Academic and Curriculum Policies

Restricted Electives - These credit hours are included in the curriculum with the intent to enhance the technical skills and knowledge of the student. Students may choose to select restricted electives in a single area of computer science or information technology to advance their understanding of a particular area or technology, or they may choose to take coursework in a diversity of technical areas so as to give both breadth and depth to more than one area of interest. It is highly recommended that students talk to an advisor before registering for an elective.

Courses which are considered professional development in content are not accepted as restricted electives. For professional development in areas of business or management, the Engineering Leadership minor or a business minor should be considered.

- *Restrictions on electives -*

- Any Computer Science Department scheduled course which is listed 4000-4899 which is not already a required course for the degree program is an accepted restricted elective. Please note that in all cases the prerequisites for any of these courses must be satisfied prior to enrolling in the course. In addition 5000-5899 courses may be used as restricted electives but student must have a UCF grade point average of at least 3.00 at the time the student registers for the course. Courses at the 3000 level, taught by the CS Department, will be accepted as restricted electives for information technology students only.

- The above also allows for courses which are required for other degree programs. For example, computer science students are required to take COP 3503C and COP 3402 as required coursework, and information technology students are required to take CNT 4703 and CNT 4714 as required coursework. Therefore COP 3503C would be an accepted restricted elective for information technology students, while CNT 4703 would be an accepted restricted elective for computer science students. Please note that in most cases the prerequisites for any of these courses must be satisfied prior to enrolling in the course.

- *** Only one of the following seven IT courses may count toward the CS Restricted Electives:* CIS4004, CIS4524, CNT4603, CNT4703, CNT4714, CAP4102, and (CAP4104, No longer offered). *Prerequisite for these IT courses is Computer Science II (COP3503), except CAP4102, which is Computer Science I (COP3502).*

- Computer Science students with a UCF grade point average of at least 3.00 at the time the student registers are allowed to enroll in three hours of independent study or independent research upon completion of the required agreement between the student and the faculty offering the independent study or independent research. Only CS Department faculty are permitted to supervise independent study or independent research hours which are to be accepted as restricted electives.

- Courses which are from the College of Sciences or other UCF Colleges are not accepted as restricted electives. However, if a student has the desire to pursue additional coursework in an area such as mathematics or physics, a minor should be considered.

- Credit awarded for military, commercial, or private training will not be accepted as restricted elective hours. Internships are accepted as one restricted elective for IT students ONLY, through the IT internship program: http://server.cs.ucf.edu/itinternship/.

- New courses are introduced often. If a student is interested in a course offered, but it's not on the list, please inquire by contacting the CS Department advising office (HEC 345/346).

Program	Course
CS Elective Course IT Elective Course	**CAP 4053 ECS-EECS 3(3,0) AI for Game Programming:** PR: COP 3502C with a grade of "C" (2.0) or better or C.I. Surveys cutting-edge AI techniques for video games and board games and contrasts them with more traditional approaches. Spring.
** CS Elective Course (Only one IT course allowed for CS elective) IT Elective Course	**CAP 4102 ECS-EECS 3(3,0) IT Design and User Experience**: PR: COP3502C. To meet a real world customer's needs, student teams will learn and apply user-centered principles to elicit requirements, prototype, and build a complete web-based solution. *Even Fall.*
CS Elective Course IT Elective Course	**CAP 4145 ECS-CS 3(3,0) Introduction to Malware Analysis:** PR: CIS 3360, (CGS 3269 or CDA 3103C), (CGS 3763 or COP 4600), or C.I. Introduction to using reverse engineering techniques to find and analyze the behavior of programs in binary form; assembly language, reverse engineering tools, and virtual machines. *Spring.*
CS Elective Course IT Elective Course	**CAP 4314 ECS-CS 3(3,0) Social Network Analysis:** PR: CNT 3004 and COP 3330. COP3503 for CS major students. Introduce the concept of social network. Network structure and measures. Network visualization. Tie strength and propagation in networks. Methods for social network analysis (SNA). Public sector applications of SNA. Business applications of SNA. *Fall.*
CS Elective Course IT Elective Course	**CAP 4453 ECS-EECS 3(3,0) Robot Vision:** PR: COP 3503C and MAC 2312 each with a grade of "C" (2.0) or better or C.I. Perspective and orthographic projections; the processing of edges, regions, motion, shading, texture, object detection, recognition, and machine learning. Fall ,Spring.
CS Elective Course IT Elective Course	**CAP 4630 ECS-EECS 3(3,0) Artificial Intelligence:** PR: COP 3503C with a grade of "C" (2.0) or better and COT 3960. Current methods in AI: knowledge-based systems, representation, inference, planning, natural language. Programming in Lisp or Prolog required. Fall.
CS Elective Course IT Elective Course	**CAP 4720 ECS-EECS 3(3,0) Computer Graphics:** PR: COP 3503C and MAC 1114C each with a grade of "C" (2.0) or better, and COT 3960. Math for computer graphics, visibility and shading, graphics and data structure, curves and surfaces, commodity graphics hardware, and graphics API. Occasional.
CS Elective Course IT Elective Course	**CAP 5415 ECS-EECS 3(3,0) Computer Vision:** PR: COP 3503C, MAC 2312 and COT 3960. Image formation, binary vision, region growing and edge detection, shape representation, dynamic scene analysis, texture, stereo and range images, and knowledge representation. Fall.

