Computer scientists and engineers design and implement efficient software and hardware solutions to computer-solvable problems. They are involved in the development of areas such as high-speed networks, multimedia and creative technologies, systems design and virtual reality.

The Computer Science program prepares students to enter the industry in the areas of software design, development, application and maintenance. It also provides intensive study in algorithmic design and analysis and the theory of computing, which are needed for graduate studies.

Computer engineers integrate hardware and software processes to form solutions to problems arising from complex systems such as atomic reactors, guidance systems and manufacturing systems. They design and engineer computers and computer networks.

**Programs Available**

- **Computer Science**
  - Bachelor of Science
  - 128 units
- **Computer Engineering and Computer Science**
  - Bachelor of Science
  - 131 units
- **Physics/Computer Science**
  - Bachelor of Science
  - 128 units
- **Interactive Multimedia minor**
- **Multimedia and Creative Technology minor**

See page 63-64 for the curricula of each of the B.S. programs listed above. Information on each degree emphasis and minors can be found below.

See page 82 for information on minor programs offered by the USC Viterbi School of Engineering.

**Physics/Computer Science Degree**

This program is intended for students with dual interests in physics and computer science who wish to complete the essential courses for both majors within their normal four year career. See the Physics and Astronomy Department section of the USC Catalogue for course requirements.

**Minor in Interactive Multimedia**

See page 82 for information on the Minor in Interactive Multimedia. Note that this minor is not open to students in the School of Engineering (these students should pursue the Multimedia and Creative Technologies Minor instead).

**Minor in Multimedia and Creative Technologies**

See page 82 for information on the Minor in Multimedia and Creative Technologies.

**Courses of Instruction**

The terms indicated are expected but are not guaranteed. For the courses offered during any given term, consult the Schedule of Classes.

**COMPUTER SCIENCE (CSCI)**

101L Fundamentals of Computer Programming (3, FaSp)

Introduction to the design of solutions to computer solvable problems. Algorithm design, solution implementation using a high-level programming language, program correctness and verification. Prerequisite: CSCI 101L.

105 Object-Oriented Programming (2, Sp)

The principles of object-oriented programming are examined using Java. Topics include graphics, graphical user interfaces and multi-threaded programming. Prerequisite: CSCI 101L.

107 Computers and Society (3, FaSp)

What computers are and how they function. Impact of computer technology on society. Economic, political and social issues raised by computers.

110 Introduction to Digital Logic (3)

(Enroll in EE 101)

201L Principles of Software Development (4, FaSp)

The object-oriented paradigm for programming-in-the-large (using the C++ language); UNIX tools for software development; developing window-based applications under X-windows. Prerequisite: CSCI 102.

271 Discrete Methods in Computer Science (3, FaSp)

Models for discrete structures; finite state automata, regular sets. Selected applications of logic and combinatorics to program correctness, algorithms and complexity, programming language semantics and databases. Prerequisite: CSCI 102.

303 Design and Analysis of Algorithms (3, FaSp)

Upper and lower bounds on sorting and order median. Deterministic and random computation, data structures, NP-completeness, cryptography, Turing machines and undecidability. Prerequisite: CSCI 102 and CSCI 271.

320 Digital Media Basics for Multimedia (3, FaSp)

(Enroll in EE 320)

351 Programming and Multimedia on the World Wide Web (3, Sp)

HTML programming for creating home pages, installation and modification of Web server, writing programs that offer enhanced services, manipulation of graphics, video and sound. Prerequisite: CSCI 102L.

357 Basic Organization of Computer Systems (3)

(Enroll in EE 357)
377 Introduction to Software Engineering (3, Fa) Introduction of principles, methods, techniques and tools for multi-person construction of multi-version software systems. Prerequisite: CSCI 102.

390 Special Problems (1-4) Supervised, individual studies. No more than one registration permitted. Enrollment by petition only.

