

Department of Mathematics and Computer Science

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The Department of Mathematics and Computer Science is a multidisciplinary department with programs leading to baccalaureate degrees in mathematics, applied mathematics, mathematics with computer science option, computer science, and computer information systems. The department also offers minors in mathematics and computer science.

The programs in the department are designed to give the student the basic knowledge, skills, and values that build upon the foundation provided by the University Core Curriculum and that are required for professional careers in the mathematical and computing sciences. Moreover, through a series of sequenced courses, the department prepares the student for more advanced study, either at the graduate level or through company training programs. The requirements of the programs have been designed in keeping with national norms of excellence and according to well established model curricula where they exist. The major common feature shared by all the department's programs is the stress on critical thinking skills.

Students may gain work experience related to their major through the VSU Cooperative Education Program. Such experience may prove valuable in terms of career exploration, acquisition of new skills, and career development.

- Bachelor of Arts with a Major in Mathematics (<http://catalog.valdosta.edu/archive/2015-2016/undergraduate/academic-programs/arts-sciences/mathematics-computer-science/ba-mathematics>)
- Bachelor of Science with a Major in Applied Mathematics (<http://catalog.valdosta.edu/archive/2015-2016/undergraduate/academic-programs/arts-sciences/mathematics-computer-science/bs-applied-mathematics>)
- Bachelor of Science with a Major in Computer Information Systems (<http://catalog.valdosta.edu/archive/2015-2016/undergraduate/academic-programs/arts-sciences/mathematics-computer-science/bs-computer-information-systems>)
- Bachelor of Science with a Major in Computer Science (<http://catalog.valdosta.edu/archive/2015-2016/undergraduate/academic-programs/arts-sciences/mathematics-computer-science/bs-computer-science>)
- Minor in Computer Science (<http://catalog.valdosta.edu/archive/2015-2016/undergraduate/academic-programs/arts-sciences/mathematics-computer-science/minor-computer-science>)
- Minor in Mathematics (<http://catalog.valdosta.edu/archive/2015-2016/undergraduate/academic-programs/arts-sciences/mathematics-computer-science/minor-mathematics>)

CS 1000. Introduction to Microcomputers and Applications. 3 Hours.

Computing technology and concepts; applications of personal computers. Topics include hardware and software terminology, word processing, spreadsheets, e-mail, the Internet, the microcomputer's operating system and its use, ethics, and current trends in the use of computers. A hands on laboratory is integrated with the course.

CS 1010. Algorithmic Problem Solving. 3 Hours.

An introduction to algorithm design and programming as components of the software life cycle, with emphasis on the development of algorithms for solving problems; introduction to the development environment for a particular programming language.

CS 1301. Principles of Programming I. 4 Hours.

Prerequisite: MATH 1101 or MATH 1111 or MATH 1112 or MATH 1113 or MATH 1261 or MATH 1262 or MATH 2261 or MATH 2262, with a grade of "C" or better. Programming-language syntax and semantics; problem solving; algorithm design and implementation using modern programming paradigms and techniques; data types and elementary data structures. This course involves extensive programming activities. Students without strong math and programming background are encouraged to take CS 1010 first.

CS 1302. Principles of Programming II. 4 Hours.

Prerequisite: CS 1301 with a grade of "C" or better. A continuation of CS 1301 with emphasis on advanced programming structures and techniques. Theory and applications of stacks, queues, and lists; recursion; file processing; introduction to binary trees. This course involves extensive programming activities.

CS 1340. Computing for Scientists. 3 Hours.

Prerequisite or corequisite: MATH 2261. Foundations of computing, with an introduction to design and analysis of algorithms, including design and construction of programs for scientific and engineering applications.

CS 2620. Discrete Structures. 3 Hours.

Prerequisite: MATH 1112, or MATH 1113 or MATH 1261 or MATH 2261, with a grade of C or better. Propositional and predicate logic mathematical induction, and recursion. Sets, relations, functions. Graphs and trees. Boolean algebra and computer logic. Finite state machines and computability.

CS 3000. Tutoring in Computer Science I. 2 Hours.

Prerequisite or corequisite: CS 3410 or consent of instructor. Graded "Satisfactory" or "Unsatisfactory." Fundamentals of one-on-one tutoring in computer science. Review of the principles in programming, including programming language syntax and semantics; problem solving; algorithm design and implementation using current paradigms; data types and data structures; theory and applications of stacks, queues, lists, and binary trees; recursion; and file processing. Introduction to techniques and guidelines for tutoring. Designed for the Tutoring Center tutors in computer science.