Program	Course
CS Elective Course IT Elective Course	**CAP 5510 ECS-EECS 3(3,0) Bioinformatics:** PR: Background in programing language or molecular biology. This course introduces problems, concepts, algorithms, and applications in Bioinformatics. It covers essential topics such as sequence alignment and prediction of gene and protein structure. Occasional.
CS Elective Course IT Elective Course	**CAP 5512 ECS-EECS 3(3,0) Evolutionary Computation:** PR: CAP 4630 or COP 3503C or C.I. This course covers the field of evolutionary computation, focusing on the theory and application of genetic algorithms. Spring.
CS Elective Course IT Elective Course	**CAP 5610 ECS-EECS 3(3,0) Machine Learning:** PR: CAP 4630 or C.I. Origin/evaluation of machine intelligence; machine learning concepts and their applications in problem solving, planning and "expert systems" symbolic role of human and computers. Occasional.
CS Elective Course IT Elective Course	**CAP 5636 ECS-EECS 3(3,0) Advanced Artificial Intelligence:** PR: CAP 4630. AI theory of knowledge representation, "expert systems", memory organization, problem solving, learning, planning, vision, and natural language. Fall.
CS Elective Course IT Elective Course	**CAP 5725 ECS-EECS 3(3,0) Computer Graphics I:** Architecture of graphics processors; display hardware; principles of programming and display software; problems and applications of graphic systems. Spring.
CS Required Course IT Elective Course	**CDA 3103C ECS-EECS 3(3,1) Computer Logic and Organization:** PR: COP 3223C with a grade of "C" (2.0) or better; CR: COT 3100C or MHF 3302 or MAD 2104. Logic design, computer arithmetic, Instruction Set Architecture (MIPS, SPIM simulator), performance, data path, control unit, memory hierarchy, I/O interface. Fall, Spring.
CS Elective Course IT Elective Course	**CDA 5106 ECS-EECS 3(3,0) Advanced Computer Architecture:** PR: EEL 4768C. Modern processor design, instruction-level parallelism, thread-level parallelism, data-level parallelism, memory hierarchy, and I/O. Fall, Spring.
CS Elective Course IT Elective Course	**CDA 5110 ECS-EECS 3(3,0) Parallel Architecture and Algorithms:** PR: COT 4210, CDA 5106. General-purpose vs. special-purpose parallel computers; arrays, message-passing; shared-memory; taxonomy; parallelization techniques; communication synchronization and granularity; parallel data structures; automatic program restructuring. Occasional.
CS Elective Course IT Elective Course	**CEN 5016 ECS-EECS 3(3,0) Software Engineering:** PR: COP 4331C. Application of formal software processes, engineering methods, and documentation standards to the development of large scale software systems. A team project is required. Spring.