402x Operating Systems (3, FaSp) Basic issues in concurrency, deadlock control, synchronization scheduling, memory management, protection and access control, inter-process communication, and structured design. Laboratory experiences with Unix-like operating system. Not available for graduate credit to computer science majors. Prerequisite: CSCI 201L or CSCI 455x; EE 357.

410x Translation of Programming Languages (3, Fa) Concepts of assemblers, compilers, interpreters and their design; macro assemblers, Polish notation and translation techniques; operator precedence parsing, push down automata, code generation. Not available for graduate credit to computer science majors. Prerequisite: CSCI 201; corequisite: EE 357.

445 Introduction to Robotics (4, Fa) Designing, building and programming mobile robots; sensors, effectors, basic control theory, control architectures, some advanced topics, illustrations of state-of-the-art. Teamwork; final project tested in a robot contest. Junior standing or higher. Prerequisite: CSCI 101L or C language programming.

450 Introduction to Computer Networks (3) (Enroll in EE 450)

454L Introduction to Systems Design Using Microprocessors (4) (Enroll in EE 454L)

455x Introduction to Programming Systems Design (4, FaSp) Intensive introduction to programming principles, discrete mathematics for computing, software design and software engineering concepts. Not available for credit to computer science majors, graduate or undergraduate. Prerequisite: departmental approval.

457x Computer Systems Organization (3) (Enroll in EE 457Lx)

458 Numerical Methods (4) (Enroll in MATH 458)

459 Computer Systems and Applications Modeling Fundamentals (3, Sp) Techniques and tools needed to construct/evaluate models of computer systems and applications. Analytical and simulation methods, capacity planning, performance/reliability evaluation, and decision-making. Prerequisite: MATH 225, CSCI 201.

460 Introduction to Artificial Intelligence (3, FaSp) Concepts and algorithms underlying the understanding and construction of intelligent systems. Agents, problem solving, search, representation, reasoning, planning, communication, perception, robotics, neural networks. Junior standing. Prerequisite: CSCI 102L or CSCI 455x.

465 Probabilistic Methods in Computer Systems Modeling (3) (Enroll in EE 465)

477 Design and Construction of Large Software Systems (3, Sp) Programming methodologies; intra-group and inter-group communication; software lifecycle; software economics. A large software project is a central aspect of the course. Prerequisite: CSCI 201, CSCI 377.

480 Computer Graphics (3, FaSp) Hardware for interactive graphic systems; picture representations; data structures for graphics; picture processing techniques; languages for graphics; survey of applications such as animation and simulation. Prerequisite: CSCI 102.

485 File and Database Management (3, FaSp) File input/output techniques, basic methods for file organization, file managers, principles of databases, conceptual data models, and query languages. Prerequisite: CSCI 201.

490x Directed Research (2-8, max 8) Individual research and readings. Not available for graduate credit. Prerequisite: departmental approval.

