Electricl + Computer Engrg-ECE (ECE)

Courses

ECE 102 Digital Circuit Logic Credits: 4 (3-2-0)
Course Description: Boolean algebra; Karnaugh maps; multiplexers, decoders, ROMS, PLAS, flip-flops, counters; sequential networks; state tables.
Prerequisite: None.
Registration Information: Must register for lecture and laboratory. Sections may be offered: Online.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: Yes.

ECE 103 DC Circuit Analysis Credits: 3 (2-2-0)
Course Description: Basic DC circuit analysis. Use of scientific-oriented software to solve problems and analyze small projects.
Prerequisite: MATH 160 with a minimum grade of C.
Registration Information: Must register for lecture and laboratory.
Terms Offered: Fall, Spring.
Grade Mode: Traditional.
Special Course Fee: Yes.

ECE 202 Circuit Theory Applications Credits: 4 (3-3-0)
Course Description: Basic circuit analysis techniques and applications to engineering design problems.
Prerequisites: ECE 103 with a minimum grade of C and MATH 161 with a minimum grade of C.
Registration Information: Must register for lecture and laboratory.
Terms Offered: Spring, Summer.
Grade Mode: Traditional.
Special Course Fee: Yes.

ECE 204 Introduction to Electrical Engineering Credits: 3 (3-0-0)
Course Description: Basic analog and digital circuits and systems; introduction to electromechanical devices.
Prerequisites: MATH 161 and PH 142.
Registration Information: Sections may be offered: Online.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 251 Introduction to Microprocessors Credits: 4 (3-3-0)
Course Description: Microprocessor organization, assembly language, I/O techniques, real-time interfaces, applications, hardware/software.
Prerequisite: ECE 102 with a minimum grade of C.
Registration Information: Must register for lecture and laboratory.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: Yes.

ECE 303 Introduction to Communications Principles Credits: 3 (3-0-0)
Also Offered As: STAT 303.
Course Description: Basic concepts in design and analysis of communication systems.
Prerequisites: MATH 261 with a minimum grade of C and ECE 311, may be taken concurrently.
Registration Information: Credit not allowed for both ECE 303 and STAT 303.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 311 Linear System Analysis I Credits: 3 (3-0-0)
Course Description: Continuous and discrete time signals and systems representations in time and frequency domain; time convolution.
Prerequisites: (ECE 202 with a minimum grade of C) and (MATH 340 with a minimum grade of C or MATH 345 with a minimum grade of C).
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 312 Linear System Analysis II Credits: 3 (3-0-0)
Course Description: Laplace and Z transforms, applications to modulation, filtering and sampling, state space representation.
Prerequisite: ECE 311 with a minimum grade of C.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 325 Telecommunication Networks Credits: 3 (3-0-0)
Course Description: Principle technologies that support data and voice communications.
Prerequisite: MATH 141 or MATH 155 or MATH 160.
Registration Information: Sections may be offered: Online.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 331 Electronics Principles I Credits: 4 (3-3-0)
Course Description: Discrete component semiconductor devices, characteristics and applications. Rectifier circuits, single-stage and multi-stage amplifiers.
Prerequisites: (ECE 202 with a minimum grade of C) and (MATH 340 with a minimum grade of C or MATH 345 with a minimum grade of C) and (PH 142 with a minimum grade of C).
Registration Information: Must register for lecture and laboratory.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: Yes.

