

Elmore Family School of Electrical and Computer Engineering

Engineering Faculty Document No. EFD 17-24 November 30, 2023

Memorandum

To: The Engineering Faculty

From: The Faculty of Elmore Family School of Electrical and Computer Engineering

**Re**: Course integration for IUPUI Realignment – BSEE and CMPE

As part of the IUPUI Realignment, the faculty of the Elmore Family School of Electrical and Computer Engineering has approved the adoption of IUPUI Undergraduate Courses for Electrical Engineering (BSEE) and Computer Engineering (CMPE) to be offered at Purdue University Indianapolis campus for teach-out purposes. This action is now submitted to the Engineering Faculty with a recommendation for approval.

## TITLE:

ECE Course Integration for IUPUI Realignment – BSEE, CMPE

## **DESCRIPTION:**

The purpose of this EFD is to formally adopt the BSEE and CMPE courses to be offered in Indianapolis so they can be included in the Purdue Course Catalog. In the attached Excel spreadsheet, recommended actions for the PWL – PIN course realignment and IUPUI BSEE and CMPE courses are listed. These actions include:

- 1. For courses that are already aligned between West Lafayette and Indianapolis, PIU (IUPUI) classification will be updated to PIN (Purdue Indianapolis). (Green on spreadsheet)
- 2. Current PWL courses that need to be offered at PIN (Purdue Indianapolis for the BSEE and CMPE degrees. (Yellow on spreadsheet)
- 3. Current PWL or PIU, only one needs to be archived and the other remains or gets updated to PIN. (Blue on spreadsheet).
- 4. PWL and/or PIU courses that need to be archived. (Red on spreadsheet).

Mithuna S. Thottethodi Professor of Electrical and Computer Engineering and Interim Associate Head of Teaching and Learning

Status	PIN	Short Title	Long Title	Credit	College	Sched Types	Attributes		Restrictions		Со
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## Course Description

Credit Hours: 1.00. This course is intended to provide an introduction to electrical and computer engineering for students in their freshman year. A goal is to provide some historical background of the respective sub-areas within ECE, a description of analytical tools that will be developed throughout their curriculum, the motivation for the tools, and to inform students of elective courses in ECE.

Credit Hours: 1.00 to 5.00. Topics vary. Permission of department required.

Credit Hours: 0.00. An introduction to the School of Electrical and Computer Engineering, ECE program objectives and outcomes, BSEE & BSCmpE degree requirements, and professional development.

Credit Hours: 3.00. This course covers fundamental concepts and applications for electrical and computer engineers as well as for engineers who need to gain a broad understanding of these disciplines. The course starts by the basic concepts of charge, current, and voltage as well as their expressions with regards to resistors and resistive circuits. Essential concepts, devices, theorems, and applications of direct-current (DC),

Credit Hours: 3.00. Continuation of Electrical and Computer Engineering Fundamentals I. The course addresses mathematical and computational foundations of circuit analysis (differential equations, Laplace Transform techniques) with a focus on application to linear circuits having variable behavior as a function of frequency, with emphasis on filtering. Variable frequency behavior is further considered for applications of electronic

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Credit Hours: 1.00. This is an introduction course in electronic measurement and circuit modeling, simulation and design techniques. These skills are developed through a variety of laboratory experiments ranging from voltage, current, and frequency, to resistors, inductors, capacitors, and operational amplifiers. When possible, the experiments develop practical skills through small design and soldering tasks. Finally, the course

Credit Hours: 1.00. This is a course in electronic measurement, circuit modeling, simulation and design techniques. These skills are developed through a variety of laboratory experiments including discrete semiconductor measurement, transistor amplifiers, motor control, and operational amplifier internals. The experiments develop practical skills through small design and soldering tasks. Finally, the course culminates in

Credit Hours: 3.00. Volt-ampere characteristics for circuit elements; independent and dependent sources; Kirchhoff's laws and circuit equations. Source transformations; Thevenin's and Norton's theorems; superposition, step response of 1st order (RC, RL) and 2nd order (RLC) circuits. Phasor analysis, impedance calculations, and computation of sinusoidal steady state responses. Instantaneous and average power, complex power, power factor correction, and maximum power transfer. Instantaneous and average power.

Credit Hours: 3.00. Continuation of ECE 20100. Use of Laplace Transform techniques to analyze linear circuits with and without initial conditions. Characterization of circuits based upon impedance, admittance, and transfer function parameters. Determination of frequency response via analysis of poles and zeros in the complex plane. Relationship between the transfer function and the impulse response of a circuit. Use of continuous

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Credit Hours: 4.00. Students will learn basics of electrical and electronic circuits including introduction to analog and digital electronic circuits. Measurement of electrical signals using meters, probes, and oscilloscopes are covered in the laboratory component of the course. Circuits are designed for minimum hardware with emphasis on understanding analog and digital electronics with particular use of digital and analog microchips. Non-ECE majors who complete this course can continue the digital course sequence offered by the ECE department including microprocessor systems and interfacing, and digital signal processing. No credit will be given for ECE majors.

Credit Hours: 3.00. Students will learn basics of electrical and electronic circuits ncluding introduction to analog and digital electronic circuits. Circuits are designed for ninimum hardware with emphasis on understanding analog and digital electronics with particular use of digital and analog microchips. Non-ECE majors who complete this course can continue the digital course sequence offered by the ECE department including microprocessor systems and interfacing, and digital signal processing. No credit will be given for ECE majors.

Credit Hours: 3.00. The basics of electrical circuit analysis using Kirchhoff's laws, node voltage, mesh current, superposition, the maximum power theorem; transient analysis of RL / RC circuits; Bipolar Junction Transistor DC analysis; basics of simple sensors; basic operation of rotating electric machines; basics of digital logic circuits. Non-ECE majors only.

Credit Hours: 1.00. Students will learn the basics of electrical signal measurements using meters, probes, oscilloscopes; basic measurements using simple sensors; basic measurements as applied to motors. Circuits are designed for basic hardware with emphasis on understanding analog and digital electronics with practical use of digital and analog-interface microcontrollers. Non-ECE majors only.

Credit Hours: 1.00. Experimental exercises in the use of laboratory instruments. Voltage, current, impedance, frequency, and wave form measurements. Frequency and transient response. Elements of circuit modeling and design.

Credit Hours: 1.00. Laboratory experiments in the measurement of electronic device characteristics. Design of biasing networks, small signal amplifiers, and switching circuits.

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Credit Hours: 3.00. This course will introduce Python programming to students through data science problems. Students will learn Python concepts as well as introductory data science topics, and will use their knowledge of Python (and prior programming experience) to implement data analyses.

Credit Hours: 1.00. An introduction to the School of Electrical and Computer Engineering, ECE program objectives and outcomes, BSEE and BSCmpE degree equirements, and professional development.

Credit Hours: 3.00. Diode, bipolar transistor, and FET circuit models for the design and analysis of electronic circuits. Single and multistage analysis and design; introduction to digital circuits. Computer-aided design calculations, amplifier operating point design, and requency response of single and multistage amplifiers. High-frequency and low-

Credit Hours: 1.00. Introduction to problem solving using software tools, in particular he C programming language.

Credit Hours: 4.00. Introduction to programming, problem solving and the C programming language.

Credit Hours: 3.00. An introductory course in computing programming with an emphasis on program decomposition and program structure. The objective of the course is to introduce the student to problem solving using high-level languages. The students are also introduced to number concepts fundamental in electrical engineering. Programming vill be in "C" in order to develop a structured approach to problem solving. Problems

Credit Hours: 3.00. Continuation of a first programming course. Topics include files, structures, pointers, and the proper use of dynamic data structures. A basic knowledge of the UNIX operating system and an introductory C programming course; C

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Credit Hours: 3.00. Introduction to logic design, with emphasis on practical design techniques and circuit implementation. Topics include Boolean algebra; theory of logic functions; mapping techniques and function minimization; logic equivalent circuits and symbol transformations; transistor-transistor-logic (TTL)/metal oxide semi-conductor (MOS) logic into gate implementations; electrical characteristics; propagation delays; signed number notations and arithmetic; binary and decimal arithmetic logic circuits; theory of sequential circuits; timing diagrams; analysis and synthesis of SR-, D-, T-, and JK-based sequential circuits.

Credit Hours: 4.00. An introduction to digital system design and hardware engineering, with an emphasis on practical design techniques and circuit implementation.

Credit Hours: 1.00 or 2.00. This course provides an opportunity for undergraduate students to explore and develop comprehensive applications of electrical and computer engineering technologies, especially as they relate to active research areas of Purdue faculty members. Students will learn about the underlying research, and will work on

Credit Hours: 1.00. Introduction to the UNIX operating system, including the UNIX file system, UNIX tools, and utilities. Introduction to Shell programming. The emphasis will be on how these tools/utilities are utilized in the Computing Engineering field.

Credit Hours: 0.00. Professional experience in electrical and/or computer engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only.

Credit Hours: 0.00. Professional experience in electrical and/or computer engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only.

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Credit Hours: 1.00. An introduction to the School of Electrical and Computer Engineering, the program's objectives, and outcomes, BSEE and BSCmpE degree equirements, professional writing and multicultural and professional development.

Credit Hours: 0.00 to 4.00. Variable topic and experimental courses appropriate at the cophomore level, as approved by the ECE Curriculum Committee at IUPUI.

Credit Hours: 1.00 to 5.00. Topics vary. Permission of department required.

Credit Hours: 0.00 to 18.00. Projects in Electrical and Computer Engineering. Permission of Department required.

Credit Hours: 3.00. Classification, analysis and design of systems in both the time- and irequency-domains. Continuous-time linear systems: Fourier Series, Fourier Transform, pilateral Laplace Transform. Discrete-time linear systems: difference equations, Discretefime Fourier Transform, bilateral Z-Transform. Sampling, quantization, and discrete-time processing of continuous-time signals. Discrete-time nonlinear systems: median-type ilters, threshold decomposition. System design examples such as the compact disc player and AM radio.

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	ECE30200	Probabilistic Methods	Probabilistic Methods In Electrical And Computer Engineerin	3	School of Elec & Computer Engr		Upper Division	Туре	Include/Exclude		Cre and
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	ECE30411	Electromagnetics I	Electromagnetics I	3.0	School of Elec & Computer Engr	DIS	Upper Division	Туре	Include/Exclude		Cre ma way
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	ECE30414	Elmt Fiber Opt/Lasers/Optoelec	Elements Of Fiber Optics, Lasers And Optoelectronics	3.0	School of Elec & Computer Engr	DIS	Upper Division	Туре	Include/Exclude		Cre pho in c mo
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	ECE30415	Fiber Optics And Lasers Lab	Fiber Optics And Lasers Laboratory	1.0	School of Elec & Computer Engr	LAB	Upper Division	Туре	Include/Exclude		Cre bea Pov
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Credit Hours: 3.00. An introductory treatment including probability of events, discrete and continuous random variables, multiple random variables, sums of random variables

Credit Hours: 3.00. This course is a continued study of vector calculus, electrostatics, magnetostatics, and Maxwell's Equations. It serves as an introduction to electromagnetic waves and transmission lines, which is continued in ECE 30412.

