

Electrical and Computer Engineering

Brian K. Johnson, Dept. Chair, Dept. of Electrical and Computer Engineering (214 Buchanan Engr. Lab. 83844-1023; phone 208/885-6554).

ECE 101 Foundations of Electrical and Computer Engineering (2 cr)

Course is geared toward freshmen ECE students with little or no fundamental electrical/computer engineering knowledge and is highly interactive and hands-on; includes introductory coverage of basic signal characteristics, amplifier applications and design, fundamental circuit analysis, data analysis, digital logic and computer architecture, electromagnetics, semiconductor physics and solar cells, and VLSI, etc.; nontechnical topics relevant to freshmen will also be included.

Coreq: Math 143 or Math 170

ECE 204 (s) Special Topics (cr arr)

ECE 210 Electrical Circuits I (3 cr)

Intro to d.c. and transient electrical circuits; mesh and nodal analysis; dependent sources; circuit theorems; transient analysis with differential equations. Three lec and one recitation a wk.

Coreq: Math 310 and Phys 212

ECE 211 Electrical Circuits Lab I (1 cr)

Lab to accompany ECE 210. Lab experiments and computer simulations. One 3-hr lab a wk.

Coreq: ECE 210 and Phys 212

ECE 212 Electrical Circuits II (3 cr)

Continuation of ECE 210. Intro to sinusoidal steady state circuits; time and frequency domain analysis; Laplace transforms; Fourier series; transfer functions; Bode plots, filters. Three lec and one recitation a wk.

Prereq: ECE 210, Math 310, and Phys 212

Coreq: ECE 213

ECE 213 Electrical Circuits II Lab (1 cr)

Lab to accompany ECE 212. Continuation of ECE 211. Lab experiments and computer simulations. One 3-hr lab a wk.

Prereq: ECE 211 and Phys 212

Coreq: ECE 212

ECE 240 Digital Logic (3 cr)

Number systems, truth tables, logic gates, flip-flops, combinational and synchronous sequential circuits using SSI, MSI, and programmable devices; intro to digital systems and basic microprocessor architecture; certification exam not reqd.

Prereq: Phys 212

Coreq: ECE 241

ECE 241 Logic Circuit Lab (1 cr)

Open lab to accompany ECE 240. Design and construction of combinational and synchronous sequential logic circuits; certification exam not reqd.

Prereq: Phys 212

Coreq: ECE 240

ECE 292 Sophomore Seminar (0 cr)

Curriculum options, elective courses, preparation for graduate study, professional ethics, and current technical topics. Field trip may be reqd. Graded P/F.

ECE 310 Fundamentals of Electronics (3 cr)

Operational amplifier fundamentals and applications, introduction to electronic devices such as diodes, bipolar junction and field effect transistors, large and small-signal modeling of non-linear electronic devices, DC and small-signal analysis of circuits with non-linear electronic devices, biasing of electronic circuits, introduction to the analysis, design, and applications of electronic circuits such as rectifiers, power supplies, and low-frequency single-stage amplifiers. Practical limitations of amplifiers of electronic circuits.

Prereq: ECE 212 and 213

Coreq: ECE 311

ECE 311 Fundamentals of Electronics Lab (1 cr)

Lab to accompany ECE 310.

Coreq: ECE 310

ECE 320 Energy Systems I (3 cr)

Single-phase AC measurements, transformer parameters, transformer performance, rotating DC machines, DC-DC PE converters. Three lec a wk.

Prereq: ECE 212 and Phys 212

Coreq: ECE 321

ECE 321 Energy Systems I Laboratory (1 cr)

Lab to accompany ECE 320. Lab experiments and computer simulations. One 3-hr lab a wk.

Prereq: ECE 213, Phys 212, Math 310

Coreq: ECE 320

ECE 330 Electromagnetic Theory (3 cr)

Vector mathematics; charge and current; fields as forces; work, potential and electro-motive force; Faraday's law of induction; Gauss's and Ampere's laws; material modeling; waves in isotropic media.

Prereq: Math 275, 310, and Phys 212

Coreq: ECE 331

ECE 331 Electromagnetics Laboratory (1 cr)

Lab to accompany ECE 330. Lab experiments and computer simulations. One 3-hr lab a wk.

