

CSCE - COMPUTER SCI & ENGR (CSCE)

CSCE 110 Programming I

Credits 4. 3 Lecture Hours. 2 Lab Hours.

Basic concepts in using computation to enhance problem solving abilities; understanding how people communicate with computers, and how computing affects society; computational thinking; representation of data; analysis of program behavior; methods for identifying and fixing errors in programs; understanding abilities and limitation of programs; development and execution of programs.

CSCE 111 Introduction to Computer Science Concepts and Programming

Credits 4. 3 Lecture Hours. 2 Lab Hours.

Computation to enhance problem solving abilities; understanding how people communicate with computers, and how computing affects society; computational thinking; software design principles, including algorithm design, data representation, abstraction, modularity, structured and object oriented programming, documentation, testing, portability, and maintenance; understanding programs' abilities and limitations; development and execution programs.

CSCE 120 Program Design and Concepts

Credits 3. 3 Lecture Hours. 1 Lab Hour.

Extend prior programming knowledge to create computer programs that solve problems; use the C++ language; apply computational thinking to enhance problem solving; analyze, design and implement computer programs; use basic and aggregate data types to develop functional and object oriented solutions; develop classes that use dynamic memory and avoid memory leaks; learn error handling strategies to develop more secure and robust programs.

Prerequisite: Grade of C or better in ENGR 102, CSCE 110, CSCE 111, or CSCE 206, or equivalent.

CSCE 121 Introduction to Program Design and Concepts

Credits 4. 3 Lecture Hours. 2 Lab Hours.

Computation to enhance problem solving abilities; computational thinking; understanding how people communicate with computers, how computing affects society; design and implementation of algorithms; data types, program control, iteration, functions, classes, and exceptions; understanding abstraction, modularity, code reuse, debugging, maintenance, and other aspects of software development; development and execution of programs.

Prerequisite: Programming course (high school or college).

CSCE 181 Introduction to Computing

Credit 1. 1 Lecture Hour.

Introduction to the broad field of computing; presentations from industry and academia about how computer science concepts are used in research and end products; includes a major writing component.

CSCE 201/CYBR 201 Fundamentals of Cybersecurity

Credits 3. 3 Lecture Hours.

Basic terminology, concepts, technology, and trends of cybersecurity; foundations of cybersecurity to include cryptography, public key infrastructure, standards and protocols, physical security, network fundamentals; workings of systems, networks, infrastructure; legal and ethical issues in cybersecurity.

Cross Listing: CYBR 201/CSCE 201.

CSCE 206 Structured Programming in C

Credits 4. 3 Lecture Hours. 2 Lab Hours.

(COSC 1420) Structured Programming in C. Basic concepts, nomenclature and historical perspective of computers and computing; internal representation of data; software design principles and practice; structured and object-oriented programming in C; use of terminals, operation of editors and executions of student-written programs.

CSCE 221 Data Structures and Algorithms

Credits 4. 3 Lecture Hours. 2 Lab Hours.

Specification and implementation of basic abstract data types and their associated algorithms including stacks, queues, lists, sorting and selection, searching, graphs, and hashing; performance tradeoffs of different implementations and asymptotic analysis of running time and memory usage; includes the execution of student programs written in C+.

Prerequisite: CSCE 113 or CSCE 121; CSCE 222/ECEN 222 or ECEN 222/CSCE 222, or concurrent enrollment.

CSCE 222/ECEN 222 Discrete Structures for Computing

Credits 3. 3 Lecture Hours.

Provide mathematical foundations from discrete mathematics for analyzing computer algorithms, for both correctness and performance; introduction to models of computation, including finite state machines and Turing machines.

Prerequisite: MATH 151.

Cross Listing: ECEN 222/CSCE 222.

CSCE 285 Directed Studies

Credits 0 to 4. 0 to 4 Lecture Hours.

Special project in computer science. Project must be approved by the department.

Prerequisite: Approval of department head; also taught at Galveston campus.

CSCE 289 Special Topics in...

Credits 1 to 4. 1 to 4 Lecture Hours.

Selected topics in an identified area of computer science. May be repeated for credit.

Prerequisite: Approval of instructor.

CSCE 291 Research

Credits 0 to 4. 0 to 4 Other Hours.

Research conducted under the direction of faculty member in computer science. May be taken three times for credit.

Prerequisites: Freshman or sophomore classification and approval of instructor.

CSCE 310 Database Systems

Credits 3. 3 Lecture Hours.

File structures and access methods; database modeling, design and user interface; components of database management systems; information storage and retrieval, query languages, high-level language interface with database systems.

