COMPUTER SCIENCE AND ENGINEERING (CSCE)

CSCE 801 Introduction to Programming
Notes: This course does not count towards any graduate program in the School of Computing.
Description: Provides an introduction to programming for graduate students with no prior experience. Covers the fundamentals of programming, focusing on logical problem-solving, code structure, and best practices for software development in academic research. Students will primarily use Python, a versatile language suited for both general-purpose programming and scientific computing.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Offered: FALL/SPR

CSCE 802 Data Structures and Algorithms
Prerequisites: A grade of "Pass" or "C" or better in CSCE 155A, CSCE 155E, CSCE 155H, CSCE 155N, or CSCE 155T.
Notes: This course does not count towards any graduate program in the School of Computing.
Description: Introductory course on algorithms and data structures for students with diverse non-CS backgrounds but interested in informatics. Foundational coverage of data structures includes lists, tables, trees, graphs, and multidimensional arrays, while the foundational coverage of algorithms includes both problems (such as indexing, searching, sorting, pattern matching, graph reachability) and methods (such as divide-and-conquer, dynamic programming, and greedy). Advanced techniques in data management and analysis and problem solving will be studied in the context of informatics applications. Specifically, covers the fundamental ideas for efficient analysis of bio-sequences, images, and network data.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Offered: FALL/SPR
Prerequisite for: CSCE 417, CSCE 817; CSCE 420, CSCE 820; CSCE 422, CSCE 822; CSCE 877

CSCE 805T Introduction to Computer Science I for Teachers
Notes: This course does not count towards a graduate degree in Computer Science or Computer Engineering.
Description: Introduction to problem solving with computers for teachers. Topics include problem solving methods, software development principles, computer programming, computing in society, and teaching practices for K-12 computer science courses.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Offered: SUMMER
Prerequisite for: CSCE 806T

CSCE 806T Introduction to Computer Science II for Teachers
Prerequisites: A grade of "P" or "C" or better in CSCE 805T
Notes: Mathematical courses through trigonometry expected. This course does not count towards a graduate degree in Computer Science or Computer Engineering.
Description: Data structures, including linked lists, stacks, queues, and trees; algorithms, including searching, sorting, and recursion; programming language topics, including object-oriented programming; pointers, references, and memory management; design and implementation of a multi-layer application with an SQL database; and teaching practices for K-12 computer science courses.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Offered: SUMMER

CSCE 810 Information Retrieval Systems
Crosslisted with: CSCE 410
Prerequisites: A grade of "P" or "C" or better in CSCE 310, CSCE 310H, CSCE 311, SOFT 260, SOFT 260H or RAIK 283H.
Description: Outline of the general information retrieval problem, functional overview of information retrieval. Deterministic models of information retrieval systems; conventional Boolean, fuzzy set theory, p-norm, and vector space models. Probabilistic models. Text analysis and automatic indexing. Automatic query formulation. System-user adaptation and learning mechanisms. Intelligent information retrieval. Retrieval evaluation. Review of new theories and future directions. Practical experience with a working experimental information retrieval system.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Offered: SPRING

CSCE 811 Data Modeling for Systems Development
Crosslisted with: CSCE 411
Prerequisites: A grade of "P" or "C" or better in CSCE 310, CSCE 310H, CSCE 311, SOFT 260, SOFT 260H or RAIK 283H.
Description: Concepts of relational and object-oriented data modeling through the process of data model development including conceptual, logical and physical modeling. Techniques for identifying and creating relationships between discrete data members, reasoning about how data modeling and analysis are incorporated in system design and development, and specification paradigms for data models. Common tools and technologies for engineering systems and frameworks for integrating data. Design and analysis of algorithms and techniques for identification and exploration of data relationships, such as Bayesian probability and statistics, clustering, map-reduce, and web-based visualization.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option

CSCE 812 Data Visualization
Crosslisted with: CSCE 412
Prerequisites: A grade of "P" or "C" or better in CSCE 310, CSCE 310H, CSCE 311, SOFT 260, SOFT 260H or RAIK 283H; MATH 314.
Description: Fundamentals and implementations of data visualization techniques. Programming skills and practices in interactive visualization applications. Visualization foundations, human perception for information processing, and visualization techniques for different data types, such as scalar-field data, vector-field data, geospatial data, multivariate data, graph/network data, and text/document data. Advanced visualization algorithms and topics as time permits.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Offered: FALL/SPR

CSCE 813 Database Systems
Crosslisted with: CSCE 413
Prerequisites: A grade of "P" or "C" or better in CSCE 310, CSCE 310H, CSCE 311, SOFT 260, SOFT 260H or RAIK 283H.
Notes: Involves practical experience with a working database system.
Description: Data and storage models for database systems; entity/relationship, relational, and constraint models; relational databases; relational algebra and calculus; structured query language; Logical database design: normalization; integrity; distributed data storage; concurrency; security issues. Spatial databases and geographic information systems.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Prerequisite for: CSCE 913; CSCE 914
Course and Laboratory Fee: $40

CSCE 815 Computational Linguistics
Crosslisted with: CSCE 415
Prerequisites: Standing of junior class or above; one of CSCE 310, CSCE 311 or SOFT 260.
Description: Covers the fundamentals of language modeling, parsing, machine translation, computational and statistical methods in comparative linguistics, laws of phonological change and language evolution, language families and script families, ancient scripts, computational methods for script comparison and the analysis of script evolution.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Offered: FALL/SPR
Prerequisite for: CSCE 915