Credit Hours: 3.00. Electromagnetics II builds on Electromagnetics I (ECE 31100) and emphasizes time-varying electromagnetic fields. Both fundamental understanding and an appreciation for applications that span all technologies related to electrical and computer engineering are emphasized. The topics covered include: Maxwell's equations, plane

Credit Hours: 3.00. Fundamental of photonics, guided-wave optics, optical fibers, lasers, photon detectors, integrated optical components, optical information processing, devices in communication and sensor applications. Topics include generation, transformation, modulation and detection of laser beams and their applications.

Credit Hours: 1.00. This laboratory course exercises in lasers, modulation of laser beams, fiber components and systems. It covers some simple optical measurements like Power and beam spot measurement of Gaussian beams. Students learn about lens-

Credit Hours: 3.00. Basic control over propagation, reflection, refraction of optical radiation are covered. Applications to optical instrumentation such as microscopy, polarization optics such as wave plates, thin films, and holography are discussed. Geometrical optics including lenses, mirrors, prisms; Huygens' principle, Fermat principle;

Credit Hours: 1.00. A set of laboratory experiments dealing with fundamentals and basic applications of geometrical optics, beams, polarization optics, wave optics and Fourier optics. Permission of instructor required.

	ECE30500	Semiconductor Devices	Semiconductor Devices	3.0	School of Elec & Computer Engr	LEC	Upper Division	Туре	Include/Exclude		Cre cor inte
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	ECE30600	Circuits & Systems Lab	Electronic Circuits And Systems Laboratory	1.0	School of Elec & Computer Engr		Upper Division	Туре	Include/Exclude		Cre ana
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	ECE30653	Intro To Nano, Qntm Sci & Tech	Introduction To Nanotechnology And Quantum Science & To	3.0	School of Elec & Computer Engr	DIS	Upper Division	Туре	Include/Exclude		Cre and eng fiel
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	ECE30700	Fields & Waves Lab	Electromagnetic Fields And Waves Laboratory	1.0	School of Elec & Computer Engr	LAB	Credit By Exam	Туре	Include/Exclude		Cre fiel
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	ECE30800	Sysm Simul & Contr Lab	Systems Simulation And Control Laboratory	1.0	School of Elec & Computer Engr	LAB	Upper Division	Туре	Include/Exclude	Restriction	Cre equ
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	ECE30834	Fund Of Computer Graphics	Fundamentals Of Computer Graphics	0.0 OR 3.0	School of Elec & Computer Engr	DIS	Upper Division	Туре	Include/Exclude		Cre cou Ope illui alg
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	ECE30862	Obj Orient Prog C++ &Java	Object-Oriented Programming In C++ And Java	3.0	School of Elec & Computer Engr	LEC	Upper Division	Туре	Include/Exclude		Cre inh stai har
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	ECE30864	Software Engineering Tools	Software Engineering Tools	0.0 OR 1.0	School of Elec & Computer Engr	DIS	Dept Credit	Туре	Include/Exclude		Cre soft itse
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Credit Hours: 3.00. Introduces and explains terminology, models, properties, and concepts associated with semiconductor devices. Provides detailed insight into the nternal workings of the "building-block" device structures such as the pn-junction diode,

Credit Hours: 1.00. Experiments in electronic circuits and systems, including spectral analysis techniques, sampling, distortion measurements, random signals, signal-to-noise

Credit Hours: 3.00. This interdisciplinary course offers an introduction to nanotechnology and quantum science and technology for undergraduate students in science and engineering. The students will develop understanding of interdisciplinary nature of these fields and utilize concepts in physics, chemistry and mechanics to describe and analyze

Credit Hours: 1.00. Experimental exercises illustrating concepts in electric and magnetic fields, transmission lines, electromagnetic fields, simple waveguides, and antennas.

Credit Hours: 1.00. Instruction and laboratory exercises in the solution of differential equations that arise in the modeling of physical systems. Instruction in the principles of

Credit Hours: 3.00. Fundamental principles and techniques of computer graphics. The course covers the basics of going from a scene representation to a raster image using OpenGL. Specific topics include coordinate manipulations, perspective, basics of illumination and shading, color models, texture maps, clipping and basic raster algorithms, fundamentals of scene constructions. Permission of department required.

Credit Hours: 3.00. C++ and Java programming languages, including classes, inheritance, encapsulation, polymorphism, class derivation, abstract classes, interfaces, static class members, object construction and destruction, namespaces, exception handling, function, overloading and overriding, function name overload resolution, container classes, and template classes.

Credit Hours: 1.00. This course will acquaint students with the toolkit of the modern software engineer. Students will learn the tools surrounding the software application itself, e.g., tools for software process, software construction, and software deployment.

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	ECE31032	Power Systems Engineering	Power Systems Engineering	3.0	School of Elec & Computer Engr		Upper Division	Туре	Include/Exclude		Cı pl
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	ECE31033	Power Electronics	Power Electronics	3.0	School of Elec & Computer Engr	DIS	Upper Division	Туре	Include/Exclude	Restriction	Cr co an cir
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	ECE32100	Electromech Motion Dev	Electromechanical Motion Devices	3.0	School of Elec & Computer Engr	LEC	Upper Division	Туре	Include/Exclude		Cr ele be an
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	ECE32300	Elec-Mech Mot Dev Lab	Electromechanical Motion Devices and Systems Laboratory	1.0	School of Elec & Computer Engr	LAB	Upper Division	Туре	Include/Exclude		Cr
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Credit Hours: 3.00. Introduction to the economic operation of power systems, threephase circuit analysis, modeling of transformers and transmission lines, steady-state

Credit Hours: 3.00. Introduction to the fundamental operating principles of power conditioning circuits that are currently being used to effect power flow from AC to DC and vice versa. Emphasis is on the relationship between form and function of these circuits. Circuits discussed will include AC/DC line-commutated converters, DC/DC

Credit Hours: 3.00. Continued study of vector calculus, electrostatics, and magnetostatics, and Maxwell's equations. Introduction to electromagnetic waves, transmission lines, and radiation from antennas.

Credit Hours: 3.00. Resistive circuit analysis with controlled sources. Sinusoidal frequency response, filters and Bode plots. Complex power in AC circuits, ideal transformers and three-phase power. Power electronic circuits including diodes, transistor switches, rectifiers and AC-DC converters. Magnetic circuits, magnetic materials and B-H curves. Transformer equivalent circuit models. No credit will be given for ECE majors.

Credit Hours: 3.00. The general theory of electromechanical motion devices relating electric variables and electromagnetic forces. The basic concepts and operational behavior of DC, induction, brushless DC, and stepper motors used in control applications are presented.

Credit Hours: 1.00. Experiments closely coordinated with ECE 32100 involving measurement of fundamental parameters of various electromechanical devices using

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	ECE32600	Engineering Project Managemen	Engineering Project Management	3.0	Regional Campus Only	LEC	Upper Division	Туре	Include/Exclude		Cre in t the of
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Credit Hours: 3.00. (ME 32600) Project management is an important skill that is needed n the private and public sectors as well as specialty businesses. This course will explore he challenges facing today's project managers and will provide a broad understanding of the project management environment focused on multiple aspects of the project.

Credit Hours: 3.00. (ME 32700) Engineering Economics is designed as an overview of economics with a focus on how it relates to the practice of engineering. Topics include interest formulas, rate of return, life cost analysis, depreciation, taxes, and cash flow.

Credit Hours: 2.00. Introduction to standard cell design of Application Specific integrated Circuits (ASICs) using modern hardware description languages (HDLs). Emphasis on how to write HDL code that will map readily to hardware. Laboratory experiments using commercial grade computer-aided design (CAD) tools for HDL based design, logic simulation, automatic placement and routing, timing analysis and

Credit Hours: 3.00. Investigation and evaluation of design problems through simulation of systems described by ordinary differential and difference equations. Development of simulation models from physical parameters and from experimental data. Topics include continuous, discrete, and hybrid models of electrical, mechanical, and biological systems. aboratory experiences demonstrate concepts studied in text and lecture.

Credit Hours: 3.00. An introductory level course on C, a general purpose high-level anguage with features to facilitate such tasks as systems programming and structuring of data. Students becoming proficient in C language programming will learn techniques of structured programming data structures and how to develop programs that are used egularly in many applications.

	ECE36200	Micropro Sys & Intrfac	Microprocessor Systems And Interfacing	0.0 OR 4.0	School of Elec & Computer Engr	LEC	Upper Division	Туре	Include/Exclude	Restriction	Cre inst
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	ECE36400	Sftwr Engr Tools Lab	Software Engineering Tools Laboratory	0.0 OR 1.0	Regional Campus Only	LAB	Dept Credit	Туре	Include/Exclude	Restriction	Cre eng Stu sof
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	ECE36500	Digital Comp Design	Introduction To The Design Of Digital Computers	3.0	Regional Campus Only	LEC	Upper Division	Туре	Include/Exclude	Restriction	Cre foll mic cou
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	ECE36800	Data Structures	Data Structures	3.0	School of Elec & Computer Engr	LEC	Upper Division	Туре	Include/Exclude	Restriction	Cre sta
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	ECE37200	Principals Of Software Design	Principles Of Software Design	3.0	Regional Campus Only	DIS	Upper Division	Туре	Include/Exclude	Restriction	Cre pra acc in c
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edit Hours: 4.00.	An introduction to basic computer organization, microprocess	sor
struction sets, ass	embly language programming, and microcontroller peripheral	ls.

edit Hours: 1.00. To acquaint the students with a variety of current software gineering tools, scripting languages, and application programming languages. udents are expected to use their previous programming experience to design and test oftware programs using the techniques learned in this course.
adit Heurer 2.00. The herdure exercitation of computer systems including the
redit Hours: 3.00. The hardware organization of computer systems including the llowing topics: instruction set selection, arithmetic/logic unit design, hard-wired and icroprogrammed control schemes, memory organization, IO interface design. The purse will involve computer simulation of digital systems.
edit Hours: 3.00. Provides insight into the use of data structures. Topics include acks, queues and lists, trees, graphs, sorting, searching, and hashing.
redit Hours: 3.00. This course introduces discrete mathematical structures and finite- ate machines. Students will learn how to use logical and mathematical formalisms to rmulate and solve problems in computer engineering. Topics include formal logic, proof chniques, recurrence relations, sets, combinatorics, relations, functions, algebraic ructures, and finite-state machines.
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ate machines. Students will learn how to use logical and mathematical formalisms to rmulate and solve problems in computer engineering. Topics include formal logic, proof chniques, recurrence relations, sets, combinatorics, relations, functions, algebraic

Credit Hours: 1.00 or 2.00. This course provides an opportunity for undergraduate students to explore and develop comprehensive applications of electrical and computer engineering technologies, especially as they relate to active research areas of Purdue faculty members. Students will learn about the underlying research, and will work on

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Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Credit Hours: 3.00. In this course, classical concepts of feedback system analysis and associated compensation techniques are presented. In particular, the root locus, Bode diagram, and Nyquist criterion are used as determinants of stability.

