Electrical and Computer Engineering Undergraduate Advising Handbook for ECE Students (2025/2026)

Abstract

This advising handbook is designed for ECE undergraduate students to assist them to customize their education and to help them complete their degrees in a timely and orderly fashion under curriculum and technical guidance from their academic advisors and faculty advisors.

SCHOOL OF
ELECTRICAL AND
COMPUTER ENGINEERING
College of Engineering, Architecture and Technology

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ECE Faculty and Staff Office Map on the 2nd Floor of Engineering South

Electrical Engineering Course Plan Flow Chart (BSEE)

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Computer Engineering and Electrical Engineering (BSCpE+BSEE) Course Plan Flow Chart

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ECE Minors (EE and CpE)

Electrical and Computer Engineering Course Catalog

Message from Head

Welcome to the School of Electrical and Computer Engineering (ECE)! At ECE, we are committed to supporting you at every stage of your academic journey. To do this, you will have access to both *Academic Advisors* and *Faculty Advisors*, each serving distinct but complementary roles. The School has four dedicated Academic Advisors who are highly knowledgeable about curriculum requirements, course prerequisites, and degree planning. They also assist students in accessing campus resources and navigating university policies and procedures. In addition, our twenty full-time faculty members and three adjunct faculty members serve as Faculty Advisors, offering mentorship, career guidance, and support for exploring graduate school opportunities. Lists of both Academic Advisors and Faculty Advisors can be found in this handbook.

At ECE, our faculty and staff are deeply committed to supporting you throughout your academic journey and helping you achieve your professional goals. We take pride in cultivating a student-centered and faculty-supportive learning community grounded in three core pillars: *Engage*, *Communicate*, and *Empower*—the essence of the ECE spirit. These guiding values shape our approach to education by encouraging multifaceted engagement, peer collaboration, teamwork, personalized advising, faculty mentorship, and hands-on undergraduate research opportunities. We believe that a strong and supportive learning environment is key to developing confident, well-prepared engineers and future leaders. We're excited to accompany you on this journey and look forward to seeing all that you will accomplish.

Dr. Guoliang Fan

Professor and Head

Introduction to Undergraduate Advising

The School of Electrical and Computer Engineering (ECE) has compiled this advising handbook for undergraduate students to assist them with the selection of their courses and to help them complete their degree in a timely and orderly fashion. This handbook is not intended to replace or supersede the University Catalog or the official degree sheets for the Bachelor of Science (BS) in Electrical Engineering (EE) or the BS in Computer Engineering (CpE) degree programs. The student is expected to meet all requirements listed on the official Degree Requirement Sheet corresponding to the year of matriculation.

Per the University Catalog, Section 7.1: "**The responsibility for satisfying all requirements for a degree rests with the student. Advisers, faculty members and administrators offer help to the student in meeting this responsibility**." **Prerequistes to courses can change from year to year. Always check the University Catalog for course prerequisites and grade requirements. Students are strongly encouraged to consult their Advisor before enrolling in or dropping any course. Prerequisites cannot be waived.**

Upon admission into ECE as either a new student or transfer student, a student is assigned an Academic Staff Adviser. That adviser will assist students with course selections, prerequisite compliance, degree audit, graduation requirements, and other nuances associated with the ECE programs. Upon completion of ECEN 2714, Fundamentals of Electric Circuits, the student will also be assigned an ECE Faculty Adviser. Students are strongly encouraged to discuss with their faculty adviser all aspects of the ECE curriculum and inquire about the career paths and technologies of electrical engineering and/or computer engineering. The faculty adviser assignment can be found using Banner (https://my.okstate.edu).

Many lower division ECE courses have rigorous "C or better" prerequisites. For example, a "C" or better grade in ECEN 2714, MATH 2233, and PHYS 2114 is required to be enrolled in ECEN 3714. Students who do not satisfy such prerequisites will not be allowed to enroll in the intended course (e.g., ECEN 3714) or stay enrolled if they "slip" through the enrollment system. Students are strongly encouraged to review course listings in the *OSU General Catalog* to be fully informed about any course and its prerequisites.

Transfer students are encouraged to discuss previously completed courses taken at a non-OSU university with their academic adviser. Transferable courses are determined on a case-by-case basis unless an articulation agreement has been established between OSU and the non-OSU university. Students who wish to transfer a course as an equivalent ECEN course must have earned a "C" or better in that course and taken it from an ABET (or equivalent) accredited institution. In most cases, the School does not accept engineering technology courses.

Degree Programs in ECE

Students pursuing the BS degree in Electrical Engineering (**BSEE**) are given the opportunity during their junior year and senior year to take courses that align with their personal interests and career goals. These "elective" courses cover many electrical engineering sub-disciplines including a) communications (Com), control systems, and digital signal processing (DSP), b) electric power and energy, c) computer architecture, embedded systems, and digital electronics, d) solid-state and analog electronics, and e) microwaves and photonics. ECE faculty can provide advice about the alignment of a student's career goals with any given sub-discipline.

Students pursuing the BS degree in Computer Engineering (**BSCpE**) are taking a set of courses in Computer Architecture, Embedded Systems, Robotics, Digital Electronics, with additional topics in computer science, including discrete mathematics, programming, data structures, and operating systems. Six credit hours of technical electives in any ECEN designated course are allowed to broaden a student's educational experience. CpE students have the opportunity to enroll in the Software Engineering Option (**BSCpE+SOFT**). This option adds three credit hours to the BSCpE degree program and specifies a total of 12 credit hours of software-specific courses.

Students also have the option to pursue a dual degree in EE and CpE (**BSEE+BSCpE**). This dual degree program requires 137 credit hours to complete (i.e., 12 credit hours beyond the BSCpE program plus ENSC 2113, Statics, as the controlled elective). In principle, it can be completed in four years by taking approximately 17 credit hours each semester. Likewise, Students can pursue a BSEE and BSCpE dual degree with a Software Engineering Option (**BSEE+BSCpE+SOFT**). This joint degree program requires 143 credit hours to complete. In principle, it can be completed in four years by taking approximately 18 credit hours each semester.

In addition to the dual degree program, the School also offers a "**4+1**" program that combines the BSEE or BSCpE program with the School's Master of Engineering in Electrical Engineering (**MEngEE**) program. Effectively, this program adds 24 credit hours of graduate courses to the BSEE/BSCpE programs to obtain a BSEE/BSCpE degree and MEngEE degree, thus suggesting that the program requires four years to complete the BSEE/BSCpE degree and one year to complete the MEngEE degree (i.e., "4+1"). Specific details of the "4+1" program can be found on the web in the "Memorandum to Graduate Students"; see https://ece.okstate.edu/.

Students are encouraged to explore the BSEE+BSCpE, BSCpE+SOFT, BSEE+BSCpE+SOFT, and "4+1" MEngEE programs with their academic and faculty advisers. These value-added pathways are designed to provide a competitive edge by broadening and deepening students' expertise across the ECE disciplines. In addition, the School offers two minors—Electrical Engineering (EE) and Computer Engineering (CpE)—which are open to both ECE and non-ECE students and include multiple concentration options (see Appendix).

ECE Course Numbers

Course advising sheets for ECE's various degree programs are available in this Handbook. Degree sheets and flow charts are provided on the web (https://ceat.okstate.edu/studentservices/degree-req.html) or are available from the ECE advisers.

A complete listing of all ECEN courses is available on the web (http://catalog.okstate.edu/courses/ecen/). It should be noted that ECE is the name of the School (i.e., School of ECE); ECEN is the four-letter, OSU course prefix (e.g., ECEN 4613). In most cases, the ECEN course numbering scheme adheres to the following algorithm: ECEN ABXY:

- A = 1 → Freshman Course
- A = 2 → Sophomore Course
- A = 3 → Junior Course
- A = 4 → Senior Course
- A = 5 → Graduate Course
- A = 6 → PhD Course
- B = 1 → Electric Power and Energy
- B = 2 → Computer Architecture, Embedded Systems, and Digital Electronic
- B = 3 → Electronics and Integrated Circuits
- B = 4 → Control Systems
- B = 5 → Communications
- B = 6 → Microwaves and Electromagnetics
- B = 7 → Signal Processing
- B = 8 → Photonics
- B = 9 → Semiconductors and Solid State Electronics
- X = 1,2…,9 for any given course in an area
- Y = Number of credit hours (CH)