CSCE 817 Artificial Intelligence For Social Good
Crosslisted with: CSCE 417
Prerequisites: A grade of "P" or "C" or better in CSCE 310, CSCE 310H, CSCE 311, SOFT 260, SOFT 260H or RAIK 283H. Graduate prerequisite CSCE 802.
Description: Analyzes studies that address societal challenges through machine learning (ML) and, more broadly, artificial intelligence (AI). Focuses on selected research categorized under AI for Social Good (AI4SG), spanning areas such as agriculture, education, environmental sustainability, healthcare, social care, public safety, and transportation.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Offered: FALL/SPR

CSCE 820 Introduction to Natural Language Processing
Crosslisted with: CSCE 420
Prerequisites: A grade of "P" or "C" or better in CSCE 310, CSCE 310H, CSCE 311, SOFT 260, SOFT 260H or RAIK 283H. Graduate prerequisite: CSCE 802.
Description: Introduction to fundamental concepts and techniques in Natural Language Processing.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Offered: FALL/SPR

CSCE 821 Foundations of Constraint Processing
Crosslisted with: CSCE 421
Prerequisites: A grade of "P" or "C" or better in CSCE 235 and CSCE 310, CSCE 310H, CSCE 311, SOFT 260, SOFT 260H or RAIK 283H.
Description: Constraint processing for articulating and solving industrial problems such as design, scheduling, and resource allocation. The foundations of constraint satisfaction, its basic mechanisms (e.g., search, backtracking, and consistency-checking algorithms), and constraint programming languages. New directions in the field, such as strategies for decomposition and for symmetry identification.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Prerequisite for: CSCE 921
Course and Laboratory Fee: $10

CSCE 822 Introduction to Computational Game Theory
Crosslisted with: CSCE 422
Prerequisites: A grade of "P" or "C" or better in CSCE 310, CSCE 310H, CSCE 311, SOFT 260, SOFT 260H or RAIK 283H. Graduate prerequisite CSCE 802.
Description: Introduction to essential tools for modeling and analyzing strategic interactions between self-interested agents. Covers key solution concepts used to predict decision-making behavior and examines the computational aspects of these solutions. Explores applications of game theory in areas such as security and social sciences.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Offered: SPRING

CSCE 823 Design and Analysis of Algorithms
Crosslisted with: CSCE 423
Prerequisites: A grade of "P" or "C" or better in CSCE 310, CSCE 310H, CSCE 311, SOFT 260, SOFT 260H or RAIK 283H.
Description: Mathematical preliminaries. Strategies for algorithm design, including divide-and-conquer, greedy, dynamic programming and backtracking. Mathematical analysis of algorithms. Introduction to NP-Completeness theory, including the classes P and NP, polynomial transformations and NP-complete problems.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Prerequisite for: CSCE 923; CSCE 924
Course and Laboratory Fee: $20

CSCE 824 Computational Complexity Theory
Crosslisted with: CSCE 424
Prerequisites: A grade of "P" or "C" or better in CSCE 310, CSCE 310H, CSCE 311, SOFT 260, SOFT 260H or RAIK 283H.
Description: Turing machine model of computation: deterministic, nondeterministic, alternating, probabilistic. Complexity classes: Time and space bounded, deterministic, nondeterministic, probabilistic. Reductions and completeness. Complexity of counting problems. Non-uniformity. Lower bounds. Interactive proofs.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option

CSCE 825 Compiler Construction
Crosslisted with: CSCE 425
Prerequisites: A grade of "P" or "C" or better in CSCE 310, CSCE 310H, CSCE 311, SOFT 260, SOFT 260H or RAIK 283H.
Description: Review of program language structures, translation, loading, execution, and storage allocation. Compilation of simple expressions and statements. Organization of a compiler including compile-time and run-time symbol tables, lexical scan, syntax scan, object code generation, error diagnostics, object code optimization techniques, and overall design.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Course and Laboratory Fee: $20

CSCE 828 Automata, Computation, and Formal Languages
Crosslisted with: CSCE 428
Prerequisites: A grade of "P" or "C" or better in CSCE 310, CSCE 310H, CSCE 311, SOFT 260, SOFT 260H or RAIK 283H.
Description: Introduction to the classical theory of computer science. Finite state automata and regular languages, minimization of automata. Context free languages and pushdown automata, Turing machines and other models of computation, undecidable problems, introduction to computational complexity.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Course and Laboratory Fee: $20

CSCE 829 Information Theory
Crosslisted with: CSCE 429
Prerequisites: A grade of "P" or "C" or better in CSCE 310, CSCE 310H, CSCE 311, SOFT 260, SOFT 260H or RAIK 283H; STAT 380, ECEN 305 or RAIK 270H.
Description: Deals with the foundations of information theory, as well as the more practical aspects of information coding. Information measures are first introduced, and then applied to the analysis of the theoretical performance achievable in data compression and propagation over noisy channels.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Offered: SPRING

CSCE 830 Computer Architecture
Crosslisted with: CSCE 430
Prerequisites: A grade of "P" or "C" or better in CSCE 310, CSCE 310H, CSCE 311, SOFT 260, SOFT 260H or RAIK 283H; Coreq: STAT 380, ECEN 305 or RAIK 270H.
Description: Architecture of single-processor (Von Neumann or SISD) computer systems. Evolution, design, implementation, and evaluation of state-of-the-art systems. Memory Systems, including interleaving, hierarchies, virtual memory and cache implementations; Communications and I/O, including bus architectures, arbitration, I/O processors and DMA channels; and Central Processor Architectures, including RISC and Stack machines, high-speed arithmetic, fetch/execute overlap, and parallelism in a single-processor system.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Course and Laboratory Fee: $20

CSCE 831 Hardware and Software Acceleration for Machine Learning
Crosslisted with: CSCE 431
Prerequisites: A grade of "P" or "C" or better in CSCE 230 or CSCE 231 and CSCE 310, CSCE 310H, CSCE 311, SOFT 260, SOFT 260H or RAIK 283H.
Description: Overview of the hardware and software acceleration techniques, including basics of deep learning, deep learning frameworks, hardware accelerators, co-optimization of algorithms and hardware, training and inference, support for state-of-the-art deep learning networks.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Offered: FALL

CSCE 835 Cluster and Grid Computing
Crosslisted with: CSCE 435
Prerequisites: A grade of "P" or "C" or better in CSCE 310, CSCE 310H, CSCE 311, SOFT 260, SOFT 260H, or RAIK 283H.
Notes: Designed for CSCE and non-CSCE students who have an interest in building or programming clusters to enhance their computationally-intense research.
Description: Build and program clusters. Cluster construction, cluster administration, cluster programming, and grid computing.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option

CSCE 836 Advanced Embedded Systems
Crosslisted with: CSCE 436
Prerequisites: A grade of "P" or "C" or better in CSCE 231, CSCE 336 or ECEN 220.
Description: Embedded hardware design techniques; transceiver design and low-power communication techniques; sensors and distributed sampling techniques; embedded software design and embedded operating systems; driver development; embedded debugging techniques;hardware and software architectures of embedded systems; and design, development, and implementation of embedded applications.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Course and Laboratory Fee: $40

CSCE 838 Internet of Things
Crosslisted with: CSCE 438
Prerequisites: CSCE 230 or CSCE 231; SOFT 260, CSCE 310, CSCE 310H, CSCE 311 or equivalent; senior or graduate standing or instructor permission.
Description: Theoretical and practical insight into the Internet of Things (IoT). Basics of IoT, including devices and sensors, connectivity, cloud processing and storage, analytics and machine learning, security, business models as well as advanced topics such as localization, synchronization, connected vehicles, and applications of IoT. Includes a group project that provides hands-on interaction with IoT.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Course and Laboratory Fee: $20

CSCE 839 Robotics: Algorithms and Applications
Crosslisted with: CSCE 439
Prerequisites: A grade of "P" or "C" or better in CSCE 231, CSCE 336 or ECEN 220 and CSCE 310, CSCE 310H, CSCE 311, SOFT 260, SOFT 260H or RAIK 283H
Description: Fundamental theory and algorithms for real world robot systems. Design and build a robot platform and implement algorithms in C++ or other high level languages. Topics include: open and closed loop control, reactive control, localization, navigation, path planning, obstacle avoidance, dynamics, kinematics, manipulation and grasping, sensing, robot vision processing, and data fusion.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Offered: FALL/SPR
Course and Laboratory Fee: $50

CSCE 840 Numerical Analysis I
Crosslisted with: CSCE 440, MATH 440, MATH 840
Prerequisites: CSCE 155A, CSCE 155E, CSCE 155H, CSCE 155N, CSCE 155T, or SOFT 160; MATH 107. Credit toward the degree may be earned in only one of the following: CSCE440/MATH 440 and MECH 480
Description: Principles of numerical computing and error analysis covering numerical error, root finding, systems of equations, interpolation, numerical differentiation and integration, and differential equations. Modeling real-world engineering problems on digital computers. Effects of floating point arithmetic.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Prerequisite for: CSCE 942
Course and Laboratory Fee: $20

CSCE 843 Cybersecurity for Big Data, Cloud and Cryptocurrencies
Crosslisted with: CSCE 443
Prerequisites: A grade of "P" or "C" or better in CSCE 310, CSCE 310H, CSCE 311, SOFT 260, SOFT 260H or RAIK 283H.
Notes: Labs will be conducted on academic cloud and compute environments as well as public clouds.
Description: Covers the cybersecurity threat landscape and the mitigation strategies for Big Data, Cloud environments and Cryptocurrencies. Discusses emerging technologies and frameworks such as End-to-end encryption, Blockchains, Smart Contracts, OpenID Connect and OAuth2.0 as promising solutions to ensure data confidentiality and privacy.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Offered: FALL

CSCE 845 Eye Tracking in Usability and Software Engineering
Crosslisted with: CSCE 445
Prerequisites: SOFT 261 or CSCE 361.
Description: Create and evaluate new and existing human computer interfaces in the context of software engineering. Interdisciplinary applications of eye tracking in various areas of software engineering, biometrics, and psychology among others will be presented. Learn how to design, conduct, and analyze a technically sound eye tracking empirical study for software engineering problems in a group setting.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Offered: SPRING

CSCE 851 Operating Systems Principles
Crosslisted with: CSCE 451
Prerequisites: A grade of "P" or "C" or better in CSCE 230 or CSCE 231 and CSCE 310, CSCE 310H, CSCE 311, SOFT 260, SOFT 260H or RAIK 283H.
Description: Organization and structure of operating systems. Control, communication, and synchronization of concurrent processes. Processor and job scheduling. Memory organization and management including paging, segmentation, and virtual memory. Resource management. Deadlock avoidance, detection, recovery. File system concepts and structure. Protection and security. Substantial programming.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Prerequisite for: CSCE 455, CSCE 855
Course and Laboratory Fee: $20

CSCE 854 Human-Robot Interaction
Crosslisted with: CSCE 454
Prerequisites: A grade of "P" or "C" or better in CSCE 156, CSCE 156H, SOFT 161, SOFT 161H, RAIK 184H or CSCE 311.
Notes: Meeting ACE1 and ACE2 requirements prior to taking this course is recommended. Non-CSCE majors may discuss qualifications with the instructor.
Description: Introduction to the area of human-robot interaction through the reading and discussion of current peer-reviewed articles on topic to include teleoperation, social robotics, and open questions with field-based or aerial robotic systems. Areas covered include: research methods, experimental design, and identification of problems/open questions.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Offered: FALL/SPR

CSCE 855 Distributed Operating Systems
Crosslisted with: CSCE 455
Prerequisites: CSCE 451/851.
Description: Organization and structure of distributed operating systems. Control, communication and synchronization of concurrent processes in the context of distributed systems. Processor allocation and scheduling. Deadlock avoidance, detection, recovery in distributed systems. Fault tolerance. Distributed file system concepts and structure.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Prerequisite for: CHME 496, CHME 896
Course and Laboratory Fee: $20

CSCE 856 Parallel Programming
Crosslisted with: CSCE 456
Prerequisites: A grade of "P" or "C" or better in CSCE 310, CSCE 310H, CSCE 311, SOFT 260, SOFT 260H, or RAIK 283H.
Description: Introduction to the fundamentals of parallel computation and applied algorithm design. Methods and models of modern parallel computation; general techniques for designing efficient parallel algorithms for distributed and shared memory multiprocessor machines; principles and practice in programming an existing parallel machine.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Course and Laboratory Fee: $10

CSCE 857 Systems Administration
Crosslisted with: CSCE 457
Prerequisites: A grade of "P" or "C" or better in CSCE 310, CSCE 310H, CSCE 311, SOFT 260, SOFT 260H or RAIK 283H.
Description: Introduction to basic concepts of system administration. Operating systems and networking overview. User and resource management. Networking, systems and internet related security. System services and common applications, web services, database services, and mail servers. Basic scripting in shell, Perl, and Expect. Systems administration on UNIX® platform.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option

CSCE 858 Molecular and Nanoscale Communication
Crosslisted with: CSCE 458
Prerequisites: A grade of "P" or "C" or better in CSCE 310, CSCE 310H, CSCE 311, SOFT 260, SOFT 260H or RAIK 283H; STAT 380, ECEN 305 or RAIK 270H.
Notes: Completing CSCE 462/862 and CSCE 465/865 prior to taking this course is recommended. Exceptions can be granted on a per-student basis by the instructor.
Description: Overview of nanoscale communication options. Focus on bio-inspired communication through molecule exchange and biochemical reactions. Different techniques to realize nanomachines will be surveyed in the course, with particular attention to the tools provided by synthetic biology for the programming of biological cooperative systems.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Offered: FALL/SPR

CSCE 859 Genetically Engineered Systems
Crosslisted with: CSCE 459
Prerequisites: A grade of "P" or "C" or better in CSCE 310, CSCE 310H, CSCE 311, SOFT 260, SOFT 260H or RAIK 283H; STAT 380, ECEN 305 or RAIK 270H.
Notes: Completing CSCE/MATH 440/840, MATH 439/839, and CSCE 471/871 prior to taking this course is recommended. Exceptions can be granted on a per-student basis by the instructor. Meeting ACE 1 and ACE 2 requirements prior to taking this course is recommended. Non-CSCE majors may discuss qualifications with the instructor.
Description: Introduction to the field of synthetic biology, and its interdisciplinary foundational concepts. Presents the technologies at the basis of synthetic biology, together with the engineering concepts that underlie the design, modeling, and realization of genetically engineered systems. Surveys examples of cutting edge applications.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Offered: FALL/SPR

CSCE 860 Software Engineering for Robotics
Crosslisted with: SOFT 460, CSCE 460
Prerequisites: SOFT 261 or RAIK 284H or CSCE 361
Description: Application of software engineering practices and principles to autonomous robotic systems.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
Offered: FALL

CSCE 861 Advanced Topics in Software Engineering
Crosslisted with: CSCE 461, SOFT 461
Prerequisites: A grade of "P" or "C" or better in CSCE 361, CSCE 361H, SOFT 261, SOFT 261H or RAIK 284H.
Description: Advanced or emerging techniques in software engineering. Topics include but not limited to design methodology, software dependability, and advanced software development environments.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option

CSCE 862 Communication Networks
Crosslisted with: CSCE 462
Prerequisites: A grade of "P" or "C" or better in CSCE 310, CSCE 310H, CSCE 311, SOFT 260, SOFT 260H or RAIK 283H; STAT 380, ECEN 305 or RAIK 270H.
Description: Introduction to the architecture of communication networks and the rudiments of performance modeling. Circuit switching, packet switching, hybrid switching, protocols, local and metro area networks, wide area networks and the Internet, elements of performance modeling, and network programming. Network security, asynchronous transfer mode (ATM), optical, wireless, cellular, and satellite networks, and their performance studies.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Prerequisite for: CSCE 952; CSCE 953
Course and Laboratory Fee: $20

CSCE 863 Data and Network Security
Crosslisted with: CSCE 463, ECEN 487, ECEN 887
Prerequisites: A grade of "P" or "C" or better in CSCE 310, CSCE 310H, CSCE 311, SOFT 260, SOFT 260H or RAIK 283H.
Description: Concepts and principles of data and network security. Focuses on practical aspects and application of crypto systems in security protocols for networks such as the Internet. Topics include: applications of cryptography and cryptosystems for digital signatures, authentication, network security protocols for wired and wireless networks, cyberattacks and countermeasures, and security in modern computing platforms.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Offered: SPRING

CSCE 864 Internet Systems and Programming
Crosslisted with: CSCE 464
Prerequisites: A grade of "Pass" or C or better in CSCE 156, SOFT 161, RAIK 184H or CSCE 311 or equivalent programming experience.
Notes: A grade of "Pass" or C or better in CSCE 156, SOFT 161, RAIK 184H or CSCE 311 or equivalent programming experience.
Description: Paradigms, systems, and languages for Internet applications. Client-side and server-side programming, object-based and event-based distributed programming, and multi-tier applications. Coverage of specific technologies varies.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option

CSCE 865 Wireless Communication Networks
Crosslisted with: CSCE 465
Prerequisites: A grade of "P" or "C" or better in STAT 380, ECEN 305 or RAIK 270H
Description: Discussion of theoretical and practical insight to wireless communications and wireless networking, current practices, and future trends. Wireless network architectures, mobility management, radio propagation, modulation, power control, antennas, channel access, pricing, and standards.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Prerequisite for: CSCE 954

CSCE 866 Software Design and Architecture
Crosslisted with: SOFT 466, CSCE 466
Prerequisites: A grade of "P" or "C" or better in CSCE 361, CSCE 361H, SOFT 261, SOFT 261H or RAIK 284H.
Notes: Letter grade only.
Description: Introduction to the concepts, principles, and state-of-the-art methods in software design and architecture. Topics include application of software engineering process models and management approaches for the design and architecture of large-scale software systems, trade-offs of designing for qualities such as performance, security, and dependability, and techniques and tools for analyzing and evaluating software architectures.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded

CSCE 867 Testing, Verification and Analysis
Crosslisted with: SOFT 467, CSCE 467
Prerequisites: A grade of "P" or "C" or better in CSCE 361, CSCE 361H, SOFT 261, SOFT 261H or RAIK 284H.
Notes: Letter grade only.
Description: In-depth coverage of problems related to software quality, and approaches for addressing them. Topics include testing techniques, dynamic and static program analysis techniques, and other approaches for verifying software qualities. Tool support for performing testing, verification, and analysis will also be studied.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded
Course and Laboratory Fee: $20

CSCE 868 Requirements Elicitation, Modeling and Analysis
Crosslisted with: SOFT 468, CSCE 468
Prerequisites: A grade of "P" or "C" or better in CSCE 361, CSCE 361H, SOFT 261, SOFT 261H or RAIK 284.
Notes: Letter grade only.
Description: In-depth coverage of processes, methods and techniques for determining, or deciding, what a proposed software system should do. Topics include the requirements engineering process, identification of stakeholders, requirements elicitation techniques, methods for informal and formal requirements documentation, techniques for analyzing requirements models for consistency and completeness, and traceability of requirements across system development and evolution. Tool support for modeling functional and non-functional requirements to support elicitation and analysis will be studied.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Graded

CSCE 869 Secure Software Engineering
Crosslisted with: CSCE 469, SOFT 469
Prerequisites: SOFT 261, CSCE 361, RAIK 284H, or graduate standing.
Description: Introduction to concepts, principles and state-of-the-art methods in creating and maintaining secure software systems.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option

CSCE 870 Computer Graphics
Crosslisted with: CSCE 470
Prerequisites: A grade of "P" or "C" or better in CSCE 310, CSCE 310H, CSCE 311, SOFT 260, SOFT 260H or RAIK 283H; MATH 314
Description: Display and recording devices; incremental plotters; point, vector, and character generation; grey scale displays, digitizers and scanners, digital image storage; interactive and passive graphics; pattern recognition; data structures and graphics software; the mathematics of three dimensions; homogeneous coordinates; projections and the hidden-line problem.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Course and Laboratory Fee: $20

CSCE 871 Computational Methods in Bioinformatics
Crosslisted with: CSCE 471
Prerequisites: A grade of "P" or "C" or better in CSCE 310, CSCE 310H, CSCE 311, SOFT 260, SOFT 260H or RAIK 283H.
Description: Introduction to computational methods for tackling challenges in biological data analysis and modeling and understanding complex systems at the molecular and cellular level. The main topics include bio-sequence analysis, motif finding, structure prediction, phylogenic inference, regulation network modeling, and high-throughput omics data analysis.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Offered: SPRING
Prerequisite for: CSCE 971

CSCE 872 Digital Image Processing
Crosslisted with: CSCE 472
Prerequisites: A grade of "Pass" or C or better in CSCE 156, SOFT 161, RAIK 184H or CSCE 311 or equivalent programming experience.
Notes: A grade of "Pass" or C or better in CSCE 156, SOFT 161, RAIK 184H or CSCE 311 or equivalent programming experience.
Description: Digital imaging systems, digital image processing, and low-level computer vision. Data structures, algorithms, and system analysis and modeling. Digital image formation and presentation, image statistics and descriptions, operations and transforms, and system simulation. Applications include system design, restoration and enhancement, reconstruction and geometric manipulation, compression, and low-level analysis for computer vision.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Course and Laboratory Fee: $10

CSCE 873 Computer Vision
Crosslisted with: CSCE 473
Prerequisites: CSCE 156, SOFT 161, or CSCE 311 or equivalent programming experience.
Notes: A grade of "Pass" or C or better in CSCE 156, SOFT 161, RAIK 184H or CSCE 311 or equivalent programming experience.
Description: High-level processing for image understanding and high-level vision. Data structures, algorithms, and modeling. Low-level representation, basic pattern-recognition and image-analysis techniques, segmentation, color, texture and motion analysis, and representation of 2-D and 3-D shape. Applications for content-based image retrieval, digital libraries, and interpretation of satellite imagery.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Course and Laboratory Fee: $40

CSCE 874 Introduction to Data Mining
Crosslisted with: CSCE 474
Prerequisites: A grade of "P" or "C" or better in CSCE 310, CSCE 310H, CSCE 311, SOFT 260, SOFT 260H or RAIK 283H; STAT 380, ECEN 305 or RAIK 270H.
Notes: Requires the completion of a project involving the application of data mining techniques to real-world problems.
Description: Data mining and knowledge discovery methods and their application to real-world problems. Algorithmic and systems issues. Statistical foundations, association discovery, classification, prediction, clustering, spatial data mining and advanced techniques.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option

CSCE 875 Multiagent Systems
Crosslisted with: CSCE 475
Prerequisites: A grade of "P" or "C" or better in CSCE 310, CSCE 310H, CSCE 311, SOFT 260, SOFT 260H or RAIK 283H.
Description: Distributed problem solving and planning, search algorithms for agents, distributed rational decision making, learning multiagent systems, computational organization theory, formal methods in Distributed Artificial Intelligence, multiagent negotiations, emergent behaviors (such as ants and swarms), and Robocup technologies and real-time coalition formation.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option

CSCE 876 Introduction to Artificial Intelligence
Crosslisted with: CSCE 476
Prerequisites: A grade of "P" or "C" or better in CSCE 310, CSCE 310H, CSCE 311, SOFT 260, SOFT 260H or RAIK 283H.
Description: Introduction to basic principles, techniques, and tools now being used in the area of machine intelligence. Languages for AI programming introduced with emphasis on LISP. Lecture topics include problem solving, search, game playing, knowledge representation, expert systems, and applications.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Prerequisite for: CSCE 976
Course and Laboratory Fee: $40

CSCE 877 Cryptography and Security
Prerequisites: A grade of "P" or "C" or better in CSCE 310, CSCE 310H, CSCE 311, SOFT 260, SOFT 260H or RAIK 283H. Graduate prerequisite CSCE 802.
Description: Introduction to security concepts and basic cryptographic building blocks. Implementation of fundamental security properties such as message and user authentication, confidentiality, privacy, anonymity, authorization, certification, non-repudiation, and revocation. Application of basic cryptographic primitives on building secure protocols and systems, wireless and network security protocols.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Offered: FALL

CSCE 878 Introduction to Machine Learning
Crosslisted with: CSCE 478
Prerequisites: A grade of "P" or "C" or better in CSCE 310, CSCE 310H, CSCE 311, SOFT 260, SOFT 260H or RAIK 283H.
Notes: STAT 380, ECEN 305, or RAIK 270H recommended.
Description: Introduction to the fundamentals and current trends in machine learning. Possible applications for game playing, text categorization, speech recognition, automatic system control, date mining, computational biology, and robotics. Theoretical and empirical analyses of decision trees, artificial neural networks, Bayesian classifiers, genetic algorithms, instance-based classifiers and reinforcement learning.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Course and Laboratory Fee: $50

CSCE 879 Introduction to Deep Learning
Crosslisted with: CSCE 479
Prerequisites: A grade of "P" or "C" or better in CSCE 310, CSCE 310H, CSCE 311, SOFT 260, SOFT 260H or RAIK 283H.
Notes: Completing STAT 380/RAIK 270H or ECEN 305 prior to taking this course is recommended.
Description: Fundamentals and current trends in deep learning. Backpropagation, activation functions, loss functions, choosing an optimizer, and regularization. Common architectures such as convolutional, autoencoders, and recurrent. Applications such as image analysis, text analysis, sequence analysis, and reinforcement learning.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Offered: SPRING
Course and Laboratory Fee: $50

CSCE 880 Honors: Generative AI - Applications, Ethics, and Research
Crosslisted with: CSCE 480H, RAIK 480H
Prerequisites: Good standing in the University Honors Program; CSCE 320 or RAIK 370. Familiarity with machine learning is recommended.
Description: Focuses on research and discussion to examine recent developments in and the implementations of Generative Artificial Intelligence (AI) systems. Covers ethical implications and potential broader impacts, while applying them to various domains, culminating in a class project. Specific concepts covered include core generative technologies ranging from variational autoencoders (VAEs), generative adversarial networks (GANs), and transformer-based models like large language models (LLMs) and diffusion image generation; key related concepts in terms of data considerations, model parameters and hyperparameters, finetuning and prompt engineering techniques; and practical use cases in terms of technology and industry through research paper reviews and case study discussions.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Offered: FALL

CSCE 891 Internship in Computer Practice
Description: Experiential learning in conjunction with an approved industrial or governmental agency under the joint supervision of an outside sponsor and a faculty member. A detailed project proposal must be prepared by the student and approved by the department prior to the start of the project. A final report must be submitted.
Credit Hours: 1-3
Min credits per semester: 1
Max credits per semester: 3
Max credits per degree: 6
Grading Option: Pass No-Pass
Course and Laboratory Fee: $10

CSCE 892 Special Topics in Computer Science
Crosslisted with: CSCE 492
Prerequisites: CSCE 310/310H, CSCE 311, SOFT 260/260H/RAIK 283H, or graduate standing.
Description: Aspects of computers and computing not covered elsewhere in the curriculum presented as the need arises.
Credit Hours: 1-3
Min credits per semester: 1
Max credits per semester: 3
Max credits per degree: 6
Grading Option: Grade Pass/No Pass Option
Course and Laboratory Fee: $40

CSCE 897 Masters Project
Prerequisites: Permission of adviser
Notes: Designed for students pursuing a non-thesis option (Option III) to work on a project under the supervision of a member of the computer science and engineering faculty.
Credit Hours: 1-6
Min credits per semester: 1
Max credits per semester: 6
Max credits per degree: 6
Grading Option: Grade Pass/No Pass Option
Course and Laboratory Fee: $10

CSCE 898 Computer Problems
Crosslisted with: CSCE 498
Prerequisites: Senior or graduate standing.
Description: Independent project executed under the guidance of a member of the faculty of the School of Computing. Solution and documentation of a computer problem demanding a thorough knowledge of either the numerical or nonnumerical aspects of computer science.
Credit Hours: 1-6
Min credits per semester: 1
Max credits per semester: 6
Max credits per degree: 6
Grading Option: Grade Pass/No Pass Option

CSCE 899 Masters Thesis
Prerequisites: Admission to masters degree program and permission of major adviser
Credit Hours: 1-10
Min credits per semester: 1
Max credits per semester: 10
Max credits per degree: 99
Grading Option: Grade Pass/No Pass Option

CSCE 913 Advanced Topics in Database Systems
Prerequisites: CSCE 813
Description: Database system topics, coverage varying from year to year. Examples: Normalization theory; statistical databases; distributed databases; failure recovery; implementation issues. Readings in the current literature.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Prerequisite for: CSCE 914

CSCE 914 Constraint Database Systems
Prerequisites: CSCE 813 or 913 and permission
Description: Introduction to constraint database systems. Constraint data model, constraint query languages, query optimization and evaluation, constraint data storage and applications. Assignments in both use and the implementation of systems.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option

CSCE 915 Advanced Computational Linguistics
Prerequisites: CSCE 415/815 is recommended.
Description: Covers advanced topics in language modeling, machine translation, computational and statistical methods in comparative linguistics, ancient and modern scripts, computational methods for script comparison and decipherment methods.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Offered: SPRING

CSCE 921 Advanced Constraint Processing
Prerequisites: CSCE421/821
Description: A continuation of the course on Foundations of Constraint Processing (CSCE 421/821). Intended for students with some sophistication and considerable interest in exploring methods for designing and using algorithms useful for solving combinatorial problems. The goal of the course is to study, analyze and critique seminal and recent research papers. Projects are optional.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option

CSCE 923 Development and Analysis of Efficient Algorithms
Prerequisites: CSCE 423/823
Description: Analysis of performance of algorithms on random access machines and Turing machines, data structures for design of efficient algorithms, sorting algorithms, divide and conquer strategies, algorithms on graphs and their performance bounds, pattern matching algorithms, achievable lower bounds on complexity, NP complete problems.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Course and Laboratory Fee: $10

CSCE 924 Graph Algorithms
Prerequisites: CSCE 423/823
Description: Review concepts related to analysis of algorithms and graph theory. Classical graph theoretic algorithms including Eulerian paths, Hamiltonian circuits, shortest paths, network flows and traveling salesman. Planar graph algorithms. Theory of alternating chains and algorithms for graph matching problems. Approximate and parallel algorithms. Applications of graph algorithms to engineering and physical sciences.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Course and Laboratory Fee: $10

CSCE 925 Scheduling Theory
Prerequisites: Permission
Description: Scheduling theory with particular emphasis to its application in computer science. Polynomial-time algorithms, NP-hardness proofs and analysis of heuristics. Minimization of makespan and mean flow time. Real-Time scheduling.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option

CSCE 936 Cyber-Physical Systems
Prerequisites: Permission.
Description: Introduction to the research, design, and analysis of cyber-physical systems - the tight integration of computing, control, and communication. Applications for CPS research are far reaching and span medical devices, smart buildings, vehicle systems, and mobile computing.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option

CSCE 942 Numerical Analysis III
Prerequisites: CSCE/MATH 840 or 841 or 847
Description: Advanced topics in numerical analysis.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option

CSCE 952 Advanced Computer Networks
Prerequisites: CSCE 862
Description: Advanced-level course on the recent development in computer networks. Integrated Services Digital Networks (ISDN), Broadband-ISDN and Asynchronous Transfer Mode (ATM), Multimedia Source and Traffic Characteristics, Source Policing, Scheduling and Quality of Service, Wireless Communication, Tracking of Mobile Users, Performance Computer networks.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Course and Laboratory Fee: $10

