MATHEMATICS AND COMPUTER SCIENCE

The Department of Mathematics and Computer Science in the College of Science and Technology offers Bachelor of Science degrees in cybersecurity and mathematics, as well as a Bachelor of Arts in computer information systems and the Bachelor of Science degree in computer science. The Computer Science program is accredited by the Computing Accreditation Commission of ABET, https://www.abet.org. Minors are offered in mathematics and computer science.

Bachelors

- Computer Information Systems, Bachelor of Arts (https://academic-catalog.uscupstate.edu/cst/mcs/computer-information-systems-ba/)
- Computer Science, Bachelor of Science (https://academic-catalog.uscupstate.edu/cst/mcs/computer-science-bs/)
- Cybersecurity, Bachelor of Science (https://academic-catalog.uscupstate.edu/cst/mcs/cybersecurity-bs/)
- Data Science, Bachelor of Science (https://academic-catalog.uscupstate.edu/cst/mcs/data-science-bs/)
- Mathematics, Bachelor of Science (https://academic-catalog.uscupstate.edu/cst/mcs/mathematics-bs/)

Minors

- Computer Science Minor (https://academic-catalog.uscupstate.edu/cst/mcs/computer-science-minor/)
- Mathematics Minor (https://academic-catalog.uscupstate.edu/cst/mcs/mathematics-minor/)

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Sohrabi, Elham, Asst Professor

Summers, Victor, Asst Professor

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Zhang, Xudong "Jimmy", Asst Professor

Zhong, Wei, Asst Chair for Computer Science, Professor

Computer Science

CSCI U138 Introduction to Computer Technology 3 Credit Hours
Introduction to graphical user interface, word processing, spreadsheet, database, Internet, cross-platform training, computer components and peripherals, input/output concepts, storage concepts, and computer buyer's guide considerations.

CSCI U150 Introduction to Computer Science 3 Credit Hours
Current application, security and systems software, hardware devices, social and ethical issues in computing and information technology, propositional logic, search engines, and computer programming concepts. Basic problem solving, logic, and computer programming are introduced through an active learning environment.
Pre/Corequisite(s): MATH U126 or consent of instructor.

CSCI U200 Computer Science I 3 Credit Hours
Design, analysis and testing of algorithms and classes, including programming from an Object-Oriented perspective, simple data types, control structures, and arrays.

CSCI U210 Computer Organization 3 Credit Hours
Computer organization, logic gates and expressions, circuits, CPU, memory, numbering systems, assembly language programming, instruction formats, and addressing modes.
Prerequisite(s): Grade of C or better in CSCI U200; or consent of instructor.

CSCI U211 Information Systems Hardware and Software 3 Credit Hours
An introduction to computer and system architecture and operating systems for system development personnel. Topics include OS platforms, storage architectures, CPU architectures, instruction sets, memory, registers, input-output, and operating system modules such as process, memory, and file management.
Prerequisite(s): Grade of C or better in CSCI U200; or consent of instructor.

CSCI U236 Python Programming 3 Credit Hours
Introduction to Python Programming as an object-oriented language with concepts of OO programming, functions, selection statements, iteration statements, argument passing, strings, arrays, lists, dictionaries, files IO, dynamic typing, sequences, sets, assignments, multiple-target assignments, recursion, polymorphism and Python timing methods and tools.
Prerequisite(s): Grade of C or better in CSCI U200; or consent of instructor.

CSCI U238 C++ Programming 3 Credit Hours
Introduction to C++ as a second object-oriented language with concepts of OO programming, data abstraction, polymorphism, inheritance, graphical user interface design with MFC, and memory management issues.
Prerequisite(s): Grade of C or better in CSCI U200; or consent of instructor.

CSCI U300 Computer Science II 3 Credit Hours
Advanced design, analysis and testing of algorithms and classes, including inheritance, polymorphism, UML, complexity analysis, recursion, search and sorting techniques, linked lists, stacks and queues.
Prerequisite(s): Grade of C or better in CSCI U200; or consent of instructor.

