

## 2009-11 Cal Poly Catalog

### Computer Science Department

#### CSC—COMPUTER SCIENCE

##### CSC 100 Computer Science Orientation (2)

Introduction to the computer science discipline for majors. Computer problem solving and the use of computers. Success skills for computer science majors. Career paths and opportunities. Interaction with upper division students and faculty. 2 seminars. Prerequisite: Computer science major or minor or software engineering major.

##### CSC 101 Fundamentals of Computer Science I (4)

Basic principles of algorithmic problem solving and programming using methods of top-down design, stepwise refinement and procedural abstraction. Basic control structures, data types, and input/output. Introduction to the software development process: design, implementation, testing and documentation. The syntax and semantics of a modern programming language. Credit not available for students who have taken CSC/CPE 108. 3 lectures, 1 laboratory. Prerequisite: MATH 118 (or equivalent) with a grade of C- or better, and basic computer literacy (CSC 100 or CSC 232 or equivalent). *Crosslisted as CPE/CSC 101.*

##### CSC 102 Fundamentals of Computer Science II (4)

Basic design, implementation, testing, and documentation of object-oriented software. Introduction to classes, interfaces, inheritance, algorithms (sort, search, recursion), abstract data types, data structures (lists, stacks, queues), file I/O, and exceptions. Credit not available for students who have taken CSC/CPE 108. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 101 with a C- grade or better and either MATH 141 or MATH 221 with a C- grade or better. ~~Corequisite: CSC 144.~~ *Crosslisted as CPE/CSC 102. Change effective Winter 2011.*

##### CSC 103 Fundamentals of Computer Science III (4)

Introduction to data structures and analysis of algorithms. Abstract data types. Specification and implementation of advanced data structures. Theoretical and empirical analysis and proofs of properties of recursive and iterative algorithms. Software performance evaluation and testing techniques. 3 lectures, 1 laboratory. Prerequisite: CPE 102 with a C- grade or better and CSC 141 with a C- grade or better. *Crosslisted as CPE/CSC 103.*

##### CSC 108 Accelerated Introduction to Computer Science (4)

Accelerated introduction to basic principles of algorithmic and object-oriented problem solving and programming. Introduction to programming language concepts including control structures, data types, classes, and inheritance. Program design principles. Use and implementation of algorithms (searching, sorting, recursion) and data structures (lists, stacks, and queues). Intended for students with experience in algorithmic problem solving and using basic control structures and data types in a modern programming language (CSC/CPE 101), but who are not ready for CSC/CPE 102. Credit not available for students who have taken CSC/CPE 102. 3 lectures, 1 laboratory. Prerequisite: Math 118 (or equivalent) with a grade of C- or better, significant experience in computer programming, and consent of instructor. Corequisite: CSC 141. *Crosslisted as CPE/CSC 108.*

##### CSC 110 Computers and Computer Applications: Windows (3)

The computer as a problem-solving tool. A working introduction to microcomputers and fundamental computer concepts. Use of applications software. Credit not allowed for CSC or Software Engineering majors. 2 lectures, 1 activity. Prerequisite: Passing score on ELM examination, or an ELM exemption, or credit in MATH 104.

##### CSC 113 Computers and Computer Applications: Macintosh (3)

The computer as a problem-solving tool. A working introduction to microcomputers and fundamental computer concepts. Use of applications software. Credit not allowed for CSC or Software Engineering majors. 2 lectures, 1 activity. Prerequisite: Passing score on ELM examination, or an ELM exemption, or credit in MATH 104.

##### CSC 119 Information Retrieval and Management (4)

Use of applications software, including database software, to create and manage information. Credit not allowed for CSC or Software Engineering majors. 4 lectures. Prerequisite: Passing score on ELM examination, or an ELM exemption, or credit in MATH 104.

##### CSC 123 Introduction to Computing (4)

Use of a supportive software development environment to design, develop, and test applications in a selected topic domain that demonstrates the potential of

careers in computing. An introduction to computing and to the selected topic domain. The Schedule of Classes will list topic selected. No programming experience required. Not for students with credit in CPE/CSC 103 ~~404~~. 3 lectures, 1 laboratory. Prerequisite: Basic computer literacy. *Crosslisted as CPE/CSC 123. New course, effective Fall 2010. Change effective Fall 2010.*

##### CSC 141 Discrete Structures I (4)

Introduction to structures of computer science: logic, sets, relations, functions, graphs and trees. Propositional and predicate logic. Applications of predicate logic to preconditions, postconditions, and proof techniques. Introduction to complexity of algorithms. 4 lectures. ~~Corequisite: CSC/CPE 102.~~ Prerequisite: MATH 118 and MATH 119, or high school equivalent, ~~and CSC/CPE 101 or equivalent.~~ *Recommended: prior programming experience. Change effective Winter 2011.*

##### CSC 142 Discrete Structures II (4)

Advanced structures of computer science: sequences, strings, graphs, networks. Recursion and recurrence relations. Introduction to combinatorics. Proof techniques. Complexity of algorithms. Advanced application to verification of algorithms. 4 lectures. Prerequisite: CSC/CPE 102 and CSC 141.

