

Department of Mathematics

Rhoades Science Center 203

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www.vcsu.edu/math (<http://www.vcsu.edu/math/>)

Mathematics is the foundation for all science, technology, and engineering. Mathematical sophistication is a fundamental skill for a technical society like ours. The VCSU Mathematics Department specializes in the preparation of secondary mathematics teachers. There is plentiful demand in the job market for math teachers. In fact, recent graduates of VCSU's Math Education program have enjoyed 100% job placement over the past 10+ years. The program follows the guidelines of the Council for the Accreditation of Educator Preparation (CAEP) and the North Dakota Education Standards and Practices Board (ESPB).

Learning Outcomes

1. Students will demonstrate the ability to make mathematical connections and properly use mathematical problem solving, reasoning, communication, and representation.
2. Students will demonstrate appropriate use of technology and concrete materials for building understanding of mathematical concepts.
3. Students will demonstrate an understanding of both secondary school mathematics and college core mathematics including the history and philosophy of math and basic computer programming.
4. Students will demonstrate the ability to use a variety of teaching methods and assessment strategies.

Bush, Preston (1994) Associate Professor; B.S. Massachusetts Institute of Technology, M.S. Boston College, Ph.D. Northeastern University, Boston

Murphy, Kevin (2018) Assistant Professor; A.A. Chemeketa Community College, B.S. Eastern Oregon University, M.S. Portland State University, Ph.D. Center for Computational Quantum Chemistry University of Georgia

Wirth, Jamie (2008) Associate Professor; B.A. University of North Dakota, B.S. Mayville State University, M.A. Minot State University, Ph.D. North Dakota State University

Majors

- Mathematics Education (B.S. in Education) (<http://catalog.vcsu.edu/undergraduate-catalog/programs/majors/mathematics-education/>)

Minors

- Mathematics (<http://catalog.vcsu.edu/undergraduate-catalog/programs/minors/mathematics/>)

MATH 103. College Algebra. 3 Credits.

Relations and functions, equations and inequalities, complex numbers; polynomial, rational, exponential and logarithmic functions and systems of equations.

Typically Offered: On sufficient demand.

Prerequisite: ASC 93 with a grade of C or better, ACT Math score of 21 or higher, or qualifying math placement score.

MATH 104. Finite Mathematics. 3 Credits.

An extension of basic algebra to areas that have applications in the economic, behavior, social, and life sciences. Topics include systems of linear equations and inequalities, matrices, linear programming, mathematics of finance, elementary probability and descriptive statistics.

Typically Offered: Fall, Spring.

Prerequisite: ASC 93 with a grade of C or better, ACT Math score of 21 or higher, or qualifying math placement score.

MATH 105. Trigonometry. 2 Credits.

The study of trigonometric functions and their properties. Topics include angle measure; trigonometric and inverse trigonometric functions; trigonometric identities and equations; parametric and polar coordinates; and general applications.

Typically Offered: On sufficient demand.

Prerequisite: ASC 93 with a grade of C or better, ACT Math score of 21 or higher, or qualifying math placement score.

MATH 107. Precalculus. 3 Credits.

The study of algebraic functions in preparation for calculus. Topics include equations and inequalities; polynomial, rational, exponential, logarithmic, trigonometric and inverse trigonometric functions; trigonometric identities and equations; and applications.

Typically Offered: Fall, Spring.

Prerequisite: ASC 93 with a grade of C or better, ACT Math score of 21 or higher, or qualifying math placement score.

MATH 146. Applied Calculus I. 3 Credits.

A study of limits, derivatives, integrals, exponential, logarithmic functions and applications.

Typically Offered: On sufficient demand.

Prerequisite: MATH 103.

MATH 165. Calculus I. 4 Credits.

The concepts, techniques, and applications of analytic geometry and differential and integral calculus. Topics include limits, continuity, differentiation, Mean Value Theorem, integration, Fundamental Theorem of Calculus, and applications.

Typically Offered: Spring.

Prerequisite: MATH 103 or MATH 105 or MATH 107 or MATH 146.

MATH 166. Calculus II. 4 Credits.

The concepts, techniques, and applications of analytic geometry and differential and integral calculus. Topics include applications and techniques of integration; polar equations; parametric equations; sequences and series; power series and applications.

Typically Offered: Fall.

Prerequisite: MATH 165.

**MATH 199. Special Topics. 1-4 Credits.**

Courses not offered in the regular catalog that provide an opportunity to extend student learning.

Typically Offered: On sufficient demand.

Repeatable: Up to 12 Credits.

MATH 208. Discrete Mathematics. 3 Credits.

Sets, relations and functions, combinatorics, logic, methods of proof, Boolean Algebra, difference equations, mathematical induction, combinatorics, introduction to graph theory and automata.

