ELECT. ENGINEERING - ECE UGRD (ECE-UY)

ECE-UY 106 Feedback Control (4 Credits)
Typically offered not typically offered
This course introduces analysis and design of linear feedback-control systems; modeling of physical systems, performance specifications, sensitivity and steady-state error; Routh- Hurwitz and Nyquist Stability tests; the use of Root Locus and frequency-response techniques to analyze system performance and design compensation (lead/lag and PID controllers) to meet performance specifications. Students analyze and design control systems using math packages in the alternate-week computer laboratory. The course establishes the foundation of feedback-control theory for use in more advanced courses; introduces control-systems design concepts and practices; and develops facility with computer-design packages for design and simulation. | Prerequisites for Brooklyn Engineering Students: EE-UY 3054 (C- or better) and PH-UY 2023. | Prerequisites for Shanghai Students: EENG-SHU 2054 (C- or better) and PHYS-SHU 93 or CCSC-SHU 51. ABET competencies: a, b, c, e, g, i, k.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 107 Control System Design (3 Credits)
The course covers design of linear feedback control systems, selected from the following: lag-lead compensators; pole placement controllers; state-variable feedback and observers; linear quadratic optimal control, stochastic systems, sampled-data-and computer-controlled systems; and phase-plane and describing function techniques for nonlinear systems. | Prerequisite: EE 3064. ABET competencies: a, b, c, e, k.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 112 Fundamentals of Electronics II (4 Credits)
Typically offered not typically offered
The course concentrates on differential and multistage amplifier, current mirrors, current sources, active loads; frequency response of MOSFET, JFET and BJT amplifiers: Bode plots; feedback amplifiers, gain-bandwidth rule and feedback effect on frequency response; Class A, B and AB output stages; op-amp analog integrated circuits; piecewise-linear transient response; determination of state of transistors; wave-shaping circuits; MOS and bipolar digital design: noise margin, fan-out, propagation delay; CMOS, TTL, ECL; and an alternate week laboratory. The course studies design and analysis of analog integrated circuits, frequency response of amplifiers, feedback amplifiers, TTL and CMOS digital integrated circuits. | Prerequisite for Brooklyn Engineering Students: EE-UY 3114. | Prerequisite for Shanghai Students: EENG-SHU 322. ABET competencies a, c, e, g, k.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 116 Communication Electronics (3 Credits)
The course centers on design and analysis of small-signal and large-signal tuned amplifiers, sine-wave oscillators, mixers, AM modulators and demodulators, FM modulators and demodulators, phase-locked loops. | Prerequisite: EE 3124. ABET competencies: a, c, e, k.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 140 Fundamentals of Communication Theory (4 Credits)
Typically offered not typically offered
The course covers bandpass signal representation and quadrature receivers; noise in communication systems; Digital Modulation Schemes, coherent and noncoherent receivers; coding fundamentals, block and convolutional codes; higher-order modulation schemes, QAM, M-PSK; intersymbol interference and equalization techniques; and carrier and symbol synchronization. Alternate-week computer laboratory projects analyze and design computer packages. The course teaches principles of various modulation and coding techniques and their relative effectiveness under transmission-environments constraints and uses math packages to analyze and simulate communication systems. | Prerequisites for Brooklyn Engineering Students: ECE-UY 3054 (C- or better); computer engineering students may register with instructor's approval. Co-requisite: ECE-UY 2233 (Note: Abu Dhabi students may waive ECE-UY 2233 co-requisite if they have successfully completed ENGR-AD 195 as a prerequisite) | Prerequisite for Shanghai Students: EENG-SHU 2054 (C- or better) and co-requisite of MA-UY 3012 or ECE-UY 2223. ABET competencies a, c, e, k.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 160 Electromagnetic Waves (4 Credits)
Typically offered not typically offered
Electromagnetic wave propagation in free space and in dielectrics, starting from a consideration of distributed inductance and capacitance on transmission lines. Electromagnetic plane waves are obtained as a special case. Reflection and transmission at discontinuities are discussed for pulsed sources, while impedance transformation and matching are presented for harmonic time dependence. Snell's law and the reflection and transmission coefficients at dielectric interfaces are derived for obliquely propagation plane waves. Guiding of waves by dielectrics and by metal waveguides is demonstrated. Alternate-week laboratory. Objectives: Establish foundations of electromagnetic wave theory applicable to antennas, transmissions lines and materials; increase appreciation for properties of materials through physical experiments. | Prerequisites for Brooklyn Engineering Students: EE-UY 2024 or EE-UY 2004 (C- or better). | Prerequisites for Abu Dhabi Students: ENGR-AD 214. | Prerequisites for Shanghai Students: EENG-SHU 251 (C- or better). ABET competencies: a, b, c, e, k.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 164 Electromagnetic Fields and Radiation (3 Credits)