##### CSC 171 Introduction to Interactive Entertainment (4)

Use of click-and-drag software application to create an entertaining or informative, socially responsible application, such as a game. Team collaboration to design, develop, and test applications. Focus on design, teamwork, and using an iterative development process. An enjoyable introduction to both computer science and interactive entertainment. No computer science experience required. 3 lectures, 1 laboratory.

##### CSC 200 Special Problems for Undergraduates (1–2)

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter. Prerequisite: Consent of instructor.

##### CSC 209 Problem Solving with Computers (1) (CR/NC)

Reinforcement of computer science fundamentals. Review of important algorithms, language features, design, syntax, and testing techniques. Repeated application of techniques to solve problems in a constrained amount of time. Primarily intended to support students preparing for the Association for Computing Machinery's International Collegiate Programming Contest. Credit/No Credit grading only. Total credit limited to 15 units. 1 laboratory. Prerequisite: CSC/CPE 101 or CSC/CPE 108 with a grade of C- or better, or consent of instructor. *Crosslisted as CPE/CSC 209.*

##### CSC 225 Introduction to Computer Organization (4)

Introduction to computer systems. Simple instruction set architecture and the computer hardware needed to implement that architecture. Machine and assembly language programming. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 102. *Crosslisted as CPE/CSC 225.*

##### CSC 231 Programming for Engineering Students (2)

Programming techniques and procedures with applications to engineering problems. Introduction to numerical methods and simulation. Credit not allowed for CSC, Software Engineering or CPE majors. 2 activities. Prerequisite: MATH 142; PHYS 121 or PHYS 131 or PHYS 141.

##### CSC 232 Computer Programming for Scientists and Engineers (3)

Computer programming, with an emphasis on procedural programming, taught using a language hosted by applications commonly used in science and engineering. Credit not allowed for CSC, CPE or Software Engineering majors. 2 lectures, 1 activity. Prerequisite: MATH 118 or equivalent.

##### CSC 234 C and Unix (3)

The C programming language and the UNIX programming environment. Operators, standard I/O functions, strings, pointers and arrays, data types and storage classes. Unix shell programming and basic I/O system calls. Credit not allowed for CSC, Software Engineering or CPE majors. 3 lectures. Prerequisite: MATH 142.

##### CSC 235 Fundamentals of Computer Science for Scientists and Engineers I (4)

Introduction to the fundamentals of computer programming with an emphasis on mathematical, scientific and engineering applications: principles of algorithmic problem solving and procedural programming using a modern programming language, data types, elementary data structures, input/output and control structures. Not a substitute for CSC/CPE 101 for CSC/CPE majors or minors. 3 lectures, 1 laboratory. Prerequisite: MATH 141 or MATH 161 with a grade of C- or better, or consent of instructor. *Crosslisted as CPE/CSC 235.*

**CSC 236 Fundamentals of Computer Science for Scientists and Engineers II (4)**

Further study of computer program development with an emphasis on mathematical, scientific and engineering applications. Introduction to more complicated data types and structures. Practice of more complicated techniques of procedural programming. Introduction to the principles of object-oriented programming using a modern programming language. Detailed discussion of lists and classic list algorithms, algorithm analysis, multidimensional arrays, records, dynamic data structures, file input/output, classes. Not a substitute for CSC/CPE 102 for CSC/CPE majors or minors. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 235 with a grade of C- or better, or consent of instructor. *Crosslisted as CPE/CSC 236.*

**CSC 237 Introduction to Computer Science with Applications I (4)**

Introduction to the fundamentals of computer science using a modern programming language. Includes principles of algorithmic problem solving, data types, elementary data structures, input/output, control structures, classes and methods. Not a substitute for CSC/CPE 101 for CSC/CPE majors or minors. 3 lectures, 1 laboratory. Prerequisite: MATH 221 or STAT 252 with a grade of C- or better, or consent of instructor. *Crosslisted as CPE/CSC 237.*

**CSC 238 Introduction to Computer Science with Applications II (4)**

Continuation of CSC 237. Intermediate study of computer program development using a modern object oriented (OO) programming language. Further study of OO principles including inheritance and interfaces. Introduction to implementation of Graphical User Interfaces, multi-media, streams, database connection, and scripting. Not a substitute for CSC 102 or for CSC/CPE majors or minors. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 237 with a grade of C- or better. *Crosslisted as CPE/CSC 238.*

**CSC 239 Selected Programming Languages (4)**

A programming language selected from languages of current interest. Intended for students who want to learn another programming language. The Schedule of Classes will list topic selected. 3 lectures, 1 laboratory. Prerequisite: Knowledge of a programming language.

