

MATH MATHEMATICS

MATH 0098 ELEMENTARY ALGEBRA

Credit Hour(s): 4.0

Elementary Algebra. (Formerly LSP 0098.) Topics include review of real numbers (order of operations, fractions, decimals, percents, and integers), solving and graphing linear equations and inequalities, operations with polynomials. An introduction to solving systems of linear equations and inequalities, factoring, and operations with rationales. Applications will be emphasized.

MATH 0099 INTERMEDIATE ALGEBRA

Credit Hour(s): 4.0

Intermediate Algebra. (Formerly LSP 0099.) A transition from elementary algebra to college algebra. Topics include operations with radicals, graphing of linear and nonlinear functions, algebra of linear and nonlinear functions, systems of linear equations and inequalities, review of factoring and quadratic functions. Applications will be emphasized.

MATH 1070 ELEMENTARY STATISTICS

Credit Hour(s): 3.0

Elementary Statistics. Prerequisite: High School Algebra II or equivalent. Descriptive statistics, basic probability, and distribution of random variables, estimation and hypothesis tests for means and proportions, regression and correlation, analysis of count data.

MATH 1090 HONORS STATISTICS

Credit Hour(s): 3.0

Honors Statistics. Prerequisite: consent of Honors Program director. Nondeterministic conceptualizations of phenomena as a foundation for inference. Descriptive and inferential methods of statistics, including synopses of real experiments, means, variances, regression and correlation, probability, sampling, hypotheses testing.

MATH 1101 INTRO TO MATHEMATICAL MODELING

Credit Hour(s): 3.0

Introduction to Mathematical Modeling. Prerequisite: High School Algebra II or equivalent. Three lecture hours a week. Mathematical modeling using graphical, numerical, symbolic, and verbal techniques to describe and explore real-world data and phenomena. Emphasis is on the use of elementary functions to investigate and analyze applied problems and questions, on the use of appropriate supporting technology, and on the effective communication of quantitative concepts and results.

MATH 1111 COLLEGE ALGEBRA

Credit Hour(s): 3.0

College Algebra. Prerequisite: Math 0099 with grade of C or higher or a suitable score on the math placement test. Graphs; equations and inequalities; complex numbers; functions; polynomial, rational, exponential, and logarithmic functions; and linear systems.

MATH 1112 COLLEGE TRIGONOMETRY

Credit Hour(s): 3.0

College Trigonometry. Prerequisite: Math 1111 with a grade of C or higher, or appropriate score on the placement test. This course is a functional and visual approach to trigonometry that incorporates the use of appropriate technology. Emphasis will be placed on the study of trigonometric functions and their graphs incorporating a unit circle approach as well as special triangles angles. Topics include circular functions, solutions of triangles, trigonometric identities and equations, graphs of trigonometric functions, Law of Sines, Law of Cosines, and vectors. Appropriate applications will be included.

MATH 1113 PRECALCULUS

Credit Hour(s): 3.0

Precalculus. Prerequisite: Math 1111 with grade of C or higher or a suitable score on the math placement test, or departmental approval. Trigonometric functions, identities, inverses, and equations; vectors; polar coordinates; conic sections.

MATH 1220 SURVEY OF CALCULUS

Credit Hour(s): 3.0

Survey of Calculus. Prerequisite: Math 1111 with grade of C or higher. Differential and integral calculus of selected real-valued functions of one and several real variables with applications.

MATH 2008 FOUND NUMBERS & OPERATIONS

Credit Hour(s): 3.0

Foundations of Numbers and Operations. Prerequisite: Math 1001, Math 1101, Math 1111, or Math 1113 with grade of C or higher. This course is an Area F introductory mathematics course for early childhood education majors. This course will emphasize the understanding and use of the major concepts of number and operations. As a general theme, strategies of problem solving will be used and discussed in the context of various topics.

MATH 2201 CALC FOR THE LIFE SCIENCES I

Credit Hour(s): 4.0

Calculus for the Life Sciences I. Prerequisite: Math 1112 or Math 1113 with a grade of C or higher, or appropriate score on the placement test. Limits, derivatives and applications. Exponential and logarithmic functions. Integrals, antiderivatives and the Fundamental Theorem of Calculus. Examples and Applications are drawn from the life sciences. This course is not appropriate for mathematics, computer science, geology, and physics majors or minors.