Review and mathematical interpretation of Maxwell's Equations; basic antenna theory and radiation; antenna parameters and arrays; rectangular metal waveguides; dielectric waveguides; and applications at radio and optical frequencies are discussed. | Prerequisite: EE 3604. ABET competencies: a, c, e, k.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 219 DES PROJ: ELECTROMAGNETIC WAVES AND APPS (3 Credits)
The required design project consists of two three-credit courses. The first course, EE DP1, is one of a number of specialty lab/project courses offered by the department in various subdisciplines such as electronics, machinery, robotics, imaging, communications, etc. (EE-UY 4113-4183, below). DP1 provides significant background laboratory experience in the student's area of concentration. Students begin independent projects by finding an adviser and initiating the project work, and exercising oral presentation and written communication skills. | Prerequisite: completion of all junior-level technical courses. ABET competencies: a, b, c, e, f, g, k.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 345X UNDERGRADUATE RESEARCH IN ELECTRICAL AND COMPUTER ENGINEERING (1-3 Credits)
Typically offered Fall, Spring, and Summer terms
The student will conduct research with the guidance of a faculty member. A written report is required. This course may be repeated for up to a maximum of 6 credits.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: Yes

ECE-UY 371 GUIDED STUDIES IN EE (1 Credit)
Typically offered occasionally
Guided study under the guidance of a faculty member of a topic related to Electrical Engineering. | Prerequisite: Advisor approval.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 372 GUIDED STUDIES IN EE (2 Credits)
Typically offered occasionally
Guided study under the guidance of a faculty member of a topic related to Electrical Engineering. | Prerequisite: Advisor approval.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 373 GUIDED STUDIES IN EE (3 Credits)
Typically offered occasionally
Guided study under the guidance of a faculty member of a topic related to Electrical Engineering. | Prerequisite: Advisor approval.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: Yes

ECE-UY 374 GUIDED STUDIES IN EE (4 Credits)
Typically offered occasionally
Guided study under the guidance of a faculty member of a topic related to Electrical Engineering. | Prerequisite: Advisor approval.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 375 GUIDED STUDIES IN EE (5 Credits)
Guided study under the guidance of a faculty member of a topic related to Electrical Engineering. | Prerequisite: Advisor approval.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 376 GUIDED STUDIES IN EE (6 Credits)
Guided study under the guidance of a faculty member of a topic related to Electrical Engineering. | Prerequisite: Advisor approval.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 378X Guided Studies in Electrical and Computer Engineering (1-4 Credits)
Typically offered occasionally
Guided study under the guidance of a faculty member of a topic related to Electrical Engineering or Computer Engineering. | Prerequisite: Advisor approval.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 381 GUIDED STUDIES IN COMP/E (1 Credit)
Guided study under the guidance of a faculty member of a topic related to Computer Engineering. | Prerequisite: Advisor approval.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 382 GUIDED STUDIES IN COMP/E (2 Credits)
Guided study under the guidance of a faculty member of a topic related to Computer Engineering. | Prerequisite: Advisor approval.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 383 GUIDED STUDIES IN COMP/E (3 Credits)
Guided study under the guidance of a faculty member of a topic related to Computer Engineering. | Prerequisite: Advisor approval.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 384 GUIDED STUDIES IN COMP/E (4 Credits)
Guided study under the guidance of a faculty member of a topic related to Computer Engineering. | Prerequisite: Advisor approval.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 385 GUIDED STUDIES IN COMP/E (5 Credits)
Guided study under the guidance of a faculty member of a topic related to Computer Engineering. | Prerequisite: Advisor approval.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 386 GUIDED STUDIES IN COMP/E (6 Credits)
Guided study under the guidance of a faculty member of a topic related to Computer Engineering. | Prerequisite: Advisor approval.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 1002 INTRODUCTION TO ELECTRICAL AND COMPUTER ENGINEERING (2 Credits)
Typically offered occasionally
This course introduces numerous subject areas in Electrical and Computer Engineering (power systems, electronics, computer networking, microprocessors, digital logic, embedded systems, communications, feedback control, and signal processing). Through a series of case studies and examples, the course demonstrates how each subject area applies to practical, real-world systems and devices and discusses how the areas interact with each other to implement a complete functioning system or device. Students make presentations in teams on case studies based on articles from the IEEE Spectrum Magazine and other sources. The IEEE Code of Ethics and ethics-related issues are discussed. | ABET criteria: i, h. | Prerequisites: First-year standing
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 1012 INTRO TO COMPUTER ENGINEERING (2 Credits)
Typically offered occasionally