CS 3001. Tutoring in Computer Science II. 1 Hour.

Prerequisite: CS 3000. Graded "Satisfactory" or "Unsatisfactory." Advanced techniques for one-on-one tutoring in computer science. Review of discrete structures, computer organization, and advanced programming principles. Identification and discussion of effective methods for correcting common problems and misconceptions encountered by beginning and intermediate programming students. Discussion of techniques with less experienced tutors. Designed for the Tutoring Center tutors in computer science.

CS 3101. Computer Organization. 3 Hours.

Prerequisite: CS 1302 with a grade of "C" or better. An overview of computer organization and design including Boolean algebra, combinational and sequential circuits, data representation, register transfer and microoperations, CPU organization, microprogrammed control, and machine language programming.

CS 3102. Assembly Language. 3 Hours.

Prerequisite: CS 3101 with a grade of "C" or better. A continuation of CS 3101 with emphasis on machine and assembly language instruction and programming techniques, addressing modes, data representations, I/O, and the assembly process.

CS 3200. Computer Ethics. 3 Hours.

Prerequisite: CS 1301 with a "C" or better. Introduction to social and ethical impacts of computing, and an overview of the ethical issues created, transformed, and worsened by computing technology. Topics include professional code of ethics, cybercrime, privacy and security, rights of intellectual property, and globalization.

CS 3300. UNIX Programming. 3 Hours.

Prerequisite: CS 1302 with a grade of "C" or better. An introduction to UNIX and shell programming. Various shell languages, including ksh and bash are discussed, in addition to basic UNIX commands. Web scripting languages such as Perl, HTML, and XML are also introduced in the UNIX environment.

CS 3335. The C Programming Language. 3 Hours.

Prerequisite: CS 1302 with a grade of "C" or better. Programming using the C programming language. Syntax and semantics of C; information representation; stylistic consideration; the C library. This course also discusses issues relating to the UNIX operating system.

CS 3340. Web Programming. 3 Hours.

Prerequisite: CS 1302 with a grade of "C" or better. Examination and implementation of the foundations of web-based computing. Topics include Hypertext Markup Language (HTML), Cascading Style Sheets (CSS), client-side scripting, server-side programming, state management, data access, Extensible Markup Language (XML), web services, and component-based development.

CS 3410. Data Structures. 3 Hours.

Prerequisite: CS 1302 and CS 2620 with a grade of C or better. Trees, graphs, and other forms of data structures and their implementations. Emphasizing abstract data types; static memory allocation vs. dynamic storage allocation; searching, hashing, and sorting methods; algorithm analysis.

CS 3520. Algorithms. 3 Hours.

Prerequisite: CS 3410 with a grade of "C" or better. Sequential and parallel algorithms for solving a variety of different problems; paradigms for algorithms; algorithm analysis; NP-complete problems.

CS 3700. Introduction to E-Commerce. 3 Hours.

Prerequisite: CS 1302 with a grade of "C" or better. An introduction to e-commerce trends, technologies, and strategies. Topics include the importance and impact of e-commerce, business-to-consumer, business-to-business, wireless networks, mobile commerce, online marketing, web services, supply chains, electronic payment, security, and legal issues.

CS 4121. Data Communications and Networks I. 3 Hours.

Prerequisites: CS 3101 and CS 3410, each with a grade of "C" or better. Basic concepts of data communications and computer networks architectures: including OSI and TCP/IP models, packet switching, local area and high speed networks. Error control, routing, and transmission media.

CS 4122. Data Communications and Networks II. 3 Hours.

Prerequisite: CS 4121 with a grade of "C" or better. A continuation of CS 4121 in which advanced topics in data communication and networking are studied.

CS 4321. Software Engineering I. 3 Hours.

Prerequisite: CS 3410 with a grade of "C" or better. Concepts and techniques used in all aspects of the software life-cycle relevant to the production of large object-oriented software systems. Students will work in teams on a project.

CS 4322. Software Engineering II. 3 Hours.

Prerequisite: CS 4321 with a grade of "C" or better. Advanced topics in software engineering, such as analysis, design, architecture, testing, and maintenance.

CS 4330. Theory of Programming Languages. 3 Hours.

Prerequisite: CS 3410 with a grade of C or better. Formal description of programming languages, standard and advanced features of modern programming languages, complexity.

CS 4340. Systems Programming. 3 Hours.