ECE 332 Electronics Principles II Credits: 4 (3-3-0)
Course Description: Discrete and integrated-circuit amplifiers-frequency response, negative feedback; digital logic circuits.
Prerequisite: ECE 331 with a minimum grade of C.
Registration Information: Must register for lecture and laboratory.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: Yes.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
<th>Course Description</th>
<th>Prerequisites</th>
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<tr>
<td>ECE 411</td>
<td>Control Systems</td>
<td>4 (3-0-0)</td>
<td>Course Description: Basic concepts of control system analysis and design for linear systems: stability and performance; time and frequency domain techniques.</td>
<td>ECE 312 with a minimum grade of C.</td>
</tr>
<tr>
<td>ECE 412</td>
<td>Digital Control and Digital Filters</td>
<td>3 (3-0-0)</td>
<td>Course Description: FIR and IIR digital filter design, analog and digital invariance and direct digital control algorithms, hybrid systems analysis.</td>
<td>ECE 411.</td>
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<tr>
<td>ECE 421</td>
<td>Telecommunications I</td>
<td>3 (3-0-0)</td>
<td>Course Description: Digital communication (source coding; modulation; channel coding), analog communication (modulation).</td>
<td>ECE 421.</td>
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<tr>
<td>ECE 422</td>
<td>Telecommunications II</td>
<td>3 (3-0-0)</td>
<td>Course Description: Issues of source coding, detection and estimation, and equalization; introduction of information theory.</td>
<td>ECE 422.</td>
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<tr>
<td>ECE 423</td>
<td>DSP for Communications</td>
<td>3 (1-4-0)</td>
<td>Course Description: Design and programming of communication and signal processing algorithms into DSP hardware using C and assembly language.</td>
<td>ECE 423.</td>
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<tr>
<td>ECE 430</td>
<td>Fourier and Wavelet Analysis with Apps</td>
<td>3 (3-0-0)</td>
<td>Course Description: Fouriers analysis and transforms, FFTs; sampling theorems, computational algorithms; wavelets; applications to communication, imaging, and compression.</td>
<td>MATH 345.</td>
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<tr>
<td>ECE 441</td>
<td>Optical Electronics</td>
<td>3 (3-0-0)</td>
<td>Course Description: Concepts of modern physics, optical properties of atoms, light sources, lasers, optical detectors, optical cavities, and optical fiber transmission.</td>
<td>ECE 342 with a minimum grade of C.</td>
</tr>
</tbody>
</table>
ECE 442  Numerical Algorithms for VLSI Modeling  Credits: 4 (3-3-0)
Course Description: Provide the foundational knowledge of numerical algorithms for modeling and simulations of high speed VLSI circuits.
Prerequisites: ECE 312 with a minimum grade of C- and ECE 332 with a minimum grade of C- and ECE 342 with a minimum grade of C-.
Registration Information: Must register for lecture and laboratory.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 444  Antennas and Radiation  Credits: 3 (3-0-0)
Course Description: Retarded potential theory, antenna arrays, long wire antennas, dipoles, aperture antennas, receiving antennas.
Prerequisite: ECE 342 with a minimum grade of C-.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 450  Digital System Design Laboratory  Credit: 1 (0-3-0)
Course Description: Small digital circuits are designed and simulated using very high speed hardware description language and synthesis tools.
Prerequisite: None.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 455  Introduction to Robot Programming/Simulation  Credits: 3 (3-0-0)
Course Description: Fundamentals of simulating and programming of workcells that include robots and other articulated objects.
Prerequisites: (CS 155 with a minimum grade of C or CS 160 with a minimum grade of C) and (CS 156 with a minimum grade of C and CS 157 with a minimum grade of C).
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 456  Computer Networks  Credits: 4 (3-3-0)
Course Description: Circuit/packet switching, protocols, LAN/MAN, TCP/IP, error correction, wireless LANS, mobile networks.
Prerequisites: (CS 160 with a minimum grade of C or CS 157 with a minimum grade of C and CS 155 with a minimum grade of C and CS 155 with a minimum grade of C) and (ECE 251 with a minimum grade of C) and (ECE 303 with a minimum grade of C or STAT 303 with a minimum grade of C).
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 457  Fourier Optics  Credits: 3 (3-0-0)
Course Description: Introduction to optical systems for signal and information processing with emphasis on Fourier optics.
Prerequisites: ECE 311 with a minimum grade of C and ECE 342 with a minimum grade of C.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 461  Power Systems  Credits: 3 (3-0-0)
Course Description: Multi-phase power systems; power generation, transformer design, power distribution, power costs.
Prerequisites: ECE 332 with a minimum grade of C- and ECE 462, may be taken concurrently.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 462  Power Systems Laboratory  Credit: 1 (0-3-0)
Course Description: Set of labs designed to enhance students’ understanding of power systems.
Prerequisites: ECE 332 with a minimum grade of C- and ECE 461, may be taken concurrently.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 465  Electrical Energy Generation Technologies  Credits: 3 (3-0-0)
Course Description: Various electrical energy generation alternatives. Comparisons based on cost, reliability, availability and environmental impact.
Prerequisite: ECE 202 with a minimum grade of C-.
Registration Information: Sections may be offered: Online.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.
ECE 466  Integrated Lighting Systems  Credits: 3 (3-0-0)
Course Description: Technical underpinnings of light sources, their associated heat sink fixtures and power electronics drivers.
Prerequisite: ECE 331 or INTD 330.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 471A  Semiconductor Physics  Credit: 1 (1-0-0)
Course Description: Fundamentals of semiconductor electron, hole states and motion: bandgap, effective mass, carrier density, Fermi level, doping, drift and diffusion.
Prerequisites: (MATH 340 or MATH 345) and (PH 142).
Registration Information: This is a partial semester course.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 472  MOS Integrated Circuits  Credits: 3 (3-0-0)
Course Description: MOS transistor theory, design rules, layout design, gate, cell and circuit design, memories, clocking strategies, MOS technologies.
Prerequisite: ECE 332 with a minimum grade of C-.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 495  Independent Study  Credits: Var[1-18]
Course Description:
Prerequisite: None.
Terms Offered: Fall, Spring.
Grade Mode: Instructor Option.
Special Course Fee: No.

