Department of Electrical & Computer Engineering

The baccalaureate program in electrical engineering is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012 - telephone (410) 347-7700.

FACULTY *Professors Anakwa, Schertz, Shastry, Stewart; Associate Professors Ahn, Dempsey, Huggins (chair), Irwin, V. Prasad; Assistant Professors Malinowski; Instructors Gutschlag, Sanchez.*

The department offers degree programs in electrical engineering (B.S.E.E. and M.S.E.E.), and electrical engineering with computer option (B.S.E.E.). It takes special pride in the particularly close student-faculty relationships it has developed over the years. Entrance requirements can be obtained by contacting the chair of the ECE department.

Educational Objectives and Department Mission

Society has been transformed dramatically by the widespread use of electrical and electronic devices and systems and it is certain that even more dramatic changes are in store. These changes are fast paced and are driven by electrical and computer engineers working in many different areas including communications, computers, controls, electronics, microprocessors, integrated circuits, signal and information processing, wireless components and systems, and software development. The engineering process is complex and practitioners perform many roles such as research, design, development, product application, manufacturing, and system integration as well as marketing, sales and management. Bradley electrical engineering graduates have been involved in all of these endeavors, and it is the goal of the Bradley ECE program to continue to educate the next generation of electrical and computer engineers to meet the challenges of the future.

In this dynamic profession, the Bradley ECE faculty recognize that each career path is unique, based on the individual's particular ambitions, capabilities and interests. By coupling the focus on undergraduate education and depth of faculty expertise with the small student-to-faculty ratio and design project sequence, the ECE faculty can respond to the needs and interest of each student in the electrical engineering program. However, the ECE faculty also recognize that there are common elements to success in the profession. These are the ability to acquire, generate, and use new knowledge; the ability to complete complex electrical engineering projects; and the experience, knowledge, skills and capabilities to progress professionally. These common elements for success in the electrical engineering profession are the basis for the educational objectives of the program. These objectives are as follows.

1. Each graduate from the program will demonstrate the ability to acquire, apply, and synthesize new knowledge as required for success.

2. Each graduate from the program will successfully achieve a major engineering outcome, consistent with the individual's position, within his/her first three years working in the electrical engineering professions or obtain an advanced degree from a highly selective graduate program.
3. Each graduate from the program will demonstrate the ability to grow professionally, advance the technology, and assume increasing responsibility. A significant number of them will attain leadership positions in their industries or profession.

In order to meet these objectives, students graduating from Bradley's electrical engineering program will achieve the following outcomes.

i) A graduate from the program will demonstrate knowledge of the mathematical and scientific foundation of electrical engineering.

ii) A graduate from the program will demonstrate knowledge of and the ability to apply techniques and technology of electrical engineering.

iii) A graduate from the program will complete a design project sequence, culminating in a capstone project at or near the professional level.

iv) A graduate from the program will demonstrate the ability to acquire new knowledge as needed for success in the electrical engineering profession.

v) A graduate from the program will meet Bradley's general education requirements, which are based on the principles of liberal education.

vi) A graduate from the program will have experience in communicating technical information and working on teams.

vii) A graduate from the program will understand the importance of professional and ethical behavior.

It is the mission of the ECE Department to provide the intellectual and physical environment in which students achieve these outcomes. The intellectual component of this environment is supplied by the ECE faculty members, in their roles as mentors, advisors, and engineering professionals, as well as by the curriculum they establish for the programs. The physical component consists of quality facilities equipped with modern instrumentation, components, computers, and software.

Curriculum

The electrical engineering program, including the computer option, consists of several curricular components that give the student the opportunity to build a solid foundation of basic physical principles and obtain experience in design as well as insight into the profession and practice of electrical engineering. The lecture sequence consists mostly of required core courses through which the student learns about and acquires problem solving and/or design skills in circuit analysis, structured programming in C++, analog and digital electronics, microprocessors, signals and systems, and electromagnetic fields. Furthermore, through elective courses in the last two semesters, the student can specialize in areas such as applied electromagnetics, communications, controls, digital signal processing, digital and computer systems, electromechanical systems, embedded systems, wireless components and systems, VHDL, and VLSI design. For a student in the computer option, the electives must be in the digital area (see computer option in Programs of Study section.)