This course helps students to understand computer engineering as a balance among hardware, software, applications and theory, the notion of abstraction, computer layers and how they relate to various aspects of computer engineering, implementation of abstract and physical computer layers: Number systems, digital logic, basic processor structure, instruction set architecture, machine languages, assembly languages and high-level programming in C. Other computer concepts, including compilers, operating systems and algorithms, are presented, along with the simulator concept and its usage for understanding computer design, testing and analysis. Experts present special topics in the area. Also discussed are invention, innovation, entrepreneurship and ethics in these topics and in Computer Engineering. Cross listed as CS-UY 1012. | ABET competencies: e, h, j | Prerequisite: Only first-year students are permitted to enrol in this course.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 2004 FUND. OF ELECTRIC CIRCUITS (4 Credits)
Fundamentals of Circuits includes circuit modeling and analysis techniques for AC, DC and transient responses. Independent and dependent sources, resistors, inductors and capacitors are modeled. Analysis techniques include Kirchhoff's current and voltage laws, current and voltage division. Thevenin and Norton theorems, nodal and mesh analysis, and superposition. Natural and forced responses for RLC circuits, sinusoidal steady-state response and complex voltage and current (phasors) are analyzed. Alternate-week laboratory. A minimum of C- is required for students majoring in EE. Objective: fundamental knowledge of DC and AC circuit analysis. | Co-requisites for Brooklyn Engineering Students: (MA-UY 2034 or MA-UY 3044) and PH-UY 2023 | Prerequisites for Abu Dhabi Students: SCIEN-AD 110, MATH-AD 116, and MATH-AD 121. ABET competencies a, c, e, k.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 2013 Fundamentals of Electric Circuits I (3 Credits)
Typically offered occasionally
This course covers Passive DC circuit elements, Kirchoff's laws, electric power calculations, analysis of DC circuits, Nodal and Loop analysis techniques, voltage and current division, Thevenin's and Norton's theorems, and source-free and forced responses of RL, RC and RLC circuits. A minimum of C- is required to take other EE courses. | Co-requisites for Brooklyn Engineering Students: MA-UY 2034 and PH-UY 2023 | Prerequisites for Abu Dhabi Students: SCIEN-AD 110, MATH-AD 116, and MATH-AD 121. ABET competencies a, c, e, k.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 2024 Fundamentals of Electric Circuits II (4 Credits)
Typically offered occasionally
The course continues EE2013 and focuses on sinusoidal steady-state response; complex voltage and current and the phasor concept; impedance and admittance; average, apparent and reactive power; polyphase circuits; node and mesh analysis for AC circuits; use of Matlab for solving circuit equations; frequency response; parallel and series resonance; and operational amplifier circuits. A laboratory meets on alternate weeks. A minimum of C- is required to take other EE courses. | Prerequisites: EE-UY 2013 with C or better grade. ABET competencies a, b, c, d, e, k.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 2204 DIGITAL LOGIC AND STATE MACHINE DESIGN (4 Credits)
Typically offered occasionally
This course covers combinational and sequential digital circuits. Topics: Introduction to digital systems. Number systems and binary arithmetic. Switching algebra and logic design. Error detection and correction. Combinational integrated circuits, including adders. Timing hazards. Sequential circuits, flipflops, state diagrams and synchronous machine synthesis. Programmable Logic Devices, PLA, PAL and FPGA. Finite-state machine design. Memory elements. A grade of C or better is required of undergraduate computer-engineering majors. | Prerequisite for Brooklyn Students: CS-UY 1114 (C- or better) or CS-UY 1133 (C- or better) | Prerequisite for Abu Dhabi Students: CS-UH 1001 (C- or better) or ENGR-UH 1000 (C- or better) | Prerequisite for Shanghai Students: CSCI-SHU 101 (C- or better)
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 2233 Introduction to Probability (3 Credits)
Typically offered occasionally
Standard first course in probability, recommended for those planning further work in probability or statistics. Probability of events, random variables and expectations, discrete and continuous distributions, joint and conditional distributions, moment generating functions, the central limit theorem. | Prerequisites: MA-UY 109, MA-UY 2112, OR MA-UY 2114. Note: Not open to students who have taken MA-UY 2224 or MA-UY 3012 or MA-UY 3022.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 2613 FUND OF ELEC PWR ENG FOR NON EE STUDENTS (3 Credits)
Typically offered occasionally
Introduction to electricity: current, voltage and electrical power. Ohm's Law. Kirchhoff's Laws. Electrical materials. Electrical energy generation process. Principles of AC. Bulk electrical power generation: hydroelectricity and thermoelectricity. Alternative generation sources. Synchronous Generators. Induction Motors. Transmission and distribution systems. Substations and transformers. Low-voltage networks. Industrial, commercial and residential networks and loads. Short-circuit and protection equipment. Relays and circuit breakers. Power quality. Reliability and blackouts. Physiological effects of electric currents in the human body. Exposure to low-frequency magnetic fields. National Electric Code (NEC). ANSI-IEEE Standards. IEC standards. Certification of electrical products compliance. | Prerequisite(s): MA-UY 1024/1054/1324, and MA-UY 1124/1154/1424; and PH-UY 1004 or PH-UY 1013; and PH-UY 2004 or PH-UY 2023.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 3054 Signals and Systems (4 Credits)
Typically offered occasionally