**CSC 270 Computer Graphics Applications (4)**

Use of common graphics applications packages. Business graphics, figure editing, animation and image editing, photorealistic image generation, scientific visualization and multimedia. 2 lectures, 2 activities. *Crosslisted as CPE/CSC 270.*

**CSC 290 Selected Topics (1-4)**

Directed group study of selected topics. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 1 to 4 lectures. Prerequisite: Open to undergraduate students and consent of instructor.

**CSC 300 Professional Responsibilities (4)**

The responsibilities of the computer science professional. The ethics of science and the IEEE/ACM Software Engineering Code of Ethics. Quality tradeoffs, software system safety, intellectual property, history of computing and the social implications of computers in the modern world. Applications to ethical dilemmas in computing. Technical presentation methods and practice. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 357 and junior standing. *Crosslisted as CPE/CSC 300.*

**CSC 302 Computers and Society (4) GE Area F**

Social, ethical, political and technological implications and effects of computers in the modern world. Examination of the benefits and side-effects of computer applications and automation. Case study review and analysis. 4 lectures. Prerequisite: Junior standing and completion of GE Area B. Fulfills GE Area F.

**CSC 303 Teaching Computer Science (2)**

Practical coverage of educational techniques appropriate for tutoring in CSC/CPE undergraduate courses, including Socratic methods for tutoring of technical topics, design of test questions and grading rubrics, and lecture presentation. Intended for CSC/CPE/SE students interested in tutoring, grading, or a career in teaching computer science. 1 lecture, 1 laboratory. Prerequisite: CSC/CPE 103, with a grade of C- or better, or equivalent. Not available for technical elective credit.

**CSC 305 Individual Software Design and Development (4)**

Practical software development skills needed for construction of mid-sized production-quality software modules, using the CSC upper division programming language. Topics include inheritance, exceptions, and memory and disk-based dynamic data structures. Students must complete an individual programming project of mid-level complexity. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 357. *Crosslisted as CPE/CSC 305.*

**CSC 307 Introduction to Software Engineering (4)**

Requirements, specification, design, implementation, testing and verification of large software systems. Study and use of the software process and software engineering methodologies; working in project teams. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 103 with a grade of C- or better, and CSC/CPE 357. Not open to students with credit in CSC/CPE 308. *Crosslisted as CPE/CSC 307.*

**CSC 308 Software Engineering I (4)**

Principles for engineering requirements analysis and design of large complex software systems. Software process models. Methods of project planning, tracking, documentation, communication, and quality assurance. Analysis of engineering tradeoffs. Group laboratory project. Technical oral and written presentations. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 357. *Crosslisted as CPE/CSC 308.*

**CSC 309 Software Engineering II (4)**

Continuation of the software lifecycle. Methods and tools for the implementation, integration, testing and maintenance of large software systems. Software development and test environments. Software quality assurance. Group laboratory project. Technical presentation methods and practice. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 308. *Crosslisted as CPE/CSC 309.*

**CSC 310 Computers for Poets (4)****GE Area F**

How computers and computer devices work. Introduction to software systems and applications. How computers connect with various media including images, speech and data. How information is encoded and transmitted across networks. Relationship between the computer and human information processing. 4 lectures. Prerequisite: Junior standing and completion of GE Area B. *Crosslisted as CSC 310/HNRS 311.* Fulfills GE Area F.

**CSC 315 Computer Architecture (4)**

In-depth study of the instruction set architecture and hardware design of a specific CPU. Introduction to pipelines, input/output and multi-processors. Computer abstractions and performance measurement. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 103 and either CPE/EE 229 or CSC 225. *Crosslisted as CPE/CSC 315.*

**CSC 316 Micro Controllers and Embedded Applications (4)**

Introduction to micro controllers and their applications as embedded devices. Hardware/software tradeoffs, micro controller selection, use of on-chip peripherals, interrupt driven real-time operation, A/D conversion, serial and parallel communications, watch-dog timers, low power operation and assembly language programming techniques. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 315 or CPE/EE 329. *Crosslisted as CPE/CSC 316.*

**CSC 334 Advanced Topics in Unix (4)**

Advanced topics in Unix, system calls, library functions, shell scripts, and selected Unix tools. 4 lectures. Prerequisite: CSC/CPE 103, with a grade of C- or better, or CSC 234.