MATH 2202 CALC FOR THE LIFE SCIENCES II

Credit Hour(s): 4.0

Calculus for the Life Sciences II. Prerequisite: Math 2201 with a grade of C or higher. Matrices, functions of several variables, differential equations and solutions with applications. Examples and applications are drawn from the life sciences. This course is not appropriate for mathematics, computer science, geology, and physics majors or minors.

MATH 2211 CALCULUS OF ONE VARIABLE I

Credit Hour(s): 4.0

Calculus of One Variable I. Prerequisite: Math 1113 with grade of C or higher or a suitable score on the math placement test. Limits and Continuity, Differentiation, Mean Value Theorem for Derivatives; applications of differentiation; definition of the integral; Fundamental Theorem of Calculus; applications of integration to area.

MATH 2212 CALCULUS OF ONE VARIABLE II

Credit Hour(s): 4.0

Calculus of One Variable II. Prerequisite: Math 2211 with grade of C or higher. Applications and techniques of integration; transcendental and trigonometric functions; polar coordinates; infinite sequences and series; indeterminate forms; improper integrals.

MATH 2215 MULTIVARIATE CALCULUS

Credit Hour(s): 4.0

Multivariate Calculus. Prerequisite: Math 2212 with grade of C or higher. Real-valued functions of several variables, limits, continuity, differentials, directional derivatives, partial derivatives, chain rule, multiple integrals, applications.

MATH 2420 DISCRETE MATHEMATICS

Credit Hour(s): 3.0

Discrete Mathematics. Prerequisite: Math 1113 or 1220 with grade of C or higher. Introduction to discrete structures which are applicable to computer science. Topics include number bases, logic, sets, Boolean algebra, and elementary concepts of graph theory.

MATH 3000 BRIDGE TO HIGHER MATH-CTW

Credit Hour(s): 3.0

Bridge to Higher Mathematics-CTW. Prerequisites: Math 2212 and Math 2420 with grades of C or higher. Topics from set theory, real numbers, analysis, and algebra, which illustrate a formal approach to the presentation and development of mathematical concepts and proofs. Serves as one of the two Critical Thinking Through Writing (CTW) courses required of all mathematics majors.

MATH 3030 MATH MODELS FOR COMPUTER SCI

Credit Hour(s): 3.0

Mathematical Models for Computer Science. Prerequisites: Math 2212 and Math 2420 or CSc 2510 with grades of C or higher. Elements of mathematical modeling including: multivariate functions, probability, distributions of random variables, sampling, statistical inference, operators, vector analysis; elements of linear algebra.

MATH 3050 GEOMETRY AND SPATIAL SENSE

Credit Hour(s): 3.0

Geometry and Spatial Sense. Prerequisite: Math 2030 or Math 2008 with grade of C or higher. Building on Euclidean geometry this course is designed to develop a more visual understanding of geometry and enhance geometric intuition in two- and three-dimensions. Topics include measurement, two-dimensional geometry, three-dimensional geometry, spherical geometry, symmetry, tessellations, efficient shapes, transformations.

MATH 3070 INTRO: PROBABILITY & STATISTICS

Credit Hour(s): 3.0

Introduction to Probability and Statistics. Prerequisite: Math 2030 or Math 2008 with grade of C or higher, or consent of instructor. Three lecture hours a week. This course will not be accepted as a part of the requirements for a major in mathematics. This course is intended to provide an overview of the basics of probability and descriptive statistics. Various forms of technology will be used.

MATH 3090 ALGEBRAIC CONCEPTS

Credit Hour(s): 3.0

Algebraic Concepts. Prerequisite: Math 2030 or Math 2008 with grade of C or higher. This course will not be accepted as a part of the requirements for a major in mathematics. This course is designed to broaden understanding of fundamental concepts of algebra with particular attention given to specific methods and materials of instruction. The principle algebra topics to be taught in this course are: the Language of Algebra; Patterns, Relations, and Functions; and Balance, Equations, and Inequalities.

MATH 3260 DIFFERENTIAL EQUATIONS

Credit Hour(s): 3.0

Differential Equations. Prerequisite: Math 2215 with grade of C or higher. First-order equations, linear differential equations with special emphasis on constant coefficient and Euler equations, systems of equations, applications.