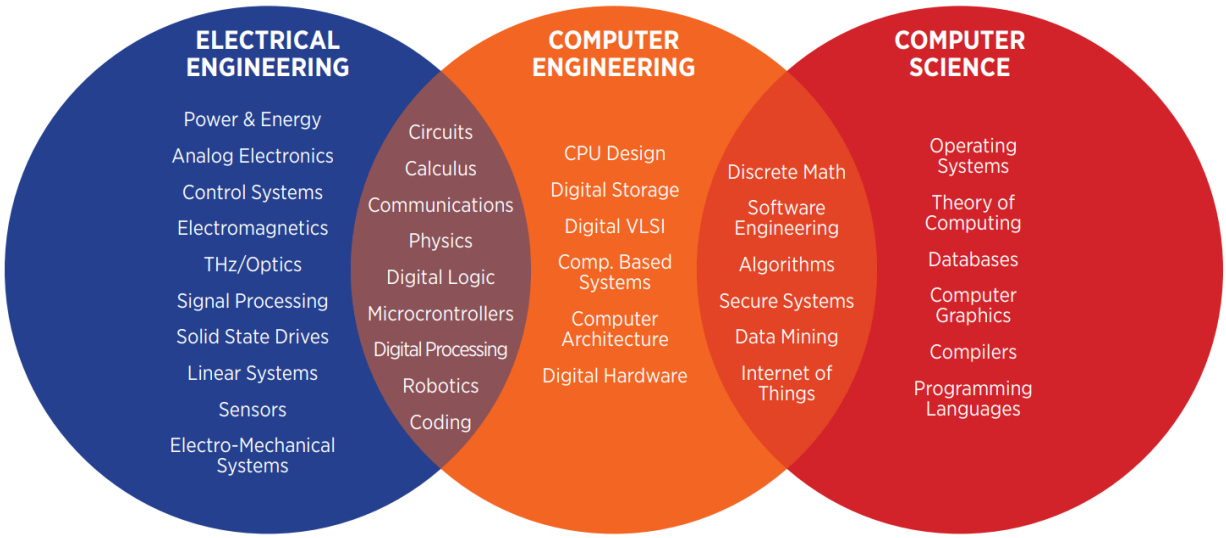
For example, ECEN 4613 is a three-credit hour, senior level course in the area of microwaves.

Cooperative (co-op) experiences are available that allow a student to earn credit towards their degree while being employed at a participating organization. Such experiences allow a student to be educated in a real-world, engineering setting. When such experiences are available with participating organizations, students can enroll in ENGR 2030, ENGR 3030, or ENGR 4030. Co-op experiences can be applied to the Controlled Elective requirements of the BSEE/BSCpE degrees.

Differences between Electrical Engineering, Computer Engineering and Computer Science

A common question is: *"What is the difference between electrical engineering (EE), computer engineering (CpE), software engineering (SOFT), and computer science (CS)?"* Before this question is answered directly, consider the following preliminary comments:

- Boundaries between these fields are not rigid; overlap is common, especially between electrical and computer engineering, and between computer engineering and computer science.
- Definitions vary depending on how broadly or narrowly one views each field.
- Because computers are everywhere, even non-computer professionals (e.g., mechanical engineers, mathematicians) often gain significant computer expertise.



The graphic illustrates the relationships among the fields: EE and CpE overlap significantly, as do CpE and CS, but EE and CS have no direct connection. Both EE and CpE are grounded in calculus and physics, with each understanding the basics of the other. CpE, however, develops a deeper focus on how computers are built, designed, and applied, while showing less interest in EE's broader areas such as motors, antennas, or wireless systems. In that sense, CpE can be seen as EE with a strong specialization in computer-based technologies.

CpE and CS share interests in software development, security, and discrete mathematics, yet they diverge at the hardware level. Computer scientists are typically not concerned with digital logic, switching circuits, VLSI layout, embedded systems, or computer architecture. In short, CS operates further from the physical realities of volts, amps, and watts, while EE and CpE remain closely tied to the electrical foundations of computing.

Electrical Engineering (124 CH): Course Advising Sheet
(2024/2025)

I. Required Courses (91 CH):

- ENGL 1113, POLS 1113, HIST 1103, ENGL 3323
- ENGR 1111, ENSC 2113, ENSC 2611, IEM 3503
- CS1113, CS 2433
- MATH 2144, MATH 2153, MATH 2233, MATH 2163, MATH 3013
- CHEM 1414, PHYS 2014, PHYS 2114
- ECEN 2714, ECEN 3213, ECEN 2233, ECEN 3314, ECEN 3513, ECEN 3613, ECEN 3714, ECEN 3903, ECEN 4013, ECEN 4024, ECEN 4503

II. ECEN Junior Elective (3 CH): Choose one course from the following list. (Depending departmental resources and instructor availability, courses on this list may or may not be offered in any given academic year or semester.)

- ECEN 3113 - Energy, Environment and Economics
- ECEN 3623 - Applied Fields and Waves II
- ECEN 3723 - Systems I
- ECEN 3913 - Solid State Electronic Devices

III. ECEN Electives (18 CH): Choose six ECEN courses, not previously chosen, from the following list. (Depending on departmental resources and instructor availability, courses on this list may or may not be offered in any given academic year or semester. Note that ECEN 3723 is a prerequisite to ECEN 4413. All of other courses listed below only have required courses as prerequisites.)

- ECEN 3113 - Energy, Environment and Economics
- ECEN 3623 - Applied Fields and Waves II
- ECEN 3723 - Systems I
- ECEN 3913 - Solid State Electronic Devices
- ECEN 4133 - Power Electronics
- ECEN 4153 - Power System Analysis and Design
- ECEN 4213 - Embedded Computer Systems Design
- ECEN 4223 - Mobile Robotics
- ECEN 4233 - High Speed Computer Arithmetic
- ECEN 4243 - Computer Architecture
- ECEN 4273 - Software Engineering
- ECEN 4293 - Applied Numerical Methods for Python for Electrical Engineers
- ECEN 4303 - Digital Integrated Circuit Design

- ECEN 4313 - Linear Electronics Circuit Design
- ECEN 4353 - Communication Electronics
- ECEN 4413 - Automatic Control Systems
- ECEN 4493 - Artificial Intelligence in Engineering
- ECEN 4523 - Communication Theory
- ECEN 4533 - Data Communications
- ECEN 4613 - Microwave Engineering
- ECEN 4743 - Introduction to Biomedical Engineering Modeling and Systems
- ECEN 4763 - Introduction to Digital Signal Processing
- ECEN 4773 - Real Time Digital Signal Processing
- ECEN 4823 - Design of Optical Systems
- ECEN 4843 - Design of Lasers and Systems

IV. Controlled Elective (3 CH): Choose a) ENSC 2123, ENSC 2143, ENSC 2213, ENSC 3233, or ENSC 3313, b) ENGR 2030, ENGR 3030, or ENGR 4030 (Co-Ops) or c) any course, 3000 level or above from ECEN, BAE, MAE, CIVE, IEM, PHYS, MATH, CHEM, STAT, or CS. Exclusions or with ECE approval (and in some cases, approval from other departments):

- All ENGR Courses, sans ENGR 2030, ENGR 3030, ENGR 4030 (Co-Ops)
- ECEN 3020
- BAE 4001, BAE 4012, BAE 4400
- CHEM 4990
- CIVE 4010, CIVE 4041, CIVE 4043
- CS3570, CS 4570, CS 4993
- IEM 4010, IEM 4020, IEM 4913, IEM 4931
- MAE 4010, MAE 4342, MAE 4344, MAE 4353, MAE 4354, MAE 4363, MAE 4374
- MATH 3403, MATH 3603, MATH 3910, MATH 3933, MATH 4033, MATH 4590, MATH 4900, MATH 4910
- PHYS 4010, PHYS 4712, PHYS 4993
- STAT 4053, STAT 4063, STAT 4910, STAT 4981, STAT 4991, STAT 4993

V. Humanities, Social Science, International, & Diversity Electives (9 CH): A total of at least 6 credits designated as “H” and 3 credits designated as “S” is required. Additionally, students must satisfy the international and diversity requirements per the degree sheets.

Computer Engineering (125 CH): Course Advising Sheet
(2024/2025)

I. Required Courses (107 CH):

- ENGL 1113, POLS 1113, HIST 1103, ENGL 3323
- ENGR 1111, ENSC 2611, IEM 3503
- CS 1113, CS 2433, CS 2351, CS 3353, CS 3653; CS 4323 or ECEN 4293.
- MATH 2144, MATH 2153, MATH 2233, MATH 2163, MATH 3013
- CHEM 1414, PHYS 2014, PHYS 2114
- ECEN 2714, ECEN 3213, ECEN 2233, ECEN 3314, ECEN 3513, ECEN 3613, ECEN 3714, ECEN 3903, ECEN 4013, ECEN 4024, ECEN 4213, ECEN 4243, ECEN 4303, ECEN 4503

II ECEN Electives (6 CH): Choose two ECEN courses from the following list. (Depending on departmental resources and instructor availability, courses on this list may or may not be offered in any given academic year or semester. Note that ECEN 3723 is a prerequisite to ECEN 4413. All of other courses listed below only have required courses as prerequisites.)