This course centers on linear system theory for analog and digital systems; linearity, causality and time invariance; impulse response, convolution and stability; the Laplace, z- transforms and applications to Linear Time Invariant (LTI) systems; frequency response, analog and digital filter design. Topics also include Fourier Series, Fourier Transforms and the sampling theorem. Weekly computer-laboratory projects use analysis- and design-computer packages. The course establishes foundations of linear systems theory needed in future courses; use of math packages to solve problems and simulate systems; and analog and digital filter design. | Prerequisites for Brooklyn Engineering Students: MA-UY 2012/2132, MA-UY 2034 or MA-UY 3044. | Prerequisites for Abu Dhabi Students: MATH-AD 116 and MATH-AD 121. | Prerequisites for Shanghai Students: MATH-SHU 124 and MATH-SHU 140. ABET competencies a, b, c, e, k.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 3064 Feedback Control (4 Credits)
Typically offered occasionally
This course introduces analysis and design of linear feedback-control systems; modeling of physical systems, performance specifications, sensitivity and steady-state error; Routh- Hurwitz and Nyquist Stability tests; the use of Root Locus and frequency-response techniques to analyze system performance and design compensation (lead/lag and PID controllers) to meet performance specifications. Students analyze and design control systems using math packages in the alternate-week computer laboratory. The course establishes the foundation of feedback-control theory for use in more advanced courses; introduces control-systems design concepts and practices; and develops facility with computer-design packages for design and simulation. | Prerequisites for Brooklyn Engineering Students: EE-UY 3054 (C- or better) and PH-UY 2023. | Prerequisites for Shanghai Students: EENG-SHU 2054 (C- or better) and PHYS-SHU 93 or CCSC-SHU 51. ABET competencies: a, b, c, e, g, i, k.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 3114 Fundamentals of Electronics I (4 Credits)
Typically offered occasionally
This course focuses on circuit models and amplifier frequency response, op-amps, difference amplifier, voltage-to-current converter, slew rate, full-power bandwidth, common-mode rejection, frequency response of closed-loop amplifier, gain-bandwidth product rule, diodes, limiters, clamps and semiconductor physics. Other topics include Bipolar Junction Transistors; small-signal models, cut-off, saturation and active regions; common emitter, common base and emitter-follower amplifier configurations; Field-Effect Transistors (MOSFET and JFET); biasing; small-signal models; common-source and common gate amplifiers; and integrated circuit MOS amplifiers. The alternate-week laboratory experiments on OP-AMP applications, BJT biasing, large signal operation and FET characteristics. The course studies design and analysis of operational amplifiers; small-signal bipolar junction transistor and field-effect transistor amplifiers; diode circuits; differential pair amplifiers and semiconductor device- physics fundamentals. | Prerequisites for Brooklyn Engineering Students: EE-UY 2024 or EE-UY 2004 (C- or better) and PH-UY 2023 | Prerequisites for Abu Dhabi Students: ENGR-AD 214 and SCIEN-AD 110. | Prerequisites for Shanghai Students: EENG-SHU 251 (C- or better) and PHYS-SHU 93 or CCSC-SHU 51. ABET competencies a, b, c, e, k.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 3124 Fundamentals of Electronics II (4 Credits)
Typically offered occasionally
The course concentrates on differential and multistage amplifier, current mirrors, current sources, active loads; frequency response of MOSFET, JFET and BJT amplifiers: Bode plots; feedback amplifiers, gain-bandwidth rule and feedback effect on frequency response; Class A, B and AB output stages; op-amp analog integrated circuits; piecewise-linear transient response; determination of state of transistors; wave-shaping circuits; MOS and bipolar digital design: noise margin, fan-out, propagation delay; CMOS, TTL, ECL; and an alternate week laboratory. The course studies design and analysis of analog integrated circuits, frequency response of amplifiers, feedback amplifiers, TTL and CMOS digital integrated circuits. | Prerequisite for Brooklyn Engineering Students: EE-UY 3114. | Prerequisite for Shanghai Students: EENG-SHU 322. ABET competencies a, c, e, g, k.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 3143 Introduction to Smart Grids (3 Credits)
Typically offered Spring
Emerging technologies such as enhanced communication and information systems, controllable electrical loads, energy storage, and renewable generation resources will constitute the backbone of future smart grids. Compared to traditional power grids, it is anticipated that smart grids will increase the overall energy efficiency, reliability and quality of energy delivery. This multi-disciplinary class is aimed at a broad audience of students and will teach basic concepts of traditional power system analysis placed in the context of emerging smart grid technologies and operating concepts (e.g., enhanced controllability and observability, demand-side participation, physical and cyber security, uncertainty-aware decision making). These aspects will be discussed with respect to deregulation, modernization, operation and expansion, and policy of the power sector. Students will gain basic theoretical and practical knowledge underlying smart grids and hands-on experience with modeling and CAD tools. | Pre-requisites: (MA-UY 1124 or an approved equivalent) and (MA-UY 2034 or an approved equivalent) or instructor's permission