CSCI U301 Computer Science, Data Science & Mathematics Career Catalyst 1 Credit Hour
An exploration of career development in computer science, cybersecurity, computer information systems, data science, and mathematics. Topics include self-assessment; career planning; use of professional networking and code hosting platforms; introduction to open-source coding projects; participation in professional networking events; development of resumes and personal statements; and job searching and interview skills.
Prerequisite(s): Grade of C or better in CSCI U200 or MATH U241.
Typically Offered: Upstate Fall Offering, Upstate Spring Offering

CSCI U310 Introduction to Computer Architecture 3 Credit Hours
Computer organization and architecture, basic processor design, hard wired and microprogrammed control, ALU, memory organization, data paths, pipelining, and interfacing and communications.
Prerequisite(s): Grade of C or better in CSCI U210; or consent of instructor.

CSCI U321 Computer Science III 3 Credit Hours
Design, analysis and testing of advanced data structures, including priority queues, trees, binary search trees, tree traversals and balancing techniques, hashing, and graph theory.
Prerequisite(s): Grade of C or better in both CSCI U300 and MATH U174; or consent of instructor.

CSCI U355 Digital Forensics 3 Credit Hours
Methods, tools and techniques used to maximize efficiency in investigations that involve digital devices, including malicious code analysis, techniques of evaluation of the physical memory of a compromised machine, digital forensics tools, challenges of anti-forensics phenomena, and use and management of storage area network technology for evidence storage.
Prerequisite(s): Grade of C or better in CSCI U300; or consent of instructor.

CSCI U375 Introduction to Cybersecurity 3 Credit Hours
Introduction of information security practices and needs including concepts of information security, types of attacks, risk analysis and management, security technologies, and basic information security implementation.
Prerequisite(s): Grade of C or better in CSCI U200; or consent of instructor.

CSCI U395 Internship 1-3 Credit Hours
Supervised practical experience related to the student's major in Computer Science, Computer Information Systems, or Cybersecurity in an elected setting planned in conjunction with the appropriate faculty member. The course may be applied for a maximum of three hours as an Upper Level Elective (CS/CIS) or Major Elective (Cybersecurity).
Prerequisite(s): Junior Standing or consent of instructor.
Typically Offered: Upstate Fall Offering, Upstate Spring Offering, Upstate Summer Offering

CSCI U399 Independent Study 1-9 Credit Hours
As needed.

CSCI U412 Introduction to Computer Networks and Security 3 Credit Hours
Basic concepts required to securely design, implement, maintain, and monitor networks. Topics covered include the OSI model, topologies, safety procedures, network addressing, VLANs, routing protocols, security protocols, security policies and hardware devices, security risks, physical vs. logical security, IoT security, packet sniffing, virtualization, and cloud computing.
Prerequisite(s): Grade of C or better in CSCI U200; or consent of instructor.

CSCI U421 Design and Analysis of Algorithms 3 Credit Hours
Concepts and fundamental strategies of algorithm design; the analysis of computing time and memory requirements; the theory of computational complexity (NP-hard and NP-complete); graph manipulation algorithms (connected components, minimum spanning trees, traveling salesman, cycles in a graph, and coloring of graphs); search algorithms (depth-first, breadth-first, best-first, and alpha-beta minimax); and computational algorithms (matrix multiplication, systems of linear equations, expression evaluation, and sorting).
Prerequisite(s): Grade of C or better in CSCI U321; or consent of instructor.

CSCI U450 E-Business Web Application Development 3 Credit Hours
A project-oriented course involving the complete application development of an online commercial Web site. Basic Web page design, including HTML and Style Sheets is covered, but the focus is on what happens behind the scenes of a business Web site, including client versus server-side information processing, CGI and Event-Driven programming, data transmission, storage and compressions, risk analysis, and security issues.
Prerequisite(s): Grade of C or better in CSCI U300; or consent of instructor.

CSCI U455 Computer Security 3 Credit Hours
A survey of the fundamentals of information security, including risks and vulnerabilities, policy formation, controls and protection methods, database security, encryption, authentication technologies, host-based and network-based security issues, personnel and physical security issues, issues of law and privacy.
Prerequisite(s): Grade of C or better in CSCI U300; or consent of instructor.

