ELECTRICAL/ELECTRONIC ENGINEERING (EECE)

See Course Description Symbols and Terms (https://catalog.csuchico.edu/academic-standards-policies/course-description-symbols-terms/) for an explanation of course description terminology and symbols, the course numbering system, and course credit units.

EECE 101 Exploration of Electrical and Computer Engineering 2 Units
Typically Offered: Fall only
Discussions of electrical and computer engineering and their roles in society and your contributions to creating our exciting future. Exploration of the fields of electrical and computer engineering through demonstrations and hands-on projects. Development of skills and resources to launch a successful professional engineering career. 2 hours activity, 1 hour lecture. (022027)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 2 units
Course Attributes: Lower Division; Laptop required, see department for details.

EECE 110 Fun with Electronics and Systems 4 Units GE
Typically Offered: Spring only
The course introduces students to electricity and magnetism as applied in audio engineering. Connections between the fundamental concepts and the physical properties of materials to digital and analog electronic circuits that are used to pick up sound; filters to remove noise and other artifacts; to amplify and distort specific frequencies; to digitize and store audio files; and to produce sound will be described. Students develop the ability to identify components from circuit schematics, construct audio circuits, and quantify the characteristics of the circuits. 2 hours activity, 3 hours discussion. (002612)
General Education: Laboratory (5C); Physical Science (5A)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Lower Division; Laptop required, see department for details.

EECE 111 Smart Electronics 3 Units GE
Typically Offered: Fall only
Innovations in the age of electronics has shrunk a room-size computer from the 1950s to today's hand-held devices that allow users to communicate with people around the world by text, voice, and/or streaming video. Sensors enable devices to monitor users so electronic systems can respond to voice and hand commands. To understand how these systems work, the course introduces students to concepts in electricity and magnetism. Applications of these concepts in electrical and electronic technology will be discussed including the operation of analog and digital circuits and systems in smart phones, robots, home automation systems, and other electronic systems that are designed to improve the quality of life. The impact of these systems on daily life, the economy, energy demand, and electronic waste, data privacy, and cybersecurity will be evaluated. 3 hours discussion. (022273)
General Education: Physical Science (5A)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Lower Division; Laptop required, see department for details.

EECE 111L Smart Electronics Activity 1 Unit GE
Prerequisite: EECE 111 (may be taken concurrently).
Typically Offered: Fall only
Innovations in the age of electronics have shrunk a room-size computer from the 1950s to today's hand-held devices that allow users to communicate with people around the world by text, voice, and/or streaming video. Sensors enable devices to monitor users so electronic systems can respond, for example, to voice and hand commands. Applying the knowledge gained in EECE 111, students create, simulate, construct, and characterize microprocessor-controlled embedded systems for smart electronic applications and identify some of the limitations of the systems. Students may evaluate techniques to control the direction and speed of an autonomous robot, explore ways in which to set up an Internet-of-Things (IoT) network, or use object recognition to find and avoid obstacles. 2 hours activity. (022692)
General Education: Laboratory (5C)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 1 unit
Course Attributes: Lower Division; Laptop required, see department for details.

EECE 144 Logic Design Fundamentals 4 Units
Prerequisite: GE Mathematical Concepts/Quantitative Reasoning (2) Ready.
Typically Offered: Fall and spring
Definition and properties of switching algebra. Minimization of algebraic function. Use of Karnaugh maps for simplification. Design of combinational logic networks. Design of sequential logic devices including flip-flops, registers, and counters. Analysis and applications of digital devices. Analysis and design of synchronous and asynchronous sequential state machines, state table derivation and reduction. Use of such CAD tools for schematic capture and logic device simulations. 2 hours activity, 3 hours lecture. (002614)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Lower Division

EECE 198 Special Topics 1-3 Units
Typically Offered: Inquire at department
This course is for special topics offered for 1.0-3.0 units. Typically the topic is offered on a one-time-only basis and may vary from term to term and be different for different sections. See the Class Schedule for the specific topic being offered. 3 hours activity. (002094)
Grade Basis: Graded
Repeatability: You may take this course more than once
Course Attributes: Lower Division