MATH 3300 PROBLEM SOLVING WITH COMPUTERS

Credit Hour(s): 3.0

Problem Solving with Computers. Prerequisite: Math 3000 with grade of C or higher. Three lectures a week. This course explores various mathematical contexts and develops mathematical knowledge necessary to solve, or attempt to solve, mathematical problems in the

computer enhanced environment. The problems come from many sources and contexts. Computer programs such as Maple, Matlab, spreadsheets, Geometer's Sketch Pad, Study Works, etc. will be used. No previous experience with computers is required.

MATH 3420 APPLIED COMBINATORICS

Credit Hour(s): 3.0

Applied Combinatorics. Prerequisite: Math 2212 or Math 2420 with grade of C or higher. Counting principles; topics include combinations, permutations, generating functions, recurrence relations, principle of inclusion and exclusion, and Polya's theory of counting.

MATH 3435 INTRODUCTORY LINEAR ALGEBRA

Credit Hour(s): 3.0

Introductory Linear Algebra. Prerequisite: Math 2215 with grade of C or higher. Corequisite: Math 3000. Theory and applications of matrix algebra and linear transformations. Topics include linear equations, vector spaces, matrices, subspaces, and bases.

MATH 3610 SPECIAL PROB AND SOLVING STRAT

Credit Hour(s): 3.0

Special Problems and Solving Strategies. Prerequisite: Math 2212 with grade of B or higher, or consent of instructor. The course will concentrate on developing solving strategies of difficult mathematical problems which require creativity and profound understanding of mathematics. Among topics to be covered: induction and pigeonhole principle, arithmetic, algebra, summation of series, intermediate real analysis, inequalities.

MATH 3690 HONORS READINGS

Credit Hour(s): 1.0 TO 3.0

Honors Readings. Prerequisite: consent of Honors Program director. Discussion and readings on selected topics.

MATH 3820 HIST/CULT DEVELOPMNT OF MATH I

Credit Hour(s): 3.0

Historical and Cultural Development of Mathematics I. Prerequisite: Math 1101 or 1111 with grade of C or higher. Three lecture hours a week. Exploration of the historical and cultural development of mathematics between ~3000 B.C. and ~A.D. 1600. Mathematics topics to include the development of arithmetic, geometry (practical, deductive, and axiomatic), number theory, trigonometry, syncopated and symbolic algebra, probability, and statistics.

MATH 3821 HIST/CULT DEVLPMENT OF MATH II

Credit Hour(s): 3.0

Historical and Cultural Development of Mathematics II. Prerequisite: Math 3000 with grade of C or higher. Three lecture hours a week. Exploration of the historical and cultural development of

mathematics from ~A.D. 1600 to present. Mathematics topics to include the development of algebraic geometry, logarithms, calculus, non-Euclidean geometry, abstract algebra, probability, and analysis.

MATH 4010 MATHEMATICAL BIOLOGY

Credit Hour(s): 3.0

Mathematical Biology. Prerequisite: Math 2212 or Math 1220 with grade of C or higher. (Same as Biol 4010.) This course provides an introduction to the use of continuous and discrete differential equations in the biological sciences. Biological topics will include single species and interacting population dynamics, modeling infectious and dynamic diseases, regulation of cell function, molecular interactions and receptor-ligand binding, biological oscillators, and an introduction to biological pattern formation. There will also be discussions of current topics of interest such as Tumor Growth and Angiogenesis, HIV and AIDS, and Control of the Mitotic Clock. Mathematical tools such as phase portraits, bifurcation diagrams, perturbation theory, and parameter estimation techniques that are necessary to analyze and interpret biological models will also be covered.

MATH 4211 OPTIMIZATION

Credit Hour(s): 3.0

Optimization. Prerequisite: Math 3435 or Math 3030 with a grade of C or higher. Lagrange multipliers, gradient methods (steepest descent), search techniques, variational methods and control problems; other varying topics such as dynamic programming, nonlinear programming.

MATH 4250 COMPLEX ANALYSIS

Credit Hour(s): 3.0

Complex Analysis. Prerequisite: Math 3000 with grade of C or higher. Complex numbers, analytic functions, complex series, Cauchy theory, residue calculus, conformal mapping.