Prerequisites: CSCE 221 with a grade of C or better; junior or senior classification.

CSCE 312 Computer Organization

Credits 4. 3 Lecture Hours. 2 Lab Hours.

Introduction to computer systems from programmer's perspective including simple logic design, data representation and processor architecture, programming of processors, memory, control flow, input/output, and performance measurements; hands-on lab assignments.

Prerequisites: Grade of C or better in CSCE 221, or concurrent enrollment; or approval of instructor.

CSCE 313 Introduction to Computer Systems**Credits 4. 3 Lecture Hours. 2 Lab Hours.**

Introduction to system support for application programs, both on single node and over network including OS application interface, inter-process communication, introduction to system and network programming, and simple computer security concepts; hands-on lab assignments.

Prerequisite: CSCE 221 with a grade of C or better; CSCE 312 or **corequisite** CSCE 350/ECEN 350.

CSCE 314 Programming Languages**Credits 3. 3 Lecture Hours.**

Exploration of the design space of programming languages via an in-depth study of two programming languages, one functional and one object-oriented; focuses on idiomatic uses of each language and on features characteristic for each language.

Prerequisites: Grade of C or better in CSCE 221, or concurrent enrollment; or approval of instructor.

CSCE 315 Programming Studio**Credits 3. 2 Lecture Hours. 2 Lab Hours.**

Intensive programming experience that integrates core concepts in Computer Science and familiarizes with a variety of programming/development tools and techniques; students work on 2 or 3 month-long projects each emphasizing a different specialization within Computer Science; focuses on programming techniques to ease code integration, reusability, and clarity.

Prerequisites: CSCE 312 and CSCE 314; or CSCE 350/ECEN 350.

Corequisite: CSCE 313.

CSCE 320/STAT 335 Principles of Data Science**Credits 3. 3 Lecture Hours.**

Theoretical foundations, algorithms and methods of deriving valuable insights from data; includes foundations in managing and analyzing data at scale, e.g. big data; data mining techniques and algorithms; exploratory data analysis; statistical methods and models; data visualization.

Prerequisites: STAT 211 or ECEN 303; STAT 212 or CSCE 222/ECEN 222.

Cross Listing: STAT 335/CSCE 320.

CSCE 350/ECEN 350 Computer Architecture and Design**Credits 4. 3 Lecture Hours. 3 Lab Hours.**

Computer architecture and design; use of register transfer languages and simulation tools to describe and simulate computer operation; central processing unit organization, microprogramming, input/output and memory system architectures.

Prerequisites: Grade of C or better in ECEN 248; junior or senior classification.

Cross Listing: ECEN 350/CSCE 350.

CSCE 399 High-Impact Experience**Credits 0. 0 Other Hours.**

Participation in an approved high-impact learning practice; documentation and self-assessment of learning experience.

Prerequisite: Junior or senior classification.

CSCE 402 Law and Policy in Cybersecurity**Credits 3. 3 Lecture Hours.**

Examination of law and policy issues related to cybersecurity for the spectrum of cybersecurity jobs; includes procurement, operations and maintenance, governance and oversight, protection and defense, analysis, intelligence collection and operation and investigation cybersecurity jobs.

Prerequisites: Junior or senior classification.

CSCE 410 Operating Systems**Credits 3. 3 Lecture Hours.**

Hardware/software evolution leading to contemporary operating systems; basic operating systems concepts; methods of operating systems design and construction including algorithms for CPU scheduling, memory and general resource allocation, process coordination and management; case studies of several operating systems.

Prerequisites: CSCE 313 and CSCE 315.

CSCE 411 Design and Analysis of Algorithms**Credits 3. 3 Lecture Hours.**

Study of computer algorithms for numeric and non-numeric problems; design paradigms; analysis of time and space requirements of algorithms; correctness of algorithms; NP-completeness and undecidability of problems.

Prerequisite: Grade of C or better in CSCE 221 and CSCE 222/ECEN 222; junior or senior classification or approval of instructor.

CSCE 412 Cloud Computing**Credits 3. 3 Lecture Hours.**

Operating system and distributed systems fields that form the basis of cloud computing such as virtualization, key-value storage solutions, group membership, failure detection, peer to peer systems, datacenter networking, resource management and scalability; popular frameworks such as MapReduce and HDFS and cases studies on failure determination.

Prerequisite: Grade of C or better in CSCE 315.

CSCE 413 Software Security**Credits 3. 3 Lecture Hours.**

Basic principles of design and implementation of defect-free software, code reviews including tool-assisted review by static and dynamic analysis, risk analysis and management and methods for software security testing.