EECE 211 Linear Circuits I 3 Units
Prerequisite: PHYS 204B (may be taken concurrently).
Corequisites: EECE 211L.
Typically Offered: Fall and spring
This course introduces students to core concepts related to analysis and applications of linear circuits. Topics include electrical quantities and components; Kirchhoff's Laws and circuits analysis methods; Thevenin and Norton theorems; operational amplifiers and applications; first-order transient response of RC and RL circuits; AC steady-state analysis including phasors and impedance; circuit simulation and analysis using SPICE. 3 hours discussion. (002519)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Lower Division; Laptop required, see department for details.

EECE 211L Linear Circuits I Activity **1 Unit**
Corequisites: EECE 211.
Typically Offered: Fall and spring
Experiments to reinforce the principles taught in EECE 211. 2 hours activity. (002520)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 1 unit
Course Attributes: Lower Division

EECE 215 Practical Circuits and Electronics **4 Units**
Prerequisite: MATH 109, MATH 119 (or high school equivalent), or MATH 120, or passing score on the Math department administered calculus readiness exam.
Typically Offered: Fall and spring
Applications-based introduction to electricity, magnetism, and electrical and electronic components used in electromechanical and other engineering systems. Course topics include DC and AC circuit analysis; component selection and circuit design; applications of diodes, transistors, and operational amplifiers; logic gates and digital circuits; microcontroller applications and interfacing with external components; and three-phase circuits and ideal transformers. Instruments in basic electrical and electronic circuits are discussed, demonstrated, and employed. This course does not satisfy prerequisite requirements for EECE 311 or EECE 315. Mechanical Engineering majors may substitute EECE 211 and EECE 211L for this course. 2 hours activity, 3 hours discussion. (022099)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Lower Division; Laptop required, see department for details.

EECE 237 Embedded Systems Development **3 Units**
Prerequisite: CSCI 111.
Typically Offered: Fall and spring
This course presents the concepts and techniques associated with developing low level Embedded Systems Applications, using both Assembly Language and C. Topics include microprocessor architecture concepts, instruction set architectures, Assembly Language programming, data representations, interrupt handling and execution modes, low level C programming, and the use of on-chip and external peripherals. 2 hours activity, 2 hours lecture. (021437)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Lower Division; Laptop required, see department for details.

EECE 311 Linear Circuits II **4 Units**
Prerequisite: EECE 211 with a grade C- or higher; MATH 260 (may be taken concurrently); PHYS 204B.
Typically Offered: Fall and spring
This course introduces students to advanced concepts related to analysis and applications of linear circuits. Topics include circuit analysis techniques for networks with both independent and dependent sources; Fourier Series and circuits response; transfer functions, poles and zeros; frequency response of passive and active circuits, Bode plots; frequency-selective circuits and applications; circuits analysis with Laplace Transforms; introduction to MATLAB. 4 hours discussion. (002527)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Upper Division

EECE 314 Bioinstrumentation **3 Units**
Prerequisite: EECE 211 and EECE 211L, or EECE 215, or PHYS 327; PHYS 204A.
Typically Offered: Fall only
An introduction to recording and analyzing electronic data collected from biological systems. Topics include measurement methods, design principles of biomedical instruments, bioelectronics, sensors, transducers, interface electronics, and embedded data acquisition systems. Explores sources of biomedical signals, bioelectrical signal monitoring, acquisition, processing, analysis, and interpretation of results. 3 hours discussion. (022130)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division; Laptop required, see department for details.

EECE 314L Bioinstrumentation Activity **1 Unit**
Prerequisite: CSCI 111 or MECH 208; EECE 314 (may be taken concurrently).
Typically Offered: Fall only
Experiments to reinforce the principles taught in EECE 314. 2 hours activity. (022131)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 1 unit
Course Attributes: Upper Division; Laptop required, see department for details.