MATH 4253 INTRO TO OPERATIONS RESEARCH

Credit Hour(s): 3.0

Introduction to Operations Research. Prerequisite: Math 3435 or 3030 with grade of C or higher. Linear programming, the simplex method, network theory, game theory, Markov analysis, and other topics such as inventory analysis, queuing theory, integer programming.

MATH 4258 VECTOR CALCULUS

Credit Hour(s): 3.0

Vector Calculus. Prerequisite: Math 2215 with grade of C or higher. (Same as Phys 4510.) Vector algebra, curvilinear motion, vector fields, gradient, divergence, Laplacian, line and surface integrals, integral theorems.

MATH 4265 PARTIAL DIFFERENTIAL EQUATIONS

Credit Hour(s): 3.0

Partial Differential Equations. Prerequisite: Math 3260 with grade of C or higher. (Same as Phys 4520.) First-order equations, classification of linear second-order equations, separation of variables, Fourier series, orthogonal functions, Green's functions.

MATH 4275 APPLIED DYNAMICAL SYSTEMS

Credit Hour(s): 3.0

Applied Dynamical Systems. Prerequisites: Math 3260, and Math 3435 or 3030 with grades of C or higher. Three lecture hours per week. An introduction to discrete and continuous dynamical systems. Topics include: phase space; linear and nonlinear systems; structural stability; classification of equilibrium states, invariant manifolds; poincare maps, fixed points and period orbits; stability boundaries; local bifurcations; homoclinic orbits; routes to chaos in dissipative systems; applications from physics, biology, population dynamics, economics.

MATH 4301 COLLEGE GEOMETRY

Credit Hour(s): 3.0

College Geometry. Prerequisite: Math 3000 with grade of C or higher. Axioms of planar Euclidean Geometry. The 5th postulate. Congruence and Similarity. Theorem of Thales. Similar Triangles: SAS, AA, and SSS. Theorem of Ceva. The Pythagorean Theorem. Polygons. Circles, secants and tangents, measurement of an angle with respect to a circle. Perimeters, areas, circumference. Inscribed and circumscribed polygons. Coordinate Geometry in the plane. Mirror symmetries, rotations, translations and dilations. Isometries and the fundamental theorem of Euclidean Geometry. Transformations in the plane and tessellations.

MATH 4371 MODERN GEOMETRY

Credit Hour(s): 3.0

Modern Geometry. Prerequisite: Math 3000 with grade of C or higher. Euclidean and non-Euclidean geometry, including incidence, order, and the parallel postulate.

MATH 4381 GENERAL TOPOLOGY

Credit Hour(s): 3.0

General Topology. Prerequisite: Math 4441 or Math 4661 with grade of C or higher. This course is an introduction to the fundamental concepts of point-set topology. Topics to be covered: review of aspects of set theory and logic; topological spaces and continuous functions (basis for a topology, product topology, basis for a topology, order topology, subspace topology, metric topology, quotient topology, homeomorphisms), connectedness and compactness in topological spaces, separation axioms, the fundamental group (homotopy of paths, covering spaces, the fundamental group of the circle, retractions and fixed points).

MATH 4391 INTO TO DIFFERENTIAL GEOMETRY

Credit Hour(s): 3.0

Introduction to Differential Geometry and Its Applications. Prerequisite: Math 2215 with grade of C or higher. (Same as Phys 4391.) Three lecture hours a week. The theory of curves and surfaces in parametric and implicit form. Curvature and torsion of a curve; the shape operator and the total and mean curvature of a surface. The Gauss-Weingarten equations; the Egregium Theorem; surfaces of constant curvature and non-Euclidean geometry. Minimal surfaces; the Gauss Bonnet Theorem; submanifolds in Euclidian spaces, vector fields, differential forms, and the theorems of Frobenius and Stokes. Applications to physics.

MATH 4420 GRAPH THEORY

Credit Hour(s): 3.0

Graph Theory. Prerequisite: Math 3000 with grade of C or higher. Introduction to graph theory; topics include structure of graphs, trees, connectivity, Eulerian and Hamiltonian graphs, planar graphs, graph colorings, matchings, independence, and domination. Additional topics may include symmetry of graphs, directed graphs, extremal graph theory and Ramsey theory, graph embeddings, and probabilistic methods in graph theory.

