-parametric statistics, and multivariate analysis. Prerequisite: Grade of C or better in MATH 165 or 165X or MATH 250, or instructor consent.

**MATH 295 COMMUNITY INVOLVEMENT PROGRAM (1-4)**

CIP involves students in basic community problems, performing such tasks as tutoring, coaching, and reading for the blind. Students receive 1 to 4 units, depending on the specific tasks performed. No more than 3 units of credit in CIP may be applied toward any Mathematics degree. Cr/NC only.

**MATH 300A ELEMENTARY NUMBER SYSTEMS (3)**

This course, designed for prospective elementary and middle school teachers, explores numerical ideas underlying the K-8 mathematics curriculum. The emphasis is on understanding the mathematical ideas and procedures, and on representing them in ways that children can understand. Alternative ways of representing and solving problems are encouraged. Problem solving and logical thinking are emphasized throughout. Prerequisite: Grade of C or better in any course that meets GE Area B4 (Mathematical Concepts and Quantitative Reasoning).

**MATH 300B DATA, CHANCE, AND ALGEBRA (3)**

This course is designed for prospective elementary and middle school teachers. The focus in algebra is on patterns and functions, algebraic structure, representations and connections, and reasoning and problem solving. The focus in data and chance is on developing solid understanding of fundamental concepts and skills in statistics and probability, and on enhancing students' understanding and skills in number and computation proportional reasoning, and algebra. Prerequisite: Grade of C or better in MATH 300A.

**MATH 303 INTEREST THEORY (3)**

Basic interest theory, including patterns of growth, interest operations, basic applications, level payment annuities, non-level payment annuities, yield rates, amortization and sinking funds, and bonds. Prerequisite: Grade of C or better in MATH 161 or 161X or equivalent, or consent of instructor.

**MATH 306 NUMBER THEORY (4)**

Topics include mathematical induction, Euclidean algorithm, congruences, primes, fundamental theorem of arithmetic, Fermat's little theorem, Euler's theorem, primitive roots, quadratic reciprocity, and polynomials over the real numbers. Additional topics may include Pythagorean triples, the Goldbach conjecture, perfect numbers, amicable numbers, Chinese remainder theorem, Fibonacci numbers, cryptography, prime number theorem, Möbius inversion. Prerequisite: Grade of C or better in MATH 220 or MATH 142 or CS 242. Not repeatable for credit.

**MATH 308 COLLEGE GEOMETRY (4)**

Topics include neutral geometry, plane and solid Euclidean geometry, isometries in the Euclidean plane (transformational geometry), and hyperbolic geometry. Additional topics may include the Hilbert postulates, construction of geometries from fields, and projective geometry. Prerequisite: Grade of C or better in MATH 220 or MATH 142 or CS 242. Not repeatable for credit.

**MATH 310 HISTORY OF MATHEMATICS (4)**

Mathematics from ancient times to the present. The student learns how to solve problems of the past using only the tools of the past. Students will complete a major project using adaptations of historical sources to link the history of mathematics to the teaching of mathematics. Prerequisite: Grade of C or better in MATH 161 or 161X or consent of instructor. Not repeatable for credit.

**MATH 316 GRAPH THEORY AND COMBINATORICS (4)**

A study of combinatorics, probability, and graph theory. Topics will include the elements of set theory, counting techniques such as permutations and combinations, discrete probability, Hamiltonian and Eulerian properties of graphs, graph isomorphism, coloring and planarity. Additional topics may include the pigeonhole principle, the inclusion-exclusion principle, generating functions, partitions and recurrence relations, Polya's theorem, matching, and trees, with applications in many disciplines. Students may not earn credit for both Math 316 and Math 416. Prerequisite: Grade of C or better in Math 142 or Math 220 or CS 242 or consent of instructor. Not repeatable for credit.

**MATH 320 MODERN ALGEBRA I (4)**

An introduction to the theory of groups, rings, and fields. Topics covered include permutation and cyclic groups, factor groups, ideals and factor rings, and isomorphism and homomorphism theory of groups and rings. Prerequisite: Grade of C or better in MATH 220 or consent of instructor.