Prerequisites: CS 3335 and CS 3410, each with a grade of "C" or better. Implementation of concepts pertaining to the UNIX environment: process control and interprocess communication, job control, file and directory structures, and client/server processes.

CS 4345. Operating Systems. 3 Hours.

Prerequisites: CS 3101 and CS 3410, each with a grade of "C" or better. A survey of operating systems structures and services including batch systems, multiprogramming, time-sharing, process scheduling and synchronization, deadlocks, memory management, file-system interfaces and implementations, and secondary storage management.

CS 4500. Formal Languages and Automata Theory. 3 Hours.

Prerequisites: CS 3410 with a grade of C or better. Concepts pertaining to regular expressions, finite state machines, regular languages, regular grammars, non regular languages, decidability, context-free grammars, and Turing machines.

CS 4700. E-Commerce Design. 3 Hours.

Prerequisite: CS 3410 with a grade of "C" or better. An in-depth study of e-commerce implementation. Through programming projects, students will learn e-commerce design principles, tools, and techniques.

CS 4721. Database Design I. 3 Hours.

Prerequisite: CS 3410 with a grade of "C" or better. The logical organization of databases: the entity-relationship model; the hierarchical model, network, and relational models. Hardware characteristics; file organization and evaluation. Functional dependencies and normal forms. Query optimization, concurrency control, and distributed database systems.

CS 4722. Database Design II. 3 Hours.

Prerequisite: CS 4721 with a grade of "C" or better. An in-depth study of advanced database design and implementation concepts including transaction processing, concurrency, control techniques, recovery techniques, distributed databases and client/server architecture, and security and authorization.

CS 4800. Internship in Computer Science. 3-6 Hours.

Prerequisites: Junior or senior standing, a minimum 2.5 GPA, and permission of the internship coordinator and Department Head. Graded "Satisfactory" or "Unsatisfactory." Active participation in research or development in computer science or in a closely allied field. A daily log of activities, a report on the work done, and a report on the internship experience or a research paper relating the work done to the field of computer science are required.

CS 4820. Artificial Intelligence. 3 Hours.

Prerequisites CS 3410 With a grade of C or better. Definition of artificial intelligence, Common Lisp, logic programming, search techniques, knowledge representation including schemas and scripts, ART-enterprise as an expert systems, and principles expert systems.

CS 4825. Neural Networks. 3 Hours.

Prerequisites: MATH 2150 and MATH 2262, each with a grade of "C" or better. Concepts pertaining to neural networks including: definition of neural intelligence, basic neural computational models, learning: supervised and unsupervised, knowledge bases neural networks, back-propagation neural networks, radial basis neural networks.

CS 4830. Computer Graphics. 3 Hours.

Prerequisites: CS 3335, CS 3410, and MATH 2150, each with a grade of "C" or better. A survey of graphics systems and graphics programming. Topics include output primitives, transformations and viewing, modeling, user interfaces, and interactive methods. Both 2-D and 3-D concepts are discussed.

CS 4835. Parallel Programming. 3 Hours.

Prerequisite: CS 3335 with a grade of "C" or better. Introduction to data parallel architectures, models, and programming environments. Students will design, develop, and optimize software for parallel computing resources.

CS 4900. Senior Seminar. 3 Hours.

Prerequisites: CS 1301 and 3410, each with a grade of "C" or better, and senior standing. A capstone experience intended primarily for computer science majors that involves group development and management of a substantial software project using current technologies and culminating in an oral presentation, product demonstration, and formal report. Advanced programming skills are used in this course.

CS 4950. Directed Study in Computer Science. 1-3 Hours.

Prerequisite: Consent of instructor. The student will undertake at least one major computer-science project under the supervision of the instructor. Credit will be assigned on the basis of the effort required by the project. May be taken more than once if topics are different.

CS 4990. Topics in Computer Science. 1-3 Hours.

Prerequisite: Consent of instructor. Topics to be assigned. May be taken more than once if topics are different.

MATH 0989. Foundations for College Algebra. 3 Hours.

Fundamental algebra skills needed prior to taking MATH 1101 and MATH 1111.

MATH 0999. Support for College Algebra. 3 Hours.

Corequisite support for students requiring remediation in mathematics while enrolled in MATH 1101 or MATH 1111.

MATH 1101. Introduction to Mathematical Modeling. 3 Hours.

A study of algebraic topics from a modeling perspective. Introduction to different types of models including linear, quadratic, polynomial, exponential, and logarithmic. Emphasis on gathering, presentation, and interpretation of data by using real-world examples as models.