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 3144 Introduction to Embedded Systems Design (4 Credits)
Typically offered occasionally
The course covers architecture and operation of embedded microprocessors; microprocessor assembly language programming; address decoding; interfacing to static and dynamic RAM; Serial I/O, Parallel I/O, analog I/O; interrupts and direct memory access; A/D and D/A converters; sensors; microcontrollers. Alternate-week laboratory. Objectives: to provide foundations of embedded systems design and analysis techniques; expose students to system level design; and teach integration of analog sensors with digital embedded microprocessors. | Prerequisites: CS-UY 2204 (C- or better) and EE-UY 2024 or EE-UY 2004 (C- or better). ABET competencies: a, c, d, e, g, j, k.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 3193 Introduction to Very Large Scale Integrated Circuits (3 Credits)
Typically offered occasionally
The course offers an overview of integrated circuit-design process: planning, design, fabrication and testing; device physics: PN junction, MOSFET and Spice models; inverter static and dynamic behavior and power dissipation; interconnects: cross talk, variation and transistor sizing; logic gates and combinational logic networks; sequential machines and sequential system design; subsystem design: adders, multipliers, static memory (SRAM), dynamic memory (DRAM). Topics include floor planning, clock distribution, power distribution and signal integrity; Input/Output buffers, packaging and testing; IC design methodology and CAD tools; implementations: full custom, application-specific integrated circuit (ASIC), field programmable gate arrays (FPGA). The course provides foundations of VLSI design and custom VLSI design methodology and state-of-the-art CAD tools. | Prerequisites: CS-UY 2204 (C- or better) and EE-UY 3114. ABET competencies: a,c,e,k.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 3363 REAL-TIME EMBEDDED CONTROLS & INSTRUMENTATION (3 Credits)
Typically offered occasionally
Introduction to real-time embedded systems. Overview of utilization of embedded microcontrollers and micro-processor for real-time applications. Concepts of modeling and simulation of real-time systems and their hardware-in-the-loop realization. Overview of various sensors and actuators and the associated instrumentation. Electrical and communication standards for interfacing sensors and actuators in embedded systems. Sample micro-controllers and micro-processors and FPGAs in embedded applications. Operating environment in real-time processing systems and software implementations. Case studies of control systems. | Prerequisite: EE-UY 2024 or EE-UY 2004 and CS-UY 2204 and the new C/C++ course (knowledge of C or C++)
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 3404 Fundamentals of Communication Theory (4 Credits)
Typically offered occasionally
The course covers bandpass signal representation and quadrature receivers; noise in communication systems; Digital Modulation Schemes, coherent and noncoherent receivers; coding fundamentals, block and convolutional codes; higher-order modulation schemes, QAM, M-PSK; intersymbol interference and equalization techniques; and carrier and symbol synchronization. Alternate-week computer laboratory projects analyze and design computer packages. The course teaches principles of various modulation and coding techniques and their relative effectiveness under transmission-environments constraints and uses math packages to analyze and simulate communication systems. | Prerequisites for Brooklyn Engineering Students: ECE-UY 3054 (C- or better); computer engineering students may register with instructor's approval. Co-requisite: ECE-UY 2233 (Note: Abu Dhabi students may waive ECE-UY 2233 co-requisite if they have successfully completed ENGR-AD 195 as a prerequisite) | Prerequisite for Shanghai Students: EENG-SHU 2054 (C- or better) and co-requisite of MA-UY 3012 or ECE-UY 2223. ABET competencies a, c, e, k.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No
Prerequisites: ECE-UY 3054 (C- or better); Co-requisite: ECE-UY 2233.

ECE-UY 3414 Multimedia Communication Systems I (4 Credits)
The course is Part I of an approved Institute Sequence in Multimedia Communications. Topics: speech and audio sampling and quantization; frequency domain characterization and processing of speech signals; speech and audio-coding standards; wired and wireless telephone systems; color perception and representation; basic image-processing tools; image-coding standards; basics of packet-switching networks and Internet technology. Requirements: one term project by a team of two or more students related to course content. Objectives: to understand basic techniques for speech, audio and image processing and principles of wired and wireless telephone systems and the Internet. | Prerequisites: CS-UY 1114 or CS-UY 1133 and MA-UY 1024. ABET competencies: a, b, d, g, h, k.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 3474 Introduction to Modern Optics (4 Credits)
Typically offered occasionally
This course covers the physics of optics using both classical and semi-classical descriptions. The classical and quantum interactions of light with matter. Diffraction of waves and wave packets by obstacles. Fourier transform optics, holography, Fourier transform spectroscopy. Coherence and quantum aspects of light. Geometrical optics. Matrix optics. Crystal optics. Introduction to electro-optics and nonlinear optics. | Prerequisite: PH-UY 2033.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 3604 Electromagnetic Waves (4 Credits)
Typically offered occasionally