495 Senior Project (3) (Enroll in PHYS 495)

499 Special Topics (2-4, max 8) Selected topics in computer science.
GRADUATE COURSES

501 Numerical Analysis and Computation (3)
502ab Numerical Analysis (3-3)
504ab Numerical Solutions of Ordinary and Partial Differential Equations (3)
505ab Applied Probability (3-3)
510 Software Management and Economics (3, Fa)
511 Personal Software Process (PSP) and Project (3, Fa)
520 Computer Animation and Simulation (3, Sp)
530 Security Systems (3)
533 Combinatorial Analysis and Algebra (3)
541 Artificial Intelligence Planning (3, Irregular)
542 Neural Computation with Artificial Neural Networks (3, Sp)
543 Software Multiagent Systems (3, Sp)
544 Natural Language Processing (3)
545 Robotics (3, Sp)
546 Intelligent Embedded Systems (3, Sp)
547 Sensing and Planning in Robotics (3, Fa)
548 Information Integration on the Web (3, Sp)
549 Nanorobotics (3, Sp)
551 Computer Communications (3, Sp)
552 Logic Design and Switching Theory (3)
553 Computational Solution of Optimization Problems (3)
554 Real Time Computer Systems (3)
555 Advanced Operating Systems (3, FaSp)
556 Introduction to Cryptography (3)
557 Computer Systems Architecture (3)
558L Internetworking and Distributed Systems Laboratory (3)
559 Mathematical Pattern Recognition (3-3)
560L Advanced Microcomputer-Based Design (3)
561 Foundations of Artificial Intelligence (3, Sp)
562 Empirical Methods in Natural Language Processing (3, 2 years, Fa)
564 Brain Theory and Artificial Intelligence (3, Fa)
565 Compiler Design (4, Sp)
566 Neural Network Self-Organization (3, Sp)
567 Machine Learning (3)
569 Integrated Intelligent Systems (3)
570 Analysis of Algorithms (3, FaSp)
571 Web Technologies (3, Fa)
573 Advanced Artificial Intelligence (3, Fa)
574 Computer Vision (3, Fa)
576 Multimedia Systems Design (3, FaSp)
577ab Software Engineering (4-4, FaSp)
578 Software Architectures (3, Sp)
580 3D Graphics and Rendering (3, Fa)
581 Logic and its Applications (3)
582 Geometric Modeling (3, Sp)
583 Computational Geometry (3)
584 Control and Learning in Mobile Robots and Multi-Robot Systems (3, Sp)
585 Database Systems (3, FaSp)
586 Database Systems Interoperability (3, Sp)
587ab Mathematical Models of Neurons and Neural Networks (3-3)
588 Specification and Design of User Interface Software (3, Fa)
589 Software Engineering for Embedded Systems (3, FaSp)
590 Directed Research (1-12)
591ab Applied Software Engineering (3-3, Sp)
592 Emerging Best Practices in Software Engineering (3, SpSm)
593 Autonomous Learning and Discovery Agents (3)
594abz Master’s Thesis (2-2-0, FaSpSm)
595 Advanced Compiler Design (4)
597 Seminar in Computer Science Research (1, max 2, FaSp)
599 Special Topics (2-4, max 9)
652 Wireless Sensor Networks (3)
658 Diagnosis and Design of Reliable Digital Systems (3)
664 Neural Models for Visually Guided Behavior (3, max 9)
674ab Advanced Topics in Computer Vision (3-3)
694ab Topics in Computer Networks and Distributed Systems (3-3)
790 Research (1-12)
794abcdz Doctoral Dissertation (2-2-2-2-0)
## Computer Science (128 units)

### Freshman (15 units)
- **GE Cat. VI** (4)
- WRIT 140 (4)
- MATH 125 (4)
- CSCI 101L (3)

### Sophomore (17 units)
- FREE ELEC. (2)
- EE 101 (3)
- MATH 226 (4)
- CSCI 105 (2)
- FOREIGN LANG. (4)

### Junior (17 units)
- BASIC SCIENCE I (4)
- EE 357 (3)
- MATH 407 (4)
- CSCI TECH. ELEC. (3)
- CSCI 303L (3)

### Senior (15 units)
- SCIENCE ELECTIVE (4)
- FREE ELEC. (4)
- GE Cat. II (4)
- CSCI 402x (3)

### Other Courses (6 units)
- Free Elective
- Free Elective

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### Mathematics (20 units)
- MATH 125: Calculus I
- MATH 126: Calculus II
- MATH 226: Calculus III
- MATH 225: Linear Algebra & Diff. Equations
- MATH 407: Probability Theory

### Science Courses (12 units)
- Basic Science I (see * below)
- Basic Science II (see * below)
- Science Elective (see ** below)

### General Education (39 units)
- WRIT 140**: Writing and Critical Reasoning
- WRIT 340: Advanced Writing
- Foreign Language
- Foreign Language
- Foreign Language
- GE Cat. I
- GE Cat. II
- GE Cat. IV
- GE Cat. V
- GE Cat. VI