Typically Offered: Fall, odd years.

Prerequisite: MATH 103 or MATH 104 or MATH 107 or MATH 165.

MATH 210. Elementary Statistics. 3 Credits.

An introduction to statistical methods of gathering, presenting and analyzing data. Topics include probability and probability distributions, confidence intervals, hypothesis testing, and linear regression and correlation.

Typically Offered: Fall, Spring.

Prerequisite: ASC 93 with a grade of C or better, ACT Math score of 21 or higher, or qualifying math placement score.

MATH 265. Calculus III. 4 Credits.

The concepts, techniques, and applications of analytic geometry and differential and integral calculus. Topics include multivariate and vector calculus including partial derivatives; multiple integration and its applications; line and surface integrals; Green's Theorem and Stoke's Theorem.

Typically Offered: Spring.

Prerequisite: MATH 166.

MATH 266. Introduction to Differential Equations. 3 Credits.

The study of differential equations. Topics include solutions of elementary differential equations by elementary techniques; Laplace transforms; systems of equations; matrix methods; numerical techniques; and applications.

Typically Offered: Fall.

Prerequisite: MATH 265.

MATH 299. Special Topics. 1-4 Credits.

Courses not offered in the regular catalog that provide an opportunity to extend student learning.

Typically Offered: On sufficient demand.

Repeatable: Up to 12 Credits.

MATH 300. Symbolic Logic. 1 Credit.

A study of truth values, truth tables, conjunctions and disjunctions, negation, quantifiers, and an introduction to Boolean algebra.

Typically Offered: On sufficient demand.

MATH 311. College Geometry I. 2 Credits.

The advanced study of geometry from an axiomatic viewpoint. Topics include incidence and separation properties of planes and space; metric and synthetic approaches to congruencies; geometric transformations; and parallelism and similarity.

Typically Offered: On sufficient demand.

Prerequisite: MATH 103 or MATH 104 or MATH 107 or MATH 146 or MATH 165.

MATH 312. College Geometry II. 3 Credits.

A continuation of the advanced study of geometry. Topics include area theory, circles in a plane, constructions with ruler and compass, solid mensuration, and an introduction to non-Euclidean geometries.

Typically Offered: On sufficient demand.

MATH 313. Algebra and Functions for Teachers. 3 Credits.

A study of algebra and functions for pre-service teachers. Topics include mathematics content from North Dakota k-12 math standards along with related applications and pedagogical approaches.

Typically Offered: Spring, odd years.

MATH 314. Geometry & Trigonometry for Teachers. 3 Credits.

A study of geometry and trigonometry for pre-service teachers. Topics include mathematics content from North Dakota k-12 math standards along with related applications and pedagogical approaches.

Typically Offered: Spring, even years.

MATH 321. Applied Probability and Statistics. 3 Credits.

A non-calculus-based introduction to methods of probability and statistics. Topics to be covered are combinatorial probability, random variables and their distributions, distribution functions and their properties, and the Central Limit Theorem and its applications. Sample-based inferences of population means and standard deviations, significance tests and confidence limits, tests of hypotheses, ANOVA, and regression analysis are covered.

Typically Offered: Spring.

Prerequisite: MATH 103 or MATH 104 or MATH 107 or MATH 165 or MATH 210.

MATH 330. Linear Algebra and Matrices. 3 Credits.

An introduction to linear algebra which includes matrix algebra, linear systems, the notion of a vector space, and linear transformations and their matrix representations.

Typically Offered: Spring.

MATH 340. Algebraic Structures I. 3 Credits.

A study of algebraic structures. Topics include sets, mappings, relations, and operations; axiomatic development of familiar algebraic systems; examples and basic algebraic properties of groups, rings and fields.

Typically Offered: Fall, even years.

Prerequisite: MATH 165.

MATH 394. Independent Study. 1-3 Credits.

Directed reading, study, and/or activities in selected topics.

Typically Offered: On sufficient demand.

Repeatable: Up to 12 Credits.

MATH 399. Special Topics. 1-4 Credits.

Courses not offered in the regular catalog that provide an opportunity to extend student learning.

Typically Offered: On sufficient demand.

Repeatable: Up to 12 Credits.

MATH 400. History and Philosophy of Mathematics. 2 Credits.

An introduction to the history and philosophy of mathematics. Topics include informal origins; ancient, medieval, and modern mathematics; the role of proofs, the status of mathematical objects, logicism, intuitionism and constructive proofs, formalism and the axiom of choice.

Typically Offered: Fall, odd years.

MATH 410. Real Analysis I. 3 Credits.

An introduction to rigorous theory of calculus. Topics covered include the real number system, sequences, limits, continuous functions in \mathbb{R} , continuous functions of several variables, metric spaces uniform convergence, interchange of limit operations, infinite series, mean value theorems and their applications, and Riemann integrals.