Program	Course
IT Required Course	**CGS 2545C ECS-EECS 3(2,1) Database Concepts:** PR: COP 2500C or high level programming course (C, Java, C#, C++) with a grade of "C" (2.0) or better. Entity-relation model, relational database managements systems, normal forms, performance or databases, report generation. Fall, Spring.
IT Elective Course	**CGS 3175 ECS-EECS 3(3,0) Internet Applications:** PR: COP 2500C or high level programming course (C, Java, C#, C++) with a grade of "C" (2.0) or better. HTML coding, using images, sound and animation, advanced text formatting, forms and CGS scripts, introduction to JavaScript. Fall, Spring.
IT Required Course	**CGS 3269 ECS-EECS 3(3,0) Computer Architecture Concepts:** PR: COP 2500C or high level programming course (C, Java, C#, C++) with a grade of "C" (2.0) or better. CPU organization, current computer architectures, network file servers. Fall, Spring.
IT Required Course	**CGS 3763 ECS-EECS 3(3,0) Operating System Concepts:** PR: COP 2500C or high level programming course (C, Java, C#, C++) with a grade of "C" (2.0) or better. System calls, concept of processes, CPU scheduling, security issues, client server paradigms, and computer supported workgroups. Occasional.
IT Required Course	**CIS 3003 ECS-EECS 3(3,0) Fundamentals of Information Technology:** PR: CGS 2545C and COP 3223C each with a grade of "C" (2.0) or better. Pervasive themes in IT. Organizational issues. History of IT. IT and its related and informing disciplines. Application domains. Applications of math and statistics to IT. Fall.
CS Required Course IT Required Course	**CIS 3360 ECS-EECS 3(3,0) Security in Computing:** PR: COP 3223C or EGN 3211 with a grade of "C" (2.0) or better. Security theory. Legal and human factors, Malware, Intrusion patterns and tools, Windows, Unix, TCP/IP, and applications vulnerabilities. Detection. Policies and enforcement. Protection and assurance. Occasional.
CS Elective Course IT Elective Course	**CIS 3362 ECS-EECS 3(3,0) Cryptography and Information Security:** PR: COP 3223C or EGN 3211, and MAC 1114C each with a grade of "C" (2.0) or better. Encryption algorithms and ciphers. Public and private keys. Key infrastructures. Authentication, confidentiality, integrity, and nonrepudiation. Digital signatures and certificates. Hash and digest algorithms. Standards. Occasional. This is a CS Elective for catalog year 2017-2018 or later.
IT Required Course	**CIS 3921 ECS-EECS 1(1,0) Careers in IT:** PR: COP 3223C and IT major. An overview of the IT field, job opportunities and careers in information technology, detailed information about some jobs as well as a broad survey. Fall, Spring.