**MATH 322 LINEAR ALGEBRA (4)**

Topics include vector spaces, linear transformations, matrices, linear equations, determinants, diagonalization, inner product spaces, and additional topics such as the Cayley-Hamilton Theorem, Singular Value Decomposition, or Canonical Forms. Prerequisite: Grade of C or better in MATH 220 and (MATH 241 or MATH 222) or consent of instructor. Not repeatable for credit.

**MATH 330 TECHNIQUES OF PROBLEM SOLVING (1)**

Cultivates by experience and example the mental disciplines for generating creative solutions to challenging problems. The problems to be considered will be taken largely from recent examinations in the William Lowell Putnam Mathematical Competition, sponsored by the Mathematical Association of America. No more than 4 units of credit in this course may be applied toward any Mathematics degree. May be taken four times for credit. Cr/NC only. Prerequisite: Grade of C or better in MATH 161 or 161X or consent of instructor.

**MATH 340 REAL ANALYSIS I (4)**

Topics may include construction of the real numbers, sequences, topology of the real numbers, metric spaces, continuity, the derivative, and the Riemann integral. Prerequisites: Grade of C or better in MATH 220 and (MATH 241 or MATH 261), or consent of instructor.

**MATH 342 DISCRETE STRUCTURES II (3)**

A study of discrete structures that have applications in computer science. Topics will include combinatorics and counting, probability and statistics, matrices, recurrence relations, generating functions, and graph theory. Throughout the course, applications to computer science will be discussed. Prerequisites: Grade of C or better in MATH 211 and one of the following: MATH 142, MATH 200, or MATH 220, or consent of instructor.

**MATH 345 PROBABILITY THEORY (4)**

Topics include probability spaces, discrete and continuous random variables, selected probability distributions for random phenomena, distributions of functions of random variables, moment generating functions, expected value, covariance and correlation, conditional expectation, law of large numbers and central limit theorem, and sampling distribution of estimators. Prerequisite: Grade of C or better in MATH 261; can be taken concurrently, or consent of instructor.

**MATH 345E PROBABILITY THEORY FOR ENGINEERING (2)**

Lecture, 2 hours. This is a two-unit one-half semester introduction to probability theory for Engineering students. Topics covered include basic set theory, probability, combinatorics, discrete and continuous random variables, probability distribution and density functions, first and second moments, and functions of random variables. Prerequisite: Math 211 or consent of instructor.

**MATH 352 NUMERICAL ANALYSIS (4)**

Selected numerical and iterative processes for solving mathematical problems and their applications. Topics include finding roots with bisection and Newton's method; solving systems of linear equations using LU decomposition and Gauss-Seidel methods; polynomial approximation using Taylor's Theorem, Lagrange interpolations, and the theory of spline functions; numerical integration using Simpson's rule and Gaussian integration; numerical solutions to ODEs using Euler's and modified Euler's method. Prerequisites: Grade of C or better in MATH 241 (may take concurrently), MATH 180 or CS 115, or consent of instructor. Not repeatable for credit.

**MATH 367 STATISTICAL CONSULTING AND COMMUNICATION (2)**

This course is a blending of theoretical and practical aspects of statistical consulting. Students learn how to consult with professionals in various fields, find creative statistical solutions to real-world problems, and present results in oral and written form. Students at Grade of C or better in so learn about research and statistical software packages. Prerequisite: MATH 265 or consent of instructor.

**MATH 375 M\*A\*T\*H COLLOQUIUM (1)**

Students will be required to attend presentations, keep a journal, and write a significant paper on one of the presentations. May be taken three times for credit. No more than 3 units may be applied to the upper-division major or minor requirements. May not be taken concurrently with MATH 175. Prerequisites: consent of instructor and upper-division standing.

**MATH 381 COMPUTING FOR STATISTICS: SAS PROGRAMMING LANGUAGE (2)**

Students will learn how to write SAS programs in order to perform data management tasks, statistical analysis, and to generate summary graphs and SAS reports. Topics include essential programming concepts (the environment and steps); typical data processing tasks; data management techniques (working with SAS libraries and different types of data, data set input and output, validation, merging, and subsets); statistical analyses (descriptive statistics, histograms and bar charts, k analysis of variance, regression analysis); and generation of SAS reports. Prerequisite: Grade of C or better in MATH 265 or concurrent enrollment, or consent of instructor.