Electromagnetic wave propagation in free space and in dielectrics, starting from a consideration of distributed inductance and capacitance on transmission lines. Electromagnetic plane waves are obtained as a special case. Reflection and transmission at discontinuities are discussed for pulsed sources, while impedance transformation and matching are presented for harmonic time dependence. Snell's law and the reflection and transmission coefficients at dielectric interfaces are derived for obliquely propagation plane waves. Guiding of waves by dielectrics and by metal waveguides is demonstrated. Alternate-week laboratory. Objectives: Establish foundations of electromagnetic wave theory applicable to antennas, transmissions lines and materials; increase appreciation for properties of materials through physical experiments. | Prerequisites for Brooklyn Engineering Students: EE-UY 2024 or EE-UY 2004 (C- or better). | Prerequisites for Abu Dhabi Students: ENGR-AD 214. | Prerequisites for Shanghai Students: EENG-SHU 251 (C- or better). ABET competencies: a, b, c, e, k.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 3613 Communication Networks (3 Credits)
Typically offered occasionally
This course develops basic techniques used in communication networks. After protocol layering is introduced, algorithms and protocols are discussed for use in each of the five layers: physical, data link, network, transport and application. Specific protocols such as TCP/IP, ATM, SS7 are included. | Prerequisite for Brooklyn Engineering Students: Junior status in electrical engineering, computer engineering, or computer science. Co-requisites for Brooklyn Engineering Students: ECE-UY 2233 (EE majors) or MA-UY 2224 (CompE/CS majors) | Prerequisites for Abu Dhabi Students: ENGR-AD 194 (or co-req of MA-UY 3113) and ENGR-AD 195 (or co-req of ECE-UY 2233) . ABET competencies: a, c, e.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 3824 Electric Energy Conversion Systems (4 Credits)
Typically offered occasionally
Introduction to electric-energy sources, energy-storage devices, energy economics, environmental issues and electrical hazards. Principles of electric power systems transmission and distribution. Basic electromechanical conversion systems pulse and distribution transformers, induction rotating machines. Principles of electric energy conversion, static power supplies, static controllers and electric-power quality. Fundamentals of power management heat-sinks and cooling systems. Alternate-week experiments with basic electrical machines. Objectives: familiarization with energy sources, storage devices and their economical and environmental management; analysis and design of transmission and distribution systems, basic electrical machinery and power electronic converters. | Prerequisite for Brooklyn Engineering Students: EE-UY 2024 or EE-UY 2004 (C- or better). | Prerequisite for Shanghai Students: EENG-SHU 251 (C- or better) | Co-requisite (for all students): EE-UY 3604. ABET competencies: a, b, c, e, g, k.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 4001 ECE Professional Development & Presentation (1 Credit)
Typically offered occasionally
This course provides electrical and computer engineering students with concepts, theory, principles and experience in project management and project presentation. Students learn how to apply skills learned in engineering coursework to team projects in a professional environment. Prerequisites: Junior or senior status or permission of the instructor. | Restricted to Electrical and Computer Engineering majors.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 4113 DP I - CONTROLS AND ROBOTICS (3 Credits)
The required design project consists of two three-credit courses. The first course, EE DP1, is one of a number of specialty lab/project courses offered by the department in various subdisciplines such as electronics, machinery, robotics, imaging, communications, etc. (EE-UY 4113-4183, below). DP1 provides significant background laboratory experience in the student's area of concentration. Students begin independent projects by finding an adviser and initiating the project work, and exercising oral presentation and written communication skills. | Prerequisite: completion of all junior-level technical courses. ABET competencies: a, b, c, e, f, g, k.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 4123 SENIOR DESIGN IN ELECTRICAL POWER & ENERGY: INTRO TO ELECTRIC POWER SYSTEMS (3 Credits)
Typically offered occasionally
The first course, EE DP1, is one of a number of specialty lab/project courses offered by the department in various subdisciplines such as electronics, machinery, robotics, imaging, communications, etc. (ECE-UY 4113-4183, below). DP1 provides significant background laboratory experience in the student's area of concentration. Students begin independent projects by finding an adviser and initiating the project work, and exercising oral presentation and written communication skills. The course focuses on basic concepts in electric power systems. Topics include: three-phase circuits; component modeling (generators, transmission lines, transformers, etc.); per-unit system; symmetrical components; power flow; short circuit; transient stability; introduction to advanced topics: contingency analysis, optimum power flow, electromagnetic transients, geomagnetically induced currents, and harmonics. The course is complemented by laboratory experiments on synchronous and induction (wind) generators. ABET competencies: a, b, c, e, f, g, k. | Prerequisite: ECE-UY 3824
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No
Prerequisites: ABET competencies: a, b, c, e, f, g, k.