Program	Course
IT Required Course	**CIS 3990 ECS-EECS 0(0,0) IT Career and Academic Advising I**: PR: PHY 2053C and IT major. Mandatory meeting with students and their faculty advisor for career/academic advising. Fall, Spring.
** CS Elective Course (Only one IT course allowed for CS elective) IT Required course	**CIS 4004 ECS-EECS 3(3,0) Web-Based Information Technology:** PR: CNT 3004 and COP 3330 each with grades of "C" (2.0) or better. Digital libraries. Media formats. Compression. Streaming Media. Mobile internet and WML. Emerging technologies. Capacity planning for web services. Fall, Spring.
CS Elective Course IT Elective Course	**CIS 4203C ECS-EECS 3(2,2) Digital Forensics:** PR: (COP 4600 or CGS 3763) and (CIS 3360 or CIS 3362) or C.I. Operating system forensics, digital media forensics, networking forensics, various digital devices forensics. User activity profiling and digital storage recovery. Fall
CS Elective Course IT Elective Course	**CIS 4361 ECS-EECS 3(3,0) Secure Operating Systems and Administration:** PR: CIS 3360 with a grade of "C" (2.0) or better; CR: COP 4600 or CGS 3763 or EEL 4882. Understanding of secure operating systems requirements, design principles and theories, protection methods, access control, authentication, vulnerability, analysis and case studies. Occasional.
** CS Elective Course (Only one IT course allowed for CS elective) IT Required course	**CIS 4524 ECS-EECS 3(3,0) Managing IT Integration:** PR: CIS 3003 with a grade of "C" (2.0) or better. Requirements, acquisition and sourcing. Integration. Project management. Testing and QA. Organizational context. Architecture. Spring.
CS Elective Course IT Elective Course	**CIS 4615 ECS-EECS 3(3,0) Secure Software Development and Assurance:** PR: (COP 4600 or CGS 3763) and (CIS 3360 or CIS 3362) or C.I. Thread modeling, Secure code life-cycle, Buffer overflows, race conditions and format string problems, Inputs and clients, File system, Cryptography applications, UMLsec, Java security and Reverse engineering. Occasional.
CS Elective Course IT Elective Course	**CIS 4940C ECS-EECS 3(1,3) Topics in Cybersecurity:** PR: CIS 3360 or C.I. A directed and supervised investigation of selected problems, issues, and trends in cybersecurity, with emphasis on laboratory simulations of system penetration methods and network defense strategies. *Spring*.
IT Required Course	**CIS 4991 ECS-EECS 0(0,0) IT Career and Academic Advising II:** PR: CIS 3990 and department consent. Mandatory meeting with students and their faculty advisor for career/academic advising. Fall, Spring.
IT Required Course	**CNT 3004 ECS-CS 3(3,0) Computer Network Concepts:** PR: PHY 2053C with a grade of "C" (2.0) or better and, CR: CIS 3990. Network media, protocol, current and evolving standards for local, metropolitan, wide area and wireless networks. *Fall,Spring.*

Program	Course
CS Elective Course IT Elective Course	**CNT 4403 ECS-EECS 3(3,0)** **Network Security and Privacy:** PR: (CNT 3004 or EEL 4781 or CNT 4704) and (CIS 3360 or CIS 3362) all with a grade of "C" (2.0) or better or C.I. Fundamentals of network security, protocols, secure applications, network intrusion detection, security policy, firewalls, and privacy issues. Occasional.
CS Elective Course IT Elective Course	**CNT 4425C ECS-CS 3(3,1) Cloud Computing Management**: PR: CGS 3763 or COP 4600 with a grade of "C" (2.0) or better. Administration of cloud computing. Topics include virtualization, container, resource management, programming models, application models, and system administration. Real-world Cloud Computing systems and tools, such as OpenStack, Amazon/Microsoft/Google public cloud systems, as well as Hadoop and Spark. Spring.
** CS Elective Course (Only one IT course allowed for CS elective) IT Required course	**CNT 4603 ECS-EECS 3(3,0) System Administration and Maintenance:** PR: CGS 3763 with a grade of "C" (2.0) or better. An examination of operating systems and applications installation, configuration, and maintenance, including client-server services, content management and deployment, server administration and management, and user/group management. Fall, Spring.
** CS Elective Course (Only one IT course allowed for CS elective) IT Required course	**CNT 4703C ECS-EECS 3(1,2) Design and Implementation of Computer Communication Networks:** PR: CNT 3004 and COP 3502C and (MAD 2104 or COT 3100C) all with a grade of "C" (2.0) or better. Data communication networking technologies (TCP/IP, Ethernet, Gigabit Ethernet, ATM, Frame Relay), products (routers, switches, adapters, cabling). Base design and detailed configuration including hands-on exercises. Fall, Spring. M&S fee $16.00
CS Elective Course IT Elective Course	**CNT 4704 ECS-EECS 3(3,0) Analysis of Computer Communication Networks:** PR: (COT 3100C or MAD 2104) and STA 2023 each with grades of "C" (2.0) or better. Network design using layering. Introduces cabling, topology, architecture, hardware and software. Includes performance and control issues such as congestion control, error control, contention resolution. Occasional.
** CS Elective Course (Only one IT course allowed for CS elective) IT Required course	**CNT 4714 ECS-EECS 3(3,0) Enterprise Computing:** PR: CGS 3269, MAD 2104, COP 3330 and COP 3502C all with a grade of "C" (2.0) or better. Client-server architecture. Server-side scripting: Servlets, JSP, PHP. JDBC and MySQL database; connectivity. Multi-threaded Java applications. J2EE development. SSL., Event-driven programming. Fall, Spring.
CS Elective Course IT Elective Course	**CNT 5008 ECS-EECS 3(3,0) Computer Communication Networks** **Architecture:** PR: EEL 4768C. Computer networks, layers, protocols and interfaces, local area networks networking. Fall.