- ECEN 3113 - Energy, Environment and Economics
- ECEN 3623 - Applied Fields and Waves II
- ECEN 3723 - Systems I
- ECEN 3913 - Solid State Electronic Devices
- ECEN 4133 - Power Electronics
- ECEN 4153 - Power System Analysis and Design
- ECEN 4223 - Mobile Robotics
- ECEN 4233 - High Speed Computer Arithmetic
- ECEN 4273 - Software Engineering
- ECEN 4293 - Applied Numerical Methods for Python for Electrical Engineers
- ECEN 4313 - Linear Electronics Circuit Design
- ECEN 4353 - Communication Electronics
- ECEN 4413 - Automatic Control Systems
- ECEN 4493 - Artificial Intelligence in Engineering
- ECEN 4523 - Communication Theory
- ECEN 4533 - Data Communications
- ECEN 4613 - Microwave Engineering
- ECEN 4743 - Introduction to Biomedical Engineering Modeling and Systems
- ECEN 4763 - Introduction to Digital Signal Processing
- ECEN 4773 - Real Time Digital Signal Processing
- ECEN 4823 - Design of Optical Systems
- ECEN 4843 - Design of Lasers and Systems

III. Controlled Elective (3 CH): Choose a) ENSC 2123, ENSC 2143, ENSC 2213, ENSC 3233, or ENSC 3313, b) ENGR 2030, ENGR 3030, or ENGR 4030 (Co-Ops) or c) any course, 3000 level or above from ECEN, BAE, MAE, CIVE, IEM, PHYS, MATH, CHEM, STAT, or CS. Exclusions or with ECE approval (and in some cases, approval from other departments):

- All ENGR Courses, sans ENGR 2030, ENGR 3030, ENGR 4030 (Co-Ops)
- ECEN 3020
- BAE 4001, BAE 4012, BAE 4400
- CHEM 4990
- CIVE 4010, CIVE 4041, CIVE 4043
- CS 3570, CS 4570, CS 4993
- IEM 4010, IEM 4020, IEM 4913, IEM 4931
- MAE 4010, MAE 4342, MAE 4344, MAE 4353, MAE 4354, MAE 4363, MAE 4374
- MATH 3403, MATH 3603, MATH 3910, MATH 3933, MATH 4033, MATH 4590, MATH 4900, MATH 4910
- PHYS 4010, PHYS 4712, PHYS 4993
- STAT 4053, STAT 4063, STAT 4910, STAT 4981, STAT 4991, STAT 4993

IV. Humanities, Social Science, International, & Diversity Electives (9 CH): A total of at least 6 credits designated as "H" and 3 credits designated as "S" is required. Additionally, students must satisfy the international and diversity requirements per the degree sheets.

Computer Engineering plus Software Engineering Option (128 CH)
Course Advising Sheet (2024/2025)

I. Required Courses (107 CH):

- ENGL 1113, POLS 1113, HIST 1103, ENGL 3323
- ENGR 1111, ENSC 2611, IEM 3503
- CS 1113, CS 2433, CS 2351, CS 3353, CS 3653, CS 4323
- MATH 2144, MATH 2153, MATH 2233, MATH 2163, MATH 3013
- CHEM 1414, PHYS 2014, PHYS 2114
- ECEN 2714, ECEN 3213, ECEN 2233, ECEN 3314, ECEN 3513, ECEN 3613, ECEN 3714, ECEN 3903, ECEN 4013, ECEN 4024, ECEN 4213, ECEN 4243, ECEN 4303, ECEN 4503

II. BSCpE/SOFT Requirement (12 CH): ECEN 4273, ECEN 4493, and CS 3363 plus one course from the following list.

- ECEN 4293 - Applied Numerical Methods for Python for Electrical Engineers
- CS 4153 - Mobile Applications Development
- CS 4243 - Introduction to Computer Security
- CS 4623 - Introduction to Cyber Physical Systems

III. Humanities, Social Science, International, & Diversity Electives (9 CH): A total of at least 6 credits designated as “H” and 3 credits designated as “S” is required. Additionally, students must satisfy the international and diversity requirements per the degree sheets.

Computer Engineering and Electrical Engineering Dual Degree (137 CH)
Course Advising Sheet (2024/2025)

I. Required Courses (110 CH):

- ENGL 1113, POLS 1113, HIST 1103, ENGL 3323
- ENGR 1111, ENSC 2113, ENSC 2611, IEM 3503
- CS 1113, CS 2433, CS 2351, CS 3353, CS 3653; CS 4323 or ECEN 4293.
- MATH 2144, MATH 2153, MATH 2233, MATH 2163, MATH 3013
- CHEM 1414, PHYS 2014, PHYS 2114
- ECEN 2714, ECEN 3213, ECEN 2233, ECEN 3314, ECEN 3513, ECEN 3613, ECEN 3714, ECEN 3903, ECEN 4013, ECEN 4024, ECEN 4213, ECEN 4243, ECEN 4303, ECEN 4503

II. ECEN Junior Elective (3 CH): Choose one course from the following list. (Depending departmental resources and instructor availability, courses on this list may or may not be offered in any given academic year or semester.)

- ECEN 3113 - Energy, Environment and Economics
- ECEN 3623 - Applied Fields and Waves II
- ECEN 3723 - Systems I
- ECEN 3913 - Solid State Electronic Devices

III. ECEN BSEE Electives (9 CH): Choose three ECEN courses, not previously chosen, from the following list. (Depending departmental resources and instructor availability, courses on this list may or may not be offered in any given academic year or semester. Note that ECEN 3723 is a prerequisite to ECEN 4413. All of other courses listed below only have required courses as prerequisites.)

- ECEN 3113 - Energy, Environment and Economics
- ECEN 3623 - Applied Fields and Waves II
- ECEN 3723 - Systems I
- ECEN 3913 - Solid State Electronic Devices
- ECEN 4133 - Power Electronics
- ECEN 4153 - Power System Analysis and Design
- ECEN 4313 - Linear Electronics Circuit Design
- ECEN 4353 - Communication Electronics
- ECEN 4413 - Automatic Control Systems
- ECEN 4523 - Communication Theory
- ECEN 4533 - Data Communications
- ECEN 4613 - Microwave Engineering
- ECEN 4743 - Introduction to Biomedical Engineering Modeling and Systems
- ECEN 4763 - Introduction to Digital Signal Processing

- ECEN 4773 - Real Time Digital Signal Processing
- ECEN 4823 - Design of Optical Systems
- ECEN 4843 - Design of Lasers and Systems

IV. ECEN BSCpE Electives (6 CH): Choose two ECEN courses, not previously chosen, from the following list. (Depending departmental resources and instructor availability, courses on this list may or may not be offered in any given academic year or semester.)

- ECEN 3113 - Energy, Environment and Economics
- ECEN 3623 - Applied Fields and Waves II
- ECEN 3723 - Systems I
- ECEN 3913 - Solid State Electronic Devices
- ECEN 4133 - Power Electronics
- ECEN 4153 - Power System Analysis and Design
- ECEN 4223 - Mobile Robotics
- ECEN 4233 - High Speed Computer Arithmetic
- ECEN 4273 - Software Engineering
- ECEN 4293 - Applied Numerical Methods for Python for Electrical Engineers
- ECEN 4313 - Linear Electronics Circuit Design
- ECEN 4353 - Communication Electronics
- ECEN 4413 - Automatic Control Systems
- ECEN 4493 - Artificial Intelligence in Engineering
- ECEN 4523 - Communication Theory
- ECEN 4533 - Data Communications
- ECEN 4613 - Microwave Engineering
- ECEN 4743 - Introduction to Biomedical Engineering Modeling and Systems
- ECEN 4763 - Introduction to Digital Signal Processing
- ECEN 4773 - Real Time Digital Signal Processing
- ECEN 4823 - Design of Optical Systems
- ECEN 4843 - Design of Lasers and Systems

V. Controlled Elective: Automatically satisfied.

VI. Humanities, Social Science, International, & Diversity Electives (9 CH): A total of at least 6 credits designated as “H” and 3 credits designated as “S” is required. Additionally, students must satisfy the international and diversity requirements per the degree sheets.

Electrical Engineering, Computer Engineering, and Software Engineering
Multiple Degree Program (143 CH)
Course Advising Sheet (2024/2025)

I. Required Courses (110 CH):

- ENGL 1113, POLS 1113, HIST 1103, ENGL 3323
- ENGR 1111, ENSC 2113, ENSC 2611, IEM 3503
- CS 1113, CS 2433, CS 2351, CS 3353, CS 3653, CS 4323
- MATH 2144, MATH 2153, MATH 2233, MATH 2163, MATH 3013
- CHEM 1414, PHYS 2014, PHYS 2114
- ECEN 2714, ECEN 3213, ECEN 2233, ECEN 3314, ECEN 3513, ECEN 3613, ECEN 3714, ECEN 3903, ECEN 4013, ECEN 4024, ECEN 4213, ECEN 4243, ECEN 4303, ECEN 4503

II. ECEN Junior Elective (3 CH): Choose one course from the following list. (Depending departmental resources and instructor availability, courses on this list may or may not be offered in any given academic year or semester.)

- ECEN 3113 - Energy, Environment and Economics
- ECEN 3623 - Applied Fields and Waves II
- ECEN 3723 - Systems I
- ECEN 3913 - Solid State Electronic Devices

III. ECEN BSEE Electives (9 CH): Choose three ECEN courses, not previously chosen, from the following list. (Depending departmental resources and instructor availability, courses on this list may or may not be offered in any given academic year or semester. Note that ECEN 3723 is a prerequisite to ECEN 4413. All of other courses listed below only have required courses as prerequisites.)