ECE-UY 4133 DES PROJ: ELECTROMAGNETIC WAVES AND APPS (3 Credits)
The required design project consists of two three-credit courses. The first course, EE DP1, is one of a number of specialty lab/project courses offered by the department in various subdisciplines such as electronics, machinery, robotics, imaging, communications, etc. (EE-UY 4113-4183, below). DP1 provides significant background laboratory experience in the student's area of concentration. Students begin independent projects by finding an adviser and initiating the project work, and exercising oral presentation and written communication skills. | Prerequisite: completion of all junior-level technical courses. ABET competencies: a, b, c, e, f, g, k.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 4143 DES PROJ I: INTEGRATED CIRCUIT DESIGN (4 Credits)
The required design project consists of two three-credit courses. The first course, EE DP1, is one of a number of specialty lab/project courses offered by the department in various subdisciplines such as electronics, machinery, robotics, imaging, communications, etc. (EE-UY 4113-4183, below). DP1 provides significant background laboratory experience in the student's area of concentration. Students begin independent projects by finding an adviser and initiating the project work, and exercising oral presentation and written communication skills. | Prerequisite: completion of all junior-level technical courses. ABET competencies: a, b, c, e, f, g, k.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 4144 Introduction to Embedded Systems Design (4 Credits)
Typically offered occasionally
The course covers architecture and operation of embedded microprocessors; microprocessor assembly language programming; address decoding; interfacing to static and dynamic RAM; Serial I/O, Parallel I/O, analog I/O; interrupts and direct memory access; A/D and D/A converters; sensors; microcontrollers. Alternate-week laboratory. Objectives: to provide foundations of embedded systems design and analysis techniques; expose students to system level design; and teach integration of analog sensors with digital embedded microprocessors. | Prerequisites: CS-UY 2204 (C- or better) and EE-UY 2024 or EE-UY 2004 (C- or better). ABET competencies: a, c, d, e, g, j, k.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 4153 MULTIMEDIA (3 Credits)
Typically offered occasionally
The required design project consists of two three-credit courses. The first course, EE DP1, is one of a number of specialty lab/project courses offered by the department in various subdisciplines such as electronics, machinery, robotics, imaging, communications, etc. (EE-UY 4113-4183, below). DP1 provides significant background laboratory experience in the student's area of concentration. Students begin independent projects by finding an adviser and initiating the project work, and exercising oral presentation and written communication skills. | Prerequisite: completion of all junior-level technical courses. ABET competencies: a, b, g, k.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 4163 REAL-TIME DIGITAL SIGNAL PROCESSING (DP1) (3 Credits)
Typically offered occasionally
The required design project consists of two three-credit courses. The first course, EE DP1, is one of a number of specialty lab/project courses offered by the department in various subdisciplines such as electronics, machinery, robotics, imaging, communications, etc. (EE-UY 4113-4183, below). DP1 provides significant background laboratory experience in the student's area of concentration. Students begin independent projects by finding an adviser and initiating the project work, and exercising oral presentation and written communication skills. | Prerequisite: completion of all junior-level technical courses. ABET competencies: a, b, c, e, f, g, k.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 4173 DESIGN PROJECT I-TELECOMMUNICATIONS NETWORK (3 Credits)
Typically offered occasionally
The required design project consists of two three-credit courses. The first course, EE DP1, is one of a number of specialty lab/project courses offered by the department in various subdisciplines such as electronics, machinery, robotics, imaging, communications, etc. (EE-UY 4113-4183, below). DP1 provides significant background laboratory experience in the student's area of concentration. Students begin independent projects by finding an adviser and initiating the project work, and exercising oral presentation and written communication skills. | Prerequisite: completion of all junior-level technical courses. ABET competencies: a, b, c, e, f, g, k.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 4183 WIRELESS COMMUNICATIONS (3 Credits)
Typically offered occasionally
The required design project consists of two three-credit courses. The first course, EE DP1, is one of a number of specialty lab/project courses offered by the department in various subdisciplines such as electronics, machinery, robotics, imaging, communications, etc. (EE-UY 4113-4183, below). DP1 provides significant background laboratory experience in the student's area of concentration. Students begin independent projects by finding an adviser and initiating the project work, and exercising oral presentation and written communication skills. | Prerequisite: ECE-UY 3054 and Senior Level
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No
Prerequisites: Prerequisite: ECE-UY 3054 and Senior Level.

ECE-UY 4193 Electrical and Computer Engineering Design Project I (3 Credits)
Typically offered occasionally
Independent Study Design Project 1. In the 2-semester Senior Design Project, a required course for seniors, you will focus on an aspect of electrical engineering. In the first semester, you will develop skills using specialized laboratory equipment and computer-design packages. You will be introduced to techniques for planning projects and how to make effective presentations. You will also learn to balance such design requirements as performance, safety, reliability, and cost effectiveness.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: Yes

ECE-UY 4283 Wireless Information Systems Laboratory II (3 Credits)
Typically offered occasionally
This course includes hands-on experience with a combination of laboratory experiments, lectures and projects relating to basic and advanced topics in wireless communications. Specific topics include mixers, IQ modulation, phase locked loops, receiver design, PN code acquisition, smart antennas and RFID. | Prerequisite: EE-UY 4183
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 4293 Electrical and Computer Design Project II (3 Credits)
Typically offered occasionally
In this concluding phase of the Design Project, students and their advisers continue to work on the independent project begun in the previous semester. The final project builds upon analytical and laboratory skills developed in previous required and elective courses. The project may be an individual one, or may be carried out by a student team working with a faculty group adviser. The final Capstone Project also may be a multidisciplinary project carried out with students from other departments. | Prerequisite: EE-UY 41X3. ABET competencies: a, b, c, d, e, f, g, h, i, j, k.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 4313 Computer Engineering Design Project I (3 Credits)