The student must also take Thermodynamics I (ME 301) as well as a three-hour course with business content related to the engineering process. This requirement is normally fulfilled by Engineering Economy I (IME 301), but can be fulfilled by an appropriate business course with academic advisor approval.

Though many design techniques are taught in the lecture courses, the student learns the practice of electrical engineering design primarily through the 15-hour laboratory and project sequence.

The lab courses integrate material from the lecture courses and are taught by experienced faculty members. In addition, small numbers of students allow for close interaction with the instructor. Furthermore, the laboratory facilities and equipment are modern and readily accessible. Many of the lecture courses and all of the lab courses require the use of computers as well as the oral and/or written presentation of technical material.

Several aspects of design are taught in the sophomore and junior labs (EE 206, EE 331, and EE 332). The student's design experience in these courses includes synthesis to meet specifications, analysis, construction, testing, and evaluation with respect to specifications. Furthermore, the sophomore and junior design projects associated with these courses are particularly valuable and establish the foundation of the design project sequence. In addition to the implementation steps described above, the projects also require the formulation of design problem statements and criteria, the consideration of alternative solutions, and system descriptions.

The design project sequence culminates in the fourth year with the senior microprocessor project and the senior capstone project. The senior microprocessor project is done in the first half of the fall semester. The student works with a partner to design a microprocessor based system, meeting particular specifications, requiring hardware design, software development, and laboratory work. The student then builds on this experience in EE 402 during the spring semester. In this course, the student works with a team to prepare a proposal delineating the design and development of a microprocessor based product. The student also explores other aspects of engineering in EE 402 and, through the process, gains a broader view of the engineering profession.

Work on the senior capstone project begins at the start of the fall semester and the primary deliverables for the semester are to:

- choose a senior project and ECE faculty advisor,
- develop a detailed functional description of the project,
- develop a detailed system block diagram of the project and description of its operation,
- present a proposal covering a design and an implementation plan for the project, and
- establish a web page for the project.

In addition to the effort on the capstone project, the seniors work on teams to review and analyze the deliverables for other senior projects. Lab work associated with the capstone senior project starts in the last half of the fall semester in EE 451 and is completed in EE 452

the following semester.

The senior capstone project is a major educational component of the program. It involves the student in design at or near the professional level and requires the formulation of design specifications, consideration of alternative solutions, feasibility considerations, time management, allocation of design responsibilities, and detailed system documentation. Project advising is done on a distributed basis with the student choosing his/her project advisor from among the members of the ECE faculty.

In addition to the technical part of the program described above, the student must also meet the University General Education requirements (see "Academic Regulations" in this catalog.) As part of the General Education requirement, the student gains effective communication skills via introductory and advanced English composition and a speech course. The General Education requirements also provide the foundation for a liberal education, which helps the student understand and participate in society as a responsible human being. Courses include Western Civilization (CIV 100, CIV 101, or CIV 102), Introduction to Economics (ECO 100), as well as selections from non-western civilization, social forces, human values, and fine arts. For these last four categories, the student chooses from a list of approved courses.

A wide range of career opportunities is available to the electrical engineering graduate in many different technical areas and industries. For those who wish to continue their professional studies, details of the M.S.E.E. program are given in the Bradley University *Graduate Catalog*.

Programs of Study

Electrical Engineering

Credit in the following courses must be obtained to meet degree requirements in electrical engineering, leading to the Bachelor of Science in Electrical Engineering.

Freshman Year

First Semester

EE 101 Intro. Electrical Engineering	1
EE 102 Computer and Programming in EE	2
MTH 121 Calculus I	4
CHM 161 General Chemistry I	4
ENG 101 English Composition	3
Gen. Ed. – CIV 100, 101, or 102 Western Civilization or ECO 100 Intro. to Economics	3
	17

Second Semester

COM 103 Oral Communication Process	3
MTH 122 Calculus II	4
PHY 110 University Physics I	4
Gen. Ed. – Fine Arts	3
Gen. Ed. – ECO 100 Intro. to Economics or CIV 100, 101, or 102 Western Civilization	3
	17

Sophomore Year

First Semester

EE 201 Digital Hardware Organization	2
EE 205 Fundamentals of Circuit Analysis	4
EE 221 Structured Programming with C	3
MTH 223 Calculus III	4
PHY 201 University Physics II	4
	17