- ECEN 3113 - Energy, Environment and Economics
- ECEN 3623 - Applied Fields and Waves II
- ECEN 3723 - Systems I
- ECEN 3913 - Solid State Electronic Devices
- ECEN 4133 - Power Electronics
- ECEN 4153 - Power System Analysis and Design
- ECEN 4313 - Linear Electronics Circuit Design
- ECEN 4353 - Communication Electronics
- ECEN 4413 - Automatic Control Systems
- ECEN 4523 - Communication Theory
- ECEN 4533 - Data Communications
- ECEN 4613 - Microwave Engineering
- ECEN 4743 - Introduction to Biomedical Engineering Modeling and Systems

- ECEN 4763 - Introduction to Digital Signal Processing
- ECEN 4773 - Real Time Digital Signal Processing
- ECEN 4823 - Design of Optical Systems
- ECEN 4843 - Design of Lasers and Systems

IV. BSCpE/SOFT Requirement (12 CH): ECEN 4273, ECEN 4493, and CS 3363 plus one course from the following list.

- ECEN 4293 - Applied Numerical Methods for Python for Electrical Engineers
- CS 4153 - Mobile Applications Development
- CS 4243 - Introduction to Computer Security
- CS 4623 - Introduction to Cyber Physical Systems

V. Controlled Elective: Automatically satisfied.

VI. Humanities, Social Science, International, & Diversity Electives (9 CH): A total of at least 6 credits designated as “H” and 3 credits designated as “S” is required. Additionally, students must satisfy the international and diversity requirements per the degree sheets.

Recommended Elective Paths for ECE Careers

The following lists provide suggested elective courses tailored to specific job titles for ECE graduates with BSEE and/or BSCpE. While students may use these recommendations as guidance, they are free to mix and match courses according to their interests and goals. Although the range of job titles in industry is broad, the titles listed here represent some of the most common roles.

Communications Systems Engineer:

- ECEN 3723, Systems I
- ECEN 4523, Communication Theory
- ECEN 4533, Data Communications
- ECEN 4763, Intro to Digital Signal Processing

Control Systems Engineer:

- ECEN 3723, Systems I
- ECEN 4413, Automatic Control Systems (Prereq. ECEN 3723)
- ECEN 4763, Intro to Digital Signal Processing
- ECEN 4493, AI in Engineering

Digital Hardware Designer and/or Computer Architect:

- ECEN 4233, High-Speed Computer Arithmetic
- ECEN 4243, Computer Architecture
- ECEN 4303, Digital Integrated Circuits

Electronics Engineer:

- ECEN 3723, Systems I
- ECEN 4303, Digital Integrated Circuit Design
- ECEN 4313, Linear Electronics Circuit Design
- ECEN 4353, Communication Electronics

Embedded and Robotics Engineer:

- ECEN 4243, Computer Architecture
- ECEN 4273, Software Engineering
- ECEN 4213, Embedded Computer System Design
- ECEN 4223, Mobile Robotics

Microwave, Antenna or Radar Engineer:

- ECEN 3623, Applied Fields and Waves II
- ECEN 4353, Communication Electronics
- ECEN 4613, Microwave Engineering

Optics and Photonics Engineer:

- ECEN 3623, Applied Fields and Waves II
- ECEN 3913, Solid State Electronic Devices
- ECEN 4613, Microwave Engineering
- ECEN 4823, Design of Optical Systems
- ECEN 4843, Design of Lasers and Systems

Power Electronics Engineer

- ECEN 3113, Energy, Environment and Economics
- ECEN 3913, Solid State Electronic Devices
- ECEN 4133, Power Electronics
- ECEN 4153, Power System Analysis and Design

Power Systems Engineer:

- ECEN 3723, Systems I
- ECEN 3113, Energy, Environment and Economics
- ECEN 4133, Power Electronics
- ECEN 4153, Power System Analysis and Design

Radio Frequency (RF) Systems Engineer:

- ECEN 3723, Systems I
- ECEN 3623, Applied Fields and Waves II
- ECEN 4353, Communication Electronics
- ECEN 4613, Microwave Engineering

Signal Processing Engineer:

- ECEN 3723, Systems I
- ECEN 4743, Introduction Biomedical Engineering (Prereq. ECEN 4673)
- ECEN 4763, Introduction to Digital Signal Processing
- ECEN 4493, AI in Engineering

ECE Academic Advisors

Electrical and Computer Engineering (ECE) students are assigned to one of four professional Academic Advisors, either after their first year (new Freshmen) or upon transferring to OSU. These Advisors are knowledgeable about curriculum, prerequisites, and overall degrees. They can also assist with finding campus resources and understanding processes. A student's Academic Advisor must be seen each semester to discuss his/her current performance, future goals, and the classes for the upcoming semester(s). The Academic Advisor (and Faculty Advisor, if assigned) must be seen BY APPOINTMENT each semester for academic advising hold to be lifted. The four Academic Advisors for ECE are:

- Kristal Soderstrom Junkens (ES 201) – Electrical Engineering, Computer Engineering
- Sarah Ayres (ATRC 109) – CEAT Student Services Assistant Director – Sees several majors.
- Julie Carter (ATRC 109) – Electrical Engineering, Computer Engineering, Aerospace Engineering, Mechanical Engineering, Civil Engineering
- Susan Malec (ATRC 109) – Electrical Engineering, Computer Engineering, Aerospace Engineering, Mechanical Engineering

Kristal Soderstrom Junkens
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kristal.junkens@okstate.edu
Office: 201 Engineering South (ES)

Sarah Ayres
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ECE Faculty Advisors

Each student in the School of Electrical and Computer Engineering (ECE) is assigned a Faculty Advisor upon successful completion of ECEN 2714 – Fundamentals of Electrical Circuits. This advisor, a faculty member in ECE, serves as a mentor, offering guidance on career pathways, graduate school opportunities, and course selection aligned with the student's academic and professional goals. Students are encouraged to meet with their Faculty Advisor each semester before scheduling an appointment with their Academic Advisor. The ECE program is supported by twenty full-time faculty members and three adjunct faculty members who are Emeritus Professors and remain actively engaged in mentoring students. All are deeply committed to student success and passionate about guiding ECE students throughout their academic journey at OSU.

Power and Energy (Area 1)

Prof. Hamidreza Nazaripouya, 261 ES
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Prof. Ying Zhang, 217 ES
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Computer Engineering (Area 2)

Prof. Weihua Sheng, 253 ES
weihua.sheng@okstate.edu

Prof. James Stine, 248 ES
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Prof. Hritom Das, 265 ES
hritom.das@okstate.edu

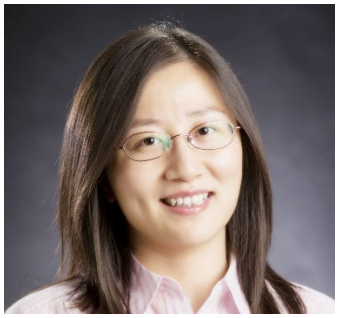
Prof. Shahriar Shahabuddin, 202 ES
shahriar.shahabuddin@okstate.edu

Electronics and Integrated Circuits (Area 3)

Prof. Tim Brown, 219 ES
tim.brown@okstate.edu

Prof. John Hu, 262 ES
john.hu@okstate.edu

Control Systems, Communications and Signal Processing (Areas 4-5-7)



Prof. Qi Cheng, 243 ES
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Prof. Pejman Ghasemzadeh, 218 ES
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Prof. Marty Hagan, 246 ES
martin.t.hagan@okstate.edu

Prof. Subhash Kak, 250 ES
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Prof. Scott Mattison, 260 ES
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Prof. Keith Teague, 252 ES
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Microwaves, Photonics and Solid State (Areas 6-8-9)

Prof. Chuck Bunting, 225 ES
reverb@okstate.edu

Prof. John O'Hara, 220 ES
oharaj@okstate.edu

Prof. Syed Jehangir, 221 ES
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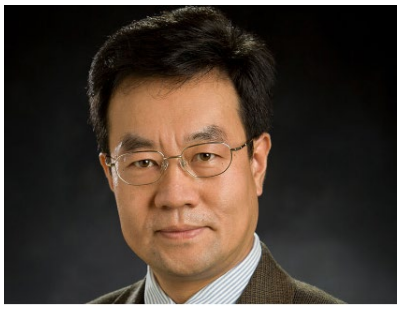
Prof. Daqing Piao, 258 ES
daqing.piao@okstate.edu

Prof. Jeffrey Young, 225 ES
jl.young@okstate.edu



Prof. Weili Zhang, 256 ES
wwzhang@okstate.edu

ECE Core

Prof. Nate Lannan, 267 ES
nate.lannan@okstate.edu

Prof. Karl Strecker, 245 ES
karl.l.strecker@okstate.edu

Availability of Elective ECE Courses in 2025/2026

(revised September 17, 2025)