**CSC 341 Numerical Engineering Analysis (4)****GE B6**

An intensive survey of numerical analysis techniques used for solving engineering problems. Topics include solution of nonlinear equations, solution of linear systems, interpolation, numerical quadrature, ordinary differential equations and boundary value problems. Not open to students who have completed CSC 342. 4 lectures. Prerequisite: MATH 244 and one of the following courses: CSC 101, CSC 231, CSC 232, CSC 234, CSC 235, or consent of instructor. Fulfills GE B6.

**CSC 342 Numerical Analysis I (3)**

Computer solutions of nonlinear equations and systems of linear equations. Polynomial interpolation. Numerical quadrature. Introduction to the solution of ordinary differential equations. 3 lectures. Prerequisite: MATH 143 and knowledge of a high level programming language, or ability to use one of the following systems: Maple, MatLab, Mathematica, or Mathcad.

**CSC 343 Numerical Analysis II (3)**

Solution of systems of differential equations, predictor-corrector methods, stiff equations. Approximation methods: cubic splines, B-splines, Bezier curves, least squares, methods for solving boundary value problems. 3 lectures. Prerequisite: CSC 342 or equivalent.

**CSC 349 Design and Analysis of Algorithms (4)**

Intermediate and advanced algorithms and their analysis. Mathematical, geometrical, and graph algorithms. NP-complete problems. Additional topics will be chosen from pattern matching, file compression, cryptography, dynamic and linear programming, and exhaustive search. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 103, with a grade of C- or better, and MATH 142 and either STAT 312 or STAT 321. *Crosslisted as CPE/CSC 349.*

**CSC 357 Systems Programming (4)**

C programming language from a system programming perspective. Standard C language including operators, I/O functions, and data types in the context of system functions. Unix commands, shell scripting, file system, editors. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 103 with a grade of C- or better, and either CSC 225 or CPE/EE 229. *Crosslisted as CPE/CSC 357.*

**CSC 358 Computer System Administration (2)**

Fundamental concepts of Unix system administration. Use of shell scripts and utilities. Techniques of networks and data communications. Methods of system maintenance and accounting. 2 seminars. Prerequisite: CSC/CPE 103 or permission of instructor.

**CSC 361 File Structures (4)**

External storage devices. Character, record, and block I/O. Blocking and buffering. File structures: sequential, indexed sequential, B trees, hashing, multi-key and linked. Primary and secondary indexing. Design and implementation of record and object storage managers. Data compression. Multi-media file formats. 4 lectures. Prerequisite: CSC/CPE 103, with a grade of C- or better.

**CSC 365 Introduction to Database Systems (4)**

Basic principles of database management systems (DBMS) and of DBMS application development. DBMS objectives, systems architecture, database models with emphasis on Entity-Relationship and Relational models, data definition and manipulation languages, the Structured Query Language (SQL), database design, application development tools. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 103. *Crosslisted as CPE/CSC 365.*

**CSC 366 Database Modeling, Design and Implementation (4)**

The database modeling problem. Database modeling levels: external, conceptual, logical and physical. Database models: entity-relationship, relational, object-oriented, semantic, and object-relational. Normal forms. Distributed database design. Functional analysis of database applications and transaction specification, design, and implementation. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 365. *Crosslisted as CPE/CSC 366.*

**CSC 369 Distributed Computing I (4)**

Introduction to distributed computing paradigms and protocols: interprocess communications, group communications, the client-server model, distributed objects, and Internet protocols. Emphasis on distributed software above the operating system and network layers. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 357. *Crosslisted as CPE/CSC 369.*

**CSC 400 Special Problems for Advanced Undergraduates (1-2) (1-4)**

Individual investigation, research, studies or surveys of selected problems. Total credit limited to 4 units; ~~with a maximum of 2 units per quarter~~. Prerequisite: Consent of instructor. *Correction, effective Summer 2009.*

**CSC 402 Software Requirements Engineering (4)**

Software requirements elicitation, analysis and documentation. Team process infrastructure and resource estimation to support appropriate levels of quality. Software architectural design. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 307 or CSC/CPE 309; CSC/CPE 305. *Crosslisted as CPE/CSC 402.*

**CSC 405 Software Construction (4)**

Design and construction of sizeable software products. Technical management of software development teams. Software development process models, software design, documentation, quality assurance during development, software unit and integration testing; CASE tools, development environments, test tools, configuration management. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 402. *Crosslisted as CPE/CSC 405.*

