

MATHEMATICS AND COMPUTER SCIENCE

Department of Mathematics and Computer Science Division of Natural Sciences and Mathematics

The Mathematics and Computer Science Department offers three majors: Mathematics, Data Science, and Computer Science. Our curricula give students technical knowledge, a broad foundation of reasoning and analytical skills that can be applied to many fields, and frameworks to critically examine the societal and ethical implications of their work. Graduates can pursue graduate work in data science, computer science, or mathematics, teach in secondary schools, work as professionals in government and industry, or use quantitative and computing techniques in the natural sciences or social sciences, and so much more. The learning environment places emphasis on reasoning, active problem-solving, and communication skills. In our classes, students can expect to collaborate on problems, discuss technical and non-technical issues, deliver oral presentations, and write detailed papers. You may find some course descriptions under the Computer Science heading. Please see other majors under their own catalog headings.

- Computer Science Major (<https://catalog.washcoll.edu/catalog/departments-programs/mathematics-computer-science/computer-science-major/>)
- Computer Science Minor (<https://catalog.washcoll.edu/catalog/departments-programs/mathematics-computer-science/computer-science-minor/>)
- Data Science Major (<https://catalog.washcoll.edu/catalog/departments-programs/mathematics-computer-science/data-science-major/>)
- Data Science Minor (<https://catalog.washcoll.edu/catalog/departments-programs/mathematics-computer-science/data-science-minor/>)
- Mathematics Major (<https://catalog.washcoll.edu/catalog/departments-programs/mathematics-computer-science/mathematics-major/>)
- Mathematics Minor (<https://catalog.washcoll.edu/catalog/departments-programs/mathematics-computer-science/mathematics-minor/>)

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Computer Science

CSI SCE Senior Capstone Experience 2 Credits

The Senior Capstone Experience in Computer Science can take one of three forms: a senior thesis and oral/poster presentation on a topic in theoretical computer science, a senior programming project with a written exposition and oral/poster presentation, or preparation for, and successful passing of, a technical interview akin to those expected in industry. Each major choosing the thesis option will research and write a senior thesis with the supervision of a faculty member and will make an oral presentation on the thesis at a departmental seminar or present a poster at a departmental poster presentation session. Each major choosing the thesis option should have a thesis topic selected and approved by the end of their junior year. Double majors are often able to combine their thesis from another department to write only one senior thesis. Each major choosing the programming project option will complete the project with the supervision of a faculty member and will also complete a written exposition and make an oral or poster presentation on the project at a departmental seminar. Each major choosing the programming project option should have a project selected and approved by the end of their junior year. The Senior Capstone Experience in computer science is graded as Pass, Fail, or Honors. Students must do a thesis or programming project and make an oral presentation to earn the grade of honors.

Term(s) Offered: All Terms, All Years

CSI 100 Basics of Computing 4 Credits

This course introduces computer programming in a modern, high-level programming language. Objectives include proficiency in the language (including variables, functions, types, flow control, and basic data structures) as well as familiarity with common computer science problem solving strategies. Students will also gain experience in team programming and in program design for practical problem solving. This course counts for distribution but does not count towards the major in computer science.

Term(s) Offered: Other, Non Conforming

CSI 104 Introduction to Game Design 4 Credits

A study of games and game design with a specific focus on building, iterating and breaking down a variety of game and game types. The tools applied in this class can be applied to many types of storytelling and they will be particularly analyzed and applied to board games and video games. A student will gain some experience with and use of at least one digital game platform. Groupwork, discussion, presentation and iterative development are heavily required in this course. This course counts for distribution but does not count towards the major in computer science,

Term(s) Offered: Other, Non Conforming

CSI 111 Computer Science I 4 Credits

The objectives of this course are threefold: to introduce programming concepts and algorithmic development, to teach an object-oriented programming language, and to teach how to design, code, debug and document programs using the techniques of good programming style.

Cross-listed as: CSI 201/CSI 111

Term(s) Offered: All Terms, All Years

CSI 112 Computer Science II 4 Credits

The objectives of this course are twofold: (a) to study data structures, such as stacks, queues, trees, dictionaries, tables, and graphs, their efficiency, and their use in solving computational problems; and (b) to gain proficiency in an object-oriented programming language. Exercises in that language will provide an opportunity to design and implement the data structures.