Program	Course
CS Elective Course IT Elective Course	**CNT 5805 ECS-EECS 3(3,0) Network Science:** PR: Undergraduate degree in CS, EE, or CpE. The emerging science of complex networks and their applications. Focus will be on algorithms, mathematical theories, and computational methods that analyze complex networks and predict their behavior. Even Fall.
CS Required Course IT Required Course	**COP 3223C ECS-EECS 3(3,1) Introduction to Programming with C:** Programming in C including arrays, pointer manipulation and use of standard C math and IO libraries. Fall, Spring.
CS Required Course IT Required Course	**COP 3330 ECS-EECS 3(3,0) Object Oriented Programming:** PR: COP 3223C or EGN 3211 with a grade of "C" (2.0) or better. Object oriented programming concepts (classes, objects, methods, encapsulating, inheritance, interfaces) and the expression of these concepts in the programming languages such as JAVA. Fall, Spring.
CS Required Course IT Elective Course	**COP 3402 ECS-EECS 3(3,0) Systems Software:** PR: CDA 3103C and COP 3502C each with a grade of "C" (2.0) or better. Design and development of assemblers, linkers, loaders, and compilers. Study memory hierarchy, program performance, and system level I/O. Fall, Spring.
CS Required Course IT Required Course	**COP 3502C ECS-EECS 3(3,1) Computer Science I:** PR: (COP 3223C or EGN 3211) and MAC 1105C all with a grade of "C" (2.0) or better. Problem solving techniques, order analysis and notation, abstract data types, and recursion. Fall, Spring.
CS Required Course IT Elective Course	**COP 3503C ECS-EECS 3(3,1) Computer Science II:** PR: COP 3502C and COP 3330 and (MAD 2104 or COT 3100C) all with a grade of "C" (2.0) or better. Algorithm design and analysis for tree, list, set, and graph data models; algorithmic strategies and applications, and algorithmic complexity analysis; sorting and searching; practical applications. Fall, Spring.
CS Elective Course IT Elective Course	**COP 4020 ECS-EECS 3(3,0) Programming Languages I:** PR: COP 3503C with a grade of "C" or better and COT 3960. Paradigms and fundamental concepts of programming languages are presented, including: scope, binding, abstraction, encapsulation, typing etc. Design paradigms object-oriented, functional and logic programming are presented. Fall, Spring. This is a CS Elective for catalog year 2017-2018 or later. (This is a CS required course for catalog year 2016 and prior).
CS Required Course IT Elective Course	**COP 4331C ECS-EECS 3(3,1) Processes for Object-Oriented Software Development:** PR: COP 3503C with a grade of "C" (2.0) or better and COT 3960 (CS majors). Concepts, principles, processes and methods for developing large software systems featuring a team project using object-oriented design in UML and implementation in C++. Fall, Spring.