**CSC 406 Software Deployment (4)**

Deployment of a sizeable software product by a student team. Software maintenance and deployment economic issues. Management of deployed software: version control, defect tracking and technical support. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 405. *Crosslisted as CPE/CSC 406.*

**CSC 409 Current Topics in Software Engineering (4)**

Selected topics in software engineering. Topics may include program generation, quality assurance, formal methods, software metrics, design methods, testing, or software development processes. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 309 or CSC/CPE 307. *Crosslisted as CPE/CSC 409.*

**CSC 416 Autonomous Mobile Robotics (4)**

Theory and application of concepts relevant to autonomous mobile robots. Sensor and actuator interfacing, programming mobile robots, mobile robot configurations, software architectures and algorithms. 3 lectures, 1 laboratory.

Prerequisite: CPE/EE 329 or both CSC/CPE 315 and CSC/CPE 357 or consent of instructor. *Crosslisted as CPE/CSC 416.*

**CSC 430 Programming Languages I (4)**

Construction of the front end of a compiler including lexical analysis, syntactic analysis, type checking, and formal semantics. Introduction to regular languages, finite automata, and context-free grammars. 3 lectures, 1 laboratory. Prerequisite: CSC 349 and CSC/CPE 357. *Crosslisted as CPE/CSC 430.*

**CSC 431 Programming Languages II (4)**

Language principles and design issues: bindings, conversion, parameter passing, and dynamic semantics. Language implementation: intermediate code representation, memory management, code optimization, and code generation. Functional programming languages. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 430. *Crosslisted as CPE/CSC 431.*

**CSC 435 Introduction to Object Oriented Design Using Graphical User Interfaces (4)**

Principles of object-oriented design, with emphasis on use of these principles in the design of graphical interfaces. Comparison and contrasting of two major object-oriented languages and their corresponding GUI class libraries. Language-independent object-oriented design methods, and application of these methods in the construction of a GUI-based project. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 103, with a grade of C- or better, or equivalent and CSC/CPE 305. *Crosslisted as CPE/CSC 435.*

**CSC 437 Dynamic Web Development (4)**

Project-based study of web-based three-tiered applications, including current best practices and tools for design, implementation and testing of browser interface, serverside business logic, object-relational mapping, databases, and web services. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 357 (with a grade of C- or better) and CSC/CPE 365 or consent of instructor. *Crosslisted as CPE/CSC 437.*

**CSC 445 Theory of Computation I (4)**

Theory of formal languages and automata. Turing machines. Chomsky hierarchy. Theory of decidability and computability. 4 lectures. Prerequisite: CSC 141 and ~~CSC/CPE 430~~ CSC 349 or consent of instructor. *Change effective Summer 2010.*

**CSC 448 Bioinformatics Algorithms (4)**

Using computers to solve problems in molecular biology. The algorithms, languages, and databases important in determining and analyzing nucleic and protein sequences and their structure. 3 lectures, 1 laboratory. Prerequisite: Consent of instructor or the following: CSC/CPE 103, with a grade of C- or better, or BIO 447 and senior standing. *Crosslisted as CPE/CSC 448.*

**CSC 449 Current Topics in Algorithms (4)**

Selected aspects of the verification, analysis and design of algorithms. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 3 lectures, 1 laboratory. Prerequisite: CSC 349. *Crosslisted as CPE/CSC 449.*

**CSC 453 Introduction to Operating Systems (4)**

Introduction to sequential and multiprogramming operating systems; kernel calls, interrupt service mechanisms, scheduling, files and protection mechanisms, conventional machine attributes that apply to operating system implementation, virtual memory management, and I/O control systems. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 357 and either CSC/CPE 225 or CPE/EE 229. *Crosslisted as CPE/CSC 453.*

**CSC 454 Implementation of Operating Systems (4)**

Design and implementation of multiprogramming kernels, systems programming methodology, interprocess communications, synchronization, device drivers and network access methods. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 453. *Crosslisted as CPE/CSC 454.*

**CSC 456 Introduction to Computer Security (4)**

Computer system and network security, including protection, access control, distributed access control, operating system security, applied cryptography, network security, firewalls, secure coding practices, and case studies from real-world systems. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 453 and either CSC/CPE 300 or CPE 350. *Crosslisted as CPE/CSC 456.*

**CSC 458 Current Topics in Computer Systems (4)**

Selected aspects of design, implementation and analysis of networks, advanced operating and distributed systems. Topics may include process management, virtual memory, process communication, context switching, file system designs, persistent objects, process and data migration, load balancing, security and networks. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 453. *Crosslisted as CPE/CSC 458.*