Cross-listed as: CSI 202/CSI 112

Term(s) Offered: All Terms, All Years

CSI 194 Special Topics 4 Credits

Topics not regularly offered in a department's normal course offerings, chosen based on current student interest and faculty expertise. Special topic courses can only be offered 3 times; after this, the course must be approved as a regular course. Graded A-F or Pass/Fail.

Term(s) Offered: All Terms, All Years

CSI 195 On-Campus Research 4 Credits

An agreement between a sponsoring faculty member and a student researching a topic of interest that is relevant to a student's major or minor. Research is conducted on campus. Students must be enrolled before the research can begin. Graded A-F or Pass/Fail. 45 hours are required per credit.

Term(s) Offered: Summer, All Years

CSI 210 Object Oriented Programming 4 Credits

This course gives a deep understanding of object-oriented design and programming, and the design and coding of applications programs using Java. The use of Java for graphics and graphical user interfaces, multithreading, connectivity with databases and across networks will be covered. Students will be required to design and write a large application for a final course project that incorporates GUIs and a selection of the principles taught.

Cross-listed as: CSI 203/CSI 210

Term(s) Offered: Fall, All Years

CSI 220 Data Science 4 Credits

The heart of data science is going from a deluge of numbers to ever-elusive insight. In this introduction we focus on first principles: asking good questions, being aware of our assumptions, and understanding what it means to do good science. Topics include exploratory analysis/descriptive statistics, statistical testing, and data visualization. The course concludes with an introduction to recent data-driven machine learning models. We discuss ethical issues pertaining to data and machine learning throughout the course, using current events and articles as they arise. The course is both math and programming intensive, although in a heavily applied manner.

Cross-listed as: CSI 220/MAT 220

Term(s) Offered: Fall, All Years

CSI 230 Applied Decision Analysis 4 Credits

The course comprises an introduction to decision analysis and data-driven decision-making. The instruction includes hands-on experience with developing decision support applications programs. A computational approach will be used to teach and demonstrate the basic principles of descriptive and inferential statistics, linear programming, the design and implementation of databases, and rudimentary differential and integral calculus. With these, students learn how to acquire and clean data, develop models, perform optimization, simulation, statistical testing, goal-seeking and what-if analysis of the models, and will communicate their results in writing and verbally.

Term(s) Offered: Other, Non Conforming

CSI 240 Discrete Mathematics 4 Credits

An introduction to logic, reasoning, and the discrete mathematical structures that are important in computer science. Topics include proposition logic, types of proof, induction and recursion, sets, combinatorics, functions, relations, and graphs.

Cross-listed as: MAT 240/CSI 240

Term(s) Offered: All Terms, All Years

CSI 250 Intro Comp Organization & Architecture 4 Credits

Principles of computer organization and architecture are introduced, including interfacing and communication, register and memory organization, digital logic, representation of data, and introduction to assembly language.

Term(s) Offered: Other, Non Conforming

CSI 252 Scientific Modeling & Data Analysis 4 Credits

This course serves as a focused introduction to programming for scientists and engineers. Topics include algorithm development, statistical tests, the fast Fourier transform (FFT), simulating the dynamics of systems represented by coupled ordinary differential equations (e.g. planetary motion via Runge-Kutta methods), numerical integration, root finding, fitting functions to experimental data, and the creation of publication-quality graphics. Students choose and complete an independent research project on a topic related to their major. This course enables students to integrate computation into advanced courses in theoretical and/or experimental science. Programming language: Python.

Cross-listed as: PHY 252/MAT 252/CSI 252

Term(s) Offered: Spring, All Years

CSI 294 Special Topics 4 Credits

Topics not regularly offered in a department's normal course offerings, chosen based on current student interest and faculty expertise. Special topic courses can only be offered 3 times; after this, the course must be approved as a regular course. Graded A-F or Pass/Fail.

Term(s) Offered: All Terms, All Years

CSI 295 On-Campus Research 4 Credits

An agreement between a sponsoring faculty member and a student researching a topic of interest that is relevant to a student's major or minor. Research is conducted on campus. Students must be enrolled before the research can begin. Graded A-F or Pass/Fail. 45 hours are required per credit.

Term(s) Offered: Summer, All Years

CSI 297 Independent Study 4 Credits

An agreement between a sponsoring faculty and a student letting the student study a topic of interest not offered at WC. 45 hours are required per credit.