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Credit Hours: 0.00. Professional experience in electrical and/or computer engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only.

Credit Hours: 1.00. This course provides ECE students with practice in relevant aspects of communication. Topics include: successfully seeking employment, working effectively in teams, delivering engaging presentations, and leveraging the advantages and

Credit Hours: 0.00. Professional experience in electrical and/or computer engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only.

Credit Hours: 0.00 to 4.00. Variable topic and experimental courses appropriate at the junior level, as approved by the ECE Curriculum Committee at IUPUI.

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edit Hours: 1.00 to 5.00	Topics vary. Permission of department required.
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Credit Hours: 1.00. A special seminar for cooperative education and curricular practical training students. Permission of instructor required.

Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required.

Credit Hours: 1.00. A lecture-demonstration series emphasizing evaluation of career options, identification and development of professional skills. Examples of career-related topics include choosing a job, and post-graduate education in engineering or other

Credit Hours: 3.00. An introduction to computational tools used in the measurement and analysis of electro-acoustic systems, and their application to sound reinforcement system engineering. Service learning based projects, serving the needs of community clients, provide the context for application of sound reinforcement system design principles and

	ECE40100	Engr Ethics/Profssnlsm	Engineering Ethics and Professionalism	1.0	Regional Campus Only	LEC	Upper Division	Туре	Include/Exclude	Restriction	Cre
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	ECE41000	Intro Dig Signal Proc	Introduction to Digital Signal Processing	0.0 OR 3 0	Regional Campus Only	LEC	Upper Division	Туре	Include/Exclude		Cr
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	ECE41023	Electromech Motion Control	Electromechanical Motion Control	3.0	School of Elec & Computer Engr	LEC	Upper Division	Туре	Include/Exclude	Restriction	Cro are co va
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redit Hours: 1.00. Some ethical, social, political, legal, and ecological issues that racticing engineers may encounter. (ECE 401 and ME 401 are cross-listed courses; tudents may not get credit for both ECE 401 and ME 401.).

Credit Hours: 3.00. Lecture sessions provide the student with background information on the design and management of projects. Formal lectures cover, for example, design or manufacturability, design for quality, test and evaluation, reliability and ethics, patents and copyrights, plus case studies. During the laboratory sessions, the students work in teams on a challenging open-ended electrical engineering project that draws on previous coursework. Projects routinely involve standard design facets (such as consideration of alternative solutions, feasibility considerations, and detailed system lescriptions) and include a number of realistic constraints (such as cost, safety, eliability, and aesthetics). Completion of BS EE or BS CmpE core curriculum.

Credit Hours: 3.00. Introduction to security issues related to the operation of computers and the workings of computer networks. Topics covered include introduction to cryptography, authentication protocols, digital signature algorithms, internet vulnerabilities, worms and virus propagation, denial of service attacks, etc. The students will also learn how to design firewalls to protect a system against unwanted intrusions. Permission of department required.

Credit Hours: 3.00. Students will learn to design and construct operating systems for both individual computers and distributed systems, and to apply and utilize operating system functionality to their application development. The course will cover basic concepts and methods for managing processor, main memory, storage, and network esources, including their system functions. Detailed examples are taken from a number of operating systems, emphasizing the techniques used in networked UNIX and embedded Linux.

Credit Hours: 3.00. This course provides an introduction to software design for embedded computing systems. Major topics covered include the importance of time and iming in embedded systems, embedded software organization (FSM-based program design, polled loop systems, foreground-background systems, event driven architectures,

Credit Hours: 3.00. This course introduces fundamental techniques in data mining, such as the techniques that extract useful knowledge from a large amount of data. Topics include data preprocessing, exploratory data analysis, association rule mining, clustering,

Credit Hours: 3.00. An introductory treatment of digital signal processing algorithms and mplementation using high-speed digital signal processors. Sampling, architecture, addressing modes and instruction set of digital signal processors, discrete Fourier ransform, fast Fourier transform, and digital filtering.

Credit Hours: 3.00. The operation, analysis, and control of electromechanical systems are covered, including a treatment of electromechanical devices, power electronics, and control systems. Sample applications include servo-systems, propulsion drives, and variable-speed rotational equipment.

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	ECE41200	Intro To Engr Optics	Introduction To Engineering Optics	3.0	School of Elec & Computer Engr	DIS	Upper Division	Туре	Include/Exclude		Crea App disc
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	ECE41700	Multimedia Application	Multimedia Applications	3.0	Regional Campus Only	LEC	Upper Division	Туре	Include/Exclude		Cre imp arct cod
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Credit Hours: 3.00. The control and characteristics of optical radiation are covered. Applications to optical instrumentation, thin films, holography, and polarizing optics are discussed.

Credit Hours: 1.00. A set of laboratory experiments dealing with fundamentals and applications of geometrical optics, polarization optics, wave optics, and Fourier optics.

Credit Hours: 3.00. Introduction to the use of lasers, fiber and integrated optical components and devices in communication and sensory applications. Topics include generation, transformation, modulation, deflection, and detection of laser beams, and heir applications in fiber communication sensory systems.

Credit Hours: 2.00. The first semester of a two-semester sequence to give teams of 3 to b students the experience of designing an ASIC (Application Specific Integrated Circuit), having the chip fabricated and testing it. The team of students will develop requirements for a design, prepare the design using VHDL ((VHSIC(very high speed integrated circuit) Hardware Description Language)), Verilog, or schematic entry tools, create and use test benches to functionally verify the design, use automated tools to prepare a circuit layout,

Credit Hours: 2.00. The second semester of a two-semester sequence to give teams of 3 o 6 students the experience of designing an ASIC (Application Specific Integrated Circuit), having the chip fabricated and testing it. The team of students will develop equirements for a design, prepare the design using VHDL ((VHSIC(very high speed integrated circuit) Hardware Description Language)), Verilog, or schematic entry tools,

Credit Hours: 1.00. Laboratory exercises in lasers, hologram, modulation and deflection of laser beams, fiber components, and systems.

Credit Hours: 3.00. An introductory treatment of multimedia algorithms and mplementation using high-speed multimedia processors. Detailed discussion of architecture, addressing modes and instruction set of multimedia processors, entropy coding, transform coding, speech compression, image compression, and video compression.

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Credit Hours: 3.00. Advanced topics in digital design. Boolean logic. Logic optimization, /LSI and ASIC design basics. Design. Simulation. Placement and routing. Logic synthesis. FPGA structure. FPGA implementation. FPGA design flow. Verilog and VHDL coding.

Credit Hours: 3.00. Design, optimization and control of electromechanical and mechatronic systems. omprehensive dynamic analysis, modeling, and simulation of electric machines, power electronics, and sensors. Application of advanced software and hardware in mechatronic systems design and optimization.

Credit Hours: 3.00. Introduction to power semiconductor devices, characteristics, and ratings. Emphasis on analysis and design of circuits with power semiconductors and associated devices. Power rectification, inversion, AC-to-AC power control, firing circuits, and microcomputer control of power circuits.

Credit Hours: 3.00. Fundamental concepts of power system analysis, transmission line parameters, basic system models, steady-state performance, network calculations, power

Credit Hours: 3.00. Fundamental concepts of power systems analysis, transmission line parameters, basic system models, steady state performance, network calculations, power

Credit Hours: 3.00. Review of OO design with C++ and Java. Difficulties caused by multiple inheritances in C++. Taking advantage of Run-Time Identification in C++. Multithreading, AWT, and Network Programming in Java. Discussion of Java applets, beans, and servlets. Unified modeling language. Use-case analysis. Constructing conceptual models. System sequence diagrams. "Gang of Four" design patterns. Case studies. Permission of instructor required.

Credit Hours: 4.00. An introduction to computer organization and design, including nstruction set selection, arithmetic logic unit design, data path design, control strategies, pipelining, memory hierarchy, and I/O interface design.

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Credit Hours: 4.00. The course is presented in five units. Foundations: the review of continuous-time and discrete-time signals and spectral analysis; design of finite impulse response and infinite impulse response digital filters; processing of random signals. Speech processing; vocal tract models and characteristics of the speech waveform; shorttime spectral analysis and synthesis; linear predictive coding. Image processing: twodimensional signals, systems and spectral analysis; image enhancement; image coding; and image reconstruction. The laboratory experiments are closely coordinated with each unit. Throughout the course, the integration of digital signal processing concepts in a design environment is emphasized.

Credit Hours: 4.00. Analysis and design of analog and digital communication systems. Emphasis on engineering applications of theory to communication system design. The laboratory introduces the use of advanced engineering workstations in the design and testing of communication systems.

Credit Hours: 3.00. Transient and steady-state behavior of transmission lines, wave guides, antennas, propagation, noise, microwave sources, and system design.

Credit Hours: 3.00. Nanoelectronic devices are an integral part of our life, including the billion-plus transistors in every smartphone, each of which has an active region that is only a few hundred atoms long. This course is designed to convey the key concepts

Credit Hours: 3.00. Analysis, design, and fabrication of silicon bipolar and MOSFET monolithic integrated circuits. Consideration of amplifier circuit design and fabrication

Credit Hours: 3.00. As applied t digital integrated circuits, the MDs transistor is studied in depth-from its fabrication to its electrical characteristics. Combinational, sequential,

Credit Hours: 1.00. Laboratory exercises illustrating the design and application of electronic circuits. Case studies of circuits presently in existing instruments, such as the

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Credit Hours: 3.00. Introduction to software engineering principles, with special emphasis on the process, methods, and tools needed to develop and test quality software products and systems.

Credit Hours: 3.00. An introduction to the design and implementation of computer communication networks. The focus is on the concepts and the fundamental design principles that have contributed to the global Internet success. Topics include: digital

Credit Hours: 4.00. The design and construction of compilers and other translators. Fopics include compilation goals, organization of a translator, grammars and languages, symbol tables, lexical analysis, syntax analysis (parsing), error handling, intermediate and final code generation, assemblers, interpreters, and an introduction to optimization. Emphasis is on engineering a compiler or interpreter for a small programming language sypically a C or Pascal subset. Projects involve the stepwise implementation (and documentation) of such a system. Department permission required.

Credit Hours: 4.00. The design and construction of operating systems for both individual computers and distributed (networked) systems. Basic concepts and methods for managing processor, main memory, block-structured storage, and network resources are covered. Detailed examples are taken from a number of operating systems, emphasizing the techniques used in networked versions of UNIX. These techniques are applied to design improvements of portions of a simplified, networked, UNIX-based operating system; the improvements are implemented and their performance is evaluated in laboratory experiments.

Credit Hours: 0.00. An electrical and/or computer engineering work experience. This internship experience is intended to complement the student's academic plan-of-study and help prepare him/her for his/her future role as a practicing engineer. A letter from the prospective employer stating the period of employment, hours per week, job title, job qualifications, and job minimum period of employment is required. This course may not be taken in successive semesters. Permission of department required.