Prereq: Math 275, 310; Phys 212

Coreq: ECE 330

ECE 340 Microcontrollers (3 cr)

Introduction to use of embedded microcontrollers and microprocessors; processor architecture; assembly language programming; use of development systems and/or emulators for system testing and debugging; software and hardware considerations of processor interfacing for I/O and memory expansion; programmed and interrupt driven I/O techniques. Three lec a wk.

Prereq: ECE 240, ECE 241, and CS 112 or CS 120

Coreq: ECE 341

ECE 341 Microcontrollers Lab (1 cr)

Lab to accompany ECE 340.

Coreq: ECE 340

ECE 350 Signals and Systems I (3 cr)

Continuous and discrete, linear time invariant systems. Continuous and discrete linear time invariant systems. Sampling. Differential and difference equations. Convolution integrals and sums. Fourier and Laplace transforms. Discrete time Fourier transforms and Z transforms. State variables. Emphasis on practical applications to engineering systems.

Prereq: ECE 212 and Math 310

Coreq: ECE 351

ECE 351 Signals and Systems I Lab (1 cr)

Laboratory to accompany ECE 350. Software and hardware laboratories. Introduction to Matlab.

Coreq: ECE 350

ECE 398 Electrical Engineering Cooperative Internship (1-3 cr, max arr)

Supervised internship in industry in professional engineering settings, integrating academic study with work experience; requires weekly progress reports, a final written report, and a talk/presentation and additional details to be worked out with the faculty supervisor. Cannot be counted as a technical elective toward the B.S.E.E. or B.S.Comp.E. Graded P/F.

Prereq: Permission

ECE 404 (s) Special Topics (cr arr)**ECE 410 Advanced Electronics (3 cr)**

Introduction to analog integrated circuit implementation and design, differential and common-mode signal concepts, differential amplifiers, multistage amplifiers, operational amplifier design, frequency response of electronic circuits, feedback in electronic circuits, large-signal amplifiers.

Prereq: ECE 310 and 311

ECE 411 Advanced Electronics Laboratory (1 cr)

Lab to accompany or follow ECE 410.

Prereq or **Coreq:** ECE 410

ECE J412/J512 Analog Filter Design (3 cr)

Second order, Butterworth, Chebychev, Elliptic and Bessel filter functions and active realizations for highpass, lowpass, bandpass, notch and all-pass filters; frequency and impedance scaling; frequency transformations; phase and group delay; filter sensitivity to passive and active elements; introduction to switched capacitor filters. Additional projects/assignments reqd for grad cr.

Prereq: ECE 310 or Permission

ECE J413/J513 Communication Circuits (3 cr)

Impedance transforms and matching networks, small-signal high frequency amplifiers, distortion in amplifiers, noise calculations and considerations, sinewave oscillators, mixers and frequency translators, phase-locked loops, and power amplifiers. Additional projects/assignments reqd for grad cr.

Prereq: ECE 410 or Permission

ECE J415/J515 Analog Integrated Circuit Design (3 cr)

Analog integrated circuit analysis, design, simulation, and layout, advanced biasing techniques, voltage references, operational amplifiers, compensation techniques, and comparators. Additional projects/assignments required for graduate credit.

Prereq: ECE 410 or Permission

ECE 416 Applications of Linear Integrated Circuits (3 cr)

Theory and practical implementation of operational amplifiers, comparators, voltage regulators, and selected integrated circuits. Non-ideal characteristics of op-amps and comparators and circuit considerations, stability and compensation, active filters, non-linear circuits.

Prereq: ECE 310 or Permission

ECE J417/J517 Pulse and Digital Circuits (3 cr)

Electronic switching, timing, and pulse-shaping techniques; logic functions, realization with diodes, transistors, and FETs. Additional projects/assignments reqd for grad cr.

Prereq: ECE 310 or Permission

ECE J418/J518 Introduction to Electronic Packaging (3 cr)

This course serves as an introduction to electronic packaging and "back-end" microelectronic processes. Topics include substrate design & fabrication, SMT & first level assembly, clean room protocol, thermal design, simulation, and process considerations. Additional project work will be required for students enrolled in 518.

Prereq: ECE 310

ECE 420 Energy Systems II (3 cr)

Three-phases, three-phase transformers, winding theory, rotating waves, steady state operation of three-phase synchronous and steady state operation of single and three-phase induction machines, and AC drives. Labs: three-phase measurements, three-phase transformers, synchronous machines, induction machines.