Typically offered occasionally
Lectures and experiments introduce computer hardware organization, assembly language programming and interfacing computer hardware to physical devices. This course exercises the student's oral presentation and written communication skills, and provides background necessary for beginning independent project work. Students find an adviser and choose DP II course project. | Prerequisite: completion of all junior level technical courses, including minimum grade requirements. ABET competencies: a, b, c, e, f, g, k.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 4323 COMPUTER ENGINEERING DESIGN PROJECT II (3 Credits)
Typically offered occasionally
Students work with faculty advisers in this concluding phase of their Capstone Project. This project builds upon the analytical and laboratory skills developed in previous required and elective courses. The project may be an individual one, or carried out by a team of students working with a faculty group adviser. The project also may be multidisciplinary, carried out with students from other departments. Students are required to make oral and written presentations. | Prerequisites: EE-UY 4313 or CS-UY 4513. ABET competencies: a, b, c, d, e, f, g, h, i, j, k.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 4414 Multimedia Communication Systems II (4 Credits)
This course is Part II of an approved Institute Sequence in Multimedia Communications. Topics: analog and digital video format, properties of human visual systems, multiplexing of separate color components, video-coding methods and standards, analog and digital TV systems. Policy and business issues in TV system development. Video conferencing systems, video streaming over the Internet, Internet protocols for real-time applications. Requires one-term project on a topic related to the course content by a team of two or more students. Objectives: to understand basic techniques for video processing and principles of television systems and real-time services over the Internet. | Prerequisites: EE-UY 3414 or 3054, or sufficient knowledge of Fourier Transforms. ABET competencies: a, b, d, g, h, k.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 4421 Special Topics in Electrical Engineering (1 Credit)
Typically offered occasionally
This course covers topics of special interest in electrical engineering to promote exposure to emerging issues in electrical engineering not covered in the program's normal course offerings. | Prerequisite: Advisor Approval
Grading: Ugrd Tandon Graded
Repeatable for additional credit: Yes

ECE-UY 4422 Special Topics in Electrical Engineering (2 Credits)
Typically offered occasionally
This course covers topics of special interest in electrical engineering to promote exposure to emerging issues in electrical engineering not covered in the program's normal course offerings. | Prerequisite: Advisor Approval
Grading: Ugrd Tandon Graded
Repeatable for additional credit: Yes

ECE-UY 4423 Special Topics in Electrical Engineering (3 Credits)
Typically offered occasionally
This course covers topics of special interest in electrical engineering to promote exposure to emerging issues in electrical engineering not covered in the program's normal course offerings. | Prerequisite: Advisor Approval
Grading: Ugrd Tandon Graded
Repeatable for additional credit: Yes

ECE-UY 4424 Special Topics in Electrical Engineering (4 Credits)
Typically offered occasionally
This course covers topics of special interest in electrical engineering to promote exposure to emerging issues in electrical engineering not covered in the program's normal course offerings. | Prerequisite: Advisor Approval
Grading: Ugrd Tandon Graded
Repeatable for additional credit: Yes

ECE-UY 4513 Nanoelectronic devices and circuits (3 Credits)
Typically offered Spring
Concepts of nanoelectronic materials, devices, and circuits. Fundamental and practical limits on the performance and energy dissipation of nanoelectronic devices. Physical, electrical and optical properties of semiconductor materials and how they are used in circuits. Relation of the properties of semiconductors to the fundamental limits at various levels of design hierarchy. Connections between the physical design and circuit-level performance of nanoelectronic circuits. | Prerequisites: MA-UY 2114 and PH-UY 2023 and EE-UY 3114
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 4563 Introduction to Machine Learning (3 Credits)
Typically offered Fall
This course provides a hands on approach to machine learning and statistical pattern recognition. The course describes fundamental algorithms for linear regression, classification, model selection, support vector machines, neural networks, dimensionality reduction and clustering. The course includes computer exercises on real and synthetic data using current software tools. A number of applications are demonstrated on audio and image processing, text classification, and more. Students should have competency in computer programming. | Prerequisites: ECE-UY 2233, MA-UY 2233, MA-UY 3012, MA-UY 2224 or MA-UY 2222, MA-UY 3514
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 4823 Electric and Hybrid Vehicles (3 Credits)
Typically offered occasionally
Electric and hybrid vehicles mechanical fundamentals. DC, induction, and permanent magnet ac motors and drives. Regenerative breaking. Automotive power electronics. Fuel cells for electric vehicles. Electric Energy storage. The class meets four hours a week for lectures and recitation. ABET criteria: a, c, h, k. | Prerequisites: EE-UY 3824, PH-UY 2033.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No

ECE-UY 4863 POWER ELECTRONICS FOR THE INTERNET OF THINGS (3 Credits)
Typically offered Fall
The course covers all aspects of supplying electric power to the Internet of Things devices and systems. Energy harvesting, conversion, and storage are discussed. Rectifiers, inverters, and dc-dc converters are analyzed and designed. Examples of wired and wireless power transfer systems for battery charging are provided. CAD software for power electronics is introduced. Just-in-time coverage of electric circuit concepts makes the course accessible to any student with an engineering math and physics background. | Prerequisite: MA-UY 2034 and PH-UY 2023; or instructor's permission.
Grading: Ugrd Tandon Graded
Repeatable for additional credit: No
Prerequisites: MA-UY 2034 and PH-UY 2023; or instructor's permission.

ECE-UY 4993 Senior Thesis (3 Credits)
Typically offered occasionally
Independent design-oriented engineering project preformed under guidance of faculty advisor. Oral thesis defense and formal, bound thesis volume required. Registration of at least 6 credits required. | Prerequisite: Senior status and adviser approval. Credits: variable.
Grading: Satisfactory/Unsatisfactory
Repeatable for additional credit: Yes
Prerequisites: Senior status and adviser approval.