Credit Hours: 0.00. A part-time electrical and/or computer engineering work experience. This internship experience is intended to complement the student's academic plan of study and help prepare him/her for his/her future role as a practicing engineer.

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Credit Hours: 3.00. A structured approach to the development and integration of embedded microcontroller/microprocessor/DSP-based systems. The course provides students with design experience of embedded systems. The course covers the microprocessor selection, the configuration of peripheral components, and the hardware abstraction techniques. The course also covers the C programming techniques for embedded systems and using a fixed point microprocessor for floating point calculations.

Credit Hours: 3.00. The course introduces fundamental areas of artificial intelligence: knowledge representation and reasoning; machine learning; planning; game playing; natural language processing; and vision.

Credit Hours: 4.00. A structured approach to the development and integration of embedded microcontroller hardware and software that provides senior-level students with significant design experience applying microcontrollers to a wide range of embedded systems (e.g., instrumentation, process control, telecommunications, and

Credit Hours: 1.00 or 2.00. This course provides an opportunity for undergraduate students to explore and develop comprehensive applications of electrical and computer engineering technologies, especially as they relate to active research areas of Purdue faculty members. Students will learn about the underlying research, and will work on

Credit Hours: 3.00. The course introduces feedback computer controlled systems, the components of digital control systems, and system models on the z-domain (z-transfer functions) and on the time domain (state variable representations.) The objectives for system design and evaluation of system performance are considered. Various discrete-

Credit Hours: 1.00. A real-life experience in engineering problem solving in a group setting from identification, planning and execution to professional-quality written and bral presentations. This is the first semester of a two semester course sequence. Prerequisites: Intent to graduate within two semesters.

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Credit Hours: 2.00. A real-life experience in engineering problem solving in a group setting from identification, planning and execution to professional-quality written and oral presentations. This is the second semester of a two semester course sequence.

Credit Hours: 3.00. Homogeneous transformations; kinematics of manipulator arms; dynamic equations using Newton-Euler and Euler-Lagrange formulations; inverse kinematics; trajectory generation; task planning; manipulator control; robot languages; robot sensing and vision; and industrial applications of robots. Lab experiments and final

Credit Hours: 1.00 to 3.00. The student selects an engineering design project and works under the direction of the faculty sponsor. Suitable projects may be from the local industrial, municipal, state, and educational communities.

Credit Hours: 3.00. General design methodology, consideration of alternative solutions, and project planning in design. Influence of safety, reliability, economics, and aesthetics on design of engineering systems. Interpretation of specifications and requests for proposals. Early in the course, teams of students will be assigned a major design problem that will be the focus throughout the course. Oral presentation and report writing required.

Credit Hours: 1.00. This course provides ECE students an opportunity to refine their professional communication skills before launching into the workplace or graduate school. Topics include: ethics in ECE, workplace communication (written and verbal), and

Credit Hours: 1.00 to 4.00. Topics vary. Permission of department required.

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	ECE49600	EE And CMPE Projects	Electrical And Computer Engineering Projects	0.0 TO 18.0	School of Elec & Computer Engr	DIS	Credit By Exam	Туре	Include/Exclude	Restriction	Cre dej
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edit Hours: 1.00 to 5.00.	Topics vary. Permission	of department required.
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Credit Hours: 0.00 to 18.00. Arrange Hours and Credit. Topics vary. Permission of department required. Permission of instructor required.

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## Course Description

Credit Hours: 1.00. This course is intended to provide an introduction to electrical and computer engineering for students in their freshman year. A goal is to provide some historical background of the respective sub-areas within ECE, a description of analytical cools that will be developed throughout their curriculum, the motivation for the tools, and to inform students of elective courses in ECE.

Credit Hours: 1.00 to 5.00. Topics vary. Permission of department required.

Credit Hours: 0.00. An introduction to the School of Electrical and Computer Engineering, ECE program objectives and outcomes, BSEE & BSCmpE degree equirements, and professional development.

Credit Hours: 3.00. This course covers fundamental concepts and applications for electrical and computer engineers as well as for engineers who need to gain a broad understanding of these disciplines. The course starts by the basic concepts of charge, current, and voltage as well as their expressions with regards to resistors and resistive circuits. Essential concepts, devices, theorems, and applications of direct-current (DC),

	ECE20002	Elect Engr Fundamental II	Electrical Engineering Fundamentals II	3.0	School of Elec & Computer Engr	DIS	Lower Division	Туре	Include/Exclude	Restriction	Cre I.
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	ECE20007	Elec Engr Fundamentals I Lab	Electrical Engineering Fundamentals I Lab	1.0	School of Elec & Computer Engr	LAB	Credit By Exam	Туре	Include/Exclude	Restriction	Cr mo
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	ECE20100	Linear Circuit Anly I	Linear Circuit Analysis I	3.0	School of Elec & Computer Engr	DIS	Credit By Exam	Туре	Include/Exclude	Restriction	Cr
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Credit Hours: 3.00. Continuation of Electrical and Computer Engineering Fundamentals I. The course addresses mathematical and computational foundations of circuit analysis (differential equations, Laplace Transform techniques) with a focus on application to linear circuits having variable behavior as a function of frequency, with emphasis on filtering. Variable frequency behavior is further considered for applications of electronic

Credit Hours: 1.00. This is an introduction course in electronic measurement and circuit modeling, simulation and design techniques. These skills are developed through a variety of laboratory experiments ranging from voltage, current, and frequency, to resistors, inductors, capacitors, and operational amplifiers. When possible, the experiments develop practical skills through small design and soldering tasks. Finally, the course

Credit Hours: 1.00. This is a course in electronic measurement, circuit modeling, simulation and design techniques. These skills are developed through a variety of laboratory experiments including discrete semiconductor measurement, transistor amplifiers, motor control, and operational amplifier internals. The experiments develop practical skills through small design and soldering tasks. Finally, the course culminates in

Credit Hours: 3.00. Volt-ampere characteristics for circuit elements; independent and dependent sources; Kirchhoff's laws and circuit equations. Source transformations; Thevenin's and Norton's theorems; superposition, step response of 1st order (RC, RL) and 2nd order (RLC) circuits. Phasor analysis, impedance calculations, and computation of sinusoidal steady state responses. Instantaneous and average power, complex power, power factor correction, and maximum power transfer. Instantaneous and average power.

Credit Hours: 3.00. Continuation of ECE 20100. Use of Laplace Transform techniques to analyze linear circuits with and without initial conditions. Characterization of circuits based upon impedance, admittance, and transfer function parameters. Determination of requency response via analysis of poles and zeros in the complex plane. Relationship between the transfer function and the impulse response of a circuit. Use of continuous

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	ECE20800	Electron Dev & Des Lab	Electronic Devices And Design Laboratory	1.0	School of Elec & Computer Engr	DIS	Dept Credit	Туре	Include/Exclude	Restriction	Cr ch
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Credit Hours: 4.00. Students will learn basics of electrical and electronic circuits including introduction to analog and digital electronic circuits. Measurement of electrical signals using meters, probes, and oscilloscopes are covered in the laboratory component of the course. Circuits are designed for minimum hardware with emphasis on understanding analog and digital electronics with particular use of digital and analog microchips. Non-ECE majors who complete this course can continue the digital course sequence offered by the ECE department including microprocessor systems and interfacing, and digital signal processing. No credit will be given for ECE majors.

Credit Hours: 3.00. Students will learn basics of electrical and electronic circuits ncluding introduction to analog and digital electronic circuits. Circuits are designed for minimum hardware with emphasis on understanding analog and digital electronics with particular use of digital and analog microchips. Non-ECE majors who complete this course can continue the digital course sequence offered by the ECE department including microprocessor systems and interfacing, and digital signal processing. No credit will be given for ECE majors.

Credit Hours: 3.00. The basics of electrical circuit analysis using Kirchhoff's laws, node voltage, mesh current, superposition, the maximum power theorem; transient analysis of RL / RC circuits; Bipolar Junction Transistor DC analysis; basics of simple sensors; basic operation of rotating electric machines; basics of digital logic circuits. Non-ECE majors only.

Credit Hours: 1.00. Students will learn the basics of electrical signal measurements using meters, probes, oscilloscopes; basic measurements using simple sensors; basic measurements as applied to motors. Circuits are designed for basic hardware with emphasis on understanding analog and digital electronics with practical use of digital and analog-interface microcontrollers. Non-ECE majors only.

Credit Hours: 1.00. Experimental exercises in the use of laboratory instruments. Voltage, current, impedance, frequency, and wave form measurements. Frequency and transient response. Elements of circuit modeling and design.

Credit Hours: 1.00. Laboratory experiments in the measurement of electronic device characteristics. Design of biasing networks, small signal amplifiers, and switching circuits.

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	ECE20875	Python For Data Science	Python For Data Science	3.0	School of Elec & Computer Engr	DIS	Lower Division	Туре	Include/Exclude		Cr
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	ECE21000	ECE Sophomore Seminar	Electrical And Computer Engineering Sophomore Seminar	1.0	Regional Campus Only	LEC	Dept Credit	Туре	Include/Exclude		Cre
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	ECE25500	Intr Electron Anly Des	Introduction To Electronic Analysis And Design	3.0	School of Elec & Computer Engr	DIS	Lower Division	Туре	Include/Exclude	Restriction	Cre ana dig fre
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	ECE26400	Advanced C Programming	Advanced C Programming	3.0	School of Elec & Computer Engr	LEC	Credit By Exam	Туре	Include/Exclude		Cre
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Credit Hours: 3.00. This course will introduce Python programming to students through data science problems. Students will learn Python concepts as well as introductory data science topics, and will use their knowledge of Python (and prior programming experience) to implement data analyses.

Credit Hours: 1.00. An introduction to the School of Electrical and Computer Engineering, ECE program objectives and outcomes, BSEE and BSCmpE degree requirements, and professional development.

Credit Hours: 3.00. Diode, bipolar transistor, and FET circuit models for the design and analysis of electronic circuits. Single and multistage analysis and design; introduction to digital circuits. Computer-aided design calculations, amplifier operating point design, and frequency response of single and multistage amplifiers. High-frequency and low-

Credit Hours: 1.00. Introduction to problem solving using software tools, in particular the C programming language.

Credit Hours: 4.00. Introduction to programming, problem solving and the C programming language.

Credit Hours: 3.00. An introductory course in computing programming with an emphasis on program decomposition and program structure. The objective of the course is to introduce the student to problem solving using high-level languages. The students are also introduced to number concepts fundamental in electrical engineering. Programming will be in "C" in order to develop a structured approach to problem solving. Problems

Credit Hours: 3.00. Continuation of a first programming course. Topics include files, structures, pointers, and the proper use of dynamic data structures. A basic knowledge of the UNIX operating system and an introductory C programming course; C

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	ECE29199	Cooperative Experience I	Cooperative Experience I	0.0	School of Elec & Computer Engr	EX	Соор	Туре	Include/Exclude		Cre Pro sul
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Credit Hours: 3.00. Introduction to logic design, with emphasis on practical design techniques and circuit implementation. Topics include Boolean algebra; theory of logic functions; mapping techniques and function minimization; logic equivalent circuits and symbol transformations; transistor-transistor-logic (TTL)/metal oxide semi-conductor (MOS) logic into gate implementations; electrical characteristics; propagation delays; signed number notations and arithmetic; binary and decimal arithmetic logic circuits; theory of sequential circuits; timing diagrams; analysis and synthesis of SR-, D-, T-, and JK-based sequential circuits.