Prerequisites: Grade of C or better in CSCE 315 or approval of instructor.

CSCE 416/ECEN 416 Hardware Design Verification**Credits 3. 3 Lecture Hours.**

Hardware functional verification; case studies on verification in integrated circuit design; introduction to industry best practices; introduction to logic functional verification.

Prerequisites: CSCE 312, CSCE 350/ECEN 350, or ECEN 350/CSCE 350, or equivalent in computer architecture; familiarity with C/C++/Verilog/VHDL programming.

Cross Listing: ECEN 416/CSCE 416.

CSCE 420 Artificial Intelligence**Credits 3. 3 Lecture Hours.**

Fundamental concepts and techniques of intelligent systems; representation and interpretation of knowledge on a computer; search strategies and control; active research areas and applications such as notational systems, natural language understanding, vision systems, planning algorithms, intelligent agents and expert systems.

Prerequisite: CSCE 411 or approval of instructor.

CSCE 421/STAT 421 Machine Learning**Credits 3. 3 Lecture Hours.**

Theoretical foundations of machine learning, pattern recognition and generating predictive models and classifiers from data; includes methods for supervised and unsupervised learning (decision trees, linear discriminants, neural networks, Gaussian models, non-parametric models, clustering, dimensionality reduction, deep learning), optimization procedures and statistical inference.

Prerequisites: Grade of C or better in MATH 304 and STAT 211; grade of C or better in CSCE 221 or STAT 404.

Cross Listing: STAT 421/CSCE 421.

CSCE 429 Software Development, Globalization and Culture Abroad**Credits 3. 3 Lecture Hours.**

Software development cycle; software outsourcing model, execution and practices; software industries on products, services and consultancy; software globalization; and offshore development culture; travel abroad required.

Prerequisite: CSCE 315 or approval of instructor.

CSCE 430 Problem Solving Programming Strategies**Credits 3. 2 Lecture Hours. 3 Lab Hours.**

Methods for analyzing fundamental programming problems from a variety of domains and implementing solutions quickly and efficiently; problems based on competitive programming contests to develop skills in problem analysis, coding and testing; solving problems will involve identifying and applying a range of algorithmic solutions; includes dealing with combinatorics, dynamic programming, graphs, numerical calculations, string processing and geometry, along with other specialized algorithms.

Prerequisites: CSCE 411 or approval of instructor.

CSCE 431 Software Engineering**Credits 3. 2 Lecture Hours. 2 Lab Hours.**

Application of engineering approach to computer software design and development; life cycle models, software requirements and specification; conceptual model design; detailed design; validation and verification; design quality assurance; software design/development environments and project management.

Prerequisite: CSCE 315 or approval of instructor.

CSCE 433 Formal Languages and Automata**Credits 3. 3 Lecture Hours.**

Basic types of abstract languages and their acceptors; the Chomsky hierarchy; solvability and recursive function theory; application of theoretical results to practical problems.

Prerequisite: CSCE 315 or approval of instructor.

CSCE 434 Compiler Design**Credits 3. 3 Lecture Hours.**

Programming language translation; functions and general organization of compiler design and interpreters; theoretical and implementation aspects of lexical scanners; parsing of context free languages; code generation and optimization; error recovery.

Prerequisite: CSCE 315 or approval of instructor.

CSCE 435 Parallel Computing**Credits 3. 3 Lecture Hours.**

Overview of parallel computing technology and programming methods; includes multiprocessor architectures, programming tools, parallel performance, parallel algorithms, and applications of parallel computing.

Prerequisites: CSCE 315 and junior or senior classification or approval of instructor.

CSCE 436 Computer-Human Interaction**Credits 3. 3 Lecture Hours.**

Comprehensive study of the Computer-Human Interaction (CHI) area; includes history and importance of CHI; CHI design theories; modeling of computer users and interfaces; empirical techniques for task analysis and interface design; styles of interaction and future directions of CHI including hypermedia and computer-supported collaborative work.

Prerequisite: CSCE 315 or concurrent enrollment or approval of instructor.

CSCE 438 Distributed Systems**Credits 3. 3 Lecture Hours.**

Principles and techniques for engineering distributed systems with topics including communication, concurrency, programming paradigms, naming, managing shared state, caching, synchronization, reaching agreement, fault tolerance, security, middleware and distributed applications; design, implement and debug large software systems.

Prerequisite: CSCE 313; junior or senior classification, or approval of instructor.

CSCE 440 Quantum Algorithms**Credits 3. 3 Lecture Hours.**

Introduction to the design and analysis of quantum algorithms; basic principles of the quantum circuit model; gives a gentle introduction to basic quantum algorithms; reviews recent results in quantum information processing.