**MATH 390 FIELDWORK AND SEMINAR: SECONDARY MATHEMATICS TEACHING (2)**

Forty-five hours of observation in middle school, junior high, and/or high school mathematics classrooms, plus a weekly seminar. Students begin to view school mathematics from the vantage point of a teacher. Intended primarily for Mathematics majors in the secondary teaching track or students considering a career in this field. This course satisfies the 45 hours of field observation required for acceptance into SSU's Single Subject Credential Program, and initiates the development of the Mathematics Portfolio required for Mathematics majors in the secondary teaching track. Cr/NC only. Prerequisite: Grade of C or better in MATH 161 or 161X or consent of instructor.

**MATH 395 COMMUNITY INVOLVEMENT PROGRAM (1-4)**

CIP involves students in the community performing such tasks as tutoring, coaching, and reading for the blind. Students receive 1 to 4 units, depending on the specific tasks performed. No more than 3 units of credit in CIP may be applied toward any Mathematics degree. May be repeated for a total of 6 units. Cr/NC only.

**MATH 399 PRACTICUM IN MATHEMATICS (1-4)**

Supervised unpaid instructional work experience in Mathematics. May include tutoring, assisting with classroom activities, and leading supplementary course workshops. Thirty hours of contact time is required for each unit. Does not count for credit in the major or the minor, except for one unit in the Integrated Program. May be repeated for up to 4 units of credit. Prerequisites: requires previous or concurrent enrollment in an upper-division mathematics course and consent of instructor. Cr/NC only.

**MATH 416 GRAPH THEORY AND COMBINATORICS (4)**

A study of combinatorics, probability, and graph theory. Math 416 covers the same topics as Math 316. Students taking Math 416 will work advanced problems from these topics and do a special research project which requires a significant paper and an oral presentation. Students may not earn credit for both Math 316 and Math 416. Prerequisite: Grade of C or better in Math 142 or Math 220 or CS 242 consent of instructor. Not repeatable for credit.

**MATH 418 TOPOLOGY (4)**

Topics include definition of a topology, open & closed sets, continuous mappings, subspaces, bases and subbases of a topology, compact topological spaces, separation axioms, connected, path connected, normal spaces, regular spaces, metric spaces, product spaces, and quotient spaces. Will also include homotopy, the fundamental group, and covering spaces as time permits. Theorems include the Urysohn lemma, Tietze Extension Theorem, and the Tychonoff Theorem. Prerequisite: Grade of C or better in MATH 340 or consent of instructor. MATH 320 is recommended. Not repeatable for credit.

**MATH 420 MODERN ALGEBRA II (4)**

A continuation of MATH 320. Advanced topics in the theory of groups, rings, and fields. Depth in Algebra at a level expected of entering graduate students. Coverage will include topics such as the direct product of groups, finite Abelian groups, Sylow Theorems, unique factorization domains, field extensions, and Galois Theory. Prerequisites: Grade of C or better in Math 320 or equivalent. Not repeatable for credit.

**MATH 430 LINEAR SYSTEMS THEORY (3)**

Topics may include correlation, convolution, Fourier, Laplace and z-transform, difference equations, fast Fourier transforms, and state variable theory. Prerequisite: Grade of C or better in one semester of differential equations (such as MATH 241), or consent of instructor. Cross-listed as ES 400 and CES 400.

**MATH 431 APPLIED PARTIAL DIFFERENTIAL EQUATIONS (4)**

Topics covered in this course will include Introduction and Classification of PDEs, Mathematical models in physics and engineering, Theory and solution of quasi-linear first-order PDEs, Power series solutions of an ODE, The Sturm separation theorem for second-order linear equations, Second-order linear and nonlinear PDEs including applications, Fourier series, boundary-value problems, Fourier and Laplace transforms, numerical methods and solutions, and approximation of solutions using the finite-difference method. Prerequisites: Grade of C or better in Math 241 and (Math 180 or CS 115), or consent of instructor. Not repeatable for credit.

**MATH 440 REAL ANALYSIS II (4)**

Topics include sequences and series of functions, pointwise versus uniform convergence, power and Taylor series, Lebesgue measure, Lebesgue measurable functions and the Lebesgue integral. Additional topics may include the Weierstrass approximation theorem, orthogonal functions, Fourier series, square-integrable functions, sigma algebras of subsets, and general measure spaces. Prerequisite: Grade of C or better in Math 340 or consent of instructor. Not repeatable for credit.