CSCI U456 Applied Cryptography 3 Credit Hours
Symmetric-key cryptography including Stream ciphers and Advanced Encryption Standard, password-based encryption, public-key cryptography, session-key encryption, digital signatures, hash functions and message authentication codes. The hands-on laboratories provide extensive practice on file encryption using public-key cryptography, password storage and authentication by message digest, utilization of key transport and key agreement to establish secure channel for socket programming and RSA encryption implementation.
Prerequisite(s): Grade of C or better in CSCI U321; or consent of instructor.

CSCI U499 Directed Research 3 Credit Hours
An investigation of technical papers from the instructor's area of research. The composition and presentation of technical papers that either survey the existing literature or make an original contribution to the research area is required.
Prerequisite(s): Grade of C or better in CSCI 300; or consent of instructor.

CSCI U509 Topics in Computer Science 3 Credit Hours
Selected topics of special interest in computer science. May be repeated for credit.
Prerequisite(s): Consent of instructor.

CSCI U511 Operating Systems 3 Credit Hours
Introduces the fundamentals of operating systems design and implementation, including an overview of the components of an operating system, mutual exclusion and synchronization, I/O, interrupts, implementation of processes, scheduling algorithms, memory management, and file systems.
Prerequisite(s): Grade of C or better in CSCI U210 and CSCI U321; or consent of instructor.

CSCI U512 Advanced Networking 3 Credit Hours
Wireless and mobile computing, integration of wireless and wired networks, networking cabling and infrastructure, network performance, recovery, interconnecting LANs and WANs, design and diagrams, packet transmission, datagram encapsulation and fragmentation, network security, and network troubleshooting.
Prerequisite(s): Grade of C or better in CSCI U412; or consent of instructor.

CSCI U515 Wireless Networks 3 Credit Hours
Fundamental concepts and techniques employed in wireless and mobile networks such as cellular networks, wireless LANs, and ad-hoc networks. Topics include wireless communication basics, access technologies, medium access control, naming and addressing, routing, mobility support and management, security, and power management.
Prerequisite(s): Grade of C or better in CSCI U412; or consent of instructor.

CSCI U516 Distributed and Network Programming 3 Credit Hours
Design and implementation of distributed application and network communication programs, including network application development with UCP and TCP/IP protocols, introduction to distributed systems and computing, RIM, socket programming, client/server models, and communication primitives, such as datagrams, packet retransmission, routing, addressing, error handling, and flow control.
Prerequisite(s): Grade of C or better in CSCI U321; or consent of instructor.

CSCI U520 Database System Design 3 Credit Hours
Database Management System (DBMS) architecture and organization, design and implementation of DBMS, data models, internal databases structures, conceptual modeling, data independence, data definition language, data manipulation language, normalization, transaction processing, recovery, and security.
Prerequisite(s): Grade of C or better in CSCI U300; or consent of instructor.

CSCI U521 Database Implementation, Application and Administration 3 Credit Hours
Design and implementation of database and client/server applications, in-depth treatments of embedded queries and stored procedures, database triggers, database extended languages, architectures and design patterns of distributed application, transaction processing, performance tuning, recovery and backups, auditing, and security.
Prerequisite(s): Grade of C or better in CSCI U520; or consent of instructor.

CSCI U525 Knowledge Discovery and Data Mining 3 Credit Hours
Extraction and discovery of knowledge from large databases, data integration and data warehousing, data mining algorithms, models, and applications including association rule mining information retrieve (IR) and mining of text databases, decision tree, decision rules, classification techniques, cluster analysis, and evaluation, visualization, and interpretation of patterns.
Prerequisite(s): Grade of C or better in CSCI U300; or consent of instructor.

CSCI U530 Programming Language Structures 3 Credit Hours
Paradigms and fundamental concepts of programming languages, such as scope, binding, abstraction, encapsulation, typing, and language syntax and semantics. Functional and logic programming paradigms are also introduced through sample programming languages.
Prerequisite(s): Grade of C or better in CSCI U210 and CSCI U321; or consent of instructor.

CSCI U540 Software Engineering 3 Credit Hours
Methods and tools of software engineering, software life cycle, iterative development processes including the Agile Method and Unified Process, object oriented analysis and design of software, software testing, cost and effort estimation, project management, risk analysis, and documentation. A relatively large software system is developed in a team environment.
Prerequisite(s): Grade of C or better in CSCI U321; or consent of instructor.