Areas	Courses	Fall 2025	Spring 2026	Fall 2026
Power & Energy (Area 1)	ECEN 3113 – Energy, Environment and Economics	X		X
	ECEN 4133 – Power Electronics		X	
	ECEN 4153 – Power System Analysis and Design	X		X
	ECEN 4010 – Power System Operation & Intelligence		X	
Computer Engineering (Area 2)	ECEN 4213 – Embedded Computer Systems Design*	X		X
	ECEN 4223 – Mobile Robotics		X	
	ECEN 4233 – High Speed Computer Arithmetic	X		
	ECEN 4243 – Computer Architecture*		X	
	ECEN 4273 – Software Engineering	X		X
	ECEN 4283 – Computer Networks			
	ECEN 4293 – Applied Numerical Methods for Python	X	X	X
Electronics and Integrated Circuits (Area 3)	ECEN 4303 – Digital Integrated Circuits*	X		X
	ECEN 4313 – Linear Electronics Circuit Design	X		X
	ECEN 4353 – Communication Electronics		X	
Control and AI (Area 4)	ECEN 3723 – Systems I		X	
	ECEN 4413 – Automatic Control Systems	X		X
	ECEN 4493 – Artificial Intelligence in Engineering		X	
Communication (Area 5)	ECEN 4523 – Communication Theory		X	
	ECEN 4533 – Data Com4munications	X		X
Microwave and Electromagnetics (Area 6)	ECEN 3623 – Applied Fields and Waves II	X		X
	ECEN 4010 – Introduction to Antenna Engineering		X	
	ECEN 4613 – Microwave Engineering	X		X
Signal Processing (Area 7)	ECEN 4743 – Introduction to Biomedical Engineering Modeling and Systems		X	
	ECEN 4763 – Introduction to Digital Signal Processing		X	
	ECEN 4773 – Real Time Digital Signal Processing			
Photonics (Area 8)	ECEN 4823 – Design of Optical Systems	X		X
	ECEN 4843 – Design of Lasers and Systems		X	
Semiconductor Solid State Devices (Area 9)	ECEN 3903 – Introduction to Semiconductor Device #	X	X	X
	ECEN 3913 - Solid State Electronic Devices		X	
Total number of courses		13	15	13

* Required by the CpE degree.

ECEN3903 will be offered once a year after 2026 and only in fall.

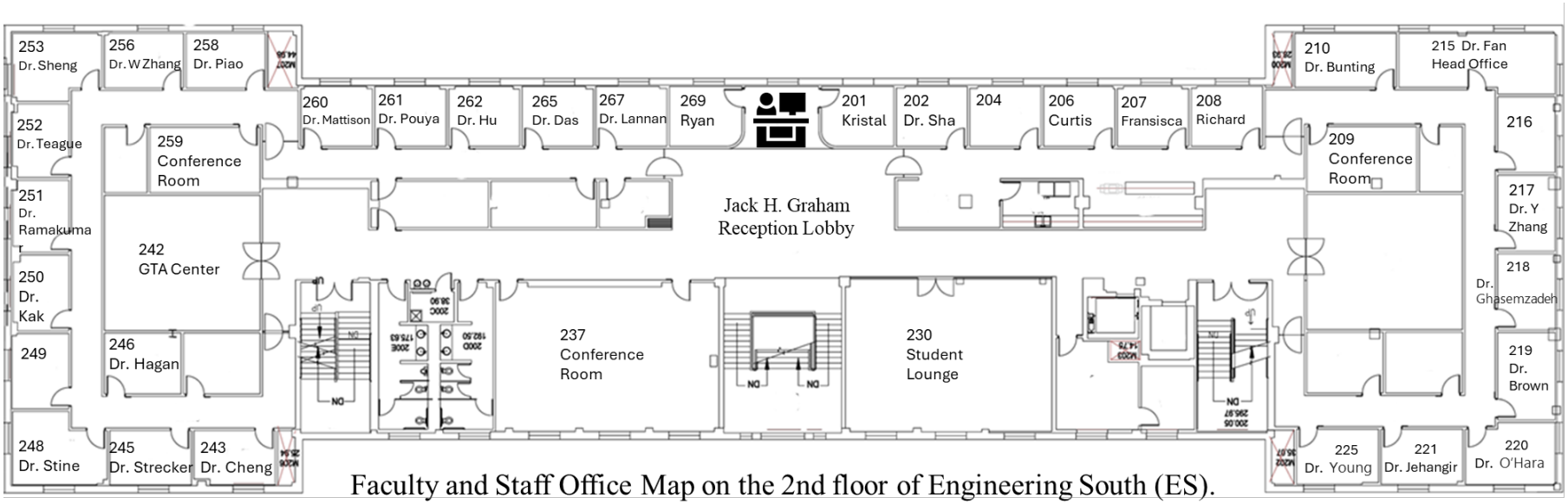
Availability of ECE Graduate Courses in 2025/2026

(Tentative)

Areas	Courses	Fall 2025	Spring 2026	Fall 2026
Power & Energy	ECEN 5133 – Power Electronics and Renewables	X		
	ECEN 5123 – Engineering Sys Reliability Evaluation		X	
	ECEN 5163 – Cyber Physical Systems and Smart Grid			X
	ECEN 5060 – AI for Engineering System			
Electronics and Integrated Circuits	ECEN 5313 – Analog IC Design	X		
	ECEN 5363 – Mixed Signal Integrated Circuits			X
Computer Engineering	ECEN 5243 – Advanced Mobile Robotics			X
	ECEN 5060 – Advanced Computer Architecture			X
	ECEN 5060 – VLSI Design for 6G			
	ECEN 5060 – Neuromorphic Computing			
	ECEN 5263 – VLSI Design			
Control and AI	ECEN 5283 – Computer Vision			
	ECEN 5453 – Engineering Applications of AI (pending)			X
	ECEN 5733 – Neural Networks	X		X
	ECEN 5743 – Deep Learning		X	
	ECEN 5793 – Digital Image Processing		X	
	ECEN 5513 – Stochastic Systems	X		X
	ECEN 5713 – Linear Systems		X	
Microwave, Electromagnetics, and Photonics	ECEN 5833 – Fiber Optics	X		
	ECEN 5843 – Microelectronic Fabrication	X		X
	ECEN 5633 – Radar Theory			
	ECEN 5623 – Antenna Theory			
	ECEN 5060 – Modern Antennas: from Theory to Design		X	
Signal Processing, Communication	ECEN 5763 – Digital Signal Processing	X		
	ECEN 5573 – Wireless Communication			
	ECEN 5060 – 6G Communications			
Total number of courses		7	5	8

* All course offerings and times are subject to change. With instructor's permission, most ECE graduate courses can be treated as senior electives. Consult with your advisor before enrollment.

Note: A complete listing of all ECEN courses is available online http://catalog.okstate.edu/courses/ecen/.



Faculty and Staff Office Map on the 2nd floor of Engineering South (ES).

Electrical Engineering 2025-2026

Electrical Engineering Course Plan (EE)

Years 1 and 2

Semester 1
15 Credit Hours

- **UNIV 1111** — Intro to OSU — 1/0
- **CS 1113** — Comp. Science I — 2/2 → CS2433
- **CHEM 1414** — Gen Chemistry — 3/2, Note 1
- **MATH 2144** — Calculus I — 4/0 → MATH2153, ENSC2113, PHYS2014
- **ENGL 1113** — Comp I — 3/0, Note 2 → ENGL3323

Semester 2
16 Credit Hours

- **ECEN 2233** — Digital Logic Des — 2/2 (MATH 1813cc) → ECEN3213, ECEN4013
- **CS 2433** — C/C++ Prog — 3/0 (CS1113) → ECEN3213
- **PHYS 2014** — General Physics I — 3/2, Note 5 (MATH2144) → PHYS2114, ENSC2113
- **MATH 2153** — Calculus II — 3/0 (MATH2144) → MATH2233, MATH3013, ECEN2714, IEM3503, MATH2163
- **HIST 1103** — American History — 3/0

Semester 3
15 Credit Hours

- **ECEN 2714** — Fund Elec Circuits — 3/2, Note 4 (MATH2153, MATH2233cc, PHYS2114cc) → ECEN3714
- **ENSC 2113** — Statics — 3/0 (PHYS2014, MATH2144)
- **PHYS 2114** — General Physics II — 3/2, Note 5 (PHYS2014) → ECEN3714, ECEN3903
- **MATH 2233** — Diff Equations — 3/0 (MATH2153) → ECEN3714
- **ENSC 2611** — Elec Fab Lab — 0/2 (ECEN2714cc) → ECEN3714

Semester 4
16 Credit Hours

- **ECEN 3714** — Network Analysis — 3/2 (ECEN2714, MATH2233, PHYS2114) → ECEN3314, ECEN3513, ECEN3613, ECEN4013
- **ECEN 3213** — Comp Based Systems — 2/2 (CS2433, ECEN2233, ECEN2714) → ECEN4013
- **IEM 3503** — Engr Economics — 3/0 (MATH2153)
- **MATH 2163** — Calculus III — 3/0 (MATH2153) → ECEN3613
- **POLS 1113** — American Gov't — 3/0

Prerequisites* | Course Number / Course Name / Lecture/Lab See Note # | Subsequent Requirement**

*Only the last prerequisite in a sequence is listed. All earlier prerequisites must also be satisfied before taking the course.

**See your Advisor, the ECE Advising Document, and Banner for additional information.

Suggested Course Plan

The anticipation at OSU and most institutions of higher education is that for *one* semester credit hour (SCH) the student spends one hour per week in lecture (two for lab courses) and two hours studying outside of class (one for lab courses). A three credit hour class requires about nine hours per week. This study plan is recommended for students who will devote full time to university studies and do not have excessive extracurricular activities or other obligations.