Term(s) Offered: All Terms, All Years

CSI 310 Database Systems 4 Credits

An introduction to the design and use of databases together with insights into the key issues related to the use of database systems. The course covers the entity relationship model; the hierarchical, network, and relational data models, and their languages; functional dependencies and normal forms; the use of SQL language, and the design and implementation of relational databases using MS ACCESS and MySQL.

Cross-listed as: CSI 310/CSI 360

Term(s) Offered: Other, Non Conforming

CSI 320 Theory of Computation 4 Credits

Formal models of computation such as finite state automata, pushdown automata, and Turing machines will be studied along with corresponding formal languages and context-free languages. Uncomputability, including the halting problem, and computational complexity including the classes P and NP and NP-completeness will be studied.

Cross-listed as: CSI 320/CSI 350

Term(s) Offered: Other, Non Conforming

CSI 330 GUI and Mobile Programming 4 Credits

Covers the fundamentals of existing mobile development frameworks, including data storage, the cloud, security, hashing, accessibility and the nature of user interaction. Other topics may include industry standards for GUI and mobile programming such as the model-view-controller framework, XML, and JSON.

Term(s) Offered: Other, Non Conforming

CSI 350 Graph Theory and Combinatorics 4 Credits

This course introduces elementary combinatorial techniques used to enumerate large but finite discrete sets, including some of the following: permutations, the binomial theorem, partitions, bijections, and well-known sequences. It also presents the fundamentals of graph theory: trees, networks, paths and connectivity, matchings, colorings, and optimization algorithms. There is a significant proof-writing component plus computations and opportunities for coding.

Cross-listed as: CSI 350/MAT 350

Term(s) Offered: Other, Non Conforming

CSI 360 Machine Learning 4 Credits

This is a class in finding patterns. Machine learning methods fit models to data to build representations of the underlying relationships. These models can then be applied to do tasks like classification, regression, and generation. As an undergraduate-level introductory course we focus on the core ideas and applications of the most important models, such as linear and logistic regression, nearest-neighbor methods, and support vector machines. We will give special emphasis to a variety of new deep learning techniques.

Term(s) Offered: Spring, Odd Years

CSI 380 Design & Analysis of Algorithms 4 Credits

The topic of this course is the design of computer algorithms and techniques for analyzing their efficiency and complexity. Types of algorithms include greedy algorithms, divide and conquer algorithms, dynamic programming, searching and sorting.

Term(s) Offered: Other, Non Conforming

CSI 390 Computer Science Internship 4 Credits

A learning contract is developed prior to enrollment in an internship. Evaluation of student performance is completed by the faculty mentor based on the fulfillment of the contract terms and written evaluation by the internship site supervisor. Students must work at least 45 hours for each internship credit and be enrolled in the course prior to beginning work. Graded A-F or Pass/Fail.

Term(s) Offered: All Terms, All Years

CSI 394 Special Topics 4 Credits

Topics not regularly offered in a department's normal course offerings, chosen based on current student interest and faculty expertise. Special topic courses can only be offered 3 times; after this, the course must be approved as a regular course. Graded A-F or Pass/Fail.

Term(s) Offered: All Terms, All Years

CSI 395 On-Campus Guided Research 4 Credits

An agreement between a sponsoring faculty member a

Term(s) Offered: Summer, Non Conforming

CSI 396 Off-Campus Research 4 Credits

An agreement between a sponsoring faculty member and a student researching a topic of interest that is relevant to a student's major or minor. Research is conducted off-campus. Students must be enrolled before the research can begin. Graded A-F or Pass/Fail. 45 hours are required per credit.

Term(s) Offered: Summer, All Years

CSI 397 Independent Study 4 Credits

An agreement between a sponsoring faculty and a student letting the student study a topic of interest not offered at WC. 45 hours are required per credit.

Term(s) Offered: All Terms, All Years

CSI 410 Computer Graphics 4 Credits

Introduces the principles of computer graphics, including transformations, viewing and modeling. Other topics may include perspective calculations, memory coherence, z-buffering, texturing, lighting and other fundamentals required to work with emerging graphics systems. Students write programs using a graphics library like OpenGL or DirectX.