Prereq: ECE 320 and ECE 321

ECE 421 Introduction to Power Systems (3 cr)

One line diagrams, regulating transformers, calculation of transmission line parameters, line models, Ybus, power flow, power flow studies using commercial software, contingency studies, and power system control. (Fall only)

Prereq: ECE 420

ECE 422 Power Systems Analysis (3 cr) (ECE 423)

Balanced and unbalanced faults, Zbus methods, transient generator models, stability analysis, fault analysis using commercial software, and introduction to power system protection. (Spring only)

Prereq: ECE 421

ECE 425 Power Electronics Lab (1 cr)

Measurement of operating characteristics of power semiconductors; experiments include testing of typical power converter circuits with emphasis on control, gating, protection requirements, and measurement techniques.

ECE 427 Power Electronics and Drives (3 cr)

Characteristics, limitations, and application of solid state power devices; induction machines; analysis and application of AC and DC drives; practical aspects of power electronic converter design, including rectifiers and inverters; choppers, AC phase control, device gating techniques, and snubbers.

Prereq: ECE 420

ECE WS428 Protection of Power Systems I (3 cr) WSU E E 493

Prereq: ECE 420

ECE WS429 Protective Relay Labs (2 cr) WSU E E 494

Prereq: ECE 420

ECE 430 Microwave and Millimeter Wave Circuits (3 cr)

Telegrapher's and wave equations; characteristic impedance, wave velocity and wave number; physical transmission lines, including coax, microstrip and stripline; circuit analysis techniques, reflection coefficient and power flow; impedance analysis, impedance matching techniques and Smith Chart; S-parameters; Wilkinson power dividers, circulators and hybrid couplers; transformers and filters.

Prereq: ECE 330 or Permission

ECE 432 Propagation of Wireless Signals (3 cr)

Maxwell's Equations, including Poynting's vector and Poynting's theorem; Wave equation with solutions, Helmholtz equation, plane waves; Reflection and refraction; Theory of guided waves, ray theory and mode theory; Atmospheric and ionospheric effects on wave propagation; Multipath effects and fading; Ground waves and surface waves. Course will be offered every third semester.

Prereq: ECE 330 or Permission

ECE 434 Antenna Principles and Design (3 cr)

Maxwell's equations, vector potential theory, radiation patterns, antenna efficiency and bandwidth, polarization, dipole and loop antennas, line sources, patch antennas, lineal arrays, antenna systems, radar equation.

Prereq: ECE 330 or Permission

ECE 440 Digital Systems Engineering (3 cr)

Design of digital systems using a hardware description language and field-programmable gate arrays; projects emphasize a top-down design process using software tools; topics include datapath optimization, pipelining, static and dynamic memory, technology issues, intra-system communication, and design for testability.

Prereq: ECE 240, 241, or Permission

ECE J441/J541 Advanced Computer Architecture (3 cr)

See CS J451/J551.

Prereq: ECE 240

ECE 443 Distributed Processing and Control Networks (3 cr)

This course has three major parts: real-time computing, distributed processing, and control networks. Analysis of hardware and software performance with respect to speed, accuracy, and reliability. Investigation ways of maximizing the three essential processors resource, member, CPU Time, and Input/output. Methods for writing error free programs and designing fault tolerant computing systems.

Prereq: ECE 340, 341, 350, and 351

ECE 445 Introduction to VLSI Design (3 cr)

Principles of design of very large scale integrated circuits; CMOS logic design; transistor sizing and layout methodologies; intro to IC CAD tools.

Prereq: ECE 310, 240 or Permission

ECE J449/J549 Fault-Tolerant Systems (3 cr)

See CS J449/J549

ECE 450 Signals and Systems II (3 cr)

Continuation of ECE 350. Two-sided Laplace transform. Relationships among Fourier series, Fourier transform, and Laplace transform. Feedback, modulation, filtering, DFT algorithm, signal flow graphs, state space analysis, and modeling of electromechanical systems. Emphasis on practical applications of theory to solve engineering problems.