NOTES:

1) CHEM 1515 may be substituted for CHEM 1414 and should be taken by all students considering medical school.
2) Students with less than a "B" in ENGL 1113 or 1313 must take ENGL 1213 or 1413 prior to ENGL 3323.
3) A total of at least 6 hours designated "H" and 3 hours designated "S" is required. Of these, 3 hrs must meet the International Dimension "I" component and 3 hrs must meet the Diversity "D" component.
4) MATH 2233 and PHYS 2114 must be taken prior to or at the same time as ECEN 2714.
5) General Physics I and II are key prerequisites and should be taken at the earliest possible time.
6) Must be at least 3 SCH.

Electrical Engineering 2025-2026

Electrical Engineering Course Plan (EE)

Years 3 and 4

Semester 5
16 Credit Hours

ECEN 3314 — Electr Dev & Appl — 3/2
- Prereq: ENSC2611, ECEN3714
- Coreq: ECEN4013

ECEN3613 — Appl Fields and Waves — 3/0
- Prereq: ECEN3714, MATH2163
- Coreq: ECEN4013

ECEN 3513 — Signal Analysis — 3/0
- Prereq: ECEN3714
- Coreq: ECEN4503, ECEN4013

ECEN 4293 — Applied Numerical Python — 3/0
- Prereq: ECEN 2233, ECEN 3213, ECEN 3714

ENGL 3323 — Technical Writing — 3/0
- Prereq: ENGL1113, JR Standing
- Coreq: ECEN4013

Diversity Attribute (3)

Semester 6
15 Credit Hours

ECEN 4503 — Prob & Stat to Random Signals — 3/0
- Prereq: ECEN3513
- Coreq: ECEN4024

ECEN Junior Elective (3) — Note 6
- Prereq: VARIES

ECEN Elective (3) — Note 6
- Prereq: VARIES

MATH 3013 — Linear Algebra — 3/0
- Prereq: MATH2153

"H" Elective (3) — Note 3,6

Global Attribute (3)

Semester 7
15 Credit Hours

ECEN 4013 — Design Engr Sys — 1/4
- Prereq: ECEN3213, ECEN2233, ECEN3314, ECEN3513, ECEN3613, ECEN3714, ENGL3323
- Coreq: ECEN4024

ECEN Elective (3) — Note 6
- Prereq: VARIES

ECEN Elective (3) — Note 6
- Prereq: VARIES

Controlled Elective (3) — Note 6

"S" Elective (3) — Note 3,6

Semester 8
16 Credit Hours

ECEN 4024 — Capstone Design — 1/8
- Prereq: ECEN4013, ECEN4503

ECEN Elective (3) — Note 6
- Prereq: VARIES

ECEN Elective (3) — Note 6
- Prereq: VARIES

ECEN Elective (3) — Note 6
- Prereq: VARIES

"H" Elective (3) — Note 3,6

- **From the OSU University Handbook: 7.1 Graduation Requirements**: "The responsibility for satisfying all requirements for a degree rests with the student. Advisors, faculty members and administrators offer help to the student in meeting this responsibility."
- This flowchart serves as an advising instrument and visual guide, not as a substitute for the official Degree Requirement sheet found in the University Catalog. When conflicts occur, the official 2025-2026 Degree Requirement Sheet takes precedence.
- This flowchart represents one path of many to graduation. While students do not have to follow the flowchart, prerequisites and course sequencing limit path options.
- Please use the most recent version of the flowchart. Pay attention to course prerequisites, grade requirements, and other official information on Banner. Prerequisites can change from year to year. Always check the most recent University Catalog for course prerequisites. Note that grade requirements are not shown on this flowchart.
- Students are strongly encouraged to consult their Advisor before enrolling in or dropping any course. As always, consult your Advisor if you have any questions or need clarification about the flowchart or official degree requirements.

Rev. 1.0 4-9-2025

Computer Engineering 2025-2026

Computer Engineering Course Plan (CpE)

Years 1 and 2

Semester 1
15 Credit Hours

- **UNIV 1111** — Intro to OSU — 1/0
- **CS 1113** — Comp. Science I — 2/2 — Subsequent: CS2433
- **CHEM 1414** — Gen Chemistry — 3/2, Note 1
- **MATH 2144** — Calculus 1 — 4/0 — Subsequent: MATH2153, ENSC2113, PHYS2014
- **ENGL 1113** — Comp I — 3/0, Note 2 — Subsequent: ENGL3323

Semester 2
17 Credit Hours

- **ECEN 2233** — Digital Logic Des — 2/2 — Prerequisites: MATH 1813cc — Subsequent: ECEN3213, ECEN4013
- **CS 2433** — C/C++ Prog — 3/0 — Prerequisites: CS1113 — Subsequent: ECEN3213
- **PHYS 2014** — General Physics I — 3/2, Note 5 — Prerequisites: MATH2144 — Subsequent: PHYS2114, ENSC2113
- **MATH 2153** — Calculus II — 3/0 — Prerequisites: MATH2144 — Subsequent: MATH2233, MATH3013, ECEN2714, IEM3503, MATH2163
- **HIST 1103** — American History — 3/0
- **CS 2351** — UNIX Prog — 1/0 — Prerequisites: CS1113

Semester 3
15 Credit Hours

- **ECEN 2714** — Fund Elec Circuits — 3/2, Note 4 — Prerequisites: MATH2153, MATH2233cc, PHYS2114cc — Subsequent: ECEN3714
- **CS 3653** — Discrete Math — 3/0 — Prerequisites: MATH2144 — Subsequent: CS3353
- **PHYS 2114** — General Physics II — 3/2, Note 5 — Prerequisites: PHYS2014 — Subsequent: ECEN3714, ECEN3903
- **MATH 2233** — Diff Equations — 3/0 — Prerequisites: MATH2153 — Subsequent: ECEN3714
- **ENSC 2611** — Elec Fab Lab — 0/2 — Prerequisites: ECEN2714cc — Subsequent: ECEN3714

Semester 4
16 Credit Hours

- **ECEN 3714** — Network Analysis — 3/2 — Prerequisites: ECEN2714, MATH2233, PHYS2114 — Subsequent: ECEN3314, ECEN3513, ECEN3613, ECEN4013
- **ECEN 3213** — Comp Based Systems — 2/2 — Prerequisites: CS2433, ECEN2233, ECEN2714 — Subsequent: ECEN4013
- **CS 3353** — Data Structures — 3/0 — Prerequisites: CS3653, CS2433 — Subsequent: CS4323
- **MATH 2163** — Calculus III — 3/0 — Prerequisites: MATH2153 — Subsequent: ECEN3613
- **POLS 1113** — American Gov't — 3/0

Course Number
Course Name
Lecture/Lab
See Note #

Prerequisites*

Subsequent Requirement**

*Only the last prerequisite in a sequence is listed. All earlier prerequisites must also be satisfied before taking the course.

**See your Advisor, the ECE Advising Document, and Banner for additional information.

Suggested Course Plan

The anticipation at OSU and most institutions of higher education is that for *one* semester credit hour (SCH) the student spends one hour per week in lecture (two for lab courses) and two hours studying outside of class (one for lab courses). A three credit hour class requires about nine hours per week. This study plan is recommended for students who will devote full time to university studies and do not have excessive extracurricular activities or other obligations.

NOTES:

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2) Students with less than a "B" in ENGL 1113 or 1313 must take ENGL 1213 or 1413 prior to ENGL 3323.
3) A total of at least 6 hours designated "H" and 3 hours designated "S" is required. Of these, 3 hrs must meet the International Dimension "I" component and 3 hrs must meet the Diversity "D" component.
4) MATH 2233 and PHYS 2114 must be taken prior to or at the same time as ECEN 2714.
5) General Physics I and II are key prerequisites and should be taken at the earliest possible time.
6) Must be at least 3 SCH.