ECE 501  Foundations of Systems Engineering  Credits: 3 (3-0-0)
Also Offered As: ENGR 501.
Course Description: Functional components of systems engineering, application of systems engineering to practical problems, system life-cycle process.
Prerequisite: None.
Registration Information: Credit not allowed for both ECE 501 and ENGR 501. Sections may be offered: Online.
Term Offered: Fall, Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 503  Ultrafast Optics  Credits: 3 (3-0-0)
Course Description: Principles and theory behind ultrashort pulse generation, amplification, and manipulation.
Prerequisites: (ECE 341) and (ECE 342 or ECE 343).
Term Offered: Spring (even years).
Grade Mode: Traditional.
Special Course Fee: No.

ECE 504  Physical Optics  Credits: 3 (3-0-0)
Course Description: Classical optics from first principles; basic electromagnetic theory to wave and geometric guides.
Prerequisites: ECE 341 and ECE 342.
Registration Information: Graduate standing can substitute for ECE 342.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 505  Nanostructures: Fundamentals and Applications  Credits: 3 (3-0-0)
Course Description: Fundamentals of quantum confinement; nanostructures optical properties; fabrication and characterization.
Prerequisites: ECE 342 and PH 353.
Registration Information: Sections may be offered: Online.
Term Offered: Fall (odd years).
Grade Mode: Traditional.
Special Course Fee: No.

ECE 507  Plasma Physics and Applications  Credits: 3 (3-0-0)
Course Description: Fundamental principles and industrial applications of plasmas.
Prerequisite: ECE 342.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 508  Introduction to Power System Markets  Credits: 3 (3-0-0)
Also Offered As: ENGR 508.
Course Description: Deregulated electrical power systems, system security, investments in generation and transmission, ancillary services, and nodal pricing.
Prerequisite: ECE 461.
Registration Information: Credit not allowed for both ECE 508 and ENGR 508. Sections may be offered: Online.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 509  Signal Processing for Power Systems  Credits: 3 (3-0-0)
Also Offered As: ENGR 509.
Course Description: Signal processing tools for analyzing power systems, voltage frequency, magnitude variations, unbalance, waveform distortion.
Prerequisites: ECE 312 and ECE 461.
Registration Information: Credit not allowed for both ECE 509 and ENGR 509. Sections may be offered: Online.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.
ECE 510  Wide-Area Monitoring for Power Systems  Credits: 3 (3-0-0)
Course Description: WAMS for modern power grid including signal processing, communications and networking techniques in WAMS/ WAMS applications.
Prerequisites: ECE 312 with a minimum grade of C and ECE 461 with a minimum grade of C.
Registration Information: Sections may be offered: Online.
Term Offered: Spring (even years).
Grade Mode: Traditional.
Special Course Fee: No.

ECE 512  Digital Signal Processing  Credits: 3 (3-0-0)
Course Description: Discrete time signals and systems, digital filter design and implementation, fast algorithms, quantization effects.
Prerequisite: ECE 312 with a minimum grade of C.
Registration Information: Sections may be offered: Online.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 513  Digital Image Processing  Credits: 3 (3-0-0)
Course Description: Image acquisition and display systems, image enhancement, restoration and encoding, image analysis; real-life applications.
Prerequisites: (ECE 303 with a minimum grade of C- or STAT 303 with a minimum grade of C-) and (ECE 312).
Registration Information: Sections may be offered: Online.
Terms Offered: Spring, Summer.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 514  Applications of Random Processes  Credits: 3 (3-0-0)
Course Description: Bit-error rates, signal-to-noise power ration, signal detection, signal estimation, Wiener filter, application.
Prerequisites: (ECE 303 with a minimum grade of C- or STAT 303 with a minimum grade of C-) and (ECE 312).
Registration Information: Sections may be offered: Online.
Terms Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 516  Information Theory  Credits: 3 (3-0-0)
Course Description: Information measures and their properties; lossless data compression; channel capacity; channel coding theorem; rate distortion theorem.
Prerequisites: (ECE 303 or STAT 303) and (ECE 421).
Term Offered: Fall (even years).
Grade Mode: Traditional.
Special Course Fee: No.

ECE 520  Optimization Methods-Control and Communication  Credits: 3 (3-0-0)
Course Description: Linear and nonlinear optimization theory and methods; applications in systems, control, and communication.
Prerequisites: MATH 229 and MATH 317.
Term Offered: Spring (odd years).
Grade Mode: Traditional.
Special Course Fee: No.