Prereq: ECE 350 and Math 330

ECE J451/J551 Electroacoustic Sensors and Systems (3 cr)

Review linear systems. Derive and solve wave equation for strings, membranes, plates, acoustic waveguides. Radiation, reflection, transmission of sound. Analogies among electrical, magnetic, mechanical, acoustical systems. Strong emphasis on 2-port networks. Modeling transducers: loudspeakers, microphones, hydrophones. Sound perception and models of human hearing. Applications to voice communication systems, medical imaging, sonar, spatial listening, seismology, hearing protectors and hearing aids, materials inspection, room acoustics, etc. Additional projects/assignments required for grad credit. (Fall only)

Prereq: ECE 350 or ME 313 or Permission

ECE ID&WS452 Communication Systems (3 cr) WSU EE 451

Introduction to modern communication systems; baseband pulse and data communication systems; communication channels and signal impairments; filtering and waveform shaping in the time and frequency domain; carrier-modulation for AM and FM transmission; bandpass digital and analog communication systems; comparison of system performance.

Prereq: ECE 450 (Alt/yrs)

ECE 453 Communication Systems Laboratory (1 cr)

Test and measurement techniques for communication systems and signal processing; experiments in the modulation and demodulation of information bearing signals. Three hrs of lab a wk.

Coreq: ECE 452

ECE 455 Information and Coding Theory (3 cr)

Introduction to information theory; information content of messages; entropy and source coding; data compression; channel capacity data translation codes; fundamentals of error correcting codes; linear block and convolutional codes; introduction to trellis-coded modulation.

Prereq: Math 330 and Stat 301

ECE 460 Semiconductor Devices (3 cr)

Introduction to semiconductor physics and basic semiconductor devices; intro to electro-optical devices.

Prereq: ECE 350

ECE J462/J562 Semiconductor Theory (3 cr)

Fundamental theory and behavior of modern semiconductor devices. Additional projects/assignments reqd for grad cr.

Prereq for ECE 462: ECE 460

Prereq for ECE 562: Permission

ECE J465/J565 Introduction to Microelectronics Fabrication (3 cr)

This course serves as an introduction to the fabrication of microelectronic devices. Topics include the basics of IC structures, clean room protocol, photolithography, film growth and deposition, as well as IC interconnect technologies. Additional projects/assignments required for graduate credit.

Prereq: ECE 310

ECE 470 Control Systems (3 cr)

Same as ME 481. Analysis and design of feedback control systems using frequency and time domain methods, and computer-aided design tools.

Prereq for EE and CoE majors: ECE 350

Prereq for ME majors: ME 313

ECE 471 Digital Control Systems (3 cr)

Design of digital control systems; sampling, A/D, and D/A conversion issues; time domain, frequency domain, and state space design methods; use of computer-aided design tools. Three lec a wk and approximately three 3-hr labs.

Prereq: ECE 450, 470 or ME 481

ECE 476 Digital Filtering (3 cr)

Design methods for recursive and non-recursive filters; frequency domain characteristics; computer-aided design; applications.

Prereq: ECE 450

ECE 477 Digital Process Control (3 cr)

See ChE 445.

ECE 480 EE Senior Design I (3 cr)

The capstone design sequence for electrical engineering majors. Course topics include design, research, simulation, and experimental methods; specifications, prototyping, troubleshooting and verification; report writing, documentation and oral presentations. Topics are considered in the context of a major design project involving a team of students. Projects incorporate realistic engineering constraints; i.e. environmental, sustainability, manufacturability, ethical, safety, social and political considerations.

Prereq: ECE 240, 241, 310, 311, 320, 321, 340, 341, 350, 351 and Stat 301, or Permission

ECE 481 EE Senior Design II (3 cr)

May be used as core credit in J-3-d. The capstone design sequence for electrical engineering majors. Course topics include design, research, simulation, and experimental methods; specifications, prototyping, troubleshooting and verification; report writing, documentation and oral presentations. Topics are considered in the context of a major design project involving a team of students. Projects incorporate realistic engineering constraints; i.e. environmental, sustainability, manufacturability, ethical, safety, social and political considerations.

Prereq: ECE 330, 331 and 480, or Permission

ECE 482 Computer Engineering Senior Design I (3 cr)

The capstone design sequence for computer engineering majors. Application of formal software and hardware design techniques, hardware/software interface considerations, project management; specifications, prototyping, troubleshooting and verification; report writing, documentation and oral presentations. Topics are considered in the context of a major design project involving a team of students. Projects incorporate realistic engineering constraints; i.e. environmental, sustainability, manufacturability, ethical, safety, social and political considerations.