Term(s) Offered: Other, Non Conforming

CSI 420 Artificial Intelligence 4 Credits

Explores the principles and techniques involved in programming computers to do tasks that usually are thought of as requiring intelligence when done by people. State-space and heuristic search techniques, logic and other knowledgeable representations, and statistical and neural network approaches are applied to problems such as game playing, planning and understanding of natural language, and computer vision.

Cross-listed as: CSI 420/CSI 460

Term(s) Offered: Other, Non Conforming

CSI 430 Operating Systems 4 Credits

Introduction to operating systems including tasking, memory management, process scheduling, file systems, protection, and distributed systems.

Term(s) Offered: Other, Non Conforming

CSI 440 Computer Networks 4 Credits

This course covers the principles, structure, and operation of computer networks. Emphasis is placed on understanding the protocols and mechanisms used in the Internet, and in local and wide-area networks. Students write application-level programs running on the LINUX or Windows operating systems.

Cross-listed as: CSI 440/CSI 470

Term(s) Offered: Other, Non Conforming

CSI 450 Data Ethics and Practicum 4 Credits

This course, intended to be taken near the end of the Data Science major, focuses on gaining hands-on experience on real problems. Students select and work a series of data analysis projects in groups. Class time focusses on technical troubleshooting, ethical reflection, and presentations of work. The class seeks to expand students' imagination around their own role as ethical agents in the process of doing data science..

Term(s) Offered: Spring, Non Conforming

CSI 460 Software Engineering 4 Credits

The topic of this course is the systematic process for creating software products as opposed to simply coding programs. The course covers project and product management, software architecture and design patterns, working in teams and effective communication. The course provides individualized and collaborative experience and a broad understanding of the practical skills necessary to be an effective software engineer in a professional environment.

Term(s) Offered: Spring, All Years

CSI 470 Computer Networks 4 Credits

this course covers the principles, structure, and operation of computer networks. Emphasis will be placed on understanding the protocols and mechanisms used in the Internet, and in local and wide area networks. The student will write application-level programs running on the LINUX or Windows Operating systems.

Cross-listed as: CSI 440/CSI 470

Term(s) Offered: Spring, All Years

CSI 490 Computer Science Internship 4 Credits

A learning contract is developed prior to enrollment in an internship. Evaluation of student performance is completed by the faculty mentor based on the fulfillment of the contract terms and written evaluation by the internship site supervisor. Students must work at least 45 hours for each internship credit and be enrolled in the course prior to beginning work. Graded A-F or Pass/Fail.

Term(s) Offered: All Terms, All Years

CSI 494 Special Topics 4 Credits

Topics not regularly offered in a department's normal course offerings, chosen based on current student interest and faculty expertise. Special topic courses can only be offered 3 times; after this, the course must be approved as a regular course. Graded A-F or Pass/Fail.

Term(s) Offered: All Terms, All Years

CSI 495 On-Campus Guided Research 4 Credits

An agreement between a sponsoring faculty member and a student researching a topic of interest that is relevant to a student's major or minor. Research is conducted on campus. Students must be enrolled before the research can begin. Graded A-F or Pass/Fail. 45 hours are required per credit.

Term(s) Offered: Summer, Even Years

CSI 496 Off-Campus Research 4 Credits

An agreement between a sponsoring faculty member and a student researching a topic of interest that is relevant to a student's major or minor. Research is conducted off-campus. Students must be enrolled before the research can begin. Graded A-F or Pass/Fail. 45 hours are required per credit.

Term(s) Offered: Summer, All Years

CSI 497 Independent Study 4 Credits

An agreement between a sponsoring faculty and a student letting the student study a topic of interest not offered at WC. 45 hours are required per credit.

Term(s) Offered: All Terms, All Years

Mathematics

MAT SCE Senior Capstone Experience 2 Credits

The Senior Capstone Experience in mathematics consists of two components: a senior thesis and either an oral presentation of the thesis in front of the faculty and majors at seminar, or a poster presentation. Comprehensive exams may be offered in place of a traditional senior thesis. The Senior Capstone Experience in mathematics is graded as Pass, Fail, or Honors. Students must do a thesis and make an oral presentation to earn the grade of honors.