Program	Course
CS Elective Course IT Elective Course	**COP 4516C ECS-EECS 3(1,3) Problem Solving Techniques and Team Dynamics:** PR: COP 3503C with a grade of "C" (2.0) or better. Design and implement solutions to problems requiring the applications of the different algorithms. Team project format. Occasional.
CS Elective Course IT Elective Course	**COP 4520 ECS-EECS 3(3,0) Concepts of Parallel and Distributed Processing:** PR: COP 3402 and COP 3503C each with a grade of "C" (2.0) or better and COT 3960. Parallel and distributed paradigms, architectures and algorithms, and the analytical tools, environments and languages needed to support these paradigms. Occasional.
CS Elective Course IT Elective Course	**COP 4600 ECS-EECS 3(3,0) Operating Systems:** PR: COP 3503C and COP 3402 (CS majors) each with a grade of "C" (2.0) or better and COT 3960 (CS majors). Function and organization of operating systems, process management, virtual memory, I/O management, and file management. Fall, Spring. This is a CS Elective for catalog year 2017-2018 or later. (This is a CS required course for catalog year 2016 and prior).
CS Elective Course IT Elective Course	**COP 4710 ECS-EECS 3(3,0) Database Systems:** PR: COP 3503C with a grade of "C" (2.0) or better. Storage and access Structures, database models and languages, related database design, and implementation techniques for database management systems. Fall, Spring.
IT Required Course	**COP 4910 ECS-EECS 3(3,0) Frontiers in Information Technology:** PR: CNT 4603 with a grade of "C" (2.0) or better; CR: CNT 4703C and CIS 4991. Research into leading edge information technologies that have a high likelihood of affecting the work place in the two to five year time frame. Fall, Spring.
CS Required Course	**COP 4934 ECS-EECS 3(3,0) Senior Design I:** PR: COP 3402 and COP 3503C each with a grade of "C" (2.0) or better and consent of Department of EECS; CR: COP 4331C. Students work in teams to demonstrate their knowledge of computer science and apply it to realistic and meaningful problems. Fall, Spring.
CS Required Course	**COP 4935 ECS-EECS 3(3,0) Senior Design II:** PR: COP 4934 with a grade of "C" (2.0) or better. Students work in teams to demonstrate their knowledge of computer science and apply it to realistic and meaningful problems. Fall, Spring.
CS Elective Course IT Elective Course	**COP 5021 ECS-EECS 3(3,0) Program Analysis:** PR: COP 4020 and COT 4210 or C.I. Static analysis of programs including theoretical and practical limitations, data flow analysis, abstract interpretation, and type and effect systems. Tools to automate program analysis. Even Spring.

Program	Course
CS Elective Course IT Elective Course	**COP 5537 ECS-EECS 3(3,0) Network Optimization:** PR: Graduate standing or C.I. Techniques for modeling complex, interconnected systems as networks; optimization with graph theory; algorithms, data structures, and computational complexity; statistical methods for studying large, evolving networks. Fall.
CS Elective Course IT Elective Course	**COP 5611 ECS-EECS 3(3,0) Operating Systems Design Principles:** PR: COP 4600. Structure and functions of operating systems, process communication techniques, high-level concurrent programming, virtual memory systems, elementary queuing theory, security, distributed systems, case studies. Spring.
CS Elective Course IT Elective Course	**COP 5621 ECS-EECS 3(3,0) Compiler Construction:** PR: COP4020 and COT 4210. Techniques in the design and implementation of compilers. Optimization, code generation, error recovery, attributed grammars. A project is required. Odd Fall.
CS Elective Course IT Elective Course	**COP 5711 ECS-EECS 3(3,0) Parallel and Distributed Database Systems:** PR: COP 4710. Storage manager, implementation techniques for parallel DBMSs, distributed DBMS architectures, distributed database design, query processing, multidatabase systems. Occasional.
CS Required Course	**COT 3100C ECS-EECS 3(3,1) Introduction to Discrete Structures:** PR: MAC 1105C and MAC 1114C each with a grade of "C" (2.0) or better. Logic, sets, functions, relations, combinatorics, graphics, Boolean algebras, finite-state machines, Turing machines, unsolvability, computational complexity. Fall, Spring.
CS Required Course	**COT 3960 ECS-EECS 0(1,0) Passed CS Foundation Exam:** PR: COP 3502C with a grade of "C" (2.0) or better. Foundation examination for computer science majors. Required before taking advanced core courses in Computer Science and upper-division 4000 and 5000 level CS electives. Graded S/U. Fall, Spring.
CS Required Course IT Elective Course	**COT 4210 ECS-EECS 3(3,0) Discrete Structures II:** PR: COP 3503C with a grade of "C" (2.0) or better and COT 3960. Computation Theory. A study of the properties of grammars and automata as formal specifications for algorithms and families of languages. Fall, Spring.
CS Elective Course IT Elective Course	**COT 4400 ECS-EECS 3(3,0) Tools for Algorithm Analysis:** PR: COT 3960 and COP 3503C. Tools from discrete and continuous mathematics for analyzing complexity of algorithms. Order notation use and manipulation. Occasional.