Second Semester

EE 206 Sophomore Laboratory	2
MTH 207 Elementary Linear Algebra with Applications	3
MTH 224 Differential Equations	4
PHY 202 Applied Quantum Physics	3
Gen. Ed. – Social Forces	3
	15

Junior Year

First Semester

EE 301 Signals & Systems I	3
EE 303 Principles of Electronics I	3
EE 365 Microprocessors	3
EE 331 Junior Laboratory I	3
ENG 300, 301, 305, or 306 Advanced Writing	3
	15

Second Semester

EE 302 Signals and Systems II	3
EE 304 Principles of Electronics II	3
EE 332 Junior Laboratory II	2
EE 381 Electromagnetic Fields	3
IME 301 Engineering Economy	3
Gen. Ed. – Human Values	3
	17

Senior Year

First Semester

EE 419 Engineering Analysis and Design	2
EE 451 Senior Laboratory I	2
*Approved EE Electives	6
Approved EE or Technical Elective	3
ME 301 Thermodynamics	3
	16

Second Semester

EE 402 Undergraduate Design Seminar	1
EE 452 Senior Laboratory II	3
*Approved EE Electives	6
Approved EE or Technical Elective	3
Gen. Ed. — Non-Western Civilization	3
	16

Total Hours 130

[1] General education courses must be selected from an approved list for each category. They may be taken in any sequence, not necessarily in the semester indicated. Other University general education requirements are satisfied by specific courses required above.

*Four EE electives are required and one must be from the control stem (EE 430, 431, or 432). A list of approved courses is available from your academic advisor.

Electrical Engineering with Computer Option

The demand for and continuing advances in computers and digital systems have created opportunities for professionals capable of not only designing computer systems but also applying these systems to a broad range of applications. Such fields as communications, automatic control, robotics, and signal processing have benefited greatly from developments in the digital area. Additionally, the development of modern computers requires a thorough understanding of the methodologies of software and hardware design.

The department offers an option to students desiring to specialize in this branch of electrical engineering and it requires students to take 23 semester hours of course work in the digital area. The required courses are digital hardware organization (EE 101 and EE 201), computational techniques for electrical engineering (EE 102), structured programming (EE 221), and microprocessors (EE 365). Four EE electives must also be taken in the digital area which includes courses such as digital image processing (EE 533), digital signal processing (EE 534), neural networks (EE 535), logic design (EE 561), computer structures (EE 562), VLSI design (EE 563), microprocessor and PC architecture (EE 565), memory and interfacing (EE 566), advanced VLSI (EE 567), and VHDL (EE 568). Also special topic courses are frequently offered that are EE digital electives. Finally, one of the EE digital electives must include coverage of computer architecture (EE 562, EE 565, or EE 566). See your advisor for a current list of approved EE digital electives. Students in the option are also required to take two approved EE or technical electives. These courses must be at the 300 level or above and can be from various departments such as CE, EE, IE, ME, MFE, CS, or MTH. The courses do not have to be in the digital area and should be chosen with career goals in mind. For example, students interested in the application of digital systems to communications or controls should consider course pairs EE 531 and EE 532 or EE 431 and EE 432, respectively, as electives.

The computer option of electrical engineering differs from the regular program in that it requires four EE digital electives. It is also expected that the students in the option focus their project work in the digital area. Credit in the following courses must be obtained to meet degree requirements in the computer option of electrical engineering, leading to the Bachelor of Science in Electrical Engineering.

Freshman Year

First Semester

EE 101 Intro. Electrical Engineering 1
EE 102 Computational Techniques for EE 2
MTH 121 Calculus I 4
CHM 161 General Chemistry I 4
ENG 101 English Composition 3
Gen. Ed. — CIV 100, 101, or 102 Western Civ. or[1]
ECO 100 Intro. to Economics 3
17

Second Semester

COM 103 Oral Communication Process 3
MTH 122 Calculus II 4
PHY 110 University Physics I 4
Gen. Ed. — Fine Arts 3
Gen. Ed. — ECO 100 Intro. to Economics[1]
or CIV 100, 101, or 102 Western Civilization 3
17

Sophomore Year

First Semester

EE 201 Digital Hardware Organization 2
EE 205 Fundamentals of Circuit Analysis 4
EE 221 Structured Programming with C 3
MTH 223 Calculus III 4
PHY 201 University Physics II 4
17