Term(s) Offered: All Terms, All Years

MAT 102 Chaos and Fractals 4 Credits

This course is an introduction to the rapidly developing science of complexity. It is a discussion of the tools-fractals, chaos, and self-organization-being refined for the purpose of understanding such things as the fractured and irregular structures of Nature, surprise and unpredictability, and the emergence of lifelike properties from inanimate matter. The theme of the course is that complexity can arise from simple origins, such as the repeated application of elementary processing rules. The course emphasizes the use of the computer for visualization. Practical application of these ideas in medicine and engineering will be discussed, as will examples of the connections between complexity in the sciences and that in the humanities and the arts.

Cross-listed as: MAT 120/MAT 102

Term(s) Offered: Other, Non Conforming

MAT 104 Finite Mathematics 4 Credits

Linear programming, matrices, sets and counting, Markov process, difference equations, and graphs. The course emphasizes developing, analyzing, and interpreting mathematical models.

Term(s) Offered: Other, Non Conforming

MAT 105 Communication, Patterns & Inventions 4 Credits

This course is designed for students in the Elementary Education Certification Program and for students planning to complete the Secondary Education Certification Program in an area other than mathematics. The framework of the course consists of four themes: Number Systems and their Operations, Algebra and Functions, Geometry and Measurement, Data Analysis, Statistics, and Probability. Emphasis throughout is on reasoning and problem-solving using concepts and procedures from all four areas. Substantial amounts of both reading and writing is required and students are expected to demonstrate both orally and in writing a thorough understanding of the concepts and the ability to communicate this understanding to others.

Cross-listed as: MAT 105/MAT 221

Term(s) Offered: Other, Non Conforming

MAT 106 Stretch Differential Calculus I 4 Credits

Analytic geometry, the derivative and differential, elementary functions, limits, continuity, and applications. This course is part 1 (of 2) of a yearlong sequence in differential calculus. At the end of this two-course sequence, students tackle all the topics above included in differential calculus. Completion of this year-long sequence is equivalent to completion of MAT 111: Differential Calculus. Please note, Pre-Calculus placement score must be less than 50 to take this course. Also note, MAT 106 and MAT 107 can be counted as a two-course quantitative sequence for distribution, but MAT 106 and 107 do not count as a quantitative course otherwise.

Term(s) Offered: Fall, All Years

MAT 107 Stretch Differential Calculus II 4 Credits

This course is the second semester of a year-long sequence in Differential Calculus. Topics in this course include trigonometry, derivatives of trigonometric functions, conic sections, implicit differentiation, and limits at infinity. The semester concludes with the Fundamental Theorem of Calculus. Throughout the semester, students work on a project involving Calculus, culminating in a final paper and a presentation. Completion of this year-long sequence is equivalent to completion of MAT 111: Differential Calculus. Also note, MAT 106 and MAT 107 can be counted as a two-course quantitative sequence for distribution, but MAT 106/107 does not count as a quantitative course otherwise.

Term(s) Offered: Spring, All Years

MAT 109 Statistical Inference & Data Analysis I 4 Credits

Introduction to the theory and practice of data analysis and statistics in the natural and social sciences. Statistical software will be used. Topics will include data ethics, sampling, experimental design, descriptive statistics, conditional probability, the normal distribution, simple linear regression, confidence intervals, hypothesis tests, and decisions. Credit for MAT 109 will not be given if taken before or subsequently to BUS 109, PSY 209, or ECN 215.

Term(s) Offered: All Terms, All Years

MAT 111 Differential Calculus 4 Credits

Analytic geometry, the derivative and differential, elementary functions, limits, continuity, and applications. Prerequisite: It is strongly recommended that a student should have strong algebra and trigonometric skills before taking this course.

Cross-listed as: MAT 111/MAT 201

Term(s) Offered: All Terms, All Years

MAT 112 Integral Calculus 4 Credits

The indefinite integral, the definite integral, the fundamental theorem of the integral calculus, sequences, series, and applications.

Cross-listed as: MAT 202/MAT 112

Term(s) Offered: All Terms, All Years

MAT 194 Special Topics 4 Credits

Topics not regularly offered in a department's normal course offerings, chosen based on current student interest and faculty expertise. Special topic courses can only be offered 3 times; after this, the course must be approved as a regular course. Graded A-F or Pass/Fail.

Term(s) Offered: All Terms, All Years

MAT 195 On-Campus Research 4 Credits

An agreement between a sponsoring faculty member and a student researching a topic of interest that is relevant to a student's major or minor. Research is conducted on campus. Students must be enrolled before the research can begin. Graded A-F or Pass/Fail. 45 hours are required per credit.