EECE 315 Electronics I **4 Units**
Prerequisite: EECE 211, EECE 211L; EECE 311 and MATH 260 (may be taken concurrently).
Typically Offered: Fall and spring
Ideal diodes. Zener diodes and regulation. Photodiodes and solar cells. Biasing and DC behavior of bipolar transistors. JFETs and MOSFETS. Small-signal AC equivalent circuits. Single-state transistor amplifiers. Low-frequency response. Discrete feedback amplifiers. 3 hours laboratory, 3 hours lecture. (002530)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Upper Division

EECE 316 Electronics II **4 Units**
Prerequisite: EECE 311, EECE 315.
Typically Offered: Spring only even years
Op Amp circuits, waveform generation and shaping, sinusoidal oscillators, high frequency amplifiers, active filters, power supply regulators, power electronics, advanced linear ICs. 3 hours discussion, 3 hours laboratory. (002534)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Upper Division; Laptop required, see department for details.

EECE 344 Embedded Systems Design **4 Units**
Prerequisite: EECE 144, EECE 237; EECE 110 or EECE 215 or EECE 211 and EECE 211L (All with a grade C- or higher).
Typically Offered: Fall and spring
Extends the study of digital circuits to LSI and VLSI devices. Microcontrollers, architecture, bus organization, and address decoding. Design concepts for microcontroller systems, including A/D and D/A conversion, serial communications, bus interfacing, interrupt processing, power regulations, timers, pulse width modulation, programmable I/O ports, and error control coding. 3 hours laboratory, 3 hours lecture. (002102)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Upper Division; Laptop required, see department for details.

EECE 344X Digital Systems Design Problem Solving Session **1 Unit**
Corequisites: EECE 344.
Typically Offered: Fall and spring
Supplemental applications and explanations intended to facilitate student understanding of content from EECE 344. 2 hours activity. (021638)
Grade Basis: Credit/No Credit
Repeatability: You may take this course for a maximum of 1 unit
Course Attributes: Upper Division

EECE 345 Introduction to Internet of Things System Design **4 Units**
Prerequisite: CSCI 111; CSCI 220, CSCI 221, or EECE 237 with a C- or higher.
Typically Offered: Inquire at department
This course introduces students to Internet of Things (IoT) systems using a project-based learning approach. Students learn programming skills in Python and apply these skills as they design, construct, and test IoT systems. Topics include the development of the field, IoT architecture, tools used in IoT system design, device interfacing, IoT platforms, and challenges in the field. 2 hours activity, 3 hours lecture. (022316)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Upper Division; Laptop required, see department for details.

EECE 365 Signals, Systems, and Transforms **4 Units**
Prerequisite: EECE 211 (with a grade C- or higher), MATH 260.
Typically Offered: Fall only
Modeling and analysis of Signals and Systems both continuous and discrete, in the time and frequency domains. Topics include theory and application of Fourier series, Fourier transforms, Parseval's Theorem and the Convolution, Laplace Transform Sampling Theorem, Z transform, discrete Fourier Transform and FFT. 4 hours discussion. (002528)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Upper Division

EECE 375 Fields and Waves **4 Units**
Prerequisite: MATH 260, PHYS 204B.
Typically Offered: Spring only even years
Transmission lines. Frequency-domain techniques. Fields and field operators. Electrostatic fields and capacitance. Magneto-static fields and inductance. Time-varying fields and Maxwell equations. Skin effect. Plane electromagnetic waves. Reflection and refraction. Waveguides and optical fibers. Radiation and antennas. 4 hours discussion. (002529)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Upper Division; Laptop required, see department for details.