Computer Engineering 2025-2026

Computer Engineering Course Plan (CpE)

Years 3 and 4

Semester 5
16 Credit Hours

- **ECEN 3314** Electr Dev & Appl — 3/2
  - Prereq: ENSC2611, ECEN3714
  - Coreq: ECEN4013
- **ECEN3613** Appl Fields and Waves — 3/0
  - Prereq: ECEN3714, MATH2163
  - Coreq: ECEN4013
- **ECEN 3513** Signal Analysis — 3/0
  - Prereq: ECEN3714
  - Coreq: ECEN4503, ECEN4013
- **ECEN 4293** Applied Numerical Python — 3/0
  - Prereq: ECEN2233, ECEN3213, ECEN3714
- **ENGL 3323** Technical Writing — 3/0
  - Prereq: ENGL1113, JR Standing
  - Coreq: ECEN4013

Semester 6
15 Credit Hours

- **ECEN 4503** Prob & Stat to Random Signals — 3/0
  - Prereq: ECEN3513
  - Coreq: ECEN4024
- **ECEN 4243** Computer Arch — 2/2
  - Prereq: ECEN2233, ECEN3213, ECEN3714
- **IEM 3503** Engr Economics — 3/0
  - Prereq: MATH2153
- **MATH 3013** Linear Algebra — 3/0
  - Prereq: MATH2153
- **"H" Elective** (3)
  - Note 3,6

Semester 7
15 Credit Hours

- **ECEN 4013** Design Engr Sys — 1/4
  - Prereq: ECEN3213, ECEN2233, ECEN3314, ECEN3513, ECEN3613, ECEN3714, ENGL3323
  - Coreq: ECEN4024
- **ECEN 4213** Emb Comp Sys — 2/2
  - Prereq: ECEN2233, ECEN3213, ECEN3714
- **ECEN 4303** Dig Elec Ckt Des — 3/0
  - Prereq: ECEN2233, ECEN3314
- **ECEN Elective** (3)
  - Prereq: VARIES
  - Note 6
- **"S" Elective** (3)
  - Note 3,6

Semester 8
16 Credit Hours

- **ECEN 4024** Capstone Design — 1/8
  - Prereq: ECEN4013, ECEN4503
- **ECEN 4283** Comp Networks Or CS 4323 Op Systems — 3/0
  - Prereq: ECEN3213, ECEN3714
- **ECEN Elective** (3)
  - Prereq: VARIES
  - Note 6
- **Controlled Elective** (3)
  - Prereq: VARIES
  - Note 6
- **"H" Elective** (3)
  - Note 3,6

Diversity Attribute (3)

Global Attribute (3)

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Rev. 1.0 4.9.2025

Computer Engineering 2025-2026

Computer Engineering – Software Engineering Course Plan (CpE-SOFT)

Years 1 and 2

Semester 1
15 Credit Hours

- **UNIV 1111** Intro to OSU — 1/0
- **CS 1113** Comp. Science I — 2/2 → CS2433
- **CHEM 1414** Gen Chemistry — 3/2, Note 1
- **MATH 2144** Calculus 1 — 4/0 → MATH2153, ENSC2113, PHYS2014
- **ENGL 1113** Comp I — 3/0, Note 2 → ENGL3323

Semester 2
17 Credit Hours

- **ECEN 2233** Digital Logic Des — 2/2 (MATH 1813cc) → ECEN3213, ECEN4013
- **CS 2433** C/C++ Prog — 3/0 (CS1113) → ECEN3213
- **PHYS 2014** General Physics I — 3/2, Note 5 (MATH2144) → PHYS2114, ENSC2113
- **MATH 2153** Calculus II — 3/0 (MATH2144) → MATH2233, MATH3013, ECEN2714, IEM3503, MATH2163
- **HIST 1103** American History — 3/0
- **CS 2351** UNIX Prog — 1/0 (CS1113)

Semester 3
15 Credit Hours

- **ECEN 2714** Fund Elec Circuits — 3/2, Note 4 (MATH2153, MATH2233cc, PHYS2114cc) → ECEN3714
- **CS 3653** Discrete Math — 3/0 (MATH2144) → CS3353
- **PHYS 2114** General Physics II — 3/2, Note 5 (PHYS2014) → ECEN3714, ECEN3903
- **MATH 2233** Diff Equations — 3/0 (MATH2153) → ECEN3714
- **ENSC 2611** Elec Fab Lab — 0/2 (ECEN2714cc) → ECEN3714

Semester 4
16 Credit Hours

- **ECEN 3714** Network Analysis — 3/2 (ECEN2714, MATH2233, PHYS2114) → ECEN3314, ECEN3513, ECEN3613, ECEN4013
- **ECEN 3213** Comp Based Systems — 2/2 (CS2433, ECEN2233, ECEN2714) → ECEN4013
- **CS 3353** Data Structures — 3/0 (CS3653, CS2433) → CS4323
- **MATH 2163** Calculus III — 3/0 (MATH2153) → ECEN3613
- **POLS 1113** American Gov't — 3/0

Course Number
Course Name
Lecture/Lab
See Note #

Prerequisites*

Subsequent Requirement**

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Suggested Course Plan

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4) MATH 2233 and PHYS 2114 must be taken prior to or at the same time as ECEN 2714.
5) General Physics I and II are key prerequisites and should be taken at the earliest possible time.
6) Must be at least 3 SCH.

Computer Engineering 2025-2026

Computer Engineering – Software Engineering Years 3 and 4 Course Plan (CpE-SOFT)

Semester 5
16 Credit Hours

ECEN 3314 Electr Dev & Appl 3/2
- Prereq: ENSC2611, ECEN3714
- Coreq: ECEN4013

ECEN3613 Appl Fields and Waves 3/0
- Prereq: ECEN3714, MATH2163
- Coreq: ECEN4013

ECEN 3513 Signal Analysis 3/0
- Prereq: ECEN3714
- Coreq: ECEN4503, ECEN4013

ECEN 4293 Applied Numerical Python 3/0
- Prereq: ECEN2233, ECEN3213, ECEN3714

ENGL 3323 Technical Writing 3/0
- Prereq: ENGL1113, JR Standing
- Coreq: ECEN4013

Diversity Attribute (3)

Global Attribute (3)

Semester 6
18 Credit Hours

ECEN 4503 Prob & Stat to Random Signals 3/0
- Prereq: ECEN3513
- Coreq: ECEN4024

ECEN 4243 Computer Arch 2/2
- Prereq: ECEN2233, ECEN3213, ECEN3714

IEM 3503 Engr Economics 3/0
- Prereq: MATH2153

MATH 3013 Linear Algebra 3/0
- Prereq: MATH2153

CS 3363 Org of Prog Lang Concentration 3/0
- Prereq: CS2433, ECEN3213

"H" Elective (3)
Note 3,6

Semester 7
15 Credit Hours

ECEN 4013 Design Engr Sys 1/4
- Prereq: ECEN3213, ECEN2233, ECEN3314, ECEN3513, ECEN3613, ECEN3714, ENGL3323
- Coreq: ECEN4024

ECEN 4213 Emb Comp Sys 2/2
- Prereq: ECEN2233, ECEN3213, ECEN3714

ECEN 4303 Dig Elec Ckt Des 3/0
- Prereq: ECEN2233, ECEN3314

ECEN 4273 Software Eng Concentration 3/0
- Prereq: ECEN3213, ECEN3714, CS3653

"S" Elective (3)
Note 3,6

Semester 8
16 Credit Hours

ECEN 4024 Capstone Design 1/8
- Prereq: ECEN4013, ECEN4503

ECEN 4493 Artificial Intelligence Concentration 3/0
- Prereq: ECEN3213, ECEN3714

SOFT Elective (3) Concentration 3/0
- Prereq: VARIES

CS 4323 Op Systems 3/0
- Prereq: CS3353, ECEN3213

"H" Elective (3)
Note 3,6

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Rev. 1.0 4-9-2025

Computer Engineering 2025-2026

Computer Engineering Course Plan (CpE)

Years 1 and 2

Semester 1
15 Credit Hours

- **UNIV 1111** — Intro to OSU — 1/0
- **CS 1113** — Comp. Science I — 2/2 — Subsequent: CS2433
- **CHEM 1414** — Gen Chemistry — 3/2, Note 1
- **MATH 2144** — Calculus 1 — 4/0 — Subsequent: MATH2153, ENSC2113, PHYS2014
- **ENGL 1113** — Comp I — 3/0, Note 2 — Subsequent: ENGL3323

Semester 2
17 Credit Hours

- **ECEN 2233** — Digital Logic Des — 2/2 — Prerequisites: MATH 1813cc — Subsequent: ECEN3213, ECEN4013
- **CS 2433** — C/C++ Prog — 3/0 — Prerequisites: CS1113 — Subsequent: ECEN3213
- **PHYS 2014** — General Physics I — 3/2, Note 5 — Prerequisites: MATH2144 — Subsequent: PHYS2114, ENSC2113
- **MATH 2153** — Calculus II — 3/0 — Prerequisites: MATH2144 — Subsequent: MATH2233, MATH3013, ECEN2714, IEM3503, MATH2163
- **HIST 1103** — American History — 3/0
- **CS 2351** — UNIX Prog — 1/0 — Prerequisites: CS1113

Semester 3
15 Credit Hours

- **ECEN 2714** — Fund Elec Circuits — 3/2, Note 4 — Prerequisites: MATH2153, MATH2233cc, PHYS2114cc — Subsequent: ECEN3714
- **CS 3653** — Discrete Math — 3/0 — Prerequisites: MATH2144 — Subsequent: CS3353
- **PHYS 2114** — General Physics II — 3/2, Note 5 — Prerequisites: PHYS2014 — Subsequent: ECEN3714, ECEN3903
- **MATH 2233** — Diff Equations — 3/0 — Prerequisites: MATH2153 — Subsequent: ECEN3714
- **ENSC 2611** — Elec Fab Lab — 0/2 — Prerequisites: ECEN2714cc — Subsequent: ECEN3714

Semester 4
16 Credit Hours

- **ECEN 3714** — Network Analysis — 3/2 — Prerequisites: ECEN2714, MATH2233, PHYS2114 — Subsequent: ECEN3314, ECEN3513, ECEN3613, ECEN4013
- **ECEN 3213** — Comp Based Systems — 2/2 — Prerequisites: CS2433, ECEN2233, ECEN2714 — Subsequent: ECEN4013
- **CS 3353** — Data Structures — 3/0 — Prerequisites: CS3653, CS2433 — Subsequent: CS4323
- **MATH 2163** — Calculus III — 3/0 — Prerequisites: MATH2153 — Subsequent: ECEN3613
- **POLS 1113** — American Gov't — 3/0

Course Number
Course Name
Lecture/Lab
See Note #

Prerequisites*

Subsequent Requirement**

*Only the last prerequisite in a sequence is listed. All earlier prerequisites must also be satisfied before taking the course.