Second Semester

EE 206 Sophomore Laboratory 2
MTH 207 Elementary Linear Algebra with Applications 3
MTH 224 Differential Equations 4
PHY 202 Applied Quantum Physics 3
Gen. Ed. – Social Forces 3
15

Junior Year

First Semester

EE 301 Signals & Systems I 3
EE 303 Principles of Electronics I 3
EE 365 Microprocessors 3
EE 331 Junior Laboratory I 3
ENG 300, 301, 305, or 306 Advanced Writing 3
15

Second Semester

EE 302 Signals and Systems II 3
EE 304 Principles of Electronics II 3
EE 332 Junior Laboratory II 2
EE 381 Electromagnetic Fields 3
IME 301 Engineering Economy 3
Gen. Ed. – Human Values 3
17

Senior Year

First Semester

EE 419 Engineering Analysis and Design 2
EE 451 Senior Laboratory I 2
*EE Digital Electives 6
*Approved EE or Technical Elective 3
ME 301 Thermodynamics I 3
16

Second Semester

EE 402 Undergraduate Design Seminar 1
EE 452 Senior Laboratory II 3
*EE Digital Electives 6
Approved EE or Technical Elective 3
Gen. Ed. – Non-Western Civilization 3
16

Total Hours 130

* Four EE digital electives are required and one must include coverage of computer architecture (EE 562, 565, or 566). A list of approved courses is available from your academic advisor.

Elective Descriptions

EE electives are available in the areas of applied electromagnetics, communications, controls, digital signal processing, digital and computer systems, embedded systems, wireless components and systems and VLSI design. Approved EE electives include all 400- and 500-level EE courses except for EE 419, EE 451, and EE 452. Special topic courses are often available. See your advisor for the most current list of approved electives.

EE digital electives include:

EE 533 Digital Image Processing
EE 534 Digital Signal Processing
EE 535 Engineering Applications of Neural Networks
EE 561 Digital Systems: Logic Design
EE 562 Digital Systems: Computer Structures
EE 563 Advanced Electronics VLSI System Design
EE 565 Digital Systems: Microprocessor & PC Architecture
EE 566 Digital Systems: Memory and Interfacing
EE 567 Advance VLSI
EE 568 VHDL
Special Topics: Object Oriented Programming
Special Topics: Web Programming
Special Topics: Digital Communication Networks
Special Topics: Design Using FPGAs
Other special topics courses may also be approved. See your advisor for the most current list.

Technical electives include most 300-level (or above) technical courses in computer science, mathematics, physics, or civil, industrial, mechanical, or manufacturing engineering. Courses that are not acceptable are CE 399, CE 499, CE 524, ME 303, ME 549, all CIS courses, all CON courses, and all IMT courses. In addition, a business course at the 300-level or above, with content related to the engineering profession, can also be used as a technical elective. All technical electives must be approved by your advisor.

Course Descriptions

EE 101 Introductory Electrical Engineering
1 hr.
Selected concepts of digital system analysis and design.

EE 102 Computers and Programming in Electrical Engineering
2 hrs.
Introduction to computers and operating systems; introduction to programming in a high level language appropriate to electrical engineering.

EE 200 Engineering Co-op
0 hrs.
Full-time cooperative education assignment for electrical engineering students who alternate periods of full-time school with periods of full-time academic or career-related work in industry. Satisfactory/Unsatisfactory. Prerequisites: Sophomore standing in the College of Engineering and Technology, 2.0 overall gradepoint average at Bradley, approval of engineering and technology Co-op coordinator and Co-op faculty advisor.

EE 201 Digital Hardware Organization
2 hrs.
Continuation of EE 101: memory elements, sequential circuits, data representation and codes, computer structures, instructions, and software concepts. Prerequisite: EE 101.

EE 205 Fundamentals of Circuit Analysis
4 hrs.
Analysis of electric circuits. Transient and steady-state phenomena. General analysis techniques: loop and nodal equations, network theorems, and matrix methods. Corequisites: MTH 223, PHY 201.

EE 206 Sophomore Laboratory
2 hrs.
Experimental work related to sophomore electrical engineering courses. Prerequisites: EE 201 and 205, with a minimum grade of C.