Prereq: CS 240, 270, ECE 240, 241, 310, 311, 340, 341, 350, 351 and Stat 301; or Permission

Coreq: ECE 440

ECE 483 Computer Engineering Senior Design II (3 cr)

May be used as core credit in J-3-d. The capstone design sequence for computer engineering majors. Application of formal software and hardware design techniques, hardware/software interface considerations, project management; specifications, prototyping, troubleshooting and verification; report writing, documentation and oral presentations. Topics are considered in the context of a major design project involving a team of students. Projects incorporate realistic engineering constraints; i.e. environmental, sustainability, manufacturability, ethical, safety, social and political considerations.

Prereq: ECE 440 and 482; or Permission

ECE 491 Senior Seminar (0 cr)

Technical topics, professional ethics, employment practice, and interviewing. One lec a wk; one 3-6 day field trip may be required. Graded P/F.

ECE 499 (s) Directed Study (cr arr)

ECE 500 Master's Research and Thesis (cr arr)

ECE 501 (s) Seminar (cr arr)

ECE 502 (s) Directed Study (cr arr)

ECE 504 (s) Special Topics (cr arr)

ECE 512 Analog Filter Design (3 cr)

See ECE J412/J512.

ECE 513 Communication Circuits (3 cr)

See ECE J413/J513.

ECE 515 Analog Integrated Circuit Design (3 cr)

See ECE J415/J515.

ECE 517 Pulse and Digital Circuits (3 cr)

See ECE J417/J517.

ECE 518 Introduction to Electronic Packaging (3 cr)

See ECE J418/J518.

ECE 520 Advanced Electrical Machinery (3 cr)

Synchronous machines and transformers, machine transient and subtransient reactances, excitation and voltage regulation, power curves, transformer connections, impedance, harmonics, and impulse characteristics.

Prereq: ECE 422

ECE 521 Power System Stability (3 cr)

Understanding, modeling, and analysis of power system transient and voltage stability; techniques for improving power system stability; use of computer tools. (Alt/yrs)

Prereq: ECE 520 or Permission

ECE 522 Induction Machines (3 cr)

Winding theory, reference frame theory, induction machine models, complex vector methods, small signal analysis, induction machine capability, simulation, introduction to variable speed drives.

Prereq: ECE 350, ECE 422, or Permission

ECE 523 Symmetrical Components (3 cr)

Concepts of symmetrical components, sequence impedances of devices and lines, circuit equivalents for unbalanced faults, management during faults.

Prereq: ECE 422

ECE 524 Transients in Power Systems (3 cr)

Voltage transients; overvoltages during faults; recovery voltage characteristics; arc restrikes, switching surges, ferroresonance, and nonlinear phenomena.

Prereq: ECE 422

ECE 525 Power System Protection and Relaying (3 cr)

Power system faults and applicable relay systems; review of symmetrical components as applied to fault current and consideration of lightning and voltage surge protection.

Prereq: ECE 422 or Permission

ECE ID&WS526 Protection of Power Systems II (3 cr) WSU E E 511

Protection of electrical equipment as related to electric power systems with emphasis on digital algorithms.

Prereq: ECE 525 or Permission

ECE 527 Dynamics and Control of AC Drives (3 cr)

Review of machine modeling techniques and simulation methods, principles of power converters for motor drive applications; analytical modeling and dynamic behavior of machine-drive systems; modulation, regulation, and control techniques; simulation of drive systems; case studies.

Prereq: ECE 320 and 470, or Permission

ECE 528 Understanding Power Quality (3 cr)

Electrical fundamentals in the context of power quality; origins and characterization of power quality problems on distribution systems; applications of standards; advanced ground techniques; case study approach to common situations.

ECE 529 Utility Applications of Power Electronics (3 cr)

HVdc transmission, static VAR compensators, FACTS devices, Custom Power devices, electrical energy storage systems, power quality, harmonic compensation, and alternative energy supply interfacing.

Prereq: ECE 422

ECE ID&WS530 Advanced Electromagnetic Theory I (3 cr) WSU E E 518

Maxwell's equations, potential theory, wave propagation and scattering, canonical problems, guided wave theory, antenna concepts, boundary value problems.

Prereq: ECE 432 or Permission

ECE 531 Advanced Electromagnetic Theory II (3 cr)

Boundary value problems in non-Cartesian systems, diffraction, perturbation techniques, variational techniques, wave transformations.