MATH 1111. College Algebra. 3 Hours.

Algebraic topics including polynomials, rational expressions, equations, inequalities, graphing, exponents and radicals, relations and functions through exponential and logarithmic functions.

MATH 1112. Trigonometry. 3 Hours.

Prerequisite: MATH 1111, 1261, 1113 or 2261 with a grade of "C" or higher, or by mathematics placement policy. Circular, trigonometric, and inverse functions, mathematical induction, the binomial theorem, and complex numbers.

MATH 1113. Precalculus. 3 Hours.

Prerequisite: MATH 1112 or MATH 2261 with a grade of "C" or higher, or by mathematics placement policy. Study of polynomial, rational, and transcendental functions and applications, conic sections, polar coordinates, parametric equations, and mathematical induction.

MATH 1113H. Honors Precalculus. 3 Hours.

Prerequisite: MATH 1112 or MATH 2261 with a grade of "C" or higher, or by mathematics placement policy. Study of polynomial, rational, and transcendental functions and applications, conic sections, polar coordinates, parametric equations, and mathematical induction. Focus on concepts and real-world applications.

MATH 1261. Survey of Calculus I. 3 Hours.

Prerequisite: MATH 1101, 1111, 1112, 1113, 1113H, or MATH 2261 with a grade of "C" or higher, or by mathematics placement policy. Topics include limits, continuity, differentiation of functions of one variable, and applications.

MATH 1262. Survey of Calculus II. 3 Hours.

Prerequisite: MATH 1261 with a grade of "C" or higher. A continuation of Survey of Calculus I. Topics include techniques and applications of integration of functions of one and several variables, and techniques and applications of differentiation of functions of several variables.

MATH 1401. Introduction to Statistics. 3 Hours.

The course is a course in basic statistics. Topics include descriptive statistics, probability, distributions, hypothesis testing, inferences, correlation, and regression. Prerequisites: MATH 1101 Mathematical Modeling, 1111 College Algebra, or 1113 Precalculus or approved equivalent. For more information on this institution's eCore courses, please see <http://www.valdosta.edu/ecore/>.

MATH 1501. Calculus I. 4 Hours.

Topics to include functions, limits, continuity, the derivative, antidifferentiation, the definite integral, and applications. Prerequisites: MATH 1113 - Precalculus or its equivalent. For more information on this institution's eCore courses, please see <http://www.valdosta.edu/ecore/>.

MATH 2008. Foundations of Numbers and Operations. 3 Hours.

Prerequisite: MATH 1101, MATH 1111, or MATH 1113 with a grade of "C" or higher. An 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 2150. Introduction to Linear Algebra. 3 Hours.

Prerequisite: MATH 2261 with a grade of "C" or higher. Systems of linear equations, matrices, determinants, and their properties; vectors and inner products; vector spaces; linear transformations; eigenvalues and eigenvectors. Special emphasis is placed on applications.

MATH 2261. Analytic Geometry and Calculus I. 4 Hours.

Prerequisite: MATH 1112 or MATH 1113 with a grade of "C" or higher, or by university placement policy. Introduction to limits, derivatives, integration, fundamental theorem of calculus, and applications.

MATH 2262. Analytic Geometry and Calculus II. 4 Hours.

Prerequisite: MATH 2261 with a grade of "C" or higher. Integrals; exponential, logarithmic, and inverse functions; applications of calculus; parametric equations; polar coordinates; sequences and series.

MATH 2263. Analytic Geometry and Calculus III. 4 Hours.

Prerequisite: MATH 2262 with a grade of "C" or higher. Three-dimensional analytic geometry; functions of several variables; partial derivatives; multiple integrals, line and surface integrals.

MATH 2620. Statistical Methods. 3 Hours.

Prerequisite: MATH 1101, 1111, 1112, 1113, 1113H, 1261, or MATH 2261. An introductory course in statistics. Topics include descriptive statistics; basic notions of probability, random variables, probability distributions, simple random sampling, and sampling distributions; confidence intervals and hypothesis tests; and regression. The application of statistical methodology and the use of computer software are emphasized.

MATH 3000. Tutoring in Mathematics. 2 Hours.

Prerequisite: consent of Tutoring Center Director. Philosophy and fundamentals of one-to-one tutoring in mathematics that takes place in the Tutoring Center. Review of basic mathematical concepts in algebra and calculus. Introduction to current technology for enhancement of mathematics instruction. Designed for the Tutoring Center tutors in mathematics, it is graded on an S/U basis. Students must complete this course prior to tutoring in the center or must register for this course during their first semester of tutoring.