CSCI U555 Advanced Computer Security and Information Assurance 3 Credit Hours
Cryptography, telecommunication and network security, applications and system development security, Business Continuity Planning (BCP), cyber-crimes and countermeasures. The hands-on laboratories provide extensive practices on firewalls, Virtual Private Networks (VPN), Intrusion Detection Systems (IDS), and other computer security tools.
Prerequisite(s): Grade of C or better in CSCI U412 and CSCI U455; or consent of instructor.

CSCI U560 Numerical Analysis 3 Credit Hours
Difference calculus, direct and interactive techniques for matrix inversion, eigen value problems, numerical solutions of initial value problems in ordinary differential equations, stability, error analysis, and laboratory applications.
Prerequisite(s): MATH U245 and MATH U344, and programming competency.

CSCI U570 Network Security 3 Credit Hours
Introduction and analysis of IP security, in-depth technical treatment of authentication, email security, web security, network management security, intruders, malicious software, and firewalls.
Prerequisite(s): Grade of C or better in CSCI U375 and CSCI U412; or consent of instructor.

CSCI U575 Applied Cybersecurity 3 Credit Hours
Introduction to practical concepts and principles of personal, organizational, and national cybersecurity, including hands-on labs and examples in computer security, network security, web security, encryption, security policies, countering cyber stalking, social engineering, fraud and abuse, malware, computer viruses, techniques used by hackers, and how to detect and combat cyber threats.
Prerequisite(s): Grade of C or better in CSCI U375; or consent of instructor.

CSCI U580 Introduction to Artificial Intelligence 3 Credit Hours
Intelligent agents, expert systems, heuristic searching, knowledge representation and reasoning, artificial neural networks, ontologies, and natural language processing.
Prerequisite(s): Grade of C or better in CSCI U321; or consent of instructor.

CSCI U599 Computer Science Senior Seminar 3 Credit Hours
Integration of knowledge at an advanced level, a review of recent developments in theoretical and applied computer science, the exploration of ethical issues, along with research and oral presentation.
Prerequisite(s): 12 hours of 300 level or above computer science courses; and consent of instructor.

Mathematics

MATH U102 Elementary Statistics 3 Credit Hours
The fundamentals of modern statistical methods, descriptive and inferential statistics, probability and sampling; primarily for students in fields other than mathematics who need a working knowledge of statistics.
Prerequisite(s): High school Algebra I and II, or equivalent.

MATH U120 College Mathematics 3 Credit Hours
Linear equations and inequalities, exponential equations, mathematics of finance, fundamental set theory, fundamentals of probability and statistics. This course may not be used to satisfy any prerequisite requirement for higher-numbered mathematics courses.
Prerequisite(s): Appropriate score on placement test and high school Algebra I and II.

MATH U120A College Mathematics with Lab 3 Credit Hours
Linear equations and inequalities, exponential equations, mathematics of finance, fundamental set theory, fundamentals of probability and statistics. This course may not be used to satisfy any prerequisite requirement for higher-numbered mathematics courses.
Prerequisite(s): Appropriate score on placement test and high school Algebra I and II.

MATH U121 College Algebra 3 Credit Hours
Equations and inequalities, graphing, polynomial, rational, exponential, logarithmic, and other functions; matrices and systems of equations. Only one of MATH U121 and MATH U126 may be used to satisfy a mathematics requirement for general education or major credit. For students who need a more intensive study, an expanded version of college algebra (MATH U121A) is available. MATH U121A is open to students who have an appropriate score on the placement test, have completed MATH U120 with the mandatory lab, or if the student, in consultation with his or her advisor, determines that extra instruction is needed in order to succeed in MATH U121.
Prerequisite(s): appropriate score on placement test and high school Algebra I and II.
Cross-Listed: MATH U121A

MATH U121A College Algebra 3 Credit Hours
Equations and inequalities, graphing, polynomial, rational, exponential, logarithmic, and other functions; matrices and systems of equations. Only one of MATH U121 and MATH U126 may be used to satisfy a mathematics requirement for general education or major credit.
Prerequisites: Appropriate score on placement test and high school Algebra I and II. For students who need a more intensive study, an expanded version of College Algebra (MATH U121A) is available.
Prerequisite(s): Appropriate score on the placement test, have completed MATH U120A, or if the student, in consultation with her or her advisor, determines that extra instruction is needed in order to succeed in MATH U121.
Cross-Listed: MATH U121

MATH U122 Calculus for Management and Social Sciences 3 Credit Hours
Derivatives and integrals of elementary algebraic, exponential and logarithmic functions; maxima, minima, rate of change, area under a curve, and volume. Problems and examples are drawn from a variety of areas which include economics, psychology, biology, geography, and geology.
Prerequisite(s): MATH U121, or MATH U126; or eligibility for exemption from MATH U121.