**MATH 441 OPERATIONS RESEARCH (3)**

A course in operations research and industrial problem solving. Topics may include optimization, simplex algorithm for linear programming, queueing theory, game theory, PERT least time path analysis, and mathematical modeling of industrial problems. Prerequisites: Grade of C or better in MATH 345 and either MATH 241 or MATH 222, or consent of instructor.

**MATH 445 MATHEMATICAL STATISTICS AND OPERATIONS RESEARCH (4)**

Topics include: properties of statistics, convergence in probability, theory of estimation and confidence intervals, Bayesian statistics, tests of significance, power and uniformly most powerful tests, random processes (with emphasis on queueing theory), and stationarity. Prerequisite: Grade of C or better in MATH 345 or consent of instructor.

**MATH 460 COMPLEX ANALYSIS (4)**

Topics will include the complex field, functions, limits, continuity, differentiation, the Cauchy-Riemann equations, conformal mappings, path integration, Cauchy's Integral Theorem and Integral Formulas, the Liouville Theorems, the Laurent Expansion, singularities, poles, residues, contour integration. Additional topics may include topics such as Mittag-Leffler's Partial-fractions Theorem, and Riemann surfaces. Prerequisite: Grade of C or better in MATH 340 or consent of instructor. Not repeatable for credit.

**MATH 465 EXPERIMENTAL DESIGN AND REGRESSION ANALYSIS (4)**

Advanced course in simple and multiple linear regression analysis; nonlinear and nonparametric regression analysis. Design of experiments and analysis of variance including one-way, two-way and block design; nonparametric techniques and multiple comparison methods. Prerequisite: Grade of C or better in MATH 265 and either MATH 241 or another course in linear algebra, and MATH 345 or consent of instructor.

**MATH 467 STATISTICAL CONSULTING, COMMUNICATION, AND PROJECT MANAGEMENT (2)**

This course is a blending of theoretical and practical aspects of statistical consulting. Students learn how to consult with professionals in various fields, find creative statistical solutions to real-world problems and present results in oral and written form. Students also learn about research and statistical software packages. MATH 467 covers the same topics as MATH 367. In addition, students taking MATH 467 will also learn how to oversee a statistical project completed by a team. Prerequisite: Grade of C or better in MATH 367 or consent of instructor.

#### **MATH 470 MATHEMATICAL AND STATISTICAL MODELING (4)**

The process of expressing scientific principles, experiments, and conjectures in mathematical terms. Topics include: gathering reliable data, exposing underlying assumptions, variables, relationships, levels, refining of models, and stochastic models. Deterministic vs. stochastic, discrete vs continuous, and deductive vs statistical models. Applications to biology, physics, chemistry, geology, social science and environmental sciences. Prerequisite: Grade of C or better in MATH 211 or consent of instructor. Not repeatable for credit.

#### **MATH 485 SELECTED TOPICS IN... (1-3)**

Subject matter and number of units to be determined by the instructor and may differ from semester to semester. Some of the possible areas of study are multivariable analysis, calculus of variations, convex geometry, differentiable manifolds, graph theory, Galois theory, algebraic topology, and integral equations. This course may be repeated for up to 6 units. The course title will appear on the student's transcript. Prerequisite: consent of instructor.

#### **MATH 490 CAPSTONE SEMINAR: SECONDARY MATHEMATICS TEACHING (1)**

Seminar focusing on connections among undergraduate coursework, secondary school curriculum, and learning and teaching mathematics. Students present their completed Mathematics Subject Matter Program portfolios for final evaluation. Students draw upon their portfolios, experiences, and readings in mathematics education to present information and engage fellow students in discussion of relevant issues. Prerequisite: senior-level standing or consent of instructor.

#### **MATH 495 SPECIAL STUDIES (1-4)**

Prerequisites: a lower-division math course and consent of instructor. May be repeated for credit.

#### **MATH 496 PROSEMINAR IN MATHEMATICS (1-3)**

A mutual exploration of selected current issues in mathematics by members of the Mathematics faculty and Mathematics majors. Non-majors may enroll by permission of the instructors. Prerequisite: upper-division standing.