**CSC 464 Introduction to Computer Networks (4)**

Computer network architectures; communications protocol standards; services provided by the network; historical and current examples presented. 3 lectures, 1 laboratory. Prerequisite: STAT 312 or STAT 321 or STAT 350 and CSC/CPE 357. *Crosslisted as CPE/CSC 464.*

**CSC 465 Advanced Computer Networks (4)**

Advanced topics in computer networks; greater detail of protocol standards and services provided by the network; focus on current industry and research topics. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 464 and CSC/CPE 453. *Crosslisted as CPE/CSC 465.*

**CSC 466 Knowledge Discovery from Data (4)**

Overview of modern knowledge discovery from data (KDD) methods and technologies. Topics in On-line Analytic Transaction Processing (OLAP), data mining (association rules mining, classification, clustering), information retrieval. Emphasis on use of KDD techniques in modern software applications. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 365 and one of STAT 312, STAT 321 or STAT 350. *Crosslisted as CPE/CSC 466.*

**CSC 468 Database Management Systems Implementation (4)**

Data structures and algorithms used in the implementation of database systems. Implementation of data and transaction managers: access methods interfaces, concurrency control and recovery, query processors and optimizers. Introduction to implementation of distributed database systems. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 365. *Crosslisted as CPE/CSC 468.*

**CSC 469 Distributed Computing II (4)**

Continued exploration of topics in distributed computing in greater depth, with emphasis on design patterns and team projects. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 369. *Crosslisted as CPE/CSC 469.*

**CSC 471 Introduction to Computer Graphics (4)**

Graphics software development and use of APIs for 3D graphics. The graphics pipeline, modeling, geometric and viewing transforms, lighting and shading, rendering, interaction techniques and graphics hardware. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 357. *Crosslisted as CPE/CSC 471.*

**CSC 473 Advanced Rendering Techniques (4)**

Illumination models, reflectance, absorption, emittance, Gouraud shading, Phong shading, raytracing polyhedra and other modeling primitives, coherence, acceleration methods, radiosity, form factors, advanced algorithms. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 471. *Crosslisted as CPE/CSC 473.*

**CSC 474 Computer Animation (4)**

Basic and advanced algorithms for generating sequences of synthetic images. Interpolation in time and space, procedural and keyframe animation, particle systems, dynamics and inverse kinematics, morphing and video. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 471. *Crosslisted as CPE/CSC 474.*

**CSC 476 Real-Time 3D Computer Graphics Software (4)**

Basic and advanced algorithms for real-time, interactive, 3D graphics software. Modeling (polygon mesh, height field, scene graph), real-time rendering and shading (visibility processing, LOD, texture and light maps), collision detection (bounding volumes, complexity management), interactive controls, multi-player game technology, game engine architecture. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 471. *Crosslisted as CPE/CSC 476.*

**CSC 478 Current Topics in Computer Graphics (4)**

Selected aspects of the design, implementation and analysis of computer graphics. Topics may include rendering, modeling, visualization, animation, virtual reality, computer vision, multimedia, and perception issues. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 471. *Crosslisted as CPE/CSC 478.*

**CSC 479 Computer Graphics Seminar (2)**

Current topics in computer graphics. Total credit limited to 4 units. 2 seminars. Prerequisite: CSC/CPE 471.

**CSC 480 Artificial Intelligence (4)**

Programs and techniques that characterize artificial intelligence. Programming in a high level language. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 103, with a grade of C- or better. *Crosslisted as CPE/CSC 480.*

**CSC 481 Knowledge Based Systems (4)**

In-depth treatment of knowledge representation, utilization and acquisition in a programming environment. Emphasis on the use of domain-specific knowledge to obtain expert performance in programs. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 480. *Crosslisted as CPE/CSC 481.*

**CSC 483 Current Topics in Human-Computer Interaction (4)**

Selected aspects of the field of human-computer interaction. Topics may include dynamic information visualization, universal access, social impact of technology usage, educational technology, human cognition and performance studies, and extended usability evaluation techniques. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 484. *Crosslisted as CPE/CSC 483.*

**CSC 484 User-Centered Interface Design and Development (4)**

Introduction to the importance of user-centered principles in the design of good interfaces and effective human-computer interaction. Topics include: human characteristics affected by interface design, effective requirements data collection and analysis, user-centered approaches to software engineering, and evaluation of interface and interaction quality. 3 lectures, 1 laboratory. Prerequisite: Junior standing and CSC/CPE 307 or CSC/CPE 308. *Crosslisted as CPE/CSC 484.*

**CSC 485 Autonomous Robot Navigation (4)**

Overview of existing autonomous mobile robot systems, basic kinematic modeling, control structures, sensing and sensor modeling, localization, and motion planning algorithms. Implementation of autonomous navigation capabilities. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 480 or consent of instructor. *Crosslisted as CPE/CSC 485.*

**CSC 486 Human-Computer Interaction Theory and Design (4)**

Application of the theories of human-computer interaction to the task of user-centered design. Survey of techniques for studying and involving users in different aspects of the design process, and demonstration of where and when applicable. Combining of theoretical understanding with practical experience to design solutions to problems facing interactive systems designers. 4 seminars. Prerequisite: CSC/CPE 484.