EECE 389 Intern in Elect & Comp Engr **1-3 Units**
Typically Offered: Inquire at department
This internship is offered for 1.0-3.0 units. Students must register directly with a supervising faculty member. 9 hours supervision. (002106)
Grade Basis: Credit/No Credit
Repeatability: You may take this course for a maximum of 15 units
Course Attributes: Upper Division

EECE 398 Special Topics **1-3 Units**
Typically Offered: Fall and spring
This course is for special topics offered for 1.0-3.0 units. Typically the topic is offered on a one-time-only basis and may vary from term to term and be different for different sections. See the Class Schedule for the specific topic being offered. 3 hours supervision. (002541)
Grade Basis: Graded
Repeatability: You may take this course more than once
Course Attributes: Upper Division

EECE 399 Special Problems **1-3 Units**
Typically Offered: Fall and spring
This course is an independent study of special problems offered for 1.0-3.0 units. You must register directly with a supervising faculty member. 3 hours supervision. (002542)
Grade Basis: Credit/No Credit
Repeatability: You may take this course for a maximum of 6 units
Course Attributes: Upper Division

EECE 416 CMOS Digital Integrated Circuits Design **4 Units**
Prerequisite: EECE 144, EECE 315.
Typically Offered: Inquire at department
This course provides an introduction to the design of CMOS digital integrated circuits. Topics include CMOS devices and integrated circuit fabrication, static CMOS inverters and gates, pass-transistor and dynamic-logic gates, propagation delay, power, scaling, and sequential circuits. CAD tools for simulation and layout are used for assignments and a course design project. 4 hours lecture. (021718)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Upper Division; Laptop required, see department for details.

EECE 437 Real-Time Embedded Systems **4 Units**
Prerequisite: EECE 344.
Typically Offered: Fall only
This course presents the concepts and techniques associated with designing, developing, and testing real-time and embedded systems. Topics include the nature and uses of real-time systems, architecture and design of real-time systems, embedded development and debugging environments, embedded programming techniques, real-time operating systems and real-time scheduling and algorithms. Special attention is given to the study of real-time process scheduling and performance, including mathematical analysis of scheduling algorithms. 4 hours discussion. (002118)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Upper Division; Laptop required, see department for details.

EECE 443 Computer Architecture Performance and Implementation 4 Units
Prerequisite: EECE 144, EECE 237 (both with a C- or higher).
Typically Offered: Fall only
Exploration of computer architecture fundamentals through analysis and implementation in a hardware description language. Coverage includes instruction set architecture and performance techniques. Implementation and testing occurs through the introduction of modern digital design techniques using a hardware description language and commercial tools. 2 hours activity, 3 hours lecture. (002105)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Upper Division; Laptop required, see department for details.

EECE 446 Introduction to Computer Networks and Network Management **3 Units**
Prerequisite: CSCI 211; CSCI 220, CSCI 221, or EECE 237 all with a C- or higher.
Typically Offered: Fall and spring
This course is an introduction to basic networking technologies and network management concepts, including major network operating systems, communication architecture focusing on ISO and Internet models with discussion of current standards and protocols. Significant laboratory work using current networking equipment reinforces lectures and provides fundamental experience with router and switch management. 3 hours laboratory, 2 hours lecture. (002340)
Cross listing(s): CSCI 446
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division

EECE 450 Optics **3 Units**
Prerequisite: PHYS 204A, PHYS 204B, PHYS 204C.
Typically Offered: Fall only
Geometrical and physical optics, interference, diffraction, reflection, dispersion, resolution, polarization, fiber optics, laser optics, and holography. 2 hours discussion, 3 hours laboratory. (002549)
Cross listing(s): PHYS 450
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division

EECE 451 Lasers and Their Applications **3 Units**
Prerequisite: PHYS 204C. Recommended: EECE 450 or PHYS 450.
Typically Offered: Spring only
The theory and mechanism of laser action, various types of lasers and their applications and future use. Laboratory involves measurements with lasers, fiber optics, data transmission, and holography. 2 hours discussion, 3 hours laboratory. (002550)
Cross listing(s): PHYS 451
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Upper Division

EECE 453 Communication Systems Design **4 Units**
Prerequisite: EECE 365, MATH 314, or MATH 350.
Typically Offered: Spring only odd years
Introduction to the principles of functional communication systems, design and performance analysis. Analog and digital modulation techniques. Information measures. Application of probability theory to the analysis of communication systems performance. Transmission and encoding of information. Spread spectrum systems. 4 hours discussion. (002548)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Upper Division