EE 221 Structured Programming with C
3 hrs.
C programming language: lexical elements, conversions, expressions, declarations, external definitions, preprocessing directives, and library. The C philosophy. Required for computer engineering option. Cross listed as CS 221. Prerequisites: EE 102 or CS 106; EE 201 or CS 206 or equivalent.

EE 301, 302 Signals and Systems I, II
3 hrs. each
Time and frequency domain analysis of linear systems. Lumped, distributed, time-varying, and discrete-time systems; network topology; state variable techniques; stability; analysis and transmission of random signals; signal processing. Prerequisite: EE 206. EE 301 prerequisite for EE 302.

EE 303, 304 Principles of Electronics I, II
3 hrs. each
Non-linear circuits; incremental analysis of multi-terminal active networks; circuits; microelectric circuits; analog and digital circuits. Prerequisite: EE 206. EE 303 prerequisite for EE 304.

EE 311 Digital Hardware Organization
3 hrs.
Introduction to Boolean algebra, combinational and sequential circuit design, computer organization, and microprocessors. Not open to students with credit in EE 101 or EE 201.

EE 327 Fundamentals of Electrical Engineering I
3 hrs.
Analysis of circuits; transient and steady state phenomena; general analysis techniques. Open to non-electrical engineering students only. Prerequisite: MTH 224.

EE 328 Fundamentals of Electrical Engineering II
3 hrs.
Electronics; magnetic fields and circuits; magnetic coupling; energy conversion; electromechanics; rotating devices; digital techniques; control systems. Prerequisite: EE 327.

EE 331 Junior Laboratory I
3 hrs.
Experimental work related to junior electrical engineering courses. Requires written assignments and an individual design project. Corequisites: EE 301, 303, 305.

EE 332 Junior Laboratory II
2 hrs.
Continuation of EE 331. Requires written assignments and an individual design project with an oral presentation. Prerequisites: EE 301, 331. Corequisite: EE 304.

EE 365 Microprocessors
3 hrs.
Design of microprocessor-based systems applied to real situations; control and data acquisition. Programming practice on several commercial microprocessors. Prerequisite: EE 201 or consent of instructor.

EE 381 Electromagnetic Fields
3 hrs.
Static electric fields; steady current; static magnetic fields of electric currents and ferromagnetic materials; charged particles in electric and magnetic fields. Prerequisite: EE 206.

EE 402 Undergraduate Design Seminar
1 hr.
Students work in teams on a large-scale electrical engineering project, considering technical and non-technical factors in seeking an optimal solution. Prerequisite: senior standing in EE.

EE 409, 410 Special Topics
1-6 hrs. each
Topics of special interest which may vary each time course is offered. Topic stated in current Schedule of Classes. Prerequisite: consent of instructor.

EE 419 Engineering Analysis and Design
2 hrs.
Development of professional method for formulation and resolution of technical problems; oral presentation of findings. Prerequisite: senior standing in EE.

EE 430 Electromechanical Systems
3 hrs.
Introduction to dynamic systems analysis with emphasis on mathematical modeling of sensors and electromechanical devices for control system applications. Fundamentals of power and industrial electronics. Prerequisites: EE 301, EE 303

EE 431, 432 Control System Theory
3 hrs. each
Linear, non-linear, and discrete automatic control systems; classical and modern control theory; computer-aided design and simulation. Prerequisite: senior standing in EE.

EE 451 Senior Laboratory I
2 hrs.
Experimental work based on student's choice of EE electives. Requires written and oral presentations and a design project proposal. Prerequisites: credit in EE 301, 302, 303, 304, 331, 332; a grade of C or better in six of the following courses: EE 301, 302, 303, 304, 331, 332, 305, and 381; credit or concurrent enrollment in two EE electives.

EE 452 Senior Laboratory II
3 hrs.
Design project laboratory. Students select individual projects drawn from industry, faculty research, and technical literature. Requires an oral project presentation and a written report. Prerequisites: EE 451; consent of department chair.

EE 530 Random Variables and Signals
3 hrs.
Correlation functions; power-density spectra; transmission of random signals through linear and non-linear systems; linear mean square estimation. Prerequisite: EE 302 or graduate standing.

EE 531 Communication Theory
3 hrs.
Optimum filtering; analogue and digital communication; detection theory. Prerequisite: EE 530.