ECE 521  Satellite Communication  Credits: 3 (3-0-0)
Course Description: Principles of satellite communication systems engineering.
Prerequisite: ECE 421.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 524  Wireless Telecommunications  Credits: 3 (3-0-0)
Course Description: Physical layer design, including channel modeling, receiver design and performance, and multiple access techniques.
Prerequisite: ECE 421.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 525  Fiber Optic Communications  Credits: 3 (3-0-0)
Course Description: Optoelectronic and optical components for fiber optics; communications system physical layer issues and examples.
Prerequisite: ECE 471B.
Registration Information: Credit not allowed for both ECE 526 and BIOM 526. Sections may be offered: Online.
Terms Offered: Spring, Summer.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 526  Biological Physics  Credits: 3 (3-0-0)
Also Offered As: BIOM 526
Course Description: Mathematical and physical modeling of biological systems. Mass transport in cellular environments. Electrical/mechanical properties of biomolecules.
Prerequisites: (MATH 340 or MATH 345) and (PH 122 or PH 142).
Registration Information: Credit not allowed for both ECE 526 and BIOM 526. Sections may be offered: Online.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 530  Overview of Systems Engineering Processes  Credits: 3 (3-0-0)
Also Offered As: ENGR 530.
Course Description: Systems engineering life-cycle process and analysis techniques. Reliability and robustness.
Prerequisite: ECE 303 or STAT 303 or STAT 315.
Registration Information: Credit not allowed for both ECE 530 and ENGR 530. Sections may be offered: Online.
Terms Offered: Fall, Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 531  Engineering Risk Analysis  Credits: 3 (3-0-0)
Also Offered As: ENGR 531.
Course Description: Estimation and risk identification, development of mitigation techniques.
Prerequisite: ECE 303 or STAT 303 or STAT 315.
Registration Information: Credit not allowed for both ECE 531 and ENGR 531. Sections may be offered: Online.
Terms Offered: Fall, Spring.
Grade Mode: Traditional.
Special Course Fee: No.
ECE 532  Dynamics of Complex Engineering Systems  Credits: 3 (3-0-0)
Also Offered As: ENGR 532.
Course Description: Higher-level behavior and issues that emerge from interaction between components in complex socio-technical systems.
Prerequisite: ENGR 501, may be taken concurrently or ECE 501, may be taken concurrently.
Registration Information: Credit not allowed for both ECE 532 and ENGR 532. Sections may be offered: Online.
Terms Offered: Fall, Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 534  Analog Integrated Circuit Design  Credits: 3 (3-0-0)
Course Description: Design methods for state-of-the-art analog integrated circuits including CMOS op-amps, comparators, and phase-locked loops.
Prerequisite: ECE 332 with a minimum grade of C-.
Registration Information: Sections may be offered: Online.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 535  Analog Integrated Circuit Laboratory  Credit: 1 (0-2-0)
Course Description: Analog integrated circuits are designed and simulated using modern software tools.
Prerequisite: None.
Registration Information: Sections may be offered: Online.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 536  RF Integrated Circuit Design  Credits: 3 (3-0-0)
Course Description: Design of state-of-the-art ICs for RF applications including CMOS low-noise amplifiers, voltage-controlled oscillators, mixers and power amplifiers.
Prerequisite: ECE 332.
Registration Information: Sections may be offered: Online.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 537  Biomedical Signal Processing  Credits: 3 (3-0-0)
Also Offered As: BIOM 537.
Course Description: Measuring, manipulating, and interpreting biomedical signals.
Prerequisite: MATH 340 or ECE 311 or STAT 303.
Registration Information: Credit not allowed for both ECE 537 and BIOM 537.
Term Offered: Spring (even years).
Grade Mode: Traditional.
Special Course Fee: No.

ECE 538  Design/Analysis of Analog Digital Interface  Credits: 4 (3-3-0)
Course Description: Topics of interface circuit designs analog and digital interfaces. Basic concept of designing and analyzing analog and digital interface circuits.
Prerequisites: ECE 312 with a minimum grade of C- and ECE 332 with a minimum grade of C- and ECE 451.
Registration Information: Must register for lecture and laboratory.
Terms Offered: Fall, Spring (even years).
Grade Mode: Traditional.
Special Course Fee: No.

ECE 540  Computational Electromagnetics  Credits: 3 (3-0-0)
Course Description: Computational techniques for practical applications in electromagnetic fields, devices, scattering, propagation, and radiation.
Prerequisite: ECE 342.
Term Offered: Spring (odd years).
Grade Mode: Traditional.
Special Course Fee: No.