**CSC 489 Current Topics in Artificial Intelligence (4)**

Selected aspects of the design, implementation and analysis of advanced systems and concepts in the area of artificial intelligence. Topics may include knowledge representation, reasoning, learning, or planning, and specific techniques like intelligent agents, genetic algorithms, semantic web, or robotics. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 480. *Crosslisted as CPE/CSC 489.*

**CSC 490 Selected Advanced Topics (1-4)**

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures. Prerequisite: Consent of instructor.

**CSC 491 Senior Project Design Laboratory I (2)**

Selection and completion of a project by individuals or team which is typical of problems which graduates must solve in their fields of employment. Project may include students from other disciplines. Formulation of outline, literature review, and project schedule. 2 laboratories. Prerequisite: CSC/CPE 307 or CSC/CPE 309 and consent of instructor.

**CSC 492 Senior Project Design Laboratory II (3)**

Selection and completion of a project by individuals or team which is typical of problems which graduates must solve in their fields of employment. Project may include students from other disciplines. Project results are presented in a formal report. 3 laboratories. Prerequisite: CSC 491 and consent of instructor.

**CSC 493 Cooperative Education Experience (2) (CR/NC)**

Part-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Credit/No Credit grading only. No major credit allowed; total credit limited to 6 units. Prerequisite: Sophomore standing and consent of instructor.

**CSC 494 Cooperative Education Experience (6) (CR/NC)**

Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Credit/No Credit grading only. No major credit allowed; total credit limited to 18 units. Prerequisite: Sophomore standing and consent of instructor.

**CSC 495 Cooperative Education Experience (12) (CR/NC)**

Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. A more fully developed formal report and evaluation by work supervisor required. Credit/No Credit

grading only. No major credit allowed; total credit limited to 24 units.

Prerequisite: Sophomore standing and consent of instructor.

**CSC 500 Directed Study (2-3) (CR/NC)**

Individual directed study of advanced topics. Total credit limited to 4 units. Credit/No Credit grading only. Prerequisite: Fully classified graduate standing and consent of instructor.

**CSC 508 Software Engineering I (4)**

In-depth study of requirements engineering, software project management, formal specifications and object-oriented analysis. 4 seminars. Prerequisite: CSC/CPE 307 or CSC/CPE 308 and graduate standing, or consent of instructor.

**CSC 509 Software Engineering II (4)**

In-depth study of software modeling and design. Formal design methodologies. Design patterns. Detailed case studies of existing projects. Tools and methods for designing large software systems. 4 seminars. Prerequisite: CSC 508 and graduate standing, or consent of instructor.

**CSC 520 Computer Architecture (4)**

Comparative study and design of multiprocessor, dataflow, RISC, high level language and other new computer architectures. VLSI processor design techniques. 3 seminars, 1 laboratory. Prerequisite: CSC/CPE 315 and graduate standing, or consent of instructor. *Crosslisted as CPE/CSC 520.*

**CSC 530 Languages and Translators (4)**

Advanced programming language and translator concepts. Language concepts to be covered will be selected from current state-of-the-art languages and current issues in language design. Compiler concepts will include retargetable code generation, use of translator-writing systems, and error recovery. 4 seminars. Prerequisite: CSC 430 and graduate standing, or consent of instructor.

**CSC 540 Theory of Computation II (4)**

Advanced topics in theoretical computer science from such areas as automata theory, cellular automata theory, computational complexity, and program verification. 4 seminars. Prerequisite: CSC 445 and graduate standing, or consent of instructor.

**CSC 541 Numerical Methods (4)**

Introduction to advanced methods used in numerical analysis. Finite element methods for one and two-dimensional problems. Study of transforms including the Fast Fourier Transform and the Fast Hartley Transform. Review of the software supporting these methods. 4 seminars. Prerequisite: CSC 342 and graduate standing, or consent of instructor.

**CSC 550 Operating Systems (4)**

Concepts of computer architecture and operating systems. Design features of advanced computers, general time-sharing systems and schemes for dynamic memory allocation, scheduling and protection. Dynamic linkage between sub-routines. Intercommunication between input/output and processors. 4 seminars. Prerequisite: CSC/CPE 453 and graduate standing, or consent of instructor.