Prerequisite: CSCE 315 or approval of instructor.

CSCE 441 Computer Graphics**Credits 3. 3 Lecture Hours.**

Principles of interactive computer graphics; 2-D and 3-D rendering pipelines, including geometric object and view transformations, projections, hidden surface removal, and rasterization; lighting models for local and global illumination; hierarchical models of 3-D objects; systems and libraries supporting display and user interaction.

Prerequisite: CSCE 221; junior or senior classification or approval of instructor.

CSCE 442 Scientific Programming**Credits 3. 3 Lecture Hours.**

Introduction to numerical algorithms fundamental to scientific and engineering applications of computers; elementary discussion of error; algorithms, efficiency; polynomial approximations, quadrature and systems of algebraic and differential equations.

Prerequisites: CSCE 221 with a grade of C or better; MATH 304 or MATH 308 or concurrent enrollment.

CSCE 443/VIST 487 Game Development**Credits 3. 2 Lecture Hours. 2 Lab Hours.**

Aesthetic and technical aspects of computer game development, including game mechanics, story development, content creation and game programming; includes game design, interface design, 3D modeling and animation, graphics algorithms, shader programming and artificial intelligence; group project includes the design and development of a game from start to finish.

Prerequisites: CSCE 441 or VIST 486 or approval of instructor; junior or senior classification.

Cross Listing: VIST 487/CSCE 443.

CSCE 444 Structures of Interactive Information**Credits 3. 2 Lecture Hours. 2 Lab Hours.**

A systems approach to the programming, design, authoring and theory of hypermedia; object-oriented visual and interactive programming; visual design, including color, space, text and layering; the reference as a metadisciplinary structure; collecting and sampling; ontologies, maps and navigation as means of structuring information; create dynamic hypermedia that is expressive and interpretive.

Prerequisite: CSCE 315 or approval of instructor.**CSCE 445 Computers and New Media****Credits 3. 3 Lecture Hours.**

Potential and realized impact of computers in the design of new media; relationship between authors and readers of interactive material; influence of media design on the content expressed.

Prerequisite: CSCE 221 or approval of instructor.**CSCE 446/VIST 477 Virtual Reality****Credits 3. 3 Lecture Hours.**

Theory and practice of virtual reality; interactive 3D virtual environments; input/output devices, 3D interaction techniques, augmented reality, role of realism in VR, navigation techniques, design guidelines and evaluation methods.

Prerequisite: Grade of C or better in VIST 271, CSCE 221, or CSCE 441.**Cross Listing:** VIST 477/CSCE 446.**CSCE 447/VIST 476 Data Visualization****Credits 3. 3 Lecture Hours.**

Visual representation and design of data and information; 3D visualization, infographics, data narratives, principles of visual data encoding and interaction techniques.

Prerequisite: Grade of C or better in VIST 271, or CSCE 221, or CSCE 441.**Cross Listing:** VIST 476/CSCE 447.**CSCE 451 Software Reverse Engineering****Credits 3. 2 Lecture Hours. 2 Lab Hours.**

Overview of the compilation mechanism to generate executable files and raw binary codes from source codes; executable file formats for an operating system to run the binary code; disassembly algorithms and control graph analysis; static and dynamic analyses; case studies on code obfuscation, codebreaking, malware analysis.

Prerequisite: CSCE 313 or approval of instructor.**CSCE 452 Robotics and Spatial Intelligence****Credits 3. 3 Lecture Hours.**

Algorithms for executing spatial tasks; path planning and obstacle avoidance in two- and three-dimensional robots-configuration space, potential field, free-space decomposition methods; stable grasping and manipulation; dealing with uncertainty; knowledge representation for planning-geometric and symbolic models of the environment; task-level programming; learning.

Prerequisite: CSCE 315 or approval of instructor.**CSCE 456 Real-Time Computing****Credits 4. 3 Lecture Hours. 3 Lab Hours.**

Introduction to principles and applications of real-time computing; system architecture; D/A and A/D conversion; synchronous data acquisition and analysis; computers in real-time control; asynchronous monitoring and control; resource scheduling; interfacing issues; lectures and laboratory.

Prerequisites: CSCE 313 and MATH 152.**CSCE 461/BMEN 428 Embedded Systems for Medical Applications****Credits 3. 2 Lecture Hours. 3 Lab Hours.**

Principles of embedded system architecture and programming; fundamentals and theoretical foundations of wireless communication systems; hands-on experiences of how an embedded system could be used to solve problems in biomedical engineering; projects on wireless sensors and imaging for medical devices.