ECE 543  Accelerator Engineering  Credits: 3 (3-0-0)
Course Description: Development and uses of accelerators and storage rings. Principles of electric and magnetic fields used to bend, focus and accelerate charged particles.
Prerequisite: ECE 342 with a minimum grade of C or PH 351 with a minimum grade of C.
Registration Information: Sections may be offered: Online.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 546  Laser Fundamentals and Devices  Credits: 3 (3-0-0)
Course Description: Amplification of light, laser excitation mechanisms, laser devices, characteristics and design.
Prerequisite: ECE 441.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 548  Microwave Theory and Component Design  Credits: 3 (3-0-0)
Course Description: Fundamentals of microwave engineering, components, devices, and measurements.
Prerequisite: ECE 342 with a minimum grade of C-.
Registration Information: Sections may be offered: Online.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 549  Radar Systems and Design  Credits: 3 (3-0-0)
Course Description: Fundamental ideas of radar operation and basic design of various radar types including current topics.
Prerequisite: ECE 444.
Registration Information: Sections may be offered: Online.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 550A  Microprocessors Based Systems  Credits: 4 (3-2-0)
Course Description: High-performance microprocessors, e.g., 68000 family; intelligent I/O processors. Asynchronous bus, virtual memory, microprocessor in control and multi-user systems.
Prerequisite: ECE 451.
Registration Information: CSUN students only. Must register for lecture and laboratory.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.
ECE 550B Microprocessors Based Systems  Credits: 3 (3-0-0)
Course Description: High-performance microprocessors, e.g., 68000 family; intelligent I/O processors. Asynchronous bus, virtual memory, microprocessor in control and multi-user systems.
Prerequisite: ECE 451.
Registration Information: CSUN students only.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 551 Microwave and Beam Instrumentation Lab  Credits: 3 (2-3-0)
Course Description: Particle beam instrumentation, microwave measurements and magnetic measurements used in the design and diagnoses of charged particle beam accelerators.
Prerequisite: ECE 342 with a minimum grade of C or PH 351 with a minimum grade of C.
Term Offered: Fall (even years).
Grade Mode: Traditional.
Special Course Fee: No.

ECE 552 Pulsed Power and Intense Beams  Credits: 3 (3-0-0)
Course Description: Engineering concepts of high-power pulsed electronics and RF systems; how to produce and utilize intense beams. The conversion of electrical power.
Prerequisite: ECE 341 with a minimum grade of C or ECE 342 with a minimum grade of C or PH 351 with a minimum grade of C.
Registration Information: Sections may be offered: Online.
Term Offered: Spring (even years).
Grade Mode: Traditional.
Special Course Fee: No.

ECE 554 Computer Architecture  Credits: 3 (3-0-0)
Course Description: Fundamentals of computer design, multiprocessors and thread-level parallelism, storage systems, and interconnection networks and clusters.
Prerequisite: ECE 452 or CS 470.
Registration Information: Sections may be offered: Online.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 555 Robot Motion Planning  Credits: 3 (3-0-0)
Course Description: Concepts in geometry and spatial reasoning for the design of autonomous robots.
Prerequisites: CS 253 and MATH 369.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 557 Digital Optical Computing  Credits: 3 (3-0-0)
Course Description: Optical devices; optical disks, holographic memories; interconnection networks. Optical systems for numerical and nonnumerical data processing.
Prerequisite: ECE 441 or ECE 451 or ECE 554.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 560 Foundations of Fine-Grain Parallelism  Credits: 4 (3-2-0)
Also Offered As: CS 560.
Course Description: Programming novel architectures; performance tuning; automatic parallelization; program transformation; polyhedral model; equational programming.
Prerequisite: CS 475.
Registration Information: Must register for lecture and laboratory. Credit not allowed for both ECE 560 and CS 560.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 561 Hardware/Software Design of Embedded Systems  Credits: 4 (3-3-0)
Also Offered As: CS 561.
Course Description: Embedded systems design including system level modeling, design space exploration, hardware-software partitioning, high level synthesis.
Prerequisite: CS 270 or CS 470 or ECE 251 or ECE 452.
Registration Information: Credit not allowed for both ECE 561 and CS 561. Sections may be offered: Online.
Term Offered: Fall, Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 562 Power Electronics I  Credits: 3 (3-0-0)
Course Description: Switch mode and resonant converters, control using switch averaged dynamic models, modeling of all circuit components including sources, loads, and switches.
Prerequisite: ECE 332 with a minimum grade of C.
Registration Information: Sections may be offered: Online.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 563 Power Electronics II  Credits: 3 (3-0-0)
Course Description: Electrical energy, processing circuits, lightweight power management, and power conversion circuits emphasizing small signal transfer functions.
Prerequisite: ECE 562.
Registration Information: Sections may be offered: Online.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 564 Resonant Converters  Credits: 3 (3-0-0)
Course Description: Analysis and design of resonant converters.
Prerequisite: ECE 562.
Term Offered: Spring (even years).
Grade Mode: Traditional.
Special Course Fee: No.