Prereq: ECE 530 or Permission

ECE ID&WS533 Antenna Theory (3 cr) WSU E E 527

Maxwell's equations, reciprocity, equivalence theorems; wire antennas, antenna arrays, aperture antennas; analysis and design techniques; hardware considerations.

Prereq: ECE 432 or Permission

ECE R538 EM Simulation (3 cr)

Computer simulation of electromagnetics using the finite-difference time-domain (FDTD) method; theory of finite-difference simulation, techniques for modeling EM propagation in lossy and dispersive media, boundary conditions for time-domain simulation.

Prereq: Permission

ECE 539 Advanced Topics in Electromagnetics (3 cr)

Topics include computational and analytical methods, remote sensing, nonlinear optics, guided wave theory, antenna theory.

Prereq: ECE 530 or Permission

ECE ID540 Asynchronous Circuit Design (3 cr) WSU E E 554

Design and analysis of asynchronous digital circuits and systems; topics include: delays and hazards, state encoding, speed-independent and delay-insensitive circuits, micropipelines, and signal transition graphs.

Prereq: ECE 440 or Permission

ECE 541 Advanced Computer Architecture (3 cr)

See ECE J441/J541.

ECE 542 Digital Systems Testing (3 cr)

Fundamentals of testing and design for testability of digital electronic systems at both the module and board level; topics include circuit simulation, fault modeling and simulation, test pattern generation, design for testability, and built-in self-test.

Prereq: ECE 440 or Equivalent

ECE 545 Advanced VLSI Design (3 cr)

CMOS circuit techniques, analysis, modeling, performance, processing, and scaling; design of CMOS logic, gate arrays, data and signal processors, and memory. May not be used with ECE 546 for graduation.

Prereq: ECE 445

ECE 549 Fault-Tolerant Systems (3 cr)

See CS J449/J549.

ECE 551 Electroacoustic Sensors and Systems (3 cr)

See ECE J451/J551.

ECE 554 Theory of Error Correcting Codes (3 cr)

Introduction to error control coding; finite field mathematics; polynomial fields; general theory of block codes; syndrome decoding; cyclic codes; encoders and decoders for cyclic codes; generator polynomials; BCH and Reed-Solomon codes; convolutional codes; the Viterbi algorithm; convolutional encoders and decoders; Trellis coded modulation.

Prereq: ECE 455 or Permission

ECE 555 Information Theory (3 cr)

Introduction to Shannon Theory; entropy, relative entropy, and mutual information; asymptotic equipartition; entropy rates of stochastic processes; data compression; channel capacity, differential entropy; the Gaussian channel, Lempel-Ziv coding, rate distortion theory.

Prereq: ECE 455 or ECE 554 or Permission

ECE 556 Adaptive Signal Processing (3 cr)

Theory and applications of adaptive signal processing; adaptive linear combiner; performance surfaces; adaptive optimization of performance by gradient search; learning curve behavior, adaptation rates, and misadjustment; applications to filtering, prediction, estimation, control, and neural networks.

Prereq: ECE 350, Math 330, ECE 452 or 476 or 477, or Permission

ECE 557 Biological Signal Processing (3 cr)

See Neur 521.

ECE 559 Advanced Topics in Communication Systems (1-3 cr, max arr)

A selection of advanced topics from new research areas in communication systems; a representative selection of topics includes: recent developments in coding and information theory, image compression, cellular and mobile communication systems, magnetic recording, satellite communication systems, spread-spectrum modulation, set-membership theory, clock and carrier recovery methods, and communication channel modeling.

Prereq: ECE 452 or Permission

ECE 562 Semiconductor Theory (3 cr)

See ECE J462/J562.

ECE 565 Introduction to Microelectronics Fabrication (3 cr)

See ECE J465/J565.

ECE ID&WS570 Random Signals (3 cr) WSU E E 507

Probability, random variables, and random signals in engineering systems; stochastic calculus, stationarity, ergodicity, correlation, and power spectra; propagation of random signals through linear systems; Kalman filter theory and applications.

Prereq: ECE 350, and Stat 301 or 451, or Permission

ECE ID&WS571 Estimation Theory for Signal Processing, Communications, and Control (3 cr) WSU E E 508

Identification of dynamic system models from test data; methods to be considered include least-squares, prediction error, maximum likelihood, instrumental variables, correlation, and extended Kalman filter; practical applications and computer-based exercises emphasized within a mathematically rigorous framework.