MATH 4435 LINEAR ALGEBRA

Credit Hour(s): 3.0

Linear Algebra. Prerequisites: Math 3435 and Math 3000 with grades of C or higher. Theory and applications of matrix algebra, vector spaces, and linear transformations; topics include characteristic values, the spectral theorem, and orthogonality.

MATH 4441 MODERN ALGEBRA I

Credit Hour(s): 3.0

Modern Algebra I. Prerequisites: Math 3435 and Math 3000 with grades of C or higher. Axiomatic approach to algebraic structures, groups, permutations, homomorphisms, and factor groups.

MATH 4442 MODERN ALGEBRA II

Credit Hour(s): 3.0

Modern Algebra II. Prerequisite: Math 4441 with grade of C or higher. Rings, integral domains, and fields; polynomials over a field, matrices over a field, algebraic numbers and ideals.

MATH 4444 POLYNOMIALS

Credit Hour(s): 3.0

Polynomials. Prerequisite: Math 3000 with grade of C or higher. Three lecture hours a week. The topic of polynomials is one of the oldest in mathematics and has applicability to almost every area of mathematics. The course will use algebra and analysis to study polynomials. Among topics to be covered: roots of polynomials (inequalities, relationship between the root of a polynomial and its derivative), resultants, discriminant, irreducible polynomials, special classes of polynomials (symmetric, cyclotomic, Chebysev).

MATH 4450 THEORY OF NUMBERS

Credit Hour(s): 3.0

Theory of Numbers. Prerequisite: Math 3000 with grade of C or higher. Properties of integers, divisibility, congruence of problems.

MATH 4455 ERROR CORRECTION CODES

Credit Hour(s): 3.0

Error Correcting Codes. Prerequisite: Math 3030 or Math 3435 with grade of C or higher. Three lectures a week. This course provides an elementary, yet rigorous introduction to the theory of error correcting codes. Topics include survey of groups, finite fields and polynomials, linear algebra, Huffman codes, data compression and entropy, linear codes, Reed-Muller codes, cyclic codes, BCH codes, and fast decoding BCH codes.

MATH 4460 CRYPTOGRAPHY

Credit Hour(s): 3.0

Cryptography. Prerequisite: Math 3030 or Math 3435 with grade of C or higher and the ability to program high-level language. Three lectures a week. This course covers the mathematical background of computational and algorithmic methods for cryptography. This includes information theory, computational complexity and number theory. Methods covered include public key cryptosystems and secure methods for authentication and digital signatures.

MATH 4544 BIOSTATISTICS

Credit Hour(s): 3.0

Biostatistics. Prerequisites: Math 2211 and Biol 1104K or Biol 1108K or Biol 2108K with grades of C or higher. (Same as Biol 4744.) Degree credit will not be given for both Math 4544 and 4547. Principles and methods of statistics as applied to biology and medicine.

MATH 4547 INTRO TO STATISTICAL METHODS

Credit Hour(s): 3.0

Introduction to Statistical Methods. Prerequisite: grade of C or higher in a course in calculus. Degree credit will not be given for both Math 4544 and 4547. Data analysis, sampling, and probability; standard methods of statistical inference, including t-tests, chi-square tests, and nonparametric methods. Applications include use of a statistical computer package.

MATH 4548 METH OF REGRESSION/ANAL OF VAR

Credit Hour(s): 3.0

Methods of Regression and Analysis of Variance. Prerequisites: grade of C or higher in a course in calculus, and a course covering methods of statistical inference. Simple and multiple regression, model selection procedures, analysis of variance, simultaneous inference, design and analysis of experiments. Applications include use of a statistical computer package.

MATH 4610 NUMERICAL ANALYSIS I

Credit Hour(s): 3.0

Numerical Analysis I. Prerequisites: Math 2215 with grade of C or higher and the ability to program in a high-level language. (Same as CSc 4610.) Nature of error; iteration; techniques for nonlinear systems; zeros of functions; interpolation; numerical differentiation; Newton-Cotes formulae for definite integrals; computer implementation of algorithms.

MATH 4620 NUMERICAL ANALYSIS II

Credit Hour(s): 3.0

Numerical Analysis II. Prerequisites: Math 3030 or 3045 with grade of C or higher, and the ability to program in a high-level language. (Same as CSc 4620.) Gaussian Elimination for linear systems; least squares; Taylor, predictor-corrector and Runge- Kutta methods for solving ordinary differential equations; boundary value problems; partial differential equations.