EECE 465 Digital Signal Processing **4 Units**
Prerequisite: EECE 365.
Typically Offered: Fall only
Properties of continuous and discrete signals. Z-transform and Fast-Fourier Transform. Digital filtering techniques. Finite word length effects on digital signal processing elements. 4 hours discussion. (002580)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Upper Division

EECE 481 Electromechanical Conversion **4 Units**
Prerequisite: EECE 211 (with a grade of C- or higher) or EECE 215 (with a grade of C- or higher).
Typically Offered: Fall only odd years
Principles of electromechanical conversion, traditional and renewable energy sources, magnetic circuits and steady state performance of synchronous, dc and induction motors, state space models and dynamic performance of electric motors, linearized models and common control schemes for various motors. 4 hours lecture. (020256)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Upper Division; Laptop required, see department for details.

EECE 482 Control System Design **4 Units**
Prerequisite: EECE 365.
Typically Offered: Spring only odd years
Modeling and simulation of dynamic system performance. Control system design for continuous systems using both analog and digital control techniques. 4 hours lecture. (002577)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Upper Division; Laptop required, see department for details.

EECE 483 Solar Energy Devices and Systems 4 Units
Prerequisite: GE Physical Science (5A); MATH 120; EECE 215 (with a grade of C- or higher) or EECE 211 and 211L (both with grades of C- or higher).
Typically Offered: Fall only even years
This course is an introduction to the fundamentals of solar energy devices and systems and their impacts on society, economy, and the environment. Basic physics of semiconductors in solar devices, operation of solar devices, design and characteristics of common types of solar cells, and approaches to increase solar cell efficiency are discussed. The operation of DC-DC and DC-AC circuits, maximum power point tracking, and energy storage systems are evaluated. Economic regulatory, political, social, and environmental aspects of energy production, distribution, and consumption are explored. 2 hours activity, 3 hours lecture. (020499)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Upper Division; Laptop required, see department for details.

EECE 484 Power System Distribution and Analysis 4 Units
Prerequisite: EECE 311 (may be taken concurrently).
Typically Offered: Inquire at department
Power system symmetrical components, fault analysis, transient stability analysis, sequence impedances of transmission systems, and distribution networks. 4 hours lecture. (020500)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Upper Division

EECE 489 Internship in Comp Engineering 1-3 Units
Typically Offered: Inquire at department
This internship is offered for 1.0 - 3.0 units. Students must register directly with a supervising faculty member. 3 hours lecture. (002124)
Grade Basis: Credit/No Credit
Repeatability: You may take this course for a maximum of 15 units
Course Attributes: Upper Division

EECE 490AW Engineering Profession and Design (W) 4 Units W, GW
Prerequisite: GE English Composition (1A), GE Oral Communication (1C); EECE 443 (may be taken concurrently), EECE 344 for Computer Engineering majors; EECE 315, EECE 344, EECE 365 (all may be taken concurrently) for Electrical/Electronic Engineering majors.
Typically Offered: Fall only
Exploration of engineering as a profession over an entire career, including technical, sociological, physiological, and psychological aspects. Readings and discussions explore the importance of life-long learning to engineering professionals. Students prepare, plan, design, present, and document a senior project. Design requirements address human factors, safety, reliability, testability, engineering standards, and cots. Students evaluate the impact of statistics and probabilistic events on project design, operation, and/or characterization. 3 hours lecture, 0 hours supervision. (002569)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Upper Division; Laptop required, see department for details.; Writing Course; Graduation Writing Assessment Requirement Course

EECE 490B Engineering Economics and Project Implementation 4 Units
Prerequisite: EECE 490AW (with a grade C- or higher); EECE 443 for Computer Engineering majors; EECE 315, EECE 344 for Electrical/Electronic Engineering majors.
Typically Offered: Spring only
Continuation of EECE 490AW, where students implement, construct, test, and demonstrate their senior design projects. A survey of economic analysis and technology markets, including market organization and regulation, incumbent and startup actors, engineering costs and return on investment, entrepreneurship, patents, and investment and funding avenues. Contemporary issues provide a framework for discussion and analysis based on professional, ethical, and economic concerns. 2 hours discussion, 0 hours supervision. (002570)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Upper Division; Laptop required, see department for details.