Credit Hours: 4.00. An introduction to digital system design and hardware engineering, with an emphasis on practical design techniques and circuit implementation.

Credit Hours: 1.00 or 2.00. This course provides an opportunity for undergraduate students to explore and develop comprehensive applications of electrical and computer engineering technologies, especially as they relate to active research areas of Purdue faculty members. Students will learn about the underlying research, and will work on

Credit Hours: 1.00. Introduction to the UNIX operating system, including the UNIX file system, UNIX tools, and utilities. Introduction to Shell programming. The emphasis will be on how these tools/utilities are utilized in the Computing Engineering field.

Credit Hours: 0.00. Professional experience in electrical and/or computer engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only.

Credit Hours: 0.00. Professional experience in electrical and/or computer engineering. Program coordinated by school with cooperation of participating employers. Students submit summary report and company evaluation. Professional Practice students only.

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	ECE30010	Intro To Mach Learn & Pat Rec	Introduction To Machine Learning And Pattern Recognition	3.0	School of Elec & Computer Engr	IND	Upper Division	Туре	Include/Exclude	Restriction	
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	ECE30100	Signals And Systems	Signals And Systems	3.0	School of Elec & Computer Engr	LEC	Upper Division	Туре	Include/Exclude	Restriction	Cr
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Credit Hours: 1.00. An introduction to the School of Electrical and Computer Engineering, the program's objectives, and outcomes, BSEE and BSCmpE degree requirements, professional writing and multicultural and professional development.

Credit Hours: 0.00 to 4.00. Variable topic and experimental courses appropriate at the sophomore level, as approved by the ECE Curriculum Committee at IUPUI.

Credit Hours: 1.00 to 5.00. Topics vary. Permission of department required.

Credit Hours: 0.00 to 18.00. Projects in Electrical and Computer Engineering. Permission of Department required.

Credit Hours: 3.00. Classification, analysis and design of systems in both the time- and frequency-domains. Continuous-time linear systems: Fourier Series, Fourier Transform, bilateral Laplace Transform. Discrete-time linear systems: difference equations, Discrete-Time Fourier Transform, bilateral Z-Transform. Sampling, quantization, and discrete-time processing of continuous-time signals. Discrete-time nonlinear systems: median-type filters, threshold decomposition. System design examples such as the compact disc player and AM radio.

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	ECE30200	Probabilistic Methods	Probabilistic Methods In Electrical And Computer Engineerin	3	School of Elec & Computer Engr	LEC	Upper Division	Туре	Include/Exclude		Cre
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	ECE30414	Elmt Fiber Opt/Lasers/Optoelec	Elements Of Fiber Optics, Lasers And Optoelectronics	3.0	School of Elec & Computer Engr	DIS	Upper Division	Туре	Include/Exclude	Restriction	Cre pho in c mo
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	ECE30415	Fiber Optics And Lasers Lab	Fiber Optics And Lasers Laboratory	1.0	School of Elec & Computer Engr	LAB	Upper Division	Туре	Include/Exclude		Cre
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	ECE30416	Basics Of Engineering Optics	Basics Of Engineering Optics	3.0	School of Elec & Computer Engr	DIS	Upper Division	Туре	Include/Exclude	Restriction	Cre rad pol Geo
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	ECE30417	Engineering Optics Laboratory	Engineering Optics Laboratory	1.0	School of Elec & Computer Engr	DIS	Upper Division	Туре	Include/Exclude		Cre
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Credit Hours: 3.00. An introductory treatment including probability of events, discrete and continuous random variables, multiple random variables, sums of random variables

Credit Hours: 3.00. This course is a continued study of vector calculus, electrostatics, magnetostatics, and Maxwell's Equations. It serves as an introduction to electromagnetic waves and transmission lines, which is continued in ECE 30412.

Credit Hours: 3.00. Electromagnetics II builds on Electromagnetics I (ECE 31100) and emphasizes time-varying electromagnetic fields. Both fundamental understanding and an appreciation for applications that span all technologies related to electrical and computer engineering are emphasized. The topics covered include: Maxwell's equations, plane

Credit Hours: 3.00. Fundamental of photonics, guided-wave optics, optical fibers, lasers, photon detectors, integrated optical components, optical information processing, devices in communication and sensor applications. Topics include generation, transformation, modulation and detection of laser beams and their applications.

Credit Hours: 1.00. This laboratory course exercises in lasers, modulation of laser beams, fiber components and systems. It covers some simple optical measurements like Power and beam spot measurement of Gaussian beams. Students learn about lens-

Credit Hours: 3.00. Basic control over propagation, reflection, refraction of optical radiation are covered. Applications to optical instrumentation such as microscopy, polarization optics such as wave plates, thin films, and holography are discussed. Geometrical optics including lenses, mirrors, prisms; Huygens' principle, Fermat principle;

Credit Hours: 1.00. A set of laboratory experiments dealing with fundamentals and basic applications of geometrical optics, beams, polarization optics, wave optics and Fourier optics. Permission of instructor required.

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	ECE30500	Semiconductor Devices	Semiconductor Devices	3.0	School of Elec & Computer Engr	LEC	Upper Division	Туре	Include/Exclude	Restriction	Cre cor inte
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	ECE30600	Circuits & Systems Lab	Electronic Circuits And Systems Laboratory	1.0	School of Elec & Computer Engr		Upper Division	Туре	Include/Exclude	Restriction	Cre an
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	ECE30653	Intro To Nano, Qntm Sci & Tech	Introduction To Nanotechnology And Quantum Science & To	e 3.l	School of Elec & Computer Engr	DIS	Upper Division	Туре	Include/Exclude	Restriction	Cre and eng fiel
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	ECE30700	Fields & Waves Lab	Electromagnetic Fields And Waves Laboratory	1.0	School of Elec & Computer Engr	LAB	Credit By Exam	Туре	Include/Exclude	Restriction	Cre fiel
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	ECE30800	Sysm Simul & Contr Lab	Systems Simulation And Control Laboratory	1.0	School of Elec & Computer Engr	LAB	Upper Division	Туре	Include/Exclude	Restriction	Cre equ
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Keep PWL - Offer at	ECE30862	Obj Orient Prog C++ &Java	Object-Oriented Programming In C++ And Java	3.0	School of Elec & Computer Engr	LEC	Upper Division	Туре	Include/Exclude	Restriction	Cre inh sta har cor
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Credit Hours: 3.00. Introduces and explains terminology, models, properties, and concepts associated with semiconductor devices. Provides detailed insight into the nternal workings of the "building-block" device structures such as the pn-junction diode,

Credit Hours: 1.00. Experiments in electronic circuits and systems, including spectral analysis techniques, sampling, distortion measurements, random signals, signal-to-noise

Credit Hours: 3.00. This interdisciplinary course offers an introduction to nanotechnology and quantum science and technology for undergraduate students in science and engineering. The students will develop understanding of interdisciplinary nature of these fields and utilize concepts in physics, chemistry and mechanics to describe and analyze

Credit Hours: 1.00. Experimental exercises illustrating concepts in electric and magnetic ields, transmission lines, electromagnetic fields, simple waveguides, and antennas.

Credit Hours: 1.00. Instruction and laboratory exercises in the solution of differential equations that arise in the modeling of physical systems. Instruction in the principles of

Credit Hours: 3.00. Fundamental principles and techniques of computer graphics. The course covers the basics of going from a scene representation to a raster image using OpenGL. Specific topics include coordinate manipulations, perspective, basics of illumination and shading, color models, texture maps, clipping and basic raster algorithms, fundamentals of scene constructions. Permission of department required.

Credit Hours: 3.00. C++ and Java programming languages, including classes, nheritance, encapsulation, polymorphism, class derivation, abstract classes, interfaces, static class members, object construction and destruction, namespaces, exception nandling, function, overloading and overriding, function name overload resolution, container classes, and template classes.

	ECE30864	Software Engineering Tools	Software Engineering Tools	0.0 OR 1.0	School of Elec & Computer Engr	DIS	Dept Credit	Туре	Include/Exclude	Restriction	Cre sof itse
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	ECE31032	Power Systems Engineering	Power Systems Engineering	3.0	School of Elec & Computer Engr	DIS	Upper Division	Туре	Include/Exclude	Restriction	Cre pha
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	ECE32100	Electromech Motion Dev	Electromechanical Motion Devices	3.0	School of Elec & Computer Engr	LEC	Upper Division	Туре	Include/Exclude		Cre
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Credit Hours: 1.00. This course will acquaint students with the toolkit of the modern software engineer. Students will learn the tools surrounding the software application tself, e.g., tools for software process, software construction, and software deployment.

Credit Hours: 3.00. Introduction to the economic operation of power systems, threephase circuit analysis, modeling of transformers and transmission lines, steady-state

Credit Hours: 3.00. Introduction to the fundamental operating principles of power conditioning circuits that are currently being used to effect power flow from AC to DC and vice versa. Emphasis is on the relationship between form and function of these circuits. Circuits discussed will include AC/DC line-commutated converters, DC/DC

Credit Hours: 3.00. Continued study of vector calculus, electrostatics, and nagnetostatics, and Maxwell's equations. Introduction to electromagnetic waves, ransmission lines, and radiation from antennas.

Credit Hours: 3.00. Resistive circuit analysis with controlled sources. Sinusoidal requency response, filters and Bode plots. Complex power in AC circuits, ideal ransformers and three-phase power. Power electronic circuits including diodes, ransistor switches, rectifiers and AC-DC converters. Magnetic circuits, magnetic materials and B-H curves. Transformer equivalent circuit models. No credit will be given for ECE majors.

Credit Hours: 3.00. The general theory of electromechanical motion devices relating electric variables and electromagnetic forces. The basic concepts and operational behavior of DC, induction, brushless DC, and stepper motors used in control applications are presented.

	ECE32300	Elec-Mech Mot Dev Lab	Electromechanical Motion Devices and Systems Laboratory	1.0	School of Elec & Computer Engr	LAB	Upper Division	Туре	Include/Exclude	Restriction	Cre me
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	ECE35900	C And Data Structures	C And Data Structures	0.0 OR 3.0			Upper Division		Include/Exclude		Cre lan of of rec
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Credit Hours: 1.00. Experiments closely coordinated with ECE 32100 involving measurement of fundamental parameters of various electromechanical devices using

Credit Hours: 3.00. (ME 32600) Project management is an important skill that is needed n the private and public sectors as well as specialty businesses. This course will explore he challenges facing today's project managers and will provide a broad understanding of the project management environment focused on multiple aspects of the project.