MAT 196 Off-Campus Research 4 Credits

An agreement between a sponsoring faculty member and a student researching a topic of interest that is relevant to a student's major or minor. Research is conducted off-campus. Students must be enrolled before the research can begin. Graded A-F or Pass/Fail. 45 hours are required per credit.

Term(s) Offered: Summer, All Years

MAT 197 Independent Study 4 Credits

An agreement between a sponsoring faculty and a student letting the student study a topic of interest not offered at WC. 45 hours are required per credit.

MAT 209 Statistical Inference & Data Analysis II 4 Credits

A continuation of the theory and practice of data analysis and statistics in the natural and social sciences. Use of statistical software constitutes a significant part of this course. Common statistical mistakes and the careful and ethical application of statistical methods are emphasized. Topics include experimental design, multivariate linear regression, non-parametric and parametric inference, power calculations, logistic regression, chi-squared tests, and ANOVA.

Term(s) Offered: Spring, All Years

MAT 210 Multivariable Calculus 4 Credits

Vectors, partial derivatives, and multiple integrals for functions of several variables. Line and surface integrals.

Cross-listed as: MAT 203/MAT 210

Term(s) Offered: Fall, All Years

MAT 220 Data Science 4 Credits

The heart of data science is going from a deluge of numbers to ever-elusive insight. In this introduction we focus on first principles: asking good questions, being aware of our assumptions, and understanding what it means to do good science. Topics include exploratory analysis/descriptive statistics, statistical testing, and data visualization. The course concludes with an introduction to recent data-driven machine learning models. We discuss ethical issues pertaining to data and machine learning throughout the course, using current events and articles as they arise. The course is both math and programming intensive, although in a heavily applied manner.

Cross-listed as: CSI 220/MAT 220

Term(s) Offered: Fall, All Years

MAT 230 Foundations of Geometry 4 Credits

A critical study of the basic concepts of geometry. This course begins with an axiomatic approach to Euclidean geometry which includes careful proofs of its principal theorems. The course will continue with an examination of various types of non-Euclidean geometries which may include spherical geometry, projective geometry, and/or hyperbolic geometry.

Term(s) Offered: Other, Non Conforming

MAT 240 Discrete Mathematics 4 Credits

An introduction to logic, reasoning, and the discrete mathematical structures that are important in computer science. Topics include proposition logic, types of proof, induction and recursion, sets, combinatorics, functions, relations, and graphs.

Cross-listed as: MAT 240/CSI 240

Term(s) Offered: All Terms, All Years

MAT 252 Scientific Modeling & Data Analysis 4 Credits

This course serves as a focused introduction to programming for scientists and engineers. Topics include algorithm development, statistical tests, the fast Fourier transform (FFT), simulating the dynamics of systems represented by coupled ordinary differential equations (e.g. planetary motion via Runge-Kutta methods), numerical integration, root finding, fitting functions to experimental data, and the creation of publication-quality graphics. Students choose and complete an independent research project on a topic related to their major. This course enables students to integrate computation into advanced courses in theoretical and/or experimental science. Programming language: Python.

Cross-listed as: PHY 252/MAT 252/CSI 252

Term(s) Offered: Spring, All Years

MAT 280 Linear Algebra 4 Credits

An introduction to linear algebra balancing computation and the reading, understanding, and writing of mathematical proofs. A selection of topics from systems of linear equations, matrices, vector spaces, bases, dimension, linear transformations, determinants, eigenvalues, change of basis, matrix representations of linear transformations, matrix decompositions, and applications of linear algebra. It is recommended that students take MAT 240 before this course.

Cross-listed as: MAT 325/MAT 280

Term(s) Offered: Spring, All Years

MAT 294 Special Topics 4 Credits

Topics not regularly offered in a department's normal course offerings, chosen based on current student interest and faculty expertise. Special topic courses can only be offered 3 times; after this, the course must be approved as a regular course. Graded A-F or Pass/Fail.

Term(s) Offered: All Terms, All Years

MAT 295 On-Campus Research 4 Credits

An agreement between a sponsoring faculty member and a student researching a topic of interest that is relevant to a student's major or minor. Research is conducted on campus. Students must be enrolled before the research can begin. Graded A-F or Pass/Fail. 45 hours are required per credit.