MATH 4650 INVERSE AND ILL-POSED PROBLEMS

Credit Hour(s): 3.0

Inverse and Ill-Posed Problems. Prerequisites: Math 3030 or 3435, and Math/CSc 4610 or Math/CSc 4620 with grades of C or higher. Three lecture hours a week. Ill-posed problems that arise in astrophysics, geophysics, spectroscopy, computerized tomography, and other areas of science and engineering are considered in this course. Topics to be covered: a general regularization theory; variational regularization and the discrepancy principle; iterative regularization; convergence analysis and stopping rules; numerical aspects.

MATH 4661 ANALYSIS I

Credit Hour(s): 3.0

Analysis I. Prerequisite: Math 3435 with grade of C or higher. Corequisite: Math 4435. The real number system, basic topology of metric spaces, sequences and series, limits and continuity.

MATH 4662 ANALYSIS II

Credit Hour(s): 3.0

Analysis II. Prerequisite: Math 4661 with grade of C or higher. Differentiation of real functions, Riemann integrals, sequences and series of functions, differentiation and integration of functions of several variables.

MATH 4671 TRANSFORMS IN APPLIED MATH

Credit Hour(s): 3.0

Transforms in Applied Mathematics. Prerequisite: Math 3030 or Math 3435 with grade of C or higher. The Laplace transform, discrete and continuous Fourier Transforms, z-transforms, discrete filters, and wavelets.

MATH 4751 MATHEMATICAL STATISTICS I

Credit Hour(s): 3.0

Mathematical Statistics I. Prerequisite: Math 2215 with grade of C or higher. Probability, random variables and their distributions, mathematical expectation, moment generating functions, sampling distributions.

MATH 4752 MATHEMATICAL STATISTICS II

Credit Hour(s): 3.0

Mathematical Statistics II. Prerequisite: Math 4751 with grade of C or higher. Theory of estimation and hypothesis testing, applications of statistical inference, introduction to regression and correlation.

MATH 4767 STATISTICAL COMPUTING

Credit Hour(s): 3.0

Statistical Computing. Prerequisites: Math 4752 or Math 4548, and Math 3435 with grades of C or higher and the ability to program in a high-level language. Computational implementation of statistical methods such as descriptive statistics and graphs, testing for normality, one and two sample tests, Wilcoxon rank sum tests, Wilcoxon signed rank tests, basic regression and analysis of variance (ANOVA). Standard statistical packages (SAS) will be used as well as user-written programs. 3.0 credit hours.

MATH 4870 HONORS THESIS: RESEARCH

Credit Hour(s): 3.0

Honors Thesis: Research. Prerequisites: consent of the instructor and Honors Program director. Readings or research preparatory to Honors thesis or project.

MATH 4880 HONORS THESIS: WRITING

Credit Hour(s): 3.0

Honors Thesis: Writing. Prerequisites: Math 4870, consent of the instructor and Honors Program director. Writing or production of Honors thesis or project.

MATH 4982 UNDERGRAD RESEARCH IN MATH

Credit Hour(s): 3.0

Undergraduate Research in Mathematics. Prerequisites: at least 12 upper-division hours in mathematics with grades of C or higher. Authorization required. Independent investigation of topics of common interest to student and instructor.

MATH 4991 SENIOR SEMINAR-CTW

Credit Hour(s): 3.0

Senior Seminar-CTW. Prerequisite: Math 4435 with grade of C or higher. This course introduces students to independent research in mathematics and related areas. Serves as one of the two Critical Thinking Through Writing (CTW) courses required of all mathematics majors.

MATH 4995 DIRECTED READINGS B.I.S.-CTW

Credit Hour(s): 3.0 TO 4.0

Directed Readings B.I.S.-CTW. Directed Readings designed for Bachelor of Interdisciplinary Studies students. This course may satisfy the junior and/or senior-level Critical Thinking Through Writing requirements.

MATH 4998 SELECTED TOPICS

Credit Hour(s): 1.0 TO 3.0

Selected Topics. Prerequisite: consent of instructor. No more than six credit hours may be applied toward the major. May be repeated if topics are different.