Credit Hours: 3.00. (ME 32700) Engineering Economics is designed as an overview of economics with a focus on how it relates to the practice of engineering. Topics include interest formulas, rate of return, life cost analysis, depreciation, taxes, and cash flow.

Credit Hours: 2.00. Introduction to standard cell design of Application Specific integrated Circuits (ASICs) using modern hardware description languages (HDLs). Emphasis on how to write HDL code that will map readily to hardware. Laboratory experiments using commercial grade computer-aided design (CAD) tools for HDL based design, logic simulation, automatic placement and routing, timing analysis and

Credit Hours: 3.00. Investigation and evaluation of design problems through simulation of systems described by ordinary differential and difference equations. Development of simulation models from physical parameters and from experimental data. Topics include continuous, discrete, and hybrid models of electrical, mechanical, and biological systems. aboratory experiences demonstrate concepts studied in text and lecture.

Credit Hours: 3.00. An introductory level course on C, a general purpose high-level anguage with features to facilitate such tasks as systems programming and structuring of data. Students becoming proficient in C language programming will learn techniques of structured programming data structures and how to develop programs that are used egularly in many applications.

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	ECE36200	Micropro Sys & Intrfac	Microprocessor Systems And Interfacing	0.0 OR 4.0	School of Elec & Computer Engr	LEC	Upper Division	Туре	Include/Exclude	Restriction	Cre
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	ECE36400	Sftwr Engr Tools Lab	Software Engineering Tools Laboratory	0.0 OR 1.0	Regional Campus Only	LAB	Dept Credit	Туре	Include/Exclude	Restriction	Cre eng Stu soft
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	ECE36500	Digital Comp Design	Introduction To The Design Of Digital Computers	3.0	Regional Campus Only	LEC	Upper Division	Туре	Include/Exclude		Cre follo mic
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edit Hours: 4.00. An introduction to basic computer organization, microprocessor	
struction sets, assembly language programming, and microcontroller peripherals.	
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edit Hours: 1.00. To acquaint the students with a variety of current software	
gineering tools, scripting languages, and application programming languages.	
udents are expected to use their previous programming experience to design and te	est
ftware programs using the techniques learned in this course.	
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edit Hours: 3.00. The hardware organization of computer systems including the	
llowing topics: instruction set selection, arithmetic/logic unit design, hard-wired and	
icroprogrammed control schemes, memory organization, IO interface design. The	
urse will involve computer simulation of digital systems.	
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	ECE37900	Junior Part In VIP In ECE	Junior Participation In Vertically Integrated Projects (VIP) In	in 0.0 TO 2.0	2.0 School of Elec & Computer Engr	DIS	Upper Division	Туре	Include/Exclude	Restriction	Cre stu eng fac
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	ECE39501	Sel Topics Elec/ Comp Engr II	Selected Topics In Electrical And Computer Engineering II	0.0 TO 4.0	Regional Campus Only	DIS	Upper Division	Туре	Include/Exclude		Cr
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redit Hours: 1.00 or 2.00. This course provides an opportunity for undergraduate tudents to explore and develop comprehensive applications of electrical and computer ngineering technologies, especially as they relate to active research areas of Purdue
aculty members. Students will learn about the underlying research, and will work on
redit Hours: 0.00. To obtain professional practice with qualified employers within dustry, government, or small business. Permission of department required.
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redit Hours: 3.00. In this course, classical concepts of feedback system analysis and ssociated compensation techniques are presented. In particular, the root locus, Bode iagram, and Nyquist criterion are used as determinants of stability.
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dustry, government, or small business. Permission of department required.
redit Hours: 0.00. To obtain professional practice with qualified employers within dustry, government, or small business. Permission of department required.
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rogram coordinated by school with cooperation of participating employers. Students ubmit summary report and company evaluation. Professional Practice students only.
redit Hours: 1.00. This course provides ECE students with practice in relevant aspects f communication. Topics include: successfully seeking employment, working effectively teams, delivering engaging presentations, and leveraging the advantages and
redit Hours: 0.00. Professional experience in electrical and/or computer engineering. rogram coordinated by school with cooperation of participating employers. Students ubmit summary report and company evaluation. Professional Practice students only.
redit Hours: 0.00 to 4.00. Variable topic and experimental courses appropriate at the unior level, as approved by the ECE Curriculum Committee at IUPUI.

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Credit Hours: 1.00 to 5.00. Topics vary. Permission of department required. Credit Hours: 1.00. A special seminar for cooperative education and curricular practical training students. Permission of instructor required. Credit Hours: 0.00. To obtain professional practice with qualified employers within industry, government, or small business. Permission of department required. Credit Hours: 1.00. A lecture-demonstration series emphasizing evaluation of career options, identification and development of professional skills. Examples of career-related topics include choosing a job, and post-graduate education in engineering or other Credit Hours: 3.00. An introduction to computational tools used in the measurement and analysis of electro-acoustic systems, and their application to sound reinforcement system engineering. Service learning based projects, serving the needs of community clients, provide the context for application of sound reinforcement system design principles and

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Credit Hours: 1.00. Some ethical, social, political, legal, and ecological issues that practicing engineers may encounter. (ECE 401 and ME 401 are cross-listed courses; students may not get credit for both ECE 401 and ME 401.).

Credit Hours: 3.00. Lecture sessions provide the student with background information on the design and management of projects. Formal lectures cover, for example, design for manufacturability, design for quality, test and evaluation, reliability and ethics, patents and copyrights, plus case studies. During the laboratory sessions, the students work in teams on a challenging open-ended electrical engineering project that draws on previous coursework. Projects routinely involve standard design facets (such as consideration of alternative solutions, feasibility considerations, and detailed system descriptions) and include a number of realistic constraints (such as cost, safety, reliability, and aesthetics). Completion of BS EE or BS CmpE core curriculum.

Credit Hours: 3.00. Introduction to security issues related to the operation of computers and the workings of computer networks. Topics covered include introduction to cryptography, authentication protocols, digital signature algorithms, internet vulnerabilities, worms and virus propagation, denial of service attacks, etc. The students will also learn how to design firewalls to protect a system against unwanted intrusions. Permission of department required.

Credit Hours: 3.00. Students will learn to design and construct operating systems for both individual computers and distributed systems, and to apply and utilize operating system functionality to their application development. The course will cover basic concepts and methods for managing processor, main memory, storage, and network resources, including their system functions. Detailed examples are taken from a number of operating systems, emphasizing the techniques used in networked UNIX and embedded Linux.

Credit Hours: 3.00. This course provides an introduction to software design for embedded computing systems. Major topics covered include the importance of time and timing in embedded systems, embedded software organization (FSM-based program design, polled loop systems, foreground-background systems, event driven architectures,

Credit Hours: 3.00. This course introduces fundamental techniques in data mining, such as the techniques that extract useful knowledge from a large amount of data. Topics include data preprocessing, exploratory data analysis, association rule mining, clustering,

Credit Hours: 3.00. An introductory treatment of digital signal processing algorithms and implementation using high-speed digital signal processors. Sampling, architecture, addressing modes and instruction set of digital signal processors, discrete Fourier transform, fast Fourier transform, and digital filtering.

	ECE41023	Electromech Motion Control	Electromechanical Motion Control	3.0	School of Elec & Computer Engr	LEC	Upper Division	Туре	Include/Exclude	Restriction	Cre are co
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	ECE41200	Intro To Engr Optics	Introduction To Engineering Optics	3.0	School of Elec & Computer Engr	DIS	Upper Division	Туре	Include/Exclude	Restriction	Cr
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	ECE41300	Intro To Optics Lab	Introduction To Optics Laboratory	1.0	School of Elec & Computer Engr	LAB	Upper Division	Туре	Include/Exclude	Restriction	Cr ap
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	ECE41500	Elect & Fiber Optc Lab	Electro- And Fiber Optics Laboratory	1.0	School of Elec & Computer Engr	DIS	Upper Division	Туре	Include/Exclude	Restriction	Cr of
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Credit Hours: 3.00. The operation, analysis, and control of electromechanical systems are covered, including a treatment of electromechanical devices, power electronics, and control systems. Sample applications include servo-systems, propulsion drives, and variable-speed rotational equipment.

Credit Hours: 3.00. The control and characteristics of optical radiation are covered. Applications to optical instrumentation, thin films, holography, and polarizing optics are discussed.

Credit Hours: 1.00. A set of laboratory experiments dealing with fundamentals and applications of geometrical optics, polarization optics, wave optics, and Fourier optics.

Credit Hours: 3.00. Introduction to the use of lasers, fiber and integrated optical components and devices in communication and sensory applications. Topics include generation, transformation, modulation, deflection, and detection of laser beams, and their applications in fiber communication sensory systems.

Credit Hours: 2.00. The first semester of a two-semester sequence to give teams of 3 to 6 students the experience of designing an ASIC (Application Specific Integrated Circuit), having the chip fabricated and testing it. The team of students will develop requirements for a design, prepare the design using VHDL ((VHSIC(very high speed integrated circuit) Hardware Description Language)), Verilog, or schematic entry tools, create and use test benches to functionally verify the design, use automated tools to prepare a circuit layout,

Credit Hours: 2.00. The second semester of a two-semester sequence to give teams of 3 to 6 students the experience of designing an ASIC (Application Specific Integrated Circuit), having the chip fabricated and testing it. The team of students will develop requirements for a design, prepare the design using VHDL ((VHSIC(very high speed integrated circuit) Hardware Description Language)), Verilog, or schematic entry tools,

Credit Hours: 1.00. Laboratory exercises in lasers, hologram, modulation and deflection of laser beams, fiber components, and systems.

	ECE41700	Multimedia Application	Multimedia Applications	3.0	Regional Campus Only	LEC	Upper Division	Туре	Include/Exclude	Restriction	Cro im aro
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	ECE43500	Object-Oriented Design	Object-Oriented Design Using C++ And Java	3.0	School of Elec & Computer Engr	LEC	Upper Division	Туре	Include/Exclude		Cre mu
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Credit Hours: 3.00. An introductory treatment of multimedia algorithms and implementation using high-speed multimedia processors. Detailed discussion of architecture, addressing modes and instruction set of multimedia processors, entropy coding, transform coding, speech compression, image compression, and video compression.

Credit Hours: 3.00. Advanced topics in digital design. Boolean logic. Logic optimization, VLSI and ASIC design basics. Design. Simulation. Placement and routing. Logic synthesis. FPGA structure. FPGA implementation. FPGA design flow. Verilog and VHDL coding.

Credit Hours: 3.00. Design, optimization and control of electromechanical and mechatronic systems. omprehensive dynamic analysis, modeling, and simulation of electric machines, power electronics, and sensors. Application of advanced software and hardware in mechatronic systems design and optimization.

Credit Hours: 3.00. Introduction to power semiconductor devices, characteristics, and ratings. Emphasis on analysis and design of circuits with power semiconductors and associated devices. Power rectification, inversion, AC-to-AC power control, firing circuits, and microcomputer control of power circuits.