### Engineering (51 units)
- CSCI 101L: Fund. of Computer Programming
- CSCI 102L: Data Structures
- CSCI 105: Object Oriented Programming
- CSCI 107: Computers and Society
- CSCI 201L: Princ. of Software Development
- CSCI 303: Design & Analysis of Algorithms
- CSCI 377: Intro to Software Engineering
- CSCI 402x: Operating Systems
- CSCI 477: Design & Constr. of Lg. Software Sys.
- EE 101: Introduction to Digital Logic
- EE 102L: Introduction to Digital Circuits
- EE 357: Basic Org. of Computer Systems
- EE 457Lx: Computer Systems Organization
- Technical Elective (see ***** below)

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### Notes
- * Basic science requirement: PHYS 151L and 152L or CHEM 105abL or BISC 120L and 220L.
- ** Any course in physics, biology or chemistry beyond the basic science requirement or in another scientific discipline. See department for approval.
- CSCI 101L: Fund. of Computer Programming
- CSCI 102L: Data Structures
- CSCI 105: Object Oriented Programming
- CSCI 107: Computers and Society
- CSCI 201L: Princ. of Software Development
- CSCI 303: Design & Analysis of Algorithms
- CSCI 377: Intro to Software Engineering
- CSCI 402x: Operating Systems
- CSCI 477: Design & Constr. of Lg. Software Sys.
- EE 101: Introduction to Digital Logic
- EE 102L: Introduction to Digital Circuits
- EE 357: Basic Org. of Computer Systems
- EE 457Lx: Computer Systems Organization
- Technical Elective (see ***** below)
- Technical Elective (see ***** below)
- Technical Elective (see ***** below)

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### Key:
- prerequisite
- co-requisite
- <<concurrent enrollment>>
# Comp. Engr. & Comp. Sci. (131 units)

**Mathematics (24 units)**
- MATH 125 Calculus I
- MATH 126 Calculus II
- MATH 225 Linear Algebra & Diff. Equations
- MATH 226 Calculus III
- MATH 407 Probability Theory
- Math Elective (see below)

**Physics (8 units)**
- PHYS 151L Mechanics and Thermodynamics
- PHYS 152L Electricity and Magnetism

**Science Course (4 units)**
- Science Elective (see ** below)

**General Education (27 units)**
- WRIT 140*** Writing and Critical Reasoning
- WRIT 340 Advanced Writing
- GE Cats. I, II, V, VIG

**Engineering (68 units)**
- CSCI 101L Fund. of Computer Programming
- CSCI 102L Data Structures
- CSCI 105 Object Oriented Programming
- CSCI 107 Computers and Society
- CSCI 201L Princ. of Software Development
- CSCI 303 Analysis and Design of Algo.
- CSCI 377 Intro to Software Engineering
- CSCI 402x Operating Systems
- CSCI 477 Design of Large Software Sys.
- EE 101 Introduction to Digital Logic
- EE 102L Introduction to Digital Circuits
- EE 105 Intro to Electrical Engineering
- EE 326Lx Essentials of Electrical Engr.
- EE 327x Digital Electronics
- EE 357 Basic Org. of Computer Systems
- EE 454L Intro. to Sys. Using Microprocessors
- EE 457Lx Computer Systems Organization
- EE 459L Senior Design Project
- ISE 460 Engineering Economy

**Technical Elective**
- Technical Elective (see **** below)

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### Key:
- prerequisite
- [co-requisite]
- <<concurrent enrollment>>

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* Any 400-level mathematics course except MATH 406 or 450.

** Science elective is selected from PHYS 151L, CHEM 105aL, 115aL, or other courses approved by your advisor.

*** Concurrent enrollment in a Social Issues GE Course is required.

**** May take a Category I, II, IV or VI GE Class.

***** See department for a list of approved technical electives and areas of specialization.