MATH 3010. History of Mathematics. 3 Hours.

Prerequisite: MATH 2262 with a grade of "C" or higher. A study of the development of mathematics from primitive times to the twentieth century; including numeral systems, arithmetical methods, origins of algebra, geometry, trigonometry, analytic geometry, calculus; and selected topics from modern mathematics.

MATH 3040. Set Theory. 3 Hours.

Prerequisite: MATH 2262 with a grade of "C" or higher. Propositional and predicate logic; mathematical induction. Logic and structure of sets as related to mathematical proof. Relations and cardinality.

MATH 3161. Mathematics for Early Childhood Teachers I. 3 Hours.

Prerequisite: EDUC 2999 or SPEC 2999 and a grade of "C" or higher in MATH 2008. An in-depth study of the concepts and processes underlying the P-5 school mathematics curriculum, with special emphasis on numeration, number systems, estimation, algebraic thinking, and computational algorithms. Problem solving and historical context serve as unifying strands.

MATH 3162. Mathematics for Early Childhood Teachers II. 3 Hours.

Prerequisite: C or better in MATH 3161. An in-depth study of concepts and processes underlying the P-5 school mathematics curriculum with special emphasis on measurement, geometry, and the fundamentals of probability and statistics. Problem solving and historical context serve as unifying strands.

MATH 3180. Mathematics for Middle School Teachers. 3 Hours.

Prerequisite: Grade of "C" or higher in either MATH 1101, MATH 1111, MATH 1112, MATH 1113, MATH 1261, or MATH 2261. Concepts and processes that provide the foundation for the middle-grades mathematics curriculum (5-8). Includes an in-depth study of the real number system with emphasis on the rational number system and axiomatic differences among number systems. Other topics include relations and functions, geometry (including coordinate geometry and graphing), measurement, and elementary probability and statistics.

MATH 3190. Algebra and Geometry for Teachers. 3 Hours.

Prerequisite: Grade of "C" or higher in MATH 3180 or MATH 2261. An in-depth study of concepts and processes underlying the middle and secondary school mathematics curriculum with special emphasis placed upon the integrated development of algebra, geometry, and analytical geometry. Problem solving and historical context serve as unifying strands.

MATH 3340. Ordinary Differential Equations. 3 Hours.

Prerequisite: MATH 2262 with a grade of "C" or higher. Differential equations of first and second order, linear equations of higher order, and applications.

MATH 3510. Foundations of Geometry. 3 Hours.

Prerequisite: MATH 3040 with a grade of "C" or higher. A study of the Euclidean and non-Euclidean plane geometry from both synthetic and metric approaches. Topics include concepts related to incidence, betweenness, plane separation and convexity, congruence, and parallelism, with some attention given to geometric transformations.

MATH 3600. Probability and Statistics. 3 Hours.

Prerequisite: Either MATH 2262 or MATH 1262, with a "C" or higher. Descriptive statistics, probability distributions for discrete and continuous random variables, statistical inference, one way analysis of variance, and regression analysis.

MATH 4081. Modern Algebra I. 3 Hours.

Prerequisite: MATH 3040 with a grade of "C" or higher. Topics from groups, rings, and fields. Subgroups, cyclic groups, permutation groups, normal subgroups, homomorphisms, Cayley's and Lagrange's Theorems, factor groups, abelian groups, direct products. Introduction to rings and fields.

MATH 4082. Modern Algebra II. 3 Hours.

Prerequisite: MATH 4081 with a grade of "C" or higher. Continuation of MATH 4081 with emphasis on rings and fields. Rings, integral domains, and fields. Vector spaces, extension fields, finite fields.

MATH 4085. Applied Modern Algebra. 3 Hours.

Prerequisite: MATH 4081 with a grade of "C" or higher. Lattices, Boolean algebras, semi-groups, binary group codes, binary relations, and graphs. Special emphasis is placed on applications.

MATH 4110. Number Theory. 3 Hours.

Prerequisite: MATH 3040 with a grade of "C" or higher. Elementary properties of integers including divisibility, unique factorization, progressions and prime numbers. Linear congruences and residue classes, complete and reduced residue systems, Chinese Remainder Theorem, quadratic residues, law of quadratic reciprocity, Theorems of Fermat and Wilson, Fibonacci and perfect numbers, sums of squares, elementary theory of continued fractions.

MATH 4150. Linear Algebra. 3 Hours.