Credit Hours: 3.00. Fundamental concepts of power system analysis, transmission line parameters, basic system models, steady-state performance, network calculations, power

Credit Hours: 3.00. Fundamental concepts of power systems analysis, transmission line parameters, basic system models, steady state performance, network calculations, power

Credit Hours: 3.00. Review of OO design with C++ and Java. Difficulties caused by multiple inheritances in C++. Taking advantage of Run-Time Identification in C++. Multithreading, AWT, and Network Programming in Java. Discussion of Java applets, beans, and servlets. Unified modeling language. Use-case analysis. Constructing conceptual models. System sequence diagrams. "Gang of Four" design patterns. Case studies. Permission of instructor required.

Credit Hours: 4.00. An introduction to computer organization and design, including instruction set selection, arithmetic logic unit design, data path design, control strategies, pipelining, memory hierarchy, and I/O interface design.

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Credit Hours: 4.00. The course is presented in five units. Foundations: the review of continuous-time and discrete-time signals and spectral analysis; design of finite impulse response and infinite impulse response digital filters; processing of random signals. Speech processing; vocal tract models and characteristics of the speech waveform; shorttime spectral analysis and synthesis; linear predictive coding. Image processing: twodimensional signals, systems and spectral analysis; image enhancement; image coding; and image reconstruction. The laboratory experiments are closely coordinated with each unit. Throughout the course, the integration of digital signal processing concepts in a design environment is emphasized.

Credit Hours: 4.00. Analysis and design of analog and digital communication systems. Emphasis on engineering applications of theory to communication system design. The laboratory introduces the use of advanced engineering workstations in the design and testing of communication systems.

Credit Hours: 3.00. Transient and steady-state behavior of transmission lines, wave guides, antennas, propagation, noise, microwave sources, and system design.

Credit Hours: 3.00. Nanoelectronic devices are an integral part of our life, including the billion-plus transistors in every smartphone, each of which has an active region that is only a few hundred atoms long. This course is designed to convey the key concepts

Credit Hours: 3.00. Analysis, design, and fabrication of silicon bipolar and MOSFET monolithic integrated circuits. Consideration of amplifier circuit design and fabrication

Credit Hours: 3.00. As applied t digital integrated circuits, the MDs transistor is studied in depth-from its fabrication to its electrical characteristics. Combinational, sequential,

Credit Hours: 1.00. Laboratory exercises illustrating the design and application of electronic circuits. Case studies of circuits presently in existing instruments, such as the

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Credit Hours: 3.00. Introduction to software engineering principles, with special emphasis on the process, methods, and tools needed to develop and test quality software products and systems.

creat Hours: 3.00. An introduction to the design and implementation of computer communication networks. The focus is on the concepts and the fundamental design principles that have contributed to the global Internet success. Topics include: digital

Credit Hours: 4.00. The design and construction of compilers and other translators. Topics include compilation goals, organization of a translator, grammars and languages, symbol tables, lexical analysis, syntax analysis (parsing), error handling, intermediate and final code generation, assemblers, interpreters, and an introduction to optimization. Emphasis is on engineering a compiler or interpreter for a small programming language typically a C or Pascal subset. Projects involve the stepwise implementation (and documentation) of such a system. Department permission required.

Credit Hours: 4.00. The design and construction of operating systems for both individual computers and distributed (networked) systems. Basic concepts and methods for managing processor, main memory, block-structured storage, and network resources are covered. Detailed examples are taken from a number of operating systems, emphasizing the techniques used in networked versions of UNIX. These techniques are applied to design improvements of portions of a simplified, networked, UNIX-based operating system; the improvements are implemented and their performance is evaluated in laboratory experiments.

Credit Hours: 0.00. An electrical and/or computer engineering work experience. This internship experience is intended to complement the student's academic plan-of-study and help prepare him/her for his/her future role as a practicing engineer. A letter from the prospective employer stating the period of employment, hours per week, job title, job qualifications, and job minimum period of employment is required. This course may not be taken in successive semesters. Permission of department required.

Credit Hours: 0.00. A part-time electrical and/or computer engineering work experience. This internship experience is intended to complement the student's academic plan of study and help prepare him/her for his/her future role as a practicing engineer.

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Credit Hours: 3.00. A structured approach to the development and integration of embedded microcontroller/microprocessor/DSP-based systems. The course provides students with design experience of embedded systems. The course covers the microprocessor selection, the configuration of peripheral components, and the hardware abstraction techniques. The course also covers the C programming techniques for embedded systems and using a fixed point microprocessor for floating point calculations.

Credit Hours: 3.00. The course introduces fundamental areas of artificial intelligence: knowledge representation and reasoning; machine learning; planning; game playing; natural language processing; and vision.

Credit Hours: 4.00. A structured approach to the development and integration of embedded microcontroller hardware and software that provides senior-level students with significant design experience applying microcontrollers to a wide range of embedded systems (e.g., instrumentation, process control, telecommunications, and

Credit Hours: 1.00 or 2.00. This course provides an opportunity for undergraduate students to explore and develop comprehensive applications of electrical and computer engineering technologies, especially as they relate to active research areas of Purdue faculty members. Students will learn about the underlying research, and will work on

Credit Hours: 3.00. The course introduces feedback computer controlled systems, the components of digital control systems, and system models on the z-domain (z-transfer functions) and on the time domain (state variable representations.) The objectives for system design and evaluation of system performance are considered. Various discrete-

Credit Hours: 1.00. A real-life experience in engineering problem solving in a group setting from identification, planning and execution to professional-quality written and bral presentations. This is the first semester of a two semester course sequence. Prerequisites: Intent to graduate within two semesters.

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Credit Hours: 2.00. A real-life experience in engineering problem solving in a group setting from identification, planning and execution to professional-quality written and pral presentations. This is the second semester of a two semester course sequence.

Credit Hours: 3.00. Homogeneous transformations; kinematics of manipulator arms; dynamic equations using Newton-Euler and Euler-Lagrange formulations; inverse kinematics; trajectory generation; task planning; manipulator control; robot languages; robot sensing and vision; and industrial applications of robots. Lab experiments and final

Credit Hours: 1.00 to 3.00. The student selects an engineering design project and works under the direction of the faculty sponsor. Suitable projects may be from the local industrial, municipal, state, and educational communities.

Credit Hours: 3.00. General design methodology, consideration of alternative solutions, and project planning in design. Influence of safety, reliability, economics, and aesthetics on design of engineering systems. Interpretation of specifications and requests for proposals. Early in the course, teams of students will be assigned a major design problem that will be the focus throughout the course. Oral presentation and report writing required.

Credit Hours: 1.00. This course provides ECE students an opportunity to refine their professional communication skills before launching into the workplace or graduate school. Topics include: ethics in ECE, workplace communication (written and verbal), and

Credit Hours: 1.00 to 4.00. Topics vary. Permission of department required.

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## Course Description

Credit Hours: 0.00. An introduction to the School of Electrical and Computer Engineering, ECE program objectives and outcomes, BSEE & BSCmpE degree requirements, and professional development.

Credit Hours: 3.00. Volt-ampere characteristics for circuit elements; independent and dependent sources; Kirchhoff's laws and circuit equations. Source transformations; Thevenin's and Norton's theorems; superposition, step response of 1st order (RC, RL) and 2nd order (RLC) circuits. Phasor analysis, impedance calculations, and computation of sinusoidal steady state responses. Instantaneous and average power, complex power, power factor correction, and maximum power transfer. Instantaneous and average power.

Credit Hours: 3.00. Continuation of ECE 20100. Use of Laplace Transform techniques to analyze linear circuits with and without initial conditions. Characterization of circuits based upon impedance, admittance, and transfer function parameters. Determination of requency response via analysis of poles and zeros in the complex plane. Relationship between the transfer function and the impulse response of a circuit. Use of continuous

Credit Hours: 4.00. Students will learn basics of electrical and electronic circuits including introduction to analog and digital electronic circuits. Measurement of electrical signals using meters, probes, and oscilloscopes are covered in the laboratory component of the course. Circuits are designed for minimum hardware with emphasis on understanding analog and digital electronics with particular use of digital and analog microchips. Non-ECE majors who complete this course can continue the digital course sequence offered by the ECE department including microprocessor systems and interfacing, and digital signal processing. No credit will be given for ECE majors.

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Credit Hours: 3.00. Students will learn basics of electrical and electronic circuits including introduction to analog and digital electronic circuits. Circuits are designed for minimum hardware with emphasis on understanding analog and digital electronics with particular use of digital and analog microchips. Non-ECE majors who complete this course can continue the digital course sequence offered by the ECE department including microprocessor systems and interfacing, and digital signal processing. No credit will be given for ECE majors.

Credit Hours: 3.00. The basics of electrical circuit analysis using Kirchhoff's laws, node voltage, mesh current, superposition, the maximum power theorem; transient analysis of RL / RC circuits; Bipolar Junction Transistor DC analysis; basics of simple sensors; basic operation of rotating electric machines; basics of digital logic circuits. Non-ECE majors only.

Credit Hours: 1.00. Students will learn the basics of electrical signal measurements using meters, probes, oscilloscopes; basic measurements using simple sensors; basic measurements as applied to motors. Circuits are designed for basic hardware with emphasis on understanding analog and digital electronics with practical use of digital and analog-interface microcontrollers. Non-ECE majors only.

Credit Hours: 1.00. Experimental exercises in the use of laboratory instruments. Voltage, current, impedance, frequency, and wave form measurements. Frequency and transient response. Elements of circuit modeling and design.

Credit Hours: 1.00. Laboratory experiments in the measurement of electronic device characteristics. Design of biasing networks, small signal amplifiers, and switching circuits.

Credit Hours: 1.00. An introduction to the School of Electrical and Computer Engineering, ECE program objectives and outcomes, BSEE and BSCmpE degree requirements, and professional development.

Credit Hours: 3.00. Diode, bipolar transistor, and FET circuit models for the design and analysis of electronic circuits. Single and multistage analysis and design; introduction to digital circuits. Computer-aided design calculations, amplifier operating point design, and requency response of single and multistage amplifiers. High-frequency and low-

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Credit Hours: 1.00. Introduction to problem solving using software tools, in particular the C programming language.

Credit Hours: 4.00. Introduction to programming, problem solving and the C programming language.

Credit Hours: 3.00. An introductory course in computing programming with an emphasis on program decomposition and program structure. The objective of the course is to introduce the student to problem solving using high-level languages. The students are also introduced to number concepts fundamental in electrical engineering. Programming will be in "C" in order to develop a structured approach to problem solving. Problems

Credit Hours: 3.00. Continuation of a first programming course. Topics include files, structures, pointers, and the proper use of dynamic data structures. A basic knowledge of the UNIX operating system and an introductory C programming course; C

Credit Hours: 3.00. Introduction to logic design, with emphasis on practical design techniques and circuit implementation. Topics include Boolean algebra; theory of logic functions; mapping techniques and function minimization; logic equivalent circuits and symbol transformations; transistor-transistor-logic (TTL)/metal oxide semi-conductor (MOS) logic into gate implementations; electrical characteristics; propagation delays; signed number notations and arithmetic; binary and decimal arithmetic logic circuits; theory of sequential circuits; tock generation circuits; algorithmic state machine method of designing sequential circuits.