Typically Offered: On sufficient demand.

Prerequisites: MATH 265 and MATH 330.

MATH 412. Ordinary Differential Equations. 3 Credits.

A continuation of the study of differential equations in MATH 266. Topics covered are Laplace Transforms, Existence and Uniqueness of Solutions, Higher Order Linear Equations, Linear Systems, regular singular points, Sturm-Liouville Theory, Nonlinear Differential Equations that arise in biology, physics, chemistry, and engineering (e.g., Competing Species, Predator-Prey Equations, Liapouov's method, the Lorenz Equations in Fluid Mechanics and Chaos).

Typically Offered: On sufficient demand.

Prerequisites: MATH 266 and MATH 330.

MATH 413. Partial Differential Equations. 3 Credits.

A continuation of the study of differential equations in MATH 266. Topics covered are classification of second order equations, boundary value problems for elliptic and parabolic equations, initial value problems for hyperbolic equations (e.g., Steady State Equations, Heat Equations, Diffusion Equations, Wave Equations, Evolution Equations with various boundary conditions and initial conditions and initial conditions), existence and uniqueness theorems, maximum principles, a priori bounds, the Fourier transform, and their applications to science and engineering.

Typically Offered: On sufficient demand.

Prerequisites: MATH 266 and MATH 330.

MATH 421. Mathematical Probability and Statistics I. 3 Credits.

An introduction to the rigorous theory of probability and statistics. Topics to be covered are Discrete and Continuous Random Variables, Joint Densities, Combining Random Variables, Conditional densities, Moment Generating Functions, Binomial Distribution, Poisson Distribution, Normal Distribution, Gamma Distribution, Parameter Estimation using the Method of Maximum Likelihood and the Method of Moments, Interval Estimation, Minimum-Variance Estimators, and Bayesian Estimation.

Typically Offered: On sufficient demand.

Prerequisite: MATH 265.

MATH 422. Mathematical Probability and Statistics II. 3 Credits.

A continuation of MATH 421. Topics to be covered are: Hypothesis Testing, Generalized Likelihood Ratio, Drawing Inferences about the Mean and Variance of a normal distribution, the theory and applications of 2-Sample t-Test and F-Test, Confidence Intervals for 2-Sample problems, Goodness-of-Fit Tests, Regression Analysis, Bivariate Normal Distributions.

Typically Offered: On sufficient demand.

Prerequisite: MATH 421.

MATH 430. Complex Analysis. 3 Credits.

An introduction to the theory of functions of one complex variable. Topics covered include Analytic Functions of One Complex Variable, Cauchy's Integral Theorem, Power Series, Laurent Series, Singularities of Analytic Functions, the Residue Theorem with Application to Improper Integrals, Conformal Mappings and their applications, and the Schwarz-Christoffel Transformations and their applications.

Typically Offered: On sufficient demand.

Prerequisite: MATH 265.

MATH 461. Numerical Analysis I. 3 Credits.

This course introduces students to fundamentals of numerical analysis and their applications to computer science, physical sciences, and engineering. Topics to be covered include solutions of equations in one or several unknowns, numerical integrations, numerical derivatives, numerical solutions of initial-value problems.

Typically Offered: On sufficient demand.

Prerequisites: MATH 266 and MATH 330.

MATH 490. Teaching Secondary School Mathematics. 3 Credits.

An opportunity for students planning to teach math in the secondary schools to understand and apply content topics which align with ND Math Education standards and ND teacher education standards.

Typically Offered: Fall, even years.

MATH 491. Math Capstone. 1 Credit.

A capstone course designed for students to demonstrate competence in math program learning outcomes.

Typically Offered: Fall.

Grading: S/U only.

MATH 494. Undergraduate Research. 3-12 Credits.

The course is designed to integrate subject matter from major coursework and other disciplines into a project that leads to the creation of an original body of knowledge.

Typically Offered: On sufficient demand.

Repeatable: Up to 12 Credits.

MATH 497. Internship. 3-12 Credits.

An opportunity for students to apply classroom learning to an on-the-job work experience. Internship must be related to the student's major or minor course of study and may be in any geographic location. Credit is granted in the range of three to twelve hours per semester and may be repeated up to a maximum of 12 credit hours. Application and approval through Career Services.

Typically Offered: Fall, Spring, Summer.

Prerequisites: Junior Standing or Senior Standing and cum GPA of 2.50 or higher.

Grading: S/U only.

Repeatable: Up to 12 Credits.

MATH 499. Special Topics. 1-4 Credits.

Courses not offered in the regular catalog that provide an opportunity to extend student learning.

Typically Offered: On sufficient demand.

Repeatable: Up to 12 Credits.