**CSC 556 Computer Security (4)**

Exploration of advanced topics in computer security with an emphasis on research topics. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 456 and graduate standing, or consent of instructor. *Crosslisted as CPE/CSC 556.*

**CSC 560 Database Systems (4)**

Current topics in database systems: distributed databases and transactions, nested and long-running transactions, distributed concurrency control, semantic and object-oriented data models, database systems for non-traditional applications: engineering design databases, active, logic, temporal, multi-media, and real-time databases. 4 seminars. Prerequisite: CSC/CPE 468 365 and graduate standing, or consent of instructor. *Change effective Fall 2010.*

**CSC 564 Computer Networks: Research Topics (4)**

Exploration of advanced topics in emerging computer networking technologies; focus on leading edge computer network research topics. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 464 and graduate standing, or consent of instructor. *Crosslisted as CPE/CSC 564.*

**CSC 568 Distributed Systems (4)**

Advanced topics in distributed systems with emphasis on recent and emerging distributed computing paradigms, fault tolerance, and distributed algorithms. 4 seminars. Prerequisite: CSC/CPE 369 or CSC/CPE 569 and graduate standing, or consent of instructor.

**CSC 569 Distributed Computing (4)**

Principles and practices in distributed computing: interprocess communications, group communications, client-server model, distributed objects, message queue system, distributed services, mobile agents, object space, Internet protocols. Distributed algorithms: consensus protocols, global state protocols. Fault tolerance:

classification of faults, replication. Not open to students with credit in CSC/CPE 369 or CSC/CPE 469. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 357 and graduate standing, or consent of instructor. *Crosslisted as CPE/CSC 569.*

**CSC 570 Current Topics in Computer Science (2-4)**

Directed group study of selected topics for graduate students. Topics will normally consist of continuations of those in CSC 520, 530, 540, 550, 560 and 580, and other topics as needed. The Schedule of Classes will list title selected. Total credit limited to 12 units. 2 to 4 seminars. Prerequisite: Graduate standing and evidence of satisfactory preparation in computer science.

**CSC 572 Computer Graphics (4)**

Advanced topics in computer graphics with emphasis on leading edge computer graphics technologies and advanced topics in graphics fundamentals. 3 lectures, 1 laboratory. Prerequisite: Successful completion of CSC/CPE 471 and graduate standing, or consent of instructor.

**CSC 580 Artificial Intelligence (4)**

Current research in the field of artificial intelligence with emphasis on cooperative agents, distributed agents, and decision making in complex, concurrent environments. AI programming in a distributed environment. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 481 and graduate standing, or consent of instructor. *Crosslisted as CPE/CSC 580.*

**CSC 581 Computer Support for Knowledge Management (4)**

Methods and techniques that computer-based systems can provide to make the management of knowledge and information in digital form easier for the user. Emphasis on support for knowledge-intensive activities performed by users. 3 lectures, 1 laboratory. Prerequisite: CSC/CPE 481. *Crosslisted as CPE/CSC 581.*

**CSC 590 Thesis Seminar (1)**

Preparation for conducting research in the field of computer science, through discussions, selected readings, and student presentations. 1 seminar. Prerequisite: Graduate standing or consent of instructor.

**CSC 593 Cooperative Education Experience (2) (CR/NC)**

Advanced study analysis and part-time work experience in student's career field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. Credit/No Credit grading only. Prerequisite: Graduate standing and consent of instructor.

**CSC 594 Cooperative Education Experience (6) (CR/NC)**

Advanced study analysis and full-time work experience in student's career field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. Credit/No Credit grading only. Prerequisite: Graduate standing and consent of instructor.

**CSC 595 Cooperative Education Experience (12) (CR/NC)**

Advanced study analysis and full-time work experience in student's career field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. A fully-developed formal report and evaluation by work supervisor required. Credit/No Credit grading only. Prerequisite: Graduate standing and consent of instructor.

**CSC 596 Thesis I (2)**

Individual research or activity under faculty supervision, beginning work on the master's thesis. Prerequisite: Graduate standing and consent of instructor. Corequisite or prerequisite: CSC 590.

**CSC 597 Thesis II (3)**

Individual research or activity under faculty supervision, continuing work on the master's thesis. Prerequisite: CSC 597-596 and consent of instructor. *Corrected effective Summer 2009.*

**CSC 599 Thesis III (3)**

Individual research or activity under faculty supervision leading to an acceptable thesis. Prerequisite: CSC 598-597, selection of thesis committee, graduate standing, and consent of instructor. *Corrected effective Summer 2009.*