MATH U126 Precalculus I 3 Credit Hours
Subsets of the real number line; polynomial, rational, absolute value, exponential and logarithmic relations and functions. Only one of MATH U121 and MATH U126 may be used to satisfy a mathematics requirement for general education or major credit.
Prerequisite(s): Appropriate score on placement test and three years of college preparatory mathematics.

MATH U127 Precalculus II 3 Credit Hours
Trigonometric functions, trigonometric identities, solution of equations and triangles, inverse trigonometric functions, vectors, polar coordinates; analytic geometry.
Prerequisite(s): Appropriate score on placement exam or consent of instructor.
Pre/Corequisite(s): MATH U126.

MATH U141 Calculus I 4 Credit Hours
Limits, continuity, the derivative, differentiation with applications in the natural sciences and engineering, antiderivatives, basic integrals with applications.
Prerequisite(s): Appropriate score on placement test and 4 years of college preparatory mathematics including Trigonometry; or grade of C or better in both MATH U126 and MATH U127; or consent of instructor.

MATH U142 Calculus II 4 Credit Hours
Applications of integration, techniques of integration, differential equations, parametric equations, and finite sequences and series.
Prerequisite(s): MATH U141 or its equivalent.

MATH U174 Elements of Discrete Mathematics 3 Credit Hours
Topics in basic logic; proof techniques; sets, relations, and functions; counting; and elementary number theory.
Prerequisite(s): High school Precalculus; or MATH U126 or equivalent; or consent of instructor.

MATH U202 Elementary Statistics II 3 Credit Hours
An expansion of topics taught in the first semester of elementary statistics such as hypothesis testing; inferences; correlation and regression. Additional topics to be covered include: multinomial experiments and contingency tables; analysis of variance; statistical process control; and individual projects.
Prerequisite(s): MATH U102, or ECON U291, or SOCY U201, or PSYC U225.

MATH U231 Basic Concepts of Elementary Mathematics I 3 Credit Hours
The meaning of number, fundamental operations of arithmetic, the structure of the real number system and its subsystems, elementary number theory. Open only to students in early childhood, elementary, middle grades, or special education.
Prerequisite(s): Grade of C or better in MATH U121 or higher, not including statistics; or consent of instructor.

MATH U232 Basic Concepts of Elementary Mathematics II 3 Credit Hours
A continuation of the development of the real number system and its subsystems, basic concepts of probability, and elementary data analysis. Open only to students in early childhood, elementary, middle grades, or special education.
Prerequisite(s): Grade of C or better in MATH U231 or consent of instructor.

MATH U233 Geometry and Measurement 3 Credit Hours
A study of properties and relationships of shape, size, and symmetry in two and three dimensions; explorations of concepts of motion in two and three dimensions through transformations. Open only to students in early childhood, elementary, middle grades, or special education.
Prerequisite(s): Grade of C or better in MATH U231 or higher; or consent of instructor.

MATH U241 Calculus III 4 Credit Hours
Vectors and geometry of space, vector functions, partial derivatives, multiple integration, vector calculus and second order differential equations.
Prerequisite(s): Grade of C or better in MATH U142 or its equivalent; or consent of instructor.

MATH U245 Elementary Differential Equations 3 Credit Hours
Ordinary differential equations of first order, higher order linear equations, Laplace transform methods, series methods; numerical solutions of differential equations; applications to the physical sciences and engineering.
Prerequisite(s): MATH U241.

MATH U255 MATLAB Programming 3 Credit Hours
Programming language and techniques designed specifically for programs that rely on the application of mathematics for solution. Topics include variables, assignment statements, expressions, vectors and matrices, MATLAB scripts, input and output, selection statements, flow control, program organization, M-files, optimizing M-files, string manipulations, data structures, advanced functions, plotting, symbolic math toolboxes, variable precision arithmetic, and tricks and tips in MATLAB programming.
Prerequisite(s): MATH U141 or consent of instructor.