EECE 498 Advanced Topics 1-5 Units
Prerequisite: To be established when courses are formulated.
Typically Offered: Inquire at department
This course is for special topics offered for 1.0-5.0 units. Typically the topic is offered on a one-time-only basis and may vary from term to term and be different for different sections. See the Class Schedule for the specific topic being offered. 1 hour discussion. (002582)
Grade Basis: Graded
Repeatability: You may take this course more than once
Course Attributes: Upper Division

EECE 499 Special Problems 1-3 Units
Typically Offered: Fall and spring
This course is an independent study of special problems and is offered for 1.0-3.0 units. You must register directly with a supervising faculty member. 1 hour supervision. (002583)
Grade Basis: Credit/No Credit
Repeatability: You may take this course for a maximum of 6 units
Course Attributes: Upper Division

EECE 499HW Honors Project (W) 3 Units W, GW
Prerequisite: GE English Composition (1A), faculty permission.
Typically Offered: Inquire at department
Completion of all junior-level EECE courses required in the major. This course may be taken twice for a maximum of 6 units. Prerequisite to the second semester is a grade of B or higher in the first semester. Open by invitation to EE and CMPE majors who have a GPA among the top 5% of ECE students based upon courses taken at CSU, Chico. This is an "Honors in the Major" course; a grade of B or higher in 6 units of EECE 499H certifies the designation of "Honors in the Major" to be printed on the transcript and the diploma. Each 3-unit course requires both formal written and oral presentations. 9 hours supervision. (002584)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 6 units
Course Attributes: Upper Division; Writing Course; Graduation Writing Assessment Requirement Course

EECE 525 High-Performance Computer Architecture **4 Units**
Prerequisite: EECE 443.
Typically Offered: Spring only
The course covers high-performance computer architecture, including branch prediction, out-of-order execution, cache coherence and consistency, many-core processors, dynamic scheduling, instruction-level parallelism, thread-level parallelism, and memory hierarchy design. 4 hours lecture. (002110)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Upper Division; Laptop required, see department for details.

EECE 537 Smart Device Security **4 Units**
Prerequisite: CSCI 111 and EECE 237 or equivalent for all majors; EECE 344 or equivalent for computer, electrical/electronic, and mechatronic engineering majors; CSCI 440 or equivalent for CSCI and CINS majors.
Typically Offered: Inquire at department
This course presents the concepts and techniques associated with designing, developing, and testing secure smart devices, such as smartphones, smartwatches, and implantable medical devices. Smart devices usually have limited computing resources but may send data to cloud computing data centers. Topics in this course include preventing hackers from stealing our password by measuring them physically from our devices, selecting appropriate encryption algorithms for resource-constraint devices, and understanding the limit in protecting your secret data during wireless network transmission. Particular attention focuses on the study of hardware security in smart embedded systems. 4 hours discussion. (022223)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Upper Division; Laptop required, see department for details.

EECE 555 Advanced Computer Networks **4 Units**
Prerequisite: CSCI 446 or EECE 446.
Typically Offered: Spring only
Examination of computer network protocol design issues and a selection of advanced computer networking topics, such as multimedia networking, wireless networks, optical networks and network security, using current and proposed standards as examples. 3 hours discussion, 3 hours laboratory. (002560)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Upper Division; Laptop required, see department for details.

EECE 565 Bioimaging Systems **4 Units**
Prerequisite: PHYS 202A or PHYS 204A; EECE 314 or EECE 365; and Senior Standing.
Typically Offered: Spring only even years
Fundamentals of bioimaging, signals and systems, tomography modalities, pattern recognition, and computer vision methods as applied to clinical diagnostics. Optics and photonics techniques, digital signal and imaging data processing, analysis, and characterization. Introduction to research methodologies and research on optical imaging systems and applications. Students presentations and written reports in cutting edge technologies. 4 hours lecture. (022132)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Upper Division; Laptop required, see department for details.