EE 532 Information Theory
3 hrs.
Coding theory; memory and memoryless systems. Prerequisite: EE 530.

EE 533 Digital Image Processing
3 hrs.
Design of computer-based imaging systems; multidimensional filtering and quantization methods for image enhancement, restoration, and pattern recognition. Prerequisite: EE 302 or MTH 325.

EE 534 Digital Signal Processing
3 hrs.
Representation and analysis of discrete time signals and systems. Finite and infinite impulse response filter design; computer-aided-design; Fast Fourier Transform; implementation of digital filters. Prerequisite: EE 302.

EE 535 Engineering Applications of Neural Networks
3 hrs.
Provides a working knowledge of the theory, design, and engineering applications of artificial neural networks. Emphasis will be directed to low-level implementation such as embedded microcontrollers and integrated circuits. Specific architectures such as correlation matrix memory, perceptron, adaline, multilayer networks, radial-basis function networks, and Hopfield networks will be examined as well as their corresponding learning rules. Prerequisite: EE 302 or graduate standing.

EE 540 Dynamic Systems Analysis
3 hrs.
Advanced techniques for analysis of electrical, mechanical and electromechanical systems. State function concepts are emphasized with applications for determining state equations, system stability, and control. Prerequisite: EE 302 or graduate standing.

EE 550 Electromagnetic Theory
3 hrs.
Time-varying electric and magnetic fields; Maxwell's equations; plane waves in conducting and dielectric media; transmission lines; wave guides; antennas. Prerequisite: EE 381.

EE 551 Radio Frequency Circuits and Systems
3 hrs.
Review of transmission lines, impedance matching and transformations, S-parameters, passive R.F. junctions, R.F. amplifier design, R.F. systems, and front end design. Prerequisites: EE 205, 206.

EE 555 Optical Fiber Communication
3 hrs.
EM wave propagation in silica glass and step index optical fibers, LP modes, multimode and singlemode fibers, optical transmitters and receivers, design of optical fiber communication systems meeting industry standards. Prerequisite: EE 381 or consent of instructor.

EE 561 Digital Systems: Logic Design
3 hrs.
Boolean algebra; logical design; storing and switching phenomena. Prerequisite: EE 304 or graduate standing.

EE 562 Digital Systems: Computer Structures
3 hrs.
Use of hardware programming language to design a small computer or other digital system: busing; control units; interfacing; transfer design. Prerequisite: EE 201.

EE 563 Advanced Electronics — VLSI System Design
3 hrs.
Design and implementation of very-large-scale-integrated systems (VLSI). Integrated circuit devices, subsystems, and architecture. Computer-aided-design (CAD) and design testing. Prerequisite: EE 304 or graduate standing.

EE 565 Digital Systems: Microprocessor and PC Architecture
3 hrs.
Architecture of PC-compatible computers; 32-bit processor architecture and assembly language programming; standard buses. Design of peripheral cards to interface with the standard PC bus architectures. Prerequisites: EE 365 or consent of instructor.

EE 566 Digital Systems: Memory and Interfacing
3 hrs.
Design of single-board computers using 32-bit processors; processor architecture and assembly language programming. Introduction to RISC processors. Prerequisites: EE 365 or consent of instructor.

EE 567 Advanced VLSI Design
3 hrs.
Addresses the testability of integrated systems, using very large scale integration or VLSI, which includes topics on devices, circuits, and digital subsystems in CMOS technology. Includes the concept and methodology for the design for testability of digital integrated systems. Prerequisite: EE 563

EE 568 VHDL: Digital System Design
3 hrs.
A structured guide to the modeling of the design of digital systems, using VHDL, a hardware description language. VHDL is designed to fill a number of needs in the design process. It allows description of the structure of a system, and the specification of the function using familiar programming language forms. As a result it allows the design of a system to be simulated and synthesized.

EE 575 Power Systems I
3 hrs. each
Analysis of electric power systems: fault studies; load flow; economic loading; stability; relaying; high voltage DC transmission; lightning and switching transients. Prerequisite: senior or graduate standing in EE.

Electrical Engineering Technology

EET 320 Electricity and Power
3 hrs.
Fundamentals of direct current and alternating circuits, transformers, rotating machinery, electrical and electronic control, and electrical energy. Not open to EET majors. Prerequisites: IMT 214; PHY 108 or equivalent.