MATH U315 Statistical Methods I 3 Credit Hours
Review of descriptive statistics, testing statistical hypothesis, introduction to correlation, regression and linear regression models, model building, variable selection and model diagnostics.
Prerequisite(s): MATH U102, or MATH U141, or ECON U291, or SOCY U201, or PSYC U225, or consent of instructor.

MATH U320 Mathematical Modeling 3 Credit Hours
Graphs of functions as models, modeling using proportionality and geometric similarity, model fitting and models requiring optimization, experimental modeling, modeling using the derivative and interactive dynamic systems.
Prerequisite(s): MATH U141.

MATH U340 Mathematical Structures and Proof 3 Credit Hours
Topics in set theory, logic, elementary application of logic, methods of mathematical proofs, equivalence relations and partial orderings, functions and mappings, and number systems.
Prerequisite(s): MATH U142.

MATH U344 Linear Algebra I 3 Credit Hours
Matrices, systems of linear equations, vectors, Euclidean vector spaces, linear transformations, eigenvalues and eigenvectors.
Prerequisite(s): MATH U142 or consent of instructor.

MATH U345 Applied Partial Differential Equations 3 Credit Hours
Basic linear Partial Differential Equations (PDEs) of hyperbolic, parabolic, and elliptic types used in mathematical modeling of physical, chemical, biological and other phenomena, systems, technical devices and financial markets. Selected topics such as the boundary value and initial value problems are covered.
Prerequisite(s): Grade of C or better in MATH U245; or consent of instructor.

MATH U346 Modern Algebra I 3 Credit Hours
Group theory and introduction to rings. Topics include abelian groups, cyclic groups, permutations, group homomorphisms and isomorphisms, Cayley's theorem, normal subgroups, quotient groups, Lagrange's theorem.
Prerequisite(s): MATH U340 or consent of instructor.

MATH U354 Real Analysis I 3 Credit Hours
Ordered field properties of the real number system; completeness; theory of limits of sequences, series and functions; continuity (including uniform continuity); introduction to theory of the derivative.
Prerequisite(s): MATH U340 or consent of instructor.

MATH U374 Theory of Discrete Mathematics 3 Credit Hours
Topics selected from theoretical Boolean algebra, algebraic structures, theory of computing, advanced set theory, and recursive functions.
Prerequisite(s): MATH U142, MATH U174, or consent of instructor.

MATH U395 Internship 1-3 Credit Hours
Supervised practical experience related to the student's major in Mathematics in an elected setting planned in conjunction with the appropriate faculty member. The course may only be applied for a maximum of three hours as an Upper Level Elective.
Prerequisite(s): Junior Standing or consent of instructor.
Typically Offered: Upstate Fall Offering, Upstate Spring Offering, Upstate Summer Offering

MATH U399 Independent Study 1-9 Credit Hours

MATH U444 Elements of Optimization 3 Credit Hours
The methods of the numerical solutions of optimization problems arising in operational research, logistics, economics, etc. Emphasis is on the simplex and Karmarkar's polynomial-time method.
Prerequisite(s): Grade of C or better in both MATH U241 and MATH U344; or consent of instructor.

MATH U501 History of Mathematics 3 Credit Hours
A survey of the major developments and procedures of mathematics, from its origins to the modern era, relating development with the diverse cultures and the aspects of mathematics they contributed.
Prerequisite(s): MATH U142 or consent of instructor.

MATH U531 Foundations of Geometry 3 Credit Hours
Geometry as a logical system based upon postulates and undefined terms; fundamental concepts and relations of Euclidean geometry developed rigorously on the basis of a set of postulates; some topics from non-Euclidean geometry.
Prerequisite(s): MATH U340 or consent of instructor.

MATH U544 Linear Algebra II 3 Credit Hours
Vector spaces, and subspaces; bases and dimension; change of basis; linear transformations and their matrices; diagonalization; canonical forms; bilinear forms; eigenspaces.
Prerequisite(s): MATH U340 and MATH U344.