EECE 566 Applied Digital Image Processing **4 Units**
Prerequisite: MATH 120; PHYS 202B or PHYS 204B.
Typically Offered: Spring only odd years
This course covers image processing principles, techniques, and algorithms. Topics in image acquisition, representation, analysis, filtering, segmentation, and feature extraction. use of image processing software tools for assignments and projects. 4 hours lecture. (022109)
Grade Basis: Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Upper Division

EECE 598 Special Topics **1-4 Units**
Typically Offered: Fall and spring
This course is for special topics offered for 1.0-4.0 units. Typically the topic is offered on a one-time-only basis and may vary from term to term and be different for different sections. See the Class Schedule for the specific topic being offered. 0 hours supervision. (021268)
Grade Basis: Graded
Repeatability: You may take this course more than once
Course Attributes: Upper Division

EECE 637 Advanced Embedded Systems **4 Units**
Prerequisite: EECE 437 or ECCE 537, or classified graduate standing.
Typically Offered: Inquire at department
This course focuses on high performance and multicore systems. Prerequisite knowledge includes extensive C programming experience, exposure to real-time operating systems concepts and development, extensive embedded systems development experience, and knowledge of computing architecture concepts. 4 hours lecture. (021524)
Grade Basis: Graduate Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Graduate Division; Laptop required, see department for details.

EECE 643 Digital Design **4 Units**
Prerequisite: EECE 443.
Typically Offered: Inquire at department
Design and implementation of large digital systems through computer-aided tools. Study of algorithms and techniques used for architectural design, synthesis, optimization, placement, routing, timing analysis, and verification in programmable logic and VLSI implementations. 4 hours discussion. (002629)
Grade Basis: Graduate Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Graduate Division

EECE 644 Advanced Cryptographic Protocols for Secure Distributed Computing **4 Units**
Prerequisite: EECE 344.
Typically Offered: Inquire at department
This course covers topics on information-theoretic secure multiparty computation (ITS-MPC), homomorphic encryption (HE), functional encryption (FE), blockchain, and their applications to distributed computing. All these protocols allow the outsourcing of sensitive data to trusted third-party computing platforms. The discussion includes their computing model, parameters chosen, and engineering application deployment. 4 hours discussion. (022550)
Grade Basis: Graduate Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Graduate Division; Laptop required, see department for details.

EECE 653 Software Defined Radio **4 Units**
Prerequisite: EECE 311 and EECE 315; or classified graduate standing.
Typically Offered: Inquire at department
This course provides the advanced concepts related to digital and wireless communication. Introductions to the constraints in the practical communication systems. Understanding the concept of SDR (Software Defined Radio). Implementation of the signal generation, capture, automatic gain control, and coherent, modulation, carrier synchronization, and demodulation. Design and implementations of the transmitter and receiver for SDR. 4 hours discussion. (021573)
Grade Basis: Graduate Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Graduate Division; Laptop required, see department for details.

EECE 655 Topics in Computer Networking **4 Units**
Prerequisite: CSCI 446 or EECE 446; EECE 555 recommended.
Typically Offered: Inquire at department
Further study of selected topics from current networking research as presented in recently published journals. 4 hours seminar. (002626)
Grade Basis: Graduate Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Graduate Division; Laptop required, see department for details.

EECE 664 Machine Learning for Engineers **4 Units**
Prerequisite: Graduate standing.
Typically Offered: Fall only
This course presents a hands-on approach of exploring machine learning (ML) techniques and state-of-the-art tools for engineering problems. Students gain the ability to identify types of data, formatting and cleaning data for an ML model. Students build, train, and test machine learning models using cutting-edge machine learning frameworks and modern artificial intelligence (AI) development environments along with ML deployment on hardware. 4 hours lecture. (022551)
Grade Basis: Graduate Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Graduate Division; Laptop required, see department for details.