Credit Hours: 4.00. An introduction to digital system design and hardware engineering, with an emphasis on practical design techniques and circuit implementation.

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Credit Hours: 1.00 or 2.00. This course provides an opportunity for undergraduate students to explore and develop comprehensive applications of electrical and computer engineering technologies, especially as they relate to active research areas of Purdue faculty members. Students will learn about the underlying research, and will work on

Credit Hours: 1.00. Introduction to the UNIX operating system, including the UNIX file system, UNIX tools, and utilities. Introduction to Shell programming. The emphasis will be on how these tools/utilities are utilized in the Computing Engineering field.

Credit Hours: 0.00 to 4.00. Variable topic and experimental courses appropriate at the sophomore level, as approved by the ECE Curriculum Committee at IUPUI.

Credit Hours: 3.00. Classification, analysis and design of systems in both the time- and frequency-domains. Continuous-time linear systems: Fourier Series, Fourier Transform, bilateral Laplace Transform. Discrete-time linear systems: difference equations, Discrete-Time Fourier Transform, bilateral Z-Transform. Sampling, quantization, and discrete-time processing of continuous-time signals. Discrete-time nonlinear systems: median-type filters, threshold decomposition. System design examples such as the compact disc player and AM radio.

Credit Hours: 3.00. An introductory treatment including probability of events, discrete and continuous random variables, multiple random variables, sums of random variables

Credit Hours: 3.00. Introduces and explains terminology, models, properties, and concepts associated with semiconductor devices. Provides detailed insight into the internal workings of the "building-block" device structures such as the pn-junction diode,

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Credit Hours: 3.00. Continued study of vector calculus, electrostatics, and magnetostatics, and Maxwell's equations. Introduction to electromagnetic waves, transmission lines, and radiation from antennas.

Credit Hours: 3.00. Resistive circuit analysis with controlled sources. Sinusoidal frequency response, filters and Bode plots. Complex power in AC circuits, ideal transformers and three-phase power. Power electronic circuits including diodes, transistor switches, rectifiers and AC-DC converters. Magnetic circuits, magnetic materials and B-H curves. Transformer equivalent circuit models. No credit will be given for ECE majors.

Credit Hours: 3.00. The general theory of electromechanical motion devices relating electric variables and electromagnetic forces. The basic concepts and operational behavior of DC, induction, brushless DC, and stepper motors used in control applications are presented.

Credit Hours: 3.00. (ME 32600) Project management is an important skill that is needed in the private and public sectors as well as specialty businesses. This course will explore the challenges facing today's project managers and will provide a broad understanding of the project management environment focused on multiple aspects of the project.

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Credit Hours: 3.00. (ME 32700) Engineering Economics is designed as an overview of economics with a focus on how it relates to the practice of engineering. Topics include interest formulas, rate of return, life cost analysis, depreciation, taxes, and cash flow.

Credit Hours: 3.00. Investigation and evaluation of design problems through simulation of systems described by ordinary differential and difference equations. Development of simulation models from physical parameters and from experimental data. Topics include continuous, discrete, and hybrid models of electrical, mechanical, and biological systems. Laboratory experiences demonstrate concepts studied in text and lecture.

Credit Hours: 3.00. An introductory level course on C, a general purpose high-level language with features to facilitate such tasks as systems programming and structuring of data. Students becoming proficient in C language programming will learn techniques of structured programming data structures and how to develop programs that are used regularly in many applications.

Credit Hours: 1.00. To acquaint the students with a variety of current software engineering tools, scripting languages, and application programming languages. Students are expected to use their previous programming experience to design and test software programs using the techniques learned in this course.

Credit Hours: 3.00. The hardware organization of computer systems including the following topics: instruction set selection, arithmetic/logic unit design, hard-wired and microprogrammed control schemes, memory organization, IO interface design. The course will involve computer simulation of digital systems.

Credit Hours: 3.00. This course introduces discrete mathematical structures and finitestate machines. Students will learn how to use logical and mathematical formalisms to formulate and solve problems in computer engineering. Topics include formal logic, proof techniques, recurrence relations, sets, combinatorics, relations, functions, algebraic structures, and finite-state machines.

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Credit Hours: 3.00. (CSCI 36300) This course is designed to teach students best practices in designing and implementing object-oriented systems of high quality. To accomplish this task, we start with an overview of software design patterns and their role n developing high-quality software. We then begin surveying different design-level

Credit Hours: 1.00 or 2.00. This course provides an opportunity for undergraduate students to explore and develop comprehensive applications of electrical and computer engineering technologies, especially as they relate to active research areas of Purdue faculty members. Students will learn about the underlying research, and will work on

Credit Hours: 3.00. In this course, classical concepts of feedback system analysis and associated compensation techniques are presented. In particular, the root locus, Bode diagram, and Nyquist criterion are used as determinants of stability.

Credit Hours: 0.00 to 4.00. Variable topic and experimental courses appropriate at the junior level, as approved by the ECE Curriculum Committee at IUPUI.

Credit Hours: 1.00. A lecture-demonstration series emphasizing evaluation of career options, identification and development of professional skills. Examples of career-related topics include choosing a job, and post-graduate education in engineering or other

Credit Hours: 3.00. An introduction to computational tools used in the measurement and analysis of electro-acoustic systems, and their application to sound reinforcement system engineering. Service learning based projects, serving the needs of community clients, provide the context for application of sound reinforcement system design principles and

Credit Hours: 1.00. Some ethical, social, political, legal, and ecological issues that practicing engineers may encounter. (ECE 401 and ME 401 are cross-listed courses; students may not get credit for both ECE 401 and ME 401.).

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	ECE41700	Multimedia Application	Multimedia Applications	3.0	Regional Campus Only	LEC	Upper Division	Туре	Include/Exclude	Restriction
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Credit Hours: 3.00. Lecture sessions provide the student with background information on the design and management of projects. Formal lectures cover, for example, design for manufacturability, design for quality, test and evaluation, reliability and ethics, patents and copyrights, plus case studies. During the laboratory sessions, the students work in teams on a challenging open-ended electrical engineering project that draws on previous coursework. Projects routinely involve standard design facets (such as consideration of alternative solutions, feasibility considerations, and detailed system descriptions) and include a number of realistic constraints (such as cost, safety, reliability, and aesthetics). Completion of BS EE or BS CmpE core curriculum.

Credit Hours: 3.00. Students will learn to design and construct operating systems for both individual computers and distributed systems, and to apply and utilize operating system functionality to their application development. The course will cover basic concepts and methods for managing processor, main memory, storage, and network resources, including their system functions. Detailed examples are taken from a number of operating systems, emphasizing the techniques used in networked UNIX and embedded Linux.

Credit Hours: 3.00. An introductory treatment of digital signal processing algorithms and implementation using high-speed digital signal processors. Sampling, architecture, addressing modes and instruction set of digital signal processors, discrete Fourier transform, fast Fourier transform, and digital filtering.

Credit Hours: 3.00. An introductory treatment of multimedia algorithms and implementation using high-speed multimedia processors. Detailed discussion of architecture, addressing modes and instruction set of multimedia processors, entropy coding, transform coding, speech compression, image compression, and video compression.

Credit Hours: 3.00. Advanced topics in digital design. Boolean logic. Logic optimization, VLSI and ASIC design basics. Design. Simulation. Placement and routing. Logic synthesis. FPGA structure. FPGA implementation. FPGA design flow. Verilog and VHDL coding.

Credit Hours: 3.00. Design, optimization and control of electromechanical and mechatronic systems. omprehensive dynamic analysis, modeling, and simulation of electric machines, power electronics, and sensors. Application of advanced software and hardware in mechatronic systems design and optimization.

Credit Hours: 3.00. Introduction to power semiconductor devices, characteristics, and ratings. Emphasis on analysis and design of circuits with power semiconductors and associated devices. Power rectification, inversion, AC-to-AC power control, firing circuits, and microcomputer control of power circuits.

Credit Hours: 3.00. Fundamental concepts of power system analysis, transmission line parameters, basic system models, steady-state performance, network calculations, power

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Credit Hours: 4.00. An introduction to computer organization and design, including instruction set selection, arithmetic logic unit design, data path design, control strategies, pipelining, memory hierarchy, and I/O interface design.

Credit Hours: 4.00. Analysis and design of analog and digital communication systems. Emphasis on engineering applications of theory to communication system design. The laboratory introduces the use of advanced engineering workstations in the design and testing of communication systems.

Credit Hours: 3.00. Analysis, design, and fabrication of silicon bipolar and MOSFET monolithic integrated circuits. Consideration of amplifier circuit design and fabrication

Credit Hours: 3.00. Introduction to software engineering principles, with special emphasis on the process, methods, and tools needed to develop and test quality software products and systems.

Credit Hours: 3.00. An introduction to the design and implementation of computer communication networks. The focus is on the concepts and the fundamental design principles that have contributed to the global Internet success. Topics include: digital

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Credit Hours: 4.00. The design and construction of compilers and other translators. Fopics include compilation goals, organization of a translator, grammars and languages, symbol tables, lexical analysis, syntax analysis (parsing), error handling, intermediate and final code generation, assemblers, interpreters, and an introduction to optimization. Emphasis is on engineering a compiler or interpreter for a small programming language ypically a C or Pascal subset. Projects involve the stepwise implementation (and documentation) of such a system. Department permission required.

Credit Hours: 3.00. A structured approach to the development and integration of embedded microcontroller/microprocessor/DSP-based systems. The course provides students with design experience of embedded systems. The course covers the microprocessor selection, the configuration of peripheral components, and the hardware abstraction techniques. The course also covers the C programming techniques for embedded systems and using a fixed point microprocessor for floating point calculations.

Credit Hours: 3.00. The course introduces feedback computer controlled systems, the components of digital control systems, and system models on the z-domain (z-transfer functions) and on the time domain (state variable representations.) The objectives for system design and evaluation of system performance are considered. Various discrete-

Credit Hours: 1.00. A real-life experience in engineering problem solving in a group setting from identification, planning and execution to professional-quality written and oral presentations. This is the first semester of a two semester course sequence. Prerequisites: Intent to graduate within two semesters.

Credit Hours: 2.00. A real-life experience in engineering problem solving in a group setting from identification, planning and execution to professional-quality written and oral presentations. This is the second semester of a two semester course sequence.

Credit Hours: 1.00 to 3.00. The student selects an engineering design project and works under the direction of the faculty sponsor. Suitable projects may be from the local industrial, municipal, state, and educational communities.

Credit Hours: 3.00. General design methodology, consideration of alternative solutions, and project planning in design. Influence of safety, reliability, economics, and aesthetics on design of engineering systems. Interpretation of specifications and requests for proposals. Early in the course, teams of students will be assigned a major design problem that will be the focus throughout the course. Oral presentation and report writing required.

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