MAT 296 Off-Campus Research 4 Credits

An agreement between a sponsoring faculty member and a student researching a topic of interest that is relevant to a student's major or minor. Research is conducted off-campus. Students must be enrolled before the research can begin. Graded A-F or Pass/Fail. 45 hours are required per credit.

Term(s) Offered: Summer, All Years

MAT 297 Independent Study 4 Credits

An agreement between a sponsoring faculty and a student letting the student study a topic of interest not offered at WC. 45 hours are required per credit.

MAT 310 Differential Equations 4 Credits

Elementary methods for the solution of ordinary differential equations, including the expansion of the solution in an infinite series.

Cross-listed as: MAT 310/MAT 345

Term(s) Offered: Spring, All Years

MAT 320 Probability 4 Credits

Events and their probabilities, dependence, and independence. Bayes Theorem. Variates and expected values. Theorems of Bernoulli and De Moivre. Special distributions. Central limit theorem and applications.

Cross-listed as: MAT 318/MAT 320

Term(s) Offered: Other, Non Conforming

MAT 330 Complex Analysis 4 Credits

Theory of functions of a complex variable, including applications to problems in the theory of functions of a real variable. Cauchy's Integral Formula and its application to the calculus of residues.

Cross-listed as: MAT 316/MAT 330

Term(s) Offered: Other, Non Conforming

MAT 340 Numerical Analysis 4 Credits

Solution of equations and systems of equations by iteration and elimination, numerical differentiation and integration, assessment of accuracy, methods of interpolation and extrapolation.

Cross-listed as: MAT 340/CSI 340

Term(s) Offered: Other, Non Conforming

MAT 350 Graph Theory & Combinatorics 4 Credits

This course introduces elementary combinatorial techniques used to enumerate large but finite discrete sets, including some of the following: permutations, the binomial theorem, partitions, bijections, and well-known sequences. It also presents the fundamentals of graph theory: trees, networks, paths and connectivity, matchings, colorings, and optimization algorithms. There is a significant proof-writing component plus computations and opportunities for coding.

Cross-listed as: CSI 350/MAT 350

Term(s) Offered: Other, Non Conforming

MAT 370 Operations Research 4 Credits

This course tackles challenges that arise in the functioning (operations) of a complex organization, and then works to formulate, analyze, and solve corresponding mathematical decision models. Some of these challenges might involve distributing tasks among processes competing for limited resources, arranging transportation between hubs to minimize cost, or scheduling employees' shifts to meet demands while lowering payroll costs. We develop mathematical and computational tools, understand how they work, and explore some of their historic usage in industry. Topics include some combination of: linear programming & the simplex method; transportation & assignment problems; network models; dynamic programming; integer programming.

Cross-listed as: Mat 370/CSI 370

Term(s) Offered: Other, Non Conforming

MAT 380 Number Theory 4 Credits

Factorization of integers. Congruences and residue classes. Theorems of Euler, Fermat, Wilson, and Gauss. Primitive roots. Quadratic residues and the reciprocity theorem.

Cross-listed as: MAT 380/MAT 360

Term(s) Offered: Other, Non Conforming

MAT 390 Mathematics Internship 4 Credits

A learning contract is developed prior to enrollment in an internship. Evaluation of student performance is completed by the faculty mentor based on the fulfillment of the contract terms and written evaluation by the internship site supervisor. Students must work at least 45 hours for each internship credit and be enrolled in the course prior to beginning work. Graded A-F or Pass/Fail.

Term(s) Offered: All Terms, All Years

MAT 391 Junior Math Major Seminar I 1 Credit

Open to mathematics majors only. Weekly meetings of the majors and faculty in the department are scheduled to provide information about careers, graduate school, thesis topics, and research areas, as well as to prepare each major to make presentations of problem solutions and to make the required presentation on the thesis. All junior mathematics majors are enrolled in the seminar and will receive a pass/fail grade at the end of the semester. Junior standing, and permission of the Department.

Term(s) Offered: Fall, All Years

MAT 392 Junior Math Major Seminar II 1 Credit

Open to mathematics majors only. Weekly meetings of the majors and faculty in the department are scheduled to provide information about careers, graduate school, thesis topics, and research areas, as well as to prepare each major to make presentations of problem solutions and to make the required presentation on the thesis. All junior mathematics majors are enrolled in the seminar and will receive a pass/fail grade at the end of the semester. Junior standing, and permission of the Department.