ECE 565 Electrical Power Engineering  Credits: 3 (3-0-0)
Also Offered As: ENGR 565.
Course Description: Analysis of power systems in terms of current, voltage, and active/reactive power; introduction of computer-aided tools for power systems.
Prerequisites: ECE 332 and ECE 342.
Registration Information: Credit not allowed for both ECE 565 and ENGR 565. Sections may be offered: Online.
Terms Offered: Fall, Spring.
Grade Mode: Traditional.
Special Course Fee: No.
ECE 566  Grid Integration of Wind Energy Systems  Credits: 3 (3-0-0)
Course Description: Aspects of integration of wind energy conversion systems (WECS) to electric power transmission grids.
Prerequisites: ECE 461 and ECE 462 or ECE 565.
Registration Information: Credit not allowed for both ECE 566 and ENGR 566. Sections may be offered: Online.
Terms Offered: Fall, Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 567  Systems Engineering Architecture  Credits: 3 (3-0-0)
Also Offered As: ENGR 567.
Course Description: Observation/classification of systems architecture. Systems architecture principles and critical evaluation through design studies.
Prerequisite: ECE 501 or ENGR 501.
Registration Information: Credit not allowed for both ECE 567 and ENGR 567. Sections may be offered: Online.
Terms Offered: Fall, Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 568  Electrical Energy Generation Systems  Credits: 3 (3-0-0)
Also Offered As: ENGR 568.
Course Description: Energy systems: renewable and traditional. Physics and operation of energy devices; solar-photovoltaic, wind energy, gas, coal and nuclear plants.
Prerequisite: None.
Registration Information: Written consent of instructor. Credit not allowed for both ECE 568 and ENGR 568. Sections may be offered: Online.
Terms Offered: Fall, Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 569  Micro-Electro-Mechanical Devices  Credits: 3 (3-0-0)
Also Offered As: MECH 569.
Course Description: Micro-electro-mechanical processes and applications in sensors, optics, and structures.
Prerequisite: ECE 331 with a minimum grade of C- or MECH 344.
Registration Information: Credit not allowed for both ECE 569 and MECH 569. Sections may be offered: Online.
Term Offered: Spring (even years).
Grade Mode: Traditional.
Special Course Fee: No.

ECE 571  VLSI System Design  Credits: 3 (3-0-0)
Course Description: Design of integrated circuits at the system level including cell design, digital systems, parallel architecture, systolic arrays.
Prerequisites: ECE 451 and (ECE 575, may be taken concurrently).
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 572  Semiconductor Transistors  Credit: 1 (1-0-0)
Course Description: Quantitative analysis of electric field, carrier and current distributions in MOSFETs and bipolar junction transistors; scaling, non-idealities.
Prerequisites: ECE 331 and ECE 471B.
Registration Information: This is a partial semester course.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 573  Semiconductor Optoelectronics Laboratory  Credits: 3 (1-4-0)
Course Description: Experimental characterization techniques for semiconductor optoelectronic devices and design and testing of related electronic circuits.
Prerequisite: ECE 471B.
Registration Information: Must register for lecture and laboratory.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 574  Optical Properties in Solids  Credits: 3 (3-0-0)
Course Description: Light propagation and interaction with materials; linear and non-linear optical properties.
Prerequisite: ECE 441 with a minimum grade of C.
Term Offered: Spring (odd years).
Grade Mode: Traditional.
Special Course Fee: No.

ECE 575  Experiments in VLSI System Design I  Credit: 1 (0-3-0)
Course Description: Set of labs designed to enhance students' understanding of the materials in ECE 571.
Prerequisite: ECE 451.
Registration Information: ECE 451; concurrent registration in ECE 571.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 576  VLSI Processing-Science and Technology  Credits: 3 (3-0-0)
Course Description: Physics, chemistry of VLSI processing including plasma, thermal techniques of oxidation, deposition; photolithography, etching, cleaning, process modeling.
Prerequisite: ECE 472.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 587  Internship  Credits: Var[1-6]
Course Description: Internship experience in Electrical or Computer Engineering.
Prerequisite: ECE 312 or ECE 456.
Terms Offered: Fall, Spring, Summer.
Grade Mode: S/U Sat/Unsat Only.
Special Course Fee: No.

ECE 604  Nonlinear Optics  Credits: 3 (3-0-0)
Course Description: Principles of nonlinear optics, symmetry properties, multiple order nonlinear phenomenon, and nonlinear spectroscopy.
Prerequisites: ECE 504 and PH 451.
Restriction: Must be a: Graduate, Professional.
Term Offered: Fall (odd years).
Grade Mode: Traditional.
Special Course Fee: No.

ECE 611  Nonlinear Control Systems  Credits: 3 (3-0-0)
Course Description: Controller analysis and design for nonlinear systems.
Prerequisite: ECE 412.
Restriction: Must be a: Graduate, Professional.
Registration Information: Sections may be offered: Online.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.
ECE 612 Robust Control Systems Credits: 3 (3-0-0)
Course Description: Introduction to modern robust control theory techniques for analysis and design of large-scale uncertain multivariable systems.
Prerequisite: ECE 411.
Restriction: Must be a: Graduate, Professional.
Registration Information: Sections may be offered: Online.
Term Offered: Spring (odd years).
Grade Mode: Traditional.
Special Course Fee: No.