**See your Advisor, the ECE Advising Document, and Banner for additional information.

Suggested Course Plan

The anticipation at OSU and most institutions of higher education is that for *one* semester credit hour (SCH) the student spends one hour per week in lecture (two for lab courses) and two hours studying outside of class (one for lab courses). A three credit hour class requires about nine hours per week. This study plan is recommended for students who will devote full time to university studies and do not have excessive extracurricular activities or other obligations.

NOTES:

1) CHEM 1515 may be substituted for CHEM 1414 and should be taken by all students considering medical school.
2) Students with less than a "B" in ENGL 1113 or 1313 must take ENGL 1213 or 1413 prior to ENGL 3323.
3) A total of at least 6 hours designated "H" and 3 hours designated "S" is required. Of these, 3 hrs must meet the International Dimension "I" component and 3 hrs must meet the Diversity "D" component.
4) MATH 2233 and PHYS 2114 must be taken prior to or at the same time as ECEN 2714.
5) General Physics I and II are key prerequisites and should be taken at the earliest possible time.
6) Must be at least 3 SCH.

Computer Engineering 2025-2026

Computer Engineering Course Plan (CpE)

Years 3 and 4

Semester 5
16 Credit Hours

- **ECEN 3314** Electr Dev & Appl — 3/2
  - Pre: ENSC2611, ECEN3714
  - Co: ECEN4013
- **ECEN3613** Appl Fields and Waves — 3/0
  - Pre: ECEN3714, MATH2163
  - Co: ECEN4013
- **ECEN 3513** Signal Analysis — 3/0
  - Pre: ECEN3714
  - Co: ECEN4503, ECEN4013
- **ECEN 4293** Applied Numerical Python — 3/0
  - Pre: ECEN2233, ECEN3213, ECEN3714
- **ENGL 3323** Technical Writing — 3/0
  - Pre: ENGL1113, JR Standing
  - Co: ECEN4013

Semester 6
15 Credit Hours

- **ECEN 4503** Prob & Stat to Random Signals — 3/0
  - Pre: ECEN3513
  - Co: ECEN4024
- **ECEN 4243** Computer Arch — 2/2
  - Pre: ECEN2233, ECEN3213, ECEN3714
- **IEM 3503** Engr Economics — 3/0
  - Pre: MATH2153
- **MATH 3013** Linear Algebra — 3/0
  - Pre: MATH2153
- **"H" Elective** (3)
  - Note 3,6

Semester 7
15 Credit Hours

- **ECEN 4013** Design Engr Sys — 1/4
  - Pre: ECEN3213, ECEN2233, ECEN3314, ECEN3513, ECEN3613, ECEN3714, ENGL3323
  - Co: ECEN4024
- **ECEN 4213** Emb Comp Sys — 2/2
  - Pre: ECEN2233, ECEN3213, ECEN3714
- **ECEN 4303** Dig Elec Ckt Des — 3/0
  - Pre: ECEN2233, ECEN3314
- **ECEN Elective** (3)
  - Pre: VARIES
  - Note 6
- **"S" Elective** (3)
  - Note 3,6

Semester 8
16 Credit Hours

- **ECEN 4024** Capstone Design — 1/8
  - Pre: ECEN4013, ECEN4503
- **ECEN 4283** Comp Networks Or CS 4323 Op Systems — 3/0
  - Pre: ECEN3213, ECEN3714
- **ECEN Elective** (3)
  - Pre: VARIES
  - Note 6
- **Controlled Elective** ENSC 2113 – Statics if Dual degree (3)
  - Pre: VARIES
  - Note 6
- **"H" Elective** (3)
  - Note 3,6

Diversity Attribute (3)

Global Attribute (3)

If Dual degree:

- **ECEN Junior Elective** (3)
- **ECEN Elective** (3)
- **ECEN Elective** (3)
- **ECEN Elective** (3)

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Rev. 1.0 4.9.2025

Computer Engineering 2025-2026

Computer Engineering – Software Engineering Course Plan (CpE-SOFT)

Years 1 and 2

Semester 1
15 Credit Hours

- **UNIV 1111** Intro to OSU — 1/0
- **CS 1113** Comp. Science I — 2/2 → CS2433
- **CHEM 1414** Gen Chemistry — 3/2, Note 1
- **MATH 2144** Calculus 1 — 4/0 → MATH2153, ENSC2113, PHYS2014
- **ENGL 1113** Comp I — 3/0, Note 2 → ENGL3323

Semester 2
17 Credit Hours

- **ECEN 2233** Digital Logic Des — 2/2 (MATH 1813cc) → ECEN3213, ECEN4013
- **CS 2433** C/C++ Prog — 3/0 (CS1113) → ECEN3213
- **PHYS 2014** General Physics I — 3/2, Note 5 (MATH2144) → PHYS2114, ENSC2113
- **MATH 2153** Calculus II — 3/0 (MATH2144) → MATH2233, MATH3013, ECEN2714, IEM3503, MATH2163
- **HIST 1103** American History — 3/0
- **CS 2351** UNIX Prog — 1/0 (CS1113)

Semester 3
15 Credit Hours

- **ECEN 2714** Fund Elec Circuits — 3/2, Note 4 (MATH2153, MATH2233cc, PHYS2114cc) → ECEN3714
- **CS 3653** Discrete Math — 3/0 (MATH2144) → CS3353
- **PHYS 2114** General Physics II — 3/2, Note 5 (PHYS2014) → ECEN3714, ECEN3903
- **MATH 2233** Diff Equations — 3/0 (MATH2153) → ECEN3714
- **ENSC 2611** Elec Fab Lab — 0/2 (ECEN2714cc) → ECEN3714

Semester 4
16 Credit Hours

- **ECEN 3714** Network Analysis — 3/2 (ECEN2714, MATH2233, PHYS2114) → ECEN3314, ECEN3513, ECEN3613, ECEN4013
- **ECEN 3213** Comp Based Systems — 2/2 (CS2433, ECEN2233, ECEN2714) → ECEN4013
- **CS 3353** Data Structures — 3/0 (CS3653, CS2433) → CS4323
- **MATH 2163** Calculus III — 3/0 (MATH2153) → ECEN3613
- **POLS 1113** American Gov't — 3/0

Course Number
Course Name
Lecture/Lab
See Note #

Prerequisites*

Subsequent Requirement**

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Suggested Course Plan

The anticipation at OSU and most institutions of higher education is that for *one* semester credit hour (SCH) the student spends one hour per week in lecture (two for lab courses) and two hours studying outside of class (one for lab courses). A three credit hour class requires about nine hours per week. This study plan is recommended for students who will devote full time to university studies and do not have excessive extracurricular activities or other obligations.

NOTES:

1) CHEM 1515 may be substituted for CHEM 1414 and should be taken by all students considering medical school.
2) Students with less than a "B" in ENGL 1113 or 1313 must take ENGL 1213 or 1413 prior to ENGL 3323.
3) A total of at least 6 hours designated "H" and 3 hours designated "S" is required. Of these, 3 hrs must meet the International Dimension "I" component and 3 hrs must meet the Diversity "D" component.
4) MATH 2233 and PHYS 2114 must be taken prior to or at the same time as ECEN 2714.
5) General Physics I and II are key prerequisites and should be taken at the earliest possible time.
6) Must be at least 3 SCH.

Computer Engineering 2025-2026

Computer Engineering – Software Engineering Years 3 and 4 Course Plan (CpE-SOFT)

Semester 5
16 Credit Hours

ECEN 3314 Electr Dev & Appl 3/2
- Prereq: ENSC2611, ECEN3714
- Coreq: ECEN4013

ECEN3613 Appl Fields and Waves 3/0
- Prereq: ECEN3714, MATH2163
- Coreq: ECEN4013

ECEN 3513 Signal Analysis 3/0
- Prereq: ECEN3714
- Coreq: ECEN4503, ECEN4013

ECEN 4293 Applied Numerical Python 3/0
- Prereq: ECEN2233, ECEN3213, ECEN3714

ENGL 3323 Technical Writing 3/0
- Prereq: ENGL1113, JR Standing
- Coreq: ECEN4013

Semester 6
18 Credit Hours

ECEN 4503 Prob & Stat to Random Signals 3/0
- Prereq: ECEN3513
- Coreq: ECEN4024

ECEN 4243 Computer Arch 2/2
- Prereq: ECEN2233, ECEN3213, ECEN3714

IEM 3503 Engr Economics 3/0
- Prereq: MATH2153

MATH 3013 Linear Algebra 3/0
- Prereq: MATH2153

CS 3363 Org of Prog Lang Concentration 3/0
- Prereq: CS2433, ECEN3213

"H" Elective (3)
Note 3,6

Semester 7
15 Credit Hours

ECEN 4013 Design Engr Sys 1/4
- Prereq: