In addition, they must have completed courses in data structures and algorithms, operating systems, database management systems, discrete mathematics, linear algebra, and probability and statistics. Students enrolled in other graduate degree programs at USC are automatically eligible to pursue the certificate as long as they have taken the prerequisite courses.

For admission to the Master of Software Engineering program, applicants normally hold the B.S. degree in computer science, computer engineering, computer information systems, management information systems, or a closely related field. Applicants should also have at least one year of experience in software development or maintenance. Students not having adequate experience in software development or maintenance will be required to take CSCE 793 Internship in Software Engineering must be completed before the degree will be awarded.

All applicants must submit GRE scores. International applicants must also submit TOEFL (IBT) or IELTS Intl. Academic Course Type 2 exam scores. The average GRE scores of the accepted applicants for fall 2008 were: verbal 545, quantitative 768, and analytical writing 4.3 (on a 1 to 6 scale).

In addition, all applicants should submit an official transcript from each school or college previously attended, and at least two letters of recommendation.

The admission committee will evaluate all aspects of each application and will make a recommendation on admission to The Graduate School. All application materials must be received by February 1 for fall and summer admission and by October 1 for spring admission.

**Programs**

- Artificial Intelligence, Certificate ([https://academicbulletins.sc.edu/graduate/engineering-computing/computer-science-engineering/artificial-intelligence-certificate/](https://academicbulletins.sc.edu/graduate/engineering-computing/computer-science-engineering/artificial-intelligence-certificate/))
- Computer Engineering, M.S. ([https://academicbulletins.sc.edu/graduate/engineering-computing/computer-science-engineering/computer-engineering-ms/](https://academicbulletins.sc.edu/graduate/engineering-computing/computer-science-engineering/computer-engineering-ms/))
- Computer Engineering, Ph.D. ([https://academicbulletins.sc.edu/graduate/engineering-computing/computer-science-engineering/computer-engineering-phd/](https://academicbulletins.sc.edu/graduate/engineering-computing/computer-science-engineering/computer-engineering-phd/))
- Computer Science, M.S. ([https://academicbulletins.sc.edu/graduate/engineering-computing/computer-science-engineering/computer-science-ms/](https://academicbulletins.sc.edu/graduate/engineering-computing/computer-science-engineering/computer-science-ms/))
- Computer Science, Ph.D. ([https://academicbulletins.sc.edu/graduate/engineering-computing/computer-science-engineering/computer-science-phd/](https://academicbulletins.sc.edu/graduate/engineering-computing/computer-science-engineering/computer-science-phd/))
- Cyber Security Studies, Certificate ([https://academicbulletins.sc.edu/graduate/engineering-computing/computer-science-engineering/cyber-security-studies-certificate/](https://academicbulletins.sc.edu/graduate/engineering-computing/computer-science-engineering/cyber-security-studies-certificate/))

**Courses**

**CSCE 500 - Computer Programming and Applications (3 Credits)**

Concepts and properties of algorithms; programming exercises with emphasis on good programming habits. Credit may not be received for both CSCE 500 and CSCE 145. Open to all majors. May not be used for major credit by computer science and engineering majors.
CSCE 510 - System Programming (3 Credits)
System software such as command language interpreters, client-server applications, debuggers; mail systems, browsers, macroprocessors, and revision control systems; file systems, processes, threads, and interprocess communication.
Prerequisites: CSCE 215, CSCE 240.

CSCE 512 - System Performance Evaluation (3 Credits)
Measuring, modeling, analyzing, and predicting performance of computer systems and networks; bottleneck analysis; Markovian queuing systems and networks; use of operational and probabilistic models.
Prerequisites: CSCE 311, STAT 509 or STAT 515.

CSCE 513 - Computer Architecture (3 Credits)
Design methodology; processor design; computer arithmetic: algorithms for addition, multiplication, floating point arithmetic; microprogrammed control; memory organization; introduction to parallel architectures.
Prerequisites: CSCE 211, CSCE 212.

CSCE 515 - Computer Network Programming (3 Credits)
Computer networks and communication protocols; socket programming; interprocess communication; development of network software; case studies.
Prerequisites: CSCE 311.

CSCE 516 - Computer Networks (3 Credits)
Structure, design, and analysis of computer networks; ISO/OSI network architecture.
Prerequisites: STAT 509 or STAT 515.

CSCE 517 - Computer Crime and Forensics (3 Credits)
Structure, design, and analysis of computer networks; ISO/OSI network architecture.
Prerequisites: CSCE 215.

CSCE 518 - Ethical Hacking (3 Credits)
Fundamental principles and techniques of ethical hacking, including penetration testing life cycle, planning and scopeing, identifying targets and goals, active and passive reconnaissance, enumeration and scanning, exploitation, post-exploitation, and results reporting.
Prerequisites: CSCE 215 or previous Linux/UNIX experience.

CSCE 520 - Database System Design (3 Credits)
Database management systems; database design and implementation; security, integrity, and privacy.
Prerequisites: CSCE 240 or GEOG 563.

CSCE 522 - Information Security Principles (3 Credits)
Threats to information resources and appropriate countermeasures. Cryptography, identification and authentication, access control models and mechanisms, multilevel database security, steganography, Internet security, and intrusion detection and prevention.
Prerequisites: CSCE 146; MATH 374 or MATH 174.

CSCE 526 - Service Oriented Computing (3 Credits)
Cooperative information systems and service-oriented computing. Techniques for achieving coordinated behavior among a decentralized group of information system components. Distributed databases, multiagent systems, conceptual modeling, Web services, and applications.
Prerequisites: CSCE 311.

CSCE 531 - Compiler Construction (3 Credits)
Techniques for design and implementation of compilers, including lexical analysis, parsing, syntax-directed translation, and symbol table management.
Prerequisites: CSCE 240.

CSCE 544 - Functional Programming (3 Credits)
Functional programming as a paradigm. History of functional languages from Lisp to the present. Programming in Haskell, ML, or similar language at an intermediate level: recursive and higher-order functions, list comprehensions, types and classes, monads, lazy evaluation, reasoning about programs.
Prerequisites: C or better in CSCE 330, CSCE 350, or MATH 374.

CSCE 546 - Mobile Application Development (3 Credits)
Development of mobile applications, including user interface design for mobile, local and cloud data storage techniques, and application architectures.
Prerequisites: CSCE 240 or previous programming experience with one of the following programming languages (C/C++, Java, Swift, Python, Matlab, Javascript).

CSCE 547 - Windows Programming (3 Credits)
Object-oriented methods and tools for application programming with graphically interactive operating systems.
Prerequisites: CSCE 240.

CSCE 548 - Building Secure Software (3 Credits)
Prerequisites: CSCE 240.

CSCE 551 - Theory of Computation (3 Credits)
Basic theoretical principles of computing as modeled by formal languages and automata; computability and computational complexity
Prerequisites: C or better in CSCE 350 or MATH 300.

Cross-listed course: MATH 562

CSCE 552 - Computer Game Development (3 Credits)
Design and development of computer games, with emphasis on the technologies used. Hands-on development of computer games.
Prerequisites: CSCE 240, CSCE 350.

CSCE 555 - Algorithms in Bioinformatics (3 Credits)
Concepts, algorithms and tools for important problems in Bioinformatics, including nucleotide and amino acid sequence alignment, DNA fragment assembly, phylogenetic reconstruction, and protein structure visualization and assessment.
Prerequisites: CSCE 350.

CSCE 556 - Data Analysis in Python: Application to Neuroscience (3 Credits)
Hands-on introduction in Python to the analysis of neuroscience data (human neuroimaging and cellular electrophysiology), including various aspects such as data wrangling, statistics, classification, and visualization.
Prerequisites: C or better in CSCE 240 or CSCE 206.
CSCE 557 - Introduction to Cryptography (3 Credits)
Design of secret codes for secure communication, including encryption and integrity verification: ciphers, cryptographic hashing, and public key cryptosystems such as RSA. Mathematical principles underlying encryption. Code-breaking techniques. Cryptographic protocols.
Prerequisites: C or better in CSCE 145 or MATH 241, and at least one of CSCE 355, MATH 300 or MATH 374.
Cross-listed course: MATH 587

CSCE 561 - Numerical Analysis (3 Credits)
Interpolation and approximation of functions; solution of algebraic equations; numerical differentiation and integration; numerical solutions of ordinary differential equations and boundary value problems; computer implementation of algorithms.
Prerequisites: C or better MATH 520 or in both MATH 242 and MATH 344.
Cross-listed course: MATH 527

CSCE 563 - Systems Simulation (3 Credits)
Computer simulation of real systems; principles of system organization; random number generation; programming exercises in a simulation language.
Prerequisites: CSCE 240, STAT 509 or STAT 515.

CSCE 564 - Computational Science (3 Credits)
Parallel algorithms; scientific visualization; techniques for solving scientific problems.
Prerequisites: MATH 526, CSCE 146 or CSCE 207 or CSCE 500.

CSCE 565 - Introduction to Computer Graphics (3 Credits)
Graphics hardware; graphics primitives; two-dimensional and three-dimensional viewing; basic modeling.
Prerequisites: CSCE 240, MATH 526 or MATH 544.

CSCE 566 - Visualization Tools (3 Credits)
Scientific visualization tools as applied to sampled and generated data; methods for data manipulation and representation; investigation of visualization techniques.
Prerequisites: CSCE 145 or CSCE 206 or CSCE 207.

CSCE 567 - Parallel Computing (3 Credits)
Architecture and interconnection of parallel computers; parallel programming models and applications; issues in high-performance computing; programming of parallel computers.
Prerequisites: knowledge of programming in a high-level language; MATH 526 or MATH 544.

CSCE 571 - Critical Interactives (3 Credits)
Foundational techniques in multidisciplinary software development, specifically of applications designed to present sensitive, sometimes controversial, materials in ways to engender empathic awareness of the interactor.
Cross-listed course: FAMS 581

CSCE 572 - Human-Computer Interaction (3 Credits)
Interdisciplinary approach to interaction design, user-centered design, human abilities, survey development, experimental study methodology, heuristic evaluations, usability testing, universal design, and accessibility.
Prerequisites: Undergraduate or graduate standing in CSE or permission of the instructor.

CSCE 574 - Robotics (3 Credits)
Design and application of robotic systems; emphasis on mobile robots and intelligent machines.
Prerequisites: CSCE 211, CSCE 212, CSCE 240.

CSCE 578 - Text Processing (3 Credits)
Text and natural language processing; formal models and data structures appropriate for text processing; selected topics in computational linguistics, stylistics, and content analysis.
Prerequisites: CSCE 330, CSCE 355.

CSCE 580 - Artificial Intelligence (3 Credits)
Heuristic problem solving, theorem proving, and knowledge representation, including the use of appropriate programming languages and tools.
Prerequisites: CSCE 350.

CSCE 581 - Trusted Artificial Intelligence (3 Credits)
AI Trust – responsible/ethical technology, fairness/ lack of bias, explanations (XAI), machine learning, reasoning, software testing, data quality and provenance, tools and projects.
Prerequisites: C or better in CSCE 240 and CSCE 350.
Prerequisite or Corequisite: D or better in CSCE 330.

CSCE 582 - Bayesian Networks and Decision Graphs (3 Credits)
Normative approaches to uncertainty in artificial intelligence. Probabilistic and causal modeling with Bayesian networks and influence diagrams. Applications in decision analysis and support. Algorithms for probability update in graphical models.
Prerequisites: CSCE 350, STAT 509, or STAT 515.
Cross-listed course: STAT 582

CSCE 585 - Machine Learning Systems (3 Credits)
Design and implementation of machine learning systems, Deep learning systems stack, machine learning platforms, scalable and distributed machine learning.
Prerequisites: C or better in CSCE 240 or CSCE 206.

CSCE 587 - Big Data Analytics (3 Credits)
Foundational techniques and tools required for data science and big data analytics. Concepts, principles, and techniques applicable to any technology and industry for establishing a baseline that can be enhanced by future study.
Prerequisites: STAT 509, STAT 513, or STAT 515.
Cross-listed course: STAT 587

CSCE 590 - Topics in Information Technology (3 Credits)
Reading and research on selected topics in information technology. Course content varies and will be announced in the schedule of courses by title. May be repeated for credit as topics vary.

CSCE 594 - Strategic Management of Information Systems (3 Credits)
Strategic management and use of information systems in organizations.
Cross-listed course: MGSC 594

CSCE 611 - Advanced Digital Design (3 Credits)
Design techniques for logic systems; emphasis on higher-level CAD tools such as hardware description languages and functional modeling.
Prerequisites: CSCE 212.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Prerequisites</th>
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<tbody>
<tr>
<td>CSCE 723</td>
<td>Advanced Database Design</td>
<td>3</td>
<td>CSCE 520.</td>
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<tr>
<td></td>
<td>Database design methodologies and tools; data</td>
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<td>models; implementation languages; user interfaces.</td>
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<td>CSCE 725</td>
<td>Information Retrieval: Algorithms and Models</td>
<td>3</td>
<td>CSCE 512.</td>
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<td>Structure, design, evaluation, and use of</td>
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<td>information retrieval systems; algorithms and</td>
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<td>mathematical models for information retrieval;</td>
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<td>storage and retrieval of textual data in</td>
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<td>information systems.</td>
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<td>CSCE 727</td>
<td>Information Warfare</td>
<td>3</td>
<td>CSCE 522.</td>
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<tr>
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<td>Current trends and challenges in information</td>
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<td>warfare, high-level analysis of information</td>
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<td>warfare threats, like cyber terrorism,</td>
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<td>espionage, Internet fraud, intelligence</td>
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<td>activities, cyber ethics, and law enforcement.</td>
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<td>CSCE 730</td>
<td>Programming Language Semantics</td>
<td>3</td>
<td>CSCE 531.</td>
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<td></td>
<td>Approaches for specifying programming language</td>
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<td>semantics, including operational, axiomatic,</td>
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<td>and denotational specification.</td>
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<td>CSCE 740</td>
<td>Software Engineering</td>
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<td>CSCE 240.</td>
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<td>Current practices and research in software</td>
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<td>development, requirements definition, design,</td>
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<td>program testing and reliability, maintenance,</td>
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<td>and management.</td>
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<td>CSCE 741</td>
<td>Software Process</td>
<td>3</td>
<td>CSCE 241.</td>
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<td>Personal, team, and organizational software</td>
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<td>processes; personal and organizational maturity</td>
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<td>application of software process and management</td>
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<td>concepts during software development, primarily</td>
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<td>at the individual level.</td>
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<td>CSCE 742</td>
<td>Software Architectures</td>
<td>3</td>
<td>CSCE 242.</td>
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<td>Structural organizations for software systems</td>
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<td>as collections of interconnected components:</td>
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<td>formal models and languages; design tools and</td>
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<td>guidelines.</td>
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<td>CSCE 743</td>
<td>Software Requirements</td>
<td>3</td>
<td>CSCE 243.</td>
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<td>Elicitation, analysis, and validation of</td>
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<td>software requirements, specification of</td>
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<td>software systems including formal specification</td>
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<td>methods; CASE tools.</td>
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<td>Prerequisite or Corequisite:</td>
<td>CSCE 740.</td>
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<td>CSCE 744</td>
<td>Object-Oriented Analysis and Design</td>
<td>3</td>
<td>CSCE 350.</td>
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<td></td>
<td>Fundamentals of object-oriented technology;</td>
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<td>object modeling of structure, function, and</td>
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<td>time-dependent behavior; system analysis and</td>
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<td>design.</td>
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<td>Prerequisites:</td>
<td>CSCE 350.</td>
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<td>CSCE 745</td>
<td>Object-Oriented Programming Methods</td>
<td>3</td>
<td>CSCE 351.</td>
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<td>Object-oriented programming paradigm, including</td>
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<td>encapsulation, inheritance, reusable classes,</td>
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<td>object classification, specialization, and</td>
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<td>message passing; case studies and applications.</td>
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<td>Prerequisites:</td>
<td>CSCE 245.</td>
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<td>CSCE 747</td>
<td>Software Testing and Quality Assurance</td>
<td>3</td>
<td>CSCE 352.</td>
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<td>Structural and functional techniques for testing</td>
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<td>software; code inspection, peer review, test</td>
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<td>verification and validation; statistical testing</td>
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<td>methods; preventing and detecting errors;</td>
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<td>testing metrics; test plans; formal methods of</td>
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<td>Prerequisites:</td>
<td>CSCE 740.</td>
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</table>
CSCE 750 - Analysis of Algorithms (3 Credits)
Algorithm design techniques; algorithms and data structures for sets and graphs; time and space complexity; sorting and searching; NP-complete problems.
Prerequisites: CSCE 350.

CSCE 755 - Computability, Automata, and Formal Languages (3 Credits)
Formal models of computation, including finite state automata, Turing machines, recursive functions, formal grammars, and abstract complexity theory.
Prerequisites: CSCE 355 or CSCE 551.

CSCE 758 - Probabilistic System Analysis (3 Credits)
Application of probability theory and stochastic processes to analyze the dynamic behavior of engineering systems.
Prerequisites: STAT 509 or STAT 511.

CSCE 760 - Numerical Analysis I (3 Credits)
Numerical solution of equations and systems of linear equations, polynomial approximation, difference calculus, solution of ordinary and partial differential equations, least squares and sets of orthogonal polynomials, Gaussian quadrature.
Prerequisites: MATH 526 or MATH 544.

CSCE 761 - Numerical Analysis II (3 Credits)
Continuation of CSCE 760.
Prerequisites: CSCE 760.

CSCE 763 - Digital Image Processing (3 Credits)
Concepts and techniques for digital image processing; emphasis on low-level processes that analyze discrete images at the pixel level.

CSCE 764 - Quantum Information (3 Credits)
Fundamentals of quantum information theory and quantum communications. Topics include: Postulates of quantum mechanics, classical information and entropy, compression of classical information and classical typical sets, quantum entropy and quantum relative entropy, quantum states discrimination, Schumacher's theory of quantum compression and quantum typical subspace, communicating classical information using quantum channels, the Classical Capacity Theorem of a quantum channel.
Prerequisites: C or better in MATH 344 or MATH 544 or equivalent, or permission by the instructor; and C or better in MATH 511 or STAT 511 or equivalent, or permission by the instructor; knowledge of quantum mechanics is not required.

Cross-listed course: MATH 764, PHYS 764

CSCE 765 - Computer Graphics System Design (3 Credits)
Graphics data structures, graphics languages, modeling, raster displays, 3-D shading, hidden surface algorithms.
Prerequisites: CSCE 565.

CSCE 766 - Scientific Visualization (3 Credits)
Visualization techniques for scientific computing; interactive steering of calculations; animation and rendering techniques for multivariate data analysis.
Prerequisites: CSCE 565.

CSCE 767 - Interactive Computer Systems (3 Credits)
Principles for the design of systems supporting effective human-computer interaction; interaction styles; displays and interactive devices; user assistance; system design and evaluation.

CSCE 768 - Pattern Recognition and Classification (3 Credits)
Bayesian classifiers; optimal risk schemes; error rates; numerical methods; implementation; architectures.
Prerequisites: STAT 509 or STAT 510 or STAT 511.

CSCE 769 - Computational Structural Biology (3 Credits)
Theoretical concepts and algorithmic tools currently utilized in the field of protein folding such as Xplor-NIH and ROSETTA are presented. Participants are enabled to embark in research of protein folding.
Prerequisites: linear algebra.

CSCE 771 - Computer Processing of Natural Language (3 Credits)
Computational models for the analysis and synthesis of natural language; representations for syntax and semantics; applications to text-to-speech conversion, speech recognition, and language understanding.
Prerequisites: CSCE 580.

CSCE 772 - Computer Speech Processing (3 Credits)
A/D conversion, digital filters, discrete Fourier transform and FFT, acoustics of speech, and synthesis and recognition of speech.
Prerequisites: CSCE 580.

CSCE 774 - Robotics Systems (3 Credits)
Design and operation of robot systems; dynamics, control, and motion trajectories of manipulators; visual, auditory, and tactile sensing systems; planning and learning.
Prerequisites: CSCE 574.

CSCE 775 - Deep Reinforcement Learning (3 Credits)
Prerequisites: D or better in CSCE 580 or graduate standing.

CSCE 780 - Knowledge Representation (3 Credits)
Representation techniques and languages for symbolic knowledge, including predicate calculus, frame-based systems, and terminological systems; computer reasoning using these systems.
Prerequisites: CSCE 580.

CSCE 781 - Knowledge Systems (3 Credits)
Expert system domains, knowledge representation techniques, inference engines, and knowledge acquisition methods.
Prerequisites: CSCE 580.

CSCE 782 - Multiagent Systems (3 Credits)
Coordinated problem solving by multiple knowledge systems.
Prerequisites: CSCE 580.

CSCE 784 - Neural Information Processing (3 Credits)
Mathematical foundations of biological and artificial neural networks, supervised and unsupervised systems, applications.
Prerequisites: MATH 526 or MATH 544.
CSCE 785 - Quantum Computing and Information (3 Credits)
Fundamentals of quantum information processing, including quantum computation, quantum cryptography, and quantum information theory. Topics include: the quantum circuit model, alternative models, qubits, unitary operators, measurement, entanglement, quantum algorithms for factoring and search, quantum cryptographic key distribution, simulation of physical systems, error-correction and fault-tolerance, information capacity of quantum channels, complexity of quantum computation, near-term implementations, quantum supremacy and quantum advantage.
Prerequisites: C or better in MATH 344, MATH 544, or MATH 700, or the equivalent, or instructor permission.

CSCE 787 - Introduction to Fuzzy Logic (3 Credits)
Principles of fuzzy set theory, fuzzy relations, and fuzzy logic; fuzzy “if-then” rules.
Prerequisites: MATH 174.

CSCE 790 - Topics in Information Technology (1-3 Credits)
Reading and research on selected topics in information technology. Course content varies and will be announced in the schedule of courses by title. May be repeated for credit as topics vary.

CSCE 791 - Seminar in Advances in Computing (1 Credit)
Technical writing and presentations in major computing research areas; ethics in research and writing.

CSCE 793 - Internship in Software Engineering (1 Credit)

CSCE 797 - Individual Study and Research (1-12 Credits)
Individual research to be arranged with the instructor.

CSCE 798 - Directed Study and Research (1-12 Credits)
Individual research to be arranged with the instructor.

CSCE 799 - Thesis Preparation (1-12 Credits)

CSCE 813 - Internet Security (3 Credits)
Study security threats and prevention/detection/response techniques on the Internet, including hackers, masqueraders, information spoofing, sniffing, and distribution of damaging software. Security analysis of Web applications.
Prerequisites: CSCE 522 and CSCE 715.

CSCE 814 - Distributed Systems Security (3 Credits)
Security mechanisms of distributed software systems, including cryptographic applications. Secure multiparty computation, group-based cryptography, and security mechanisms for emerging distributed architectures.
Prerequisites: CSCE 522.

CSCE 815 - Computer Communications (3 Credits)
Contemporary computer communication protocols and network architectures.
Prerequisites: CSCE 515 or CSCE 516.

CSCE 818 - Top-Down VLSI Design (3 Credits)
VLSI system design automation, hardware description language-based design, multi-methodology design, and introduction to HDL support tools.
Prerequisites: CSCE 611 or CSCE 612.

CSCE 819 - Custom VLSI Design (3 Credits)
Custom design methodology design rules, stick notation, logic synthesis, and circuit layout; symbolic layout languages; introduction to CAD tools.
Prerequisites: CSCE 611 or CSCE 612.

CSCE 821 - Distributed Database Design (3 Credits)
Architecture, design, and implementation of distributed database managements systems; data fragmentation, replication, and allocation; query processing and transaction management; distributed object database management systems.
Prerequisites: CSCE 520.

CSCE 822 - Data Mining and Warehousing (3 Credits)
Information processing techniques and mathematical tools to assemble, access, and analyze data for decision support and knowledge discovery.
Prerequisites: CSCE 520.

CSCE 824 - Secure Database Systems (3 Credits)
Prerequisites: CSCE 522.

CSCE 826 - Cooperative Information Systems (3 Credits)
Strategies for achieving coordinated behavior among a heterogeneous group of information system components; world-wide information networks and applications in health care, logistics, telecommunications, and manufacturing automation.
Prerequisites: CSCE 520, CSCE 580.

CSCE 846 - Software Reliability and Safety (3 Credits)
Reliability and safety of computer-intensive systems; software reliability models and analysis; operational profiles; hazard analysis using fault trees and event trees; formal verification of safety-critical systems.
Prerequisites: STAT 509 or STAT 510 or STAT 511.

CSCE 850 - Advanced Analysis of Algorithms (3 Credits)
Definitions of algorithms and formal models of computation; concepts of space and time; synthesis and analysis of algorithms for sorting, search graphs, set manipulation and pattern matching; NP-complete, and intractable problem.
Prerequisites: CSCE 750.

CSCE 853 - Formal Methods in Computer Security (3 Credits)
Formal techniques applied to computer security, including formal specification language for security properties, security analysis utilities, domain-specific security concerns, and case studies of formally verified secure systems.
Prerequisites: CSCE 522 and CSCE 715.

CSCE 855 - Cooperative Information Systems (3 Credits)
Input and display devices, data structures, architectures, primitives, and geometrical transformations appropriate to computer graphics, parametric surfaces.
Prerequisites: CSCE 765.

CSCE 867 - Computer Vision (3 Credits)
Scene segmentation using texture, color, motion; representation of 2-D or 3-D structures; knowledge-based vision systems.
Prerequisites: CSCE 763.

CSCE 868 - Advanced Pattern Recognition (3 Credits)
Feature nomination, selection, extraction, and evaluation; deterministic, stochastic, and fuzzy models for classifier design; parameter estimation; error rate estimation; clustering and sequential learning.
Prerequisites: CSCE 768.
CSCE 883 - Machine Learning (3 Credits)
Fundamentals of machine learning including rote learning, learning from examples, learning from observations, and learning by analogy; knowledge acquisition for expert systems.
Prerequisites: CSCE 580.

CSCE 895 - Ph.D. Seminar (1-3 Credits)

CSCE 899 - Dissertation Preparation (1-12 Credits)