Program	Course
CS Elective Course IT Elective Course	**COT 4500 ECS-EECS 3(3,0) Numerical Calculus:** PR: MAC 2312 and COP 3223C each with a grade of "C" (2.0) or better. Numerical methods for finding roots of nonlinear equations, solutions of systems of linear equations, and ordinary differential equations. Occasional.
CS Required Course	**COT 4810 ECS-EECS 3(3,0) Topics in Computer Science:** PR: COP 3402 and COP 3503C each with a grade of "C" (2.0) or better and COT 3960. A range of topics from the field of Computer science; application of oral and written communication skills; social, ethical and moral issues of computing. Fall, Spring. This is a required course for catalog year 2012 and prior.
CS Elective Course IT Elective Course	**COT 5405 ECS-EECS 3(3,0) Design and Analysis of Algorithms:** PR: COT 4210. Classification of algorithms, e.g., recursive, divide-and-conquer, greedy, etc. Data Structures and algorithm design and performance. Time and space complexity analysis. Fall, Spring.
CS Elective Course	**EEE 4346C ECS-ECE 3(2,3) Hardware Security and Trusted Circuit Design:** PR: EEL 3801C with a grade of "C" (2.0) or better. Design, analysis and synthesis of sequential logic circuits and systems. Data path and controller design using a hardware descriptive language. Case studies on hardware security. Spring. This is a CS Elective for catalog year 2017-2018 or later.
CS Elective Course	**EEL 4660 ECS-ECE 3(3,0) Robotic Systems:** PR: EGN 4060C or EEL 4742C or COP 3503C. Team based development of a robotic system incorporating concepts such as sensing, computer vision, machine learning, localization, mapping, manipulation and locomotion. Spring.
CS Elective Course	**EEL 4768 ECS-ECE 3(3,0) Computer Architecture:** PR: EEL 3801C or CDA3103C with a grade of "C" (2.0) or better. Computer systems performance and evaluation, processor datapath and control, microprogrammed architectures, instruction and arithmetic pipelines, cache and virtual memory, and RISC vs. CISC. *Fall,Spring.* This is a CS Elective for catalog year 2017-2018 or later. (This is a CS required course for catalog year 2016 and prior).
CS Elective Course	**EEL 4781 ECS-ECE 3(3,0) Computer Communication Networks:** PR: EEL 3801C with a grade of "C" (2.0) or better and STA 3032. Network models. Media access protocols. Data link control. Routing and flow control. Internetworking. Current architectures and protocols: OSI, ethernet, token, ring, FDDI, HSLC, X.25, etc. Fall, Spring. This is a CS Elective for catalog year 2017-2018 or later.

Program	Course
CS Elective Course	**EEL 5780 ECS-ECE 3(3,0) Wireless Networks:** PR: EEL 4781 or C.I. The wireless networking topics include: cellular networks, multiple access protocols, channel assignment and resource allocation, mobility and location management, handoffs, routing, authentication, call admission control and QoS provisioning, network layer issues, wireless data networking (WAP, GSM, GPRS, CDMA, WCDMA.). Even Spring. This is a CS Elective for catalog year 2017-2018 or later.
CS Elective Course	**EEL 5820 ECS-ECE 3(3,0) Image Processing:** PR: MAP 2302, EEL 4750 or C.I. Two-dimensional signal processing techniques; pictorial image representation; spatial filtering; image enhancement and encoding; segmentation and feature extraction; introduction to image understanding techniques. Odd Spring. This is a CS Elective for catalog year 2017-2018 or later.
CS Elective Course	**EGN 4060C ECS-ECS 3(2,3) Introduction to Robotics:** PR: COP 3223C or EGN 3211; and EEL 3657or EEL 4742C or COP 3503C or EGN 3321 or EML 3217. Theory and application of robotics topics including; architecture, path planning, sensing and manipulation. *Spring.*