CSCE 953 Optical Communication Networks
Prerequisites: CSCE 462/862 or equivalent
Description: State-of-the-art optical communication networks, encompassing traditional networks operating on optical fiber and next-generation networks such as wavelength division multiplexed (WDM) and optical time division multiplexed (OTDM) networks. Fundamentals of optical network design, control, and management. Optical network design and modeling, routing and wavelength assignment algorithms, optical network simulation tools and techniques.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option

CSCE 954 Advanced Wireless Communications and Networks
Prerequisites: CSCE 465/865 or ECEN 462/862.
Description: Covers the foundation of future generation of wireless systems, principles of physical-layer wireless channels, modulation techniques, and multi-antenna communication systems, architectures of the fifth- generation wireless communications networks, standards and spectrum regulations for existing wireless communication networks, and key enabling technologies and their technical details. Read, review, and discuss research from various emerging directions in next-generation wireless networks. For selected topic in the advanced wireless networks, understand the motivation, requirements, and the state-of-the-art in research, development, and deployment.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Offered: FALL

CSCE 961 Coding Theory
Notes: MATH 817 desirable
Description: Channels, introduction to information theory, Shannon's fundamental theorem, Linear codes, Hamming codes, Reed-Muller codes, cyclic codes, idempotents, BCH codes, Reed-Solomon codes, Quadratic residue codes, perfect single-error correcting codes, Sphere packings, the Golay codes, Lloyds theorem, nonexistence theorems, weight enumerators, the MacWilliams equation, association schemes, quasi-symmetric designs, polarities of designs, extension of graphs, self-orthogonal codes and designs.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option

CSCE 962 Advanced Software Engineering
Prerequisites: CSCE 361 or CSCE 361H
Description: Recent advances in the field of software engineering. Software reuse, artificial intelligence approaches to software design, usability and requirements engineering, and design environments. Computer tools for the design of software products. Analysis of software artifacts. Coordination in distributed software development. Readings from current software engineering literature discussed and evaluated. Students will participate in a group project which investigates specific software engineering research topics.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Course and Laboratory Fee: $10

CSCE 970 Pattern Recognition
Prerequisites: CSCE 310 or 311; MATH 314/814; MATH/STAT 380 or STAT 880 or ELEC 305
Description: Introduction to statistical decision theory, adaptive classifiers, supervised and non-supervised training. Pattern recognition systems: Transducers, feature extractors, decision units. Applications to optical character recognition, speech processing, remote sensing.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Course and Laboratory Fee: $10

CSCE 971 Advanced Bioinformatics
Prerequisites: CSCE 471/871
Description: Advanced algorithmic techniques for bioinformatics. Development and analysis of string matching, graph theoretic and dynamic programming techniques applied to systems and computational biology problems such s multiple sequence alignment, alignment of DNA and protein sequences, genome rearrangements, and phylogeny and haplotypes.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option

CSCE 975 Advanced Multiagent Systems
Notes: Background in artificial intelligence (AI) or MAS is preferred.
Description: Study of advanced multiagent systems (MAS) in theory, applications, and connections to other AI disciplines, notably in uncertainty reasoning and machine learning. The course is a hybrid of project-based and seminar-based presentations with follow-up discussions. Involve developing and implementing MAS solutions for real-world problems or simulations.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option

CSCE 976 Advanced Artificial Intelligence
Prerequisites: CSCE 876
Notes: For students with some sophistication and considerable interest in exploring methods of designing and using algorithms useful for finding adequate answers to combinatorially large problems that require largely symbolic rather than numeric computing.
Description: Study, analyze and critique basic and current research papers and to engage in artificial intelligence projects and experiments either alone or in small groups. Artificial intelligence environments, tools and expert system building. Class participation will be encouraged for the review of the more recent AI literature.
Credit Hours: 3
Max credits per semester: 3
Max credits per degree: 3
Grading Option: Grade Pass/No Pass Option
Course and Laboratory Fee: $10

CSCE 990 Seminar
Prerequisites: Permission
Description: Frontiers of an area of computer science.
Credit Hours: 1-3
Min credits per semester: 1
Max credits per semester: 3
Max credits per degree: 24
Grading Option: Grade Pass/No Pass Option
Course and Laboratory Fee: $10

CSCE 991 Directed Doctoral Research
Prerequisites: Admission to the doctoral degree program and permission.
Notes: Must be completed successfully before registering for CSCE 999 Doctoral Dissertation Research.
Description: Plan and execute a component(s) of a research project, such as a literature review, system development, exploratory experimentation, or proposal development, under supervision of a graduate faculty advisor, as an initial step for doctoral dissertation research. Write a formal report on the research project and its intellectual merit and potential impact. Successfully complete the doctoral program qualifying examination.
Credit Hours: 1-3
Min credits per semester: 1
Max credits per semester: 3
Max credits per degree: 9
Grading Option: Pass No-Pass

CSCE 996 Research Problems Other Than Thesis
Description: Investigation of minor research problems to introduce graduate students to the methods of research in computer science by assigning a problem which is of research interest but within the capacity of a graduate student to complete within a semester.
Credit Hours: 1-6
Min credits per semester: 1
Max credits per semester: 6
Max credits per degree: 6
Grading Option: Grade Pass/No Pass Option
Course and Laboratory Fee: $10

CSCE 999 Doctoral Dissertation
Prerequisites: Admission to doctoral degree program and permission of supervisory committee chair
Credit Hours: 1-24
Min credits per semester: 1
Max credits per semester: 24
Max credits per degree: 99
Grading Option: Grade Pass/No Pass Option
Course and Laboratory Fee: $10