#### **MATH 499 INTERNSHIP IN MATHEMATICS (1-3)**

Field experience in mathematics, computer science, or statistics. Cr/NC only. Prerequisite: prior arrangement with instructor.

#### **MATH 595 SPECIAL STUDIES IN MATHEMATICS (1-4)**

Subject matter and number of units to be determined by instructor and may differ from semester to semester. This course may be repeated with different subject matter for up to 12 units. The course title will appear on the student's transcript. Prerequisite: consent of instructor.

## **Modern Languages and Literatures (MLL)**

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#### **MLL 101 SPECIAL TOPICS IN FOREIGN LANGUAGE (1-4)**

#### **MLL 102 SPECIAL TOPICS IN FOREIGN LANGUAGE (1-4)**

#### **MLL 160A HUMANITIES LEARNING COMMUNITY (4)**

MLL 160 A/B is a year long course, which features weekly lectures and small seminars. It constitutes a Humanities Learning Community (HLC) for any first-year student. The learning objectives of the HLC will satisfy A3 (Critical Thinking) and C3 (Comparative Perspectives and/or Foreign Languages) GE Areas.

#### **MLL 160B HUMANITIES LEARNING COMMUNITY (4)**

MLL 160 A/B is a year long course, which features weekly lectures and small seminars. It constitutes a Humanities Learning Community (HLC) for any first-year student. The learning objectives of the HLC will satisfy A3 (Critical Thinking) and C3 (Comparative Perspectives and/or Foreign Languages) GE Areas.

#### **MLL 161A CRITICAL & CREATIVE: GLOBAL CULTURE ReMix (2)**

MLL 161 A/B is a year long course, which, combined with FR 101, GER 101, or SPAN 201, features weekly lectures and small seminars. It constitutes a Humanities Learning Community (HLC) for any first-year student. The learning objectives of the HLC will satisfy A3 (Critical Thinking) and C3 (Comparative Perspectives and/or Foreign Languages) GE categories.

#### **MLL 161B CRITICAL & CREATIVE: GLOBAL CULTURE ReMix (2)**

MLL 161 A/B is a year long course, which, combined with FR 101, GER 101, or SPAN 201, features weekly lectures and small seminars. It constitutes a Humanities Learning Community (HLC) for any first-year student. The learning objectives of the HLC will satisfy A3 (Critical Thinking) and C3 (Comparative Perspectives and/or Foreign Languages) GE Areas.

#### **MLL 195 ELEMENTARY SPECIAL STUDIES (1-4)**

Directed, individual, lower-division study in a modern language.

#### **MLL 214 WORLD LITERATURES IN ENGLISH (4)**

Introduction to selected works of world literature from Asia, Africa, Europe, North America, Latin America and Mexico, and from the classic literatures of Greece and Rome. Background lectures on literature, literary genres, and the different cultural histories will be given. Basic techniques of reading, analysis, and composition will be emphasized. Satisfies GE Area C2 (Literatures, Philosophies, and Values). Prerequisite: ENGL 101. May be repeated for credit.

#### **MLL 273 WORLD LITERATURES: CRITICAL AND CREATIVE READINGS (4)**

This course explores world literature and its relationship to the history, culture, and society from which it originates. Topics may include western and non-western cultural and religious values, colonialism versus emerging nationalisms, and the quest for personal, cultural, and national identities. Techniques of reading, analysis, research and creativity will be emphasized. Satisfies GE Area C2. Only one course numbered 273 in the Arts & Humanities will be considered for credit. Prerequisite: completion of GE Category A2 (Engl 101 or ENGL 100B) required.

#### **MLL 314 WORLD LITERATURES IN ENGLISH TRANSLATION (4)**

Studies in world literatures in English translation. Topics may include non-western cultural and religious values, colonialism versus emerging nationalisms, and the quest for identity, personal, cultural, and national. Satisfies GE Area C2 (Literatures, Philosophies, and Values). Prerequisite: ENGL 101. May be repeated for credit.

#### **MLL 450 FOREIGN LANGUAGE TEACHING SEMINAR (2-4)**

This course is designed as a seminar and Practicum to teach students to facilitate intensive language learning in a small-group setting. Students study the theory and practice of language learning and teaching while serving as a Peer Language Facilitator (PLF) for language learners enrolled in lower division classes. Prerequisite: instructor consent.