ECE 614 Principles of Digital Communications Credits: 3 (3-0-0)
Course Description: Information theory, optimal receiver design, waveform coding, error correcting coding.
Prerequisite: ECE 514.
Restriction: Must be a: Graduate, Professional.
Term Offered: Spring (odd years).
Grade Mode: Traditional.
Special Course Fee: No.

ECE 621 Energy Storage for Electrical Power Systems Credits: 3 (3-0-0)
Also Offered As: ENGR 621.
Course Description: Physics and operation of electrical, mechanical, thermal and novel energy storage systems/devices.
Prerequisite: None.
Restriction: Must be a: Graduate, Professional.
Registration Information: Written consent of instructor. Credit not allowed for both ECE 621 and ENGR 621. Sections may be offered: Online.
Terms Offered: Fall, Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 622 Energy Networks and Power Distribution Grids Credits: 3 (3-0-0)
Also Offered As: ENGR 622.
Course Description: Energy networks: generation, storage, consumers. Systems approach to analysis of distribution networks and transition to intelligent grid systems.
Prerequisites: (ECE 411 or MECH 417) and (ECE 565 or ENGR 565).
Restriction: Must be a: Graduate, Professional.
Registration Information: Credit not allowed for both ECE 622 and ENGR 622. Sections may be offered: Online.
Terms Offered: Fall, Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 623 Electric Power Quality Credits: 3 (3-0-0)
Also Offered As: ENGR 623.
Course Description: Interconnecting power electronic devices and renewable energy sources to power systems.
Prerequisite: ECE 461 or ECE 562.
Restriction: Must be a: Graduate, Professional.
Registration Information: Credit not allowed for both ECE 623 and ENGR 623. Sections may be offered: Online.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 641 Electromagnetics Credits: 3 (3-0-0)
Course Description: Electrostatics, magnetostatics, boundary value problems, EM induction, quasi-statics, Maxwell's equations.
Prerequisite: ECE 342.
Restriction: Must be a: Graduate, Professional.
Term Offered: Fall (even years).
Grade Mode: Traditional.
Special Course Fee: No.

ECE 642 Time Harmonic Electromagnetics Credits: 3 (3-0-0)
Course Description: Maxwell's equations, radiation, boundary value problem, dyadic Green's functions, scattering theory.
Prerequisite: ECE 641.
Restriction: Must be a: Graduate, Professional.
Term Offered: Spring (odd years).
Grade Mode: Traditional.
Special Course Fee: No.

ECE 650 Extreme Ultraviolet and Soft X-Ray Radiation Credits: 3 (3-0-0)
Course Description: Fundamental principles of short wavelength electromagnetic radiation.
Prerequisite: ECE 342.
Restriction: Must be a: Graduate, Professional.
Term Offered: Spring (odd years).
Grade Mode: Traditional.
Special Course Fee: No.

ECE 651 Detection Theory Credits: 3 (3-0-0)
Course Description: Neyman-Pearson and Bayes detectors and properties, matched filter and matched subspace detectors, distributed detection, and applications.
Prerequisites: ECE 512 and ECE 514.
Restriction: Must be a: Graduate, Professional.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 652 Estimation and Filtering Theory Credits: 3 (3-0-0)
Course Description: Linear and Nonlinear parameter and state estimation methods; Optimal Kalman state estimation and applications.
Prerequisites: (ECE 411 or ECE 412) and (ECE 514 or STAT 525).
Restriction: Must be a: Graduate, Professional.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 655 Multidimensional Digital Signal Processing Credits: 3 (3-0-0)
Course Description: Multidimensional signals and systems, 2-D transforms, stability methods, design and implementations, spectral factorization, and image modeling.
Prerequisite: ECE 512.
Restriction: Must be a: Graduate, Professional.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.
ECE 656  Machine Learning and Adaptive Systems  Credits: 3 (3-0-0)
Course Description: Adaptive system theory, statistical pattern recognition, supervised and unsupervised learning, support vector machines, manifold learning, applications.
Prerequisite:  ECE 512.
Restriction: Must be a: Graduate, Professional.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 658  Internet Engineering  Credits: 4 (3-3-0)
Also Offered As: CS 658.
Course Description: Link technologies, multiple access, hardware and software for internetworks routing, switching flow control, multicast, performance, and applications.
Prerequisite:  ECE 456 or CS 457.
Restriction: Must be a: Graduate, Professional.
Registration Information: Must register for lecture and laboratory. Credit not allowed for both ECE 658 and CS 658. Sections may be offered: Online.
Term Offered: Fall.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 660  Advanced Topics in VLSI Design  Credits: 3 (3-0-0)
Course Description: VLSI synthesis, optimization, and other issues.
Prerequisite:  ECE 571.
Restriction: Must be a: Graduate, Professional.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 661  Advanced Topics in Embedded Systems  Credits: 4 (3-3-0)
Course Description: Embedded systems design: networks on chip, novel memory architectures, synthesis algorithms, optimization for low power, fault tolerance, security.
Prerequisites: (ECE 452) and (ECE 561 or CS 561).
Restriction: Must be a: Graduate, Professional.
Registration Information: Must register for lecture and laboratory. Sections may be offered: Online.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

ECE 666  Topics in Robotics  Credits: 3 (3-0-0)
Course Description: Recent advances in robotics, automation, and intelligent systems.
Prerequisite:  ECE 555 or MECH 514 or MECH 564.
Restriction: Must be a: Graduate, Professional.
Term Offered: Spring.
Grade Mode: Traditional.
Special Course Fee: No.