Term(s) Offered: Spring, All Years

MAT 394 Special Topics 4 Credits

Topics not regularly offered in a department's normal course offerings, chosen based on current student interest and faculty expertise. Special topic courses can only be offered 3 times; after this, the course must be approved as a regular course. Graded A-F or Pass/Fail.

Term(s) Offered: All Terms, All Years

MAT 395 Summer Research 4 Credits

An agreement between a sponsoring faculty member and a student researching a topic of interest that is relevant to a student's major or minor. Research is conducted on campus. Students must be enrolled before the research can begin. Graded A-F or Pass/Fail. 45 hours are required per credit.

MAT 396 Off-Campus Research 4 Credits

An agreement between a sponsoring faculty member and a student researching a topic of interest that is relevant to a student's major or minor. Research is conducted off-campus. Students must be enrolled before the research can begin. Graded A-F or Pass/Fail. 45 hours are required per credit.

Term(s) Offered: Summer, All Years

MAT 397 Independent Study 4 Credits

An agreement between a sponsoring faculty and a student letting the student study a topic of interest not offered at WC. 45 hours are required per credit.

MAT 410 Abstract Algebra 4 Credits

Introduction to groups, rings and fields. Other topics may include integral domains, polynomial rings, and fields.

Cross-listed as: MAT 322/MAT 410

Term(s) Offered: Fall, Odd Years

MAT 470 Real Analysis I 4 Credits

A rigorous treatment of single-variable calculus. A selection of topics from the properties and the topology of the real numbers, sequences, series, continuity, differentiation, and Riemann integration.

Cross-listed as: MAT 311/MAT 470

Term(s) Offered: Fall, Even Years

MAT 480 Real Analysis II 4 Credits

A continuation of Real Analysis II. Topics selected according to student and instructor interest. Topics could include analysis in metric spaces, analysis in n -dimensional space, Fourier analysis, functional analysis, measure theory, and Lebesgue integration. Suitable for engineers, chemists, physicists, economists, and mathematicians.

Term(s) Offered: Other, Non Conforming

MAT 490 Mathematics Internship 4 Credits

A learning contract is developed prior to enrollment in an internship. Evaluation of student performance is completed by the faculty mentor based on the fulfillment of the contract terms and written evaluation by the internship site supervisor. Students must work at least 45 hours for each internship credit and be enrolled in the course prior to beginning work. Graded A-F or Pass/Fail.

Term(s) Offered: All Terms, All Years

MAT 491 Senior Math Major Seminar I 1 Credit

Open to mathematics majors only. Senior students make a presentation of a preliminary outline of their capstone project in the fall semester and present a report on the completed capstone project in the spring. All senior mathematics majors are enrolled in the seminar and receive a pass/fail grade at the end of the semester.

Term(s) Offered: Fall, All Years

MAT 492 Senior Math Major Seminar II 1 Credit

Open to mathematics majors only. Senior students make a presentation of a preliminary outline of their capstone project in the fall semester and present a report on the completed capstone project in the spring. All senior mathematics majors are enrolled in the seminar and receive a pass/fail grade at the end of the semester.

Term(s) Offered: Spring, All Years

MAT 494 Special Topics 4 Credits

Topics not regularly offered in a department's normal course offerings, chosen based on current student interest and faculty expertise. Special topic courses can only be offered 3 times; after this, the course must be approved as a regular course. Graded A-F or Pass/Fail.

Term(s) Offered: All Terms, All Years

MAT 495 On-Campus Research 4 Credits

An agreement between a sponsoring faculty member and a student researching a topic of interest that is relevant to a student's major or minor. Research is conducted on campus. Students must be enrolled before the research can begin. Graded A-F or Pass/Fail. 45 hours are required per credit.

MAT 496 Off-Campus Research 4 Credits

An agreement between a sponsoring faculty member and a student researching a topic of interest that is relevant to a student's major or minor. Research is conducted off-campus. Students must be enrolled before the research can begin. Graded A-F or Pass/Fail. 45 hours are required per credit.

Term(s) Offered: Summer, All Years

MAT 497 Independent Study 4 Credits

An agreement between a sponsoring faculty and a student letting the student study a topic of interest not offered at WC. 45 hours are required per credit.