Prereq: ECE 570 or Permission

ECE ID&WS572 Linear System Theory (3 cr) WSU E E 501

Same as ME 580. Linear spaces and linear operators; descriptions of dynamic systems; input-output descriptions; state-space concepts; canonical forms; controllability and observability; minimal realizations; application to control and general systems analysis; pole assignment; observers.

Prereq: ECE 470 or Equivalent

ECE 573 Fuzzy Logic Control Systems (3 cr)

See ME 581.

ECE ID&WS574 Optimal Control Theory (3 cr) WSU E E 502

Intro to optimization, parameter optimization, optimization of dynamic systems, optimization of dynamic systems with path constraints, optimal feedback control and dynamic programming, linear quadratic regulators, second variation methods, singular control problems, differential games.

Prereq: ECE 572 or Permission

ECE 575 Advanced Vibrations (3 cr)

Free and forced vibration of strings, membranes and plates; response to random inputs; advanced topics in spectral analysis to include statistical properties, windowing, and the zoom transforms; analysis of nonlinear systems including linearization, local and global stability, perturbation methods, and numerical simulation; introduction to chaos theory.

Prereq: ECE 470 or Permission

ECE ID&WS576 Digital Signal Processing (3 cr) WSU E E 530

Characteristics of discrete time signals; design of digital filters with applications; advanced digital signal processing algorithms; discrete time spectral analysis; introduction to 2D processing.

Prereq: ECE 476 or Permission

ECE 577 (s) Advanced Topics in Control Systems (3 cr)

Selection of advanced topics from new research areas in control systems; a representative selection of topics would include: adaptive, LOG/LTR, robust, nonlinear, fuzzy, and neural network control methods.

Prereq: ECE 572 or Permission

ECE 578 Neural Network Design (3 cr)

Same as CS 578 and ME 578. Introduction to neural networks and problems that can be solved by their application; introduction of basic neural network architectures; learning rules are developed for training these architectures to perform useful functions; various training techniques employing the learning rules discussed and applied; neural networks used to solve pattern recognition and control system problems.

Prereq: Permission

ECE ID579 Engineering Acoustics (3 cr)

See ME J413/ID-J513.

ECE 591 Electrical Engineering Research Colloquium (0 cr)

Graded P/F. Weekly colloquia on topics of general interest in electrical engineering and related fields; speakers will be from UI Electrical Engineering Department, other departments on campus, WSU, the local community, and outside agencies and universities.

ECE 599 (s) Non-thesis Master's Research (cr arr)

Research not directly related to a thesis or dissertation.

Prereq: Permission

ECE 600 Doctoral Research and Dissertation (cr arr)

BACKGROUND COURSES

These are not introductory-level courses. They are intended for engineers and scientists whose previous degrees are not in electrical engineering from ABET/EAC-accredited programs, who need to remove deficiencies before beginning graduate studies in electrical engineering.

ECE 319 Background Study in Electronics (3 cr)

Not applicable toward any UI undergrad degree; valid only for removal of electronics (ECE 310) deficiency for grad students who do not have BSEE background. See ECE 310 for description. Graded P/F based on comprehensive exam at completion of course.

Prereq: Permission

ECE 329 Background Study in Energy Systems (3 cr)

Not applicable toward any UI undergrad degree; valid only for removal of electrical machinery (ECE 320) deficiency for grad students who do not have BSEE background. See ECE 320 for description. Graded P/F based on comprehensive exam at completion of course.

Prereq: Permission

ECE 339 Background Study in Electromagnetic Theory (3 cr)

Not applicable toward any UI undergrad degree; valid only for removal of electromagnetic theory (ECE 330) deficiency for grad students who do not have BSEE background. See ECE 330 for description. Graded P/F based on comprehensive exam at completion of course.

Prereq: Permission

ECE 349 Background Study in Digital Logic (3 cr)

Not applicable toward any UI undergraduate degree; valid only for removal of digital computer fundamentals (ECE 240) deficiency for graduate students. See ECE 240 for description. Graded P/F.

ECE 359 Background Study in Signals and Systems Analysis (3 cr)

Not applicable toward any UI undergrad degree; valid only for removal of signals and systems analysis (ECE 350) deficiency for grad students who do not have BSEE background. See ECE 350 for description. Graded P/F based on comprehensive exam at completion of course.

Prereq: Permission