Also Offered As: CS 670B.
Course Description: Recent advances in architecture, automation, and parallel computing.
Prerequisite:  ECE 554 or CS 570.
Restriction: Must be a: Graduate, Professional.
Registration Information: Credit not allowed for both ECE 670B and CS 670B.
Terms Offered: Fall, Spring.
Grade Mode: Traditional.
Special Course Fee: No.

Also Offered As: CS 670C.
Course Description: Allocation of resources to tasks in parallel and distributed systems. A variety of architectural environments are considered.
Prerequisite:  ECE 554 or CS 570.
Restriction: Must be a: Graduate, Professional.
Registration Information: Credit not allowed for both ECE 670C and CS 670C.
Terms Offered: Fall, Spring.
Grade Mode: Traditional.
Special Course Fee: No.
ECE 695 Independent Study Credits: Var[1-18]
Course Description: 
Prerequisite: None. 
Restriction: Must be a: Graduate, Professional. 
Terms Offered: Fall, Spring, Summer. 
Grade Mode: Instructor Option. 
Special Course Fee: No.

ECE 697 Group Study Credits: Var[1-6]
Also Offered As: ENGR 697.
Course Description: 
Prerequisite: None. 
Restriction: Must be a: Graduate, Professional. 
Registration Information: Credit not allowed for both ECE 697 and ENGR 697.
Terms Offered: Fall, Spring, Summer. 
Grade Mode: Traditional. 
Special Course Fee: No.

ECE 699 Thesis Credits: Var[1-18]
Course Description: 
Prerequisite: None. 
Restriction: Must be a: Graduate, Professional. 
Terms Offered: Fall, Spring, Summer. 
Grade Mode: Instructor Option. 
Special Course Fee: No.

ECE 721 Topics in Communication Theory Credits: 3 (3-0-0)
Course Description: Detection and estimation theory; radar-sonar problems; nonlinear modulation; information theory; communication systems. 
Prerequisite: ECE 521. 
Restriction: Must be a: Graduate, Professional. 
Term Offered: Fall (even years). 
Grade Mode: Traditional. 
Special Course Fee: No.

ECE 742 Topics in Electromagnetics Credits: 3 (3-0-0)
Course Description: Applications of wave propagation and scattering to microwave radar, Doppler radar, meteorological radar applications. 
Prerequisite: ECE 641. 
Restriction: Must be a: Graduate, Professional. 
Term Offered: Spring (odd years). 
Grade Mode: Traditional. 
Special Course Fee: No.

ECE 744 Topics in Plasma Dynamics Credits: 3 (3-0-0)
Course Description: Kinetic equations, nonlinear theory of waves and instabilities; plasma fluctuation and radiations; plasma diagnostics and plasma heating. 
Prerequisite: None. 
Restriction: Must be a: Graduate, Professional. 
Term Offered: Spring (even years). 
Grade Mode: Traditional. 
Special Course Fee: No.

ECE 752 Topics in Signal Processing Credits: 3 (3-0-0)
Course Description: Adaptive filtering, spectral estimation, sonar/radar signal processing, and detection/classification schemes. 
Prerequisites: (ECE 512) and (ECE 514 or STAT 525). 
Restriction: Must be a: Graduate, Professional. 
Term Offered: Fall. 
Grade Mode: Traditional. 
Special Course Fee: No.

ECE 777 X-Ray Lasers Credits: 3 (3-0-0)
Course Description: Fundamentals, design, and implementation of soft X-ray lasers and X-ray optics. 
Prerequisite: ECE 546. 
Restriction: Must be a: Graduate, Professional. 
Term Offered: Spring (even years). 
Grade Mode: Traditional. 
Special Course Fee: No.

ECE 795 Independent Study Credits: Var[1-18]
Course Description: 
Prerequisite: None. 
Restriction: Must be a: Graduate, Professional. 
Terms Offered: Fall, Spring, Summer. 
Grade Mode: Instructor Option. 
Special Course Fee: No.

ECE 799 Dissertation Credits: Var[1-18]
Course Description: 
Prerequisite: None. 
Restriction: Must be a: Graduate, Professional. 
Terms Offered: Fall, Spring, Summer. 
Grade Mode: Instructor Option. 
Special Course Fee: No.