MATH U546 Modern Algebra II 3 Credit Hours
Advanced topics in groups, rings and fields. These topics include p-groups, polynomial rings, ideals, integral domains, extension fields, isomorphism theorems for groups and rings.
Prerequisite(s): MATH U346.

MATH U552 Complex Variables 3 Credit Hours
Complex numbers and functions, complex integration, Taylor and Laurent series, residues, and conformal mapping.
Prerequisite(s): MATH U340 or consent of instructor.

MATH U554 Real Analysis II 3 Credit Hours
Further development of the theory of differential and integral calculus including properties of the derivative and integral, Fundamental Theorem of Calculus, sequences and series of functions.
Prerequisite(s): MATH U354.

MATH U560 Numerical Analysis I 3 Credit Hours
Difference calculus; direct and iterative techniques for matrix inversion; eigenvalue problems; numerical solutions of initial value problems in ordinary differential equations; stability; error analysis; laboratory applications.
Prerequisite(s): MATH U245, MATH U344 and programming competency.

MATH U561 Numerical Analysis II 3 Credit Hours
The finite-difference and finite element methods for the numerical solution of basic linear Partial Differential Equations (PDEs) arising in mathematical modeling of physical, chemical, biological and other phenomena, systems, technical devices and financial markets.
Prerequisite(s): Grade of C or better in both MATH U345 and MATH U560; or consent of instructor.

MATH U579 Introduction to Industrial Mathematics 3 Credit Hours
Basic applications of PDEs, numerical methods for PDEs and scientific computing to applied problems arising in the natural sciences, industry, and financial engineering. Emphasis is on the formulation and solution of problems of heat transfer and diffusion equations, Maxwell's equations and differential equations governing the financial derivatives.
Prerequisite(s): Grade of C or better in both MATH U345 and MATH U561; or consent of instructor.

MATH U598 Topics in Mathematics 3 Credit Hours
Intensive study in an area of pure or applied mathematics such as mathematical modeling. Topics are selected to meet current faculty and student interest.
Prerequisite(s): MATH U241 and consent of instructor.

MATH U599 Seminar in Mathematics 3 Credit Hours
Recent developments in pure and applied mathematics at an advanced level; ethical issues; and experience in research and oral presentation.
Prerequisite(s): Senior standing.
Pre/Corequisite(s): MATH U344, MATH U346, and MATH U315.

Statistics

STAT U301 Statistical Computing 3 Credit Hours
Data entry, sorting and merging, data summarization, graphical display, reports, and statistical inferences using statistical software.
Prerequisite(s): Any college-level statistics or consent of instructor.

STAT U410 Introduction to Probability Theory 3 Credit Hours
Laws of probability and sample space; discrete and continuous distributions; joint, marginal and conditional densities; moment generating functions; univariate and bivariate normal distribution.
Prerequisite(s): Grade of C or better in MATH U142; or consent of instructor.

STAT U413 Introduction to Stochastic Processes 3 Credit Hours
Markov chains; Poisson processes; introductory renewal theory, Brownian motion and stationary processes used in mathematical modelling.
Prerequisite(s): Grade of C or better in STAT U410; or consent of instructor.

STAT U512 Mathematical Statistics 3 Credit Hours
A comprehensive development of statistical analysis that builds upon a knowledge of probability and basic statistics. Topics include sampling distributions, interval and point estimation, the law of large numbers, limiting distributions, testing hypotheses and order statistics.
Prerequisite(s): STAT U410 or consent of instructor.

STAT U516 Statistical Methods II 3 Credit Hours
More advanced development of solutions to problems involving statistics. Topics include experimental design, analysis of variance, analysis of covariance, multiple linear regression, curvilinear regression, and logistic regression.
Prerequisite(s): MATH U315; or both ECON U291 and ECON U292; or consent of instructor.

STAT U598 Topics in Statistics 3 Credit Hours
Intensive study in a specialized area of statistics. Selected topic is based on student interest and faculty expertise.
Prerequisite(s): MATH U315 or consent of instructor.

STAT U599 Seminar in Statistics 3 Credit Hours
Integration of knowledge at an advanced level, a review of recent developments and models in theoretical and applied statistics, along with research and oral presentation.
Prerequisite(s): STAT U301 and MATH U315; or consent of instructor.