Prerequisites: MATH 2150 and MATH 3040 with a grade of "C" or higher. Introduction to the theory of vector spaces, with emphasis on finite-dimensional vector spaces, linear systems, matrices, linear transformations, eigenvalues, and related subjects.

MATH 4161. Mathematical Reasoning. 3 Hours.

Prerequisite: Grade of "C" or higher in either MATH 3162 or MATH 3180 or permission of the instructor. An in-depth study of concepts and processes underlying the P-8 school mathematics curriculum with special emphasis on informal and formal mathematical reasoning. Problem solving and historical context serve as unifying strands. The analysis and remediation of student errors manifested in the application of conceptual and procedural mathematical knowledge will also be addressed.

MATH 4260. Mathematical Analysis. 3 Hours.

Prerequisites: MATH 3040 with a grade of "C" or higher. A study of the principles of mathematical analysis; point set topology in Euclidean and metric spaces, numerical sequences and series, continuity, differentiation, integration, sequences and series of functions.

MATH 4300. Functions of a Complex Variable. 3 Hours.

Prerequisite: MATH 2263 with a grade of "C" or higher. Introductory study of the algebraic and geometric properties of the complex number system and functions of a complex variable. Limits, continuity, and differentiation of complex functions. Analytic functions and the Cauchy-Riemann conditions. Integration of complex functions; Cauchy-Goursat theorem; Cauchy integral formula; the theorems of Morera and Liouville. Taylor and Laurent series expansions. Residues and poles with applications to integration. Conformal mappings.

MATH 4540. Topology. 3 Hours.

Prerequisite: MATH 3040 with a grade of "C" or higher. The study of point set topology in metric and topological spaces. Open and closed sets, compactness, connectedness, topological mappings, separation, product and functions spaces.

MATH 4621. Mathematical Statistics I. 3 Hours.

Prerequisites: MATH 2263 and MATH 3600 with a grade of "C" or higher in both. Distributions of random variables, conditional probability and stochastic independence, multivariate and some special distributions, and distributions of functions of random variables.

MATH 4622. Mathematical Statistics II. 3 Hours.

Prerequisite: MATH 4621 with a grade of "C" or higher. Introduction to statistical inference, sufficient statistic, estimation theory, theory of statistical tests, and inferences about normal models.

MATH 4651. Numerical Analysis I. 3 Hours.

Prerequisites: MATH 2262 and CS 1301 with a grade of "C" or higher in both. Development and implementation of efficient numerical methods; locating roots of nonlinear equations; solving systems of linear equations; numerical differentiation and integration; interpolation; approximation of functions.

MATH 4652. Numerical Analysis II. 3 Hours.

Prerequisites: MATH 4651 and MATH 3340 with a grade of "C" or higher in both. Continuation of MATH 4651. Determination of eigenvalues and eigenvectors of matrices; method of least squares, and curve fitting; numerical solutions of ordinary and partial differential equations.

MATH 4901. Operations Research I. 3 Hours.

Prerequisite: MATH 2150 or MATH 4150 with a grade of "C" or higher. Mathematical aspects and applications of Operations Research. Topics are selected from linear programming (mainly), integer programming, and dynamic programming.

MATH 4902. Operations Research II. 3 Hours.

Prerequisite: MATH 3600 or MATH 4621 with a grade of "C" or higher. (Note that MATH 4901 is not a prerequisite). An introduction to stochastic operations research. Topics are selected from stochastic modeling and optimization, probability models, queueing theory and Monte Carlo simulation.

MATH 4910. Mathematical Models. 3 Hours.

Prerequisite: MATH 2263 and 3600 each with a "C" or higher, or permission of instructor. An introduction to basic principles and applications of classical mathematical models, optimization models and probabilistic models.

MATH 4980. Senior Seminar. 3 Hours.

Prerequisite: A 4000-level course in algebra, analysis, or topology. A capstone experience in pure mathematics. Topics in an area of algebra, analysis, or topology will be covered and presented in a written and/or oral form.

MATH 4990. Special Topics in Mathematics. 1-3 Hours.

Prerequisites: Consent of instructor and Head of the Department of Mathematics and Computer Science. Topics and credits to be assigned. May be taken more than once if topics are different.

MATH 4990H. Honors Special Topics in Mathematics. 1-3 Hours.

Prerequisites: Consent of instructor and Head of the Department of Mathematics and Computer Science. Topics and credits to be assigned. Student presentations will be required. May be taken more than once if topics are different.