Prerequisite: BMEN 211, CSCE 350/ECEN 350, or CSCE 315, or approval of instructor.**Cross Listing:** BMEN 428/CSCE 461.**CSCE 462 Microcomputer Systems****Credits 3. 2 Lecture Hours. 1 Lab Hour.**

Microcomputers as components of systems; VLSI processor and coprocessor architectures, addressing and instruction sets; I/O interfaces and supervisory control; VLSI architectures for signal processing; integrating special purpose processors into a system.

Prerequisite: CSCE 313.**CSCE 463 Networks and Distributed Processing****Credits 3. 3 Lecture Hours.**

Basic hardware/software, architectural components for computer communications; computer networks, switching, routing, protocols and security; multiprocessing and distributed processing; interfacing operating systems and networks; case studies of existing networks and network architectures.

Prerequisite: CSCE 313 or approval of instructor.**CSCE 464 Wireless and Mobile Systems****Credits 3. 3 Lecture Hours.**

Introduction to wireless and mobile systems; wireless communication fundamentals; wireless medium access control design; transmission scheduling, network and transport protocols over wireless design, simulation and evaluation; wireless capacity; telecommunication systems; vehicular, adhoc, and sensor network systems; wireless security; mobile applications.

Prerequisites: CSCE 313; junior or senior classification or approval of instructor.**CSCE 465 Computer and Network Security****Credits 3. 3 Lecture Hours.**

Fundamental concepts and principles of computer security, operating system and network security, secret key and public key cryptographic algorithms, hash functions, authentication, firewalls and intrusion detection systems, IPsec and VPN, wireless and web security.

Prerequisites: CSCE 313 and CSCE 315; junior or senior classification; or approval of instructor.**CSCE 469/ECEN 469 Advanced Computer Architecture****Credits 3. 3 Lecture Hours.**

Advanced computer architectures including memory designs, pipeline techniques, and parallel structures such as vector computers and multiprocessors.

Prerequisite: Grade of C or better in ECEN 350/CSCE 350 or CSCE 350/ECEN 350; junior or senior classification.**Cross Listing:** ECEN 469/CSCE 469.**CSCE 470 Information Storage and Retrieval****Credits 3. 3 Lecture Hours.**

Representation of, storage of and access to very large multimedia document collections; fundamental data structures and algorithms of current information storage and retrieval systems and relates various techniques to design and evaluation of complete retrieval systems.

Prerequisite: CSCE 315 or approval of instructor.

CSCE 477/CYBR 403 Cybersecurity Risk**Credits 3. 3 Lecture Hours.**

Risks in cybersecurity; avoidance, acceptance, mitigation, or transference strategies; developing reliable cybersecurity risk assessments to include analysis, categorization, and evaluation; cybersecurity risk audit frameworks.

Prerequisites: Grade of C or better in CYBR 201/CSCE 201 or CSCE 201/CYBR 201; junior or senior classification.

Cross Listing: CYBR 403/CSCE 477.

CSCE 481 Seminar**Credit 1. 2 Lab Hours.**

Investigation and report by students on topics of current interest in computer science.

Prerequisite: Junior or senior classification.

CSCE 482 Senior Capstone Design**Credits 3. 1 Lecture Hour. 6 Lab Hours.**

Project-based course to develop system integration skills for solving real-world problems in computer science; significant team software project that integrates advanced concepts across computer science specializations; projects require design, implementation, documentation and demonstration, as well as design methodology, management process and teamwork.

Prerequisites: Senior classification; CSCE 315, CSCE 411, and two additional CSCE tracked courses.

CSCE 483 Computer Systems Design**Credits 3. 1 Lecture Hour. 6 Lab Hours.**

Engineering design; working as a design-team member, conceptual design methodology, design evaluations, total project planning and management techniques, design optimization, systems manufacturing costs considerations; emphasis placed upon students' activities as design professionals.

Prerequisites: CSCE 315, CSCE 462 and ECEN 325; senior classification.

CSCE 485 Directed Studies**Credits 0 to 6. 0 to 6 Other Hours.**

Permits work on special project in computer science. Project must be approved by the department.

Prerequisite: Senior classification; also taught at Galveston campus.

CSCE 489 Special Topics in...**Credits 1 to 4. 1 to 4 Other Hours.**

Special topics in computer science that are new or unique that are not covered in existing courses.

CSCE 491 Research**Credits 0 to 4. 0 to 4 Other Hours.**

Research conducted under the direction of faculty member in computer science. May be taken three times for credit.

Prerequisites: Junior or senior classification and approval of instructor.