EECE 665 Deep Learning Processing **4 Units**
Prerequisite: EECE 465.
Typically Offered: Inquire at department
This course enables students to enter the field of artificial intelligence (AI) in general and deep learning in particular for practical engineering applications. Students develop deep convolutional neural networks for pattern and image recognition and experience training and testing of various deep learning models using state-of-the-art tools and modern methods. 4 hours lecture. (022579)
Grade Basis: Graduate Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Graduate Division; Laptop required, see department for details.

EECE 682 Digital Control System Design Using Artificial Intelligence **4 Units**
Prerequisite: Classified graduate standing.
Typically Offered: Inquire at department
This course presents fundamental techniques for designing digital control systems using a hands-on approach and cutting edge artificial intelligence (AI) tools for real-world applications. Knowledge of classical control is assumed. Familiarity with linear algebra is assumed. 4 hours lecture. (020259)
Grade Basis: Graduate Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Graduate Division; Laptop required, see department for details.

EECE 685 Adaptive Control Systems by Artificial Intelligence **4 Units**
Prerequisite: EECE 482.
Typically Offered: Inquire at department
This course offers the foundation of adaptive control and discusses its interconnections with machine learning. Topics include parameter estimation, recursive algorithms, stability properties, and conditions for convergence and their relationship with machine learning, including the minimization of a performance error and fast convergence. 4 hours lecture. (020722)
Grade Basis: Graduate Graded
Repeatability: You may take this course for a maximum of 4 units
Course Attributes: Graduate Division

EECE 693 Research Methods in Electrical and Computer Engineering **3 Units**
Prerequisite: Candidate status.
Typically Offered: Fall and spring
This course is designed to provide graduate students in the field of electrical and computer engineering with a comprehensive understanding of research methods, simulation and/or experimentation, technical writing, and communication skills. Through immersive learning experiences, students gain practical knowledge in conducting research, interpreting results, technical writing, and oral presentation of scientific ideas. The course culminates in a comprehensive research project with a final defense. 9 hours supervision. (022594)
Grade Basis: Report in Progress: ABC/NC
Repeatability: You may take this course for a maximum of 3 units
Course Attributes: Graduate Division; Laptop required, see department for details.

EECE 697 Independent Study **1-6 Units**
Typically Offered: Fall and spring
This course is a graduate-level independent study offered for 1.0-6.0 units. You must register directly with a supervising faculty member. Independent study and investigation of special problems in the student's area of concentration. Both registration and study plan must have approval of the instructor and the student's graduate advisory committee chair. 9 hours supervision. (002592)
Grade Basis: Report in Progress: Graded
Repeatability: You may take this course for a maximum of 6 units
Course Attributes: Graduate Division

EECE 698 Seminar in Advanced Topics **1-4 Units**
Typically Offered: Fall and spring
This course is offered for 1.0-3.0 units. Typical subjects that will be taught include embedded systems design, high-speed networking, program management, and fault-tolerant system design. Consult the Class Schedule for listings. 3 hours lecture. (002630)
Grade Basis: Graduate Graded
Repeatability: You may take this course for a maximum of 12 units
Course Attributes: Graduate Division

EECE 699P Master's Project **1-6 Units**
Typically Offered: Fall and spring
This course is offered for 1.0-6.0 units. Independent study and investigation of special problems in student's area of concentration. Both registration and study plan must have approval of the instructor and the student's graduate advisory committee chair. 9 hours supervision. (002139)
Grade Basis: Report in Progress: CR/NC
Repeatability: You may take this course for a maximum of 6 units
Course Attributes: Graduate Division

EECE 699T Master's Thesis **1-6 Units**
Prerequisite: Classified graduate standing and completion of graduate literacy requirement, faculty permission.
Typically Offered: Fall and spring
This course is offered for 1.0-6.0 units. You must register directly with a supervising faculty member. Independent study and investigation of special problems in the student's area of concentration. Both registration and study plan must have approval of the instructor and the student's graduate advisory committee chair. Master's Thesis courses earn a Credit grade upon completion. 3 hours supervision. (002137)
Grade Basis: Report in Progress: CR/NC
Repeatability: You may take this course for a maximum of 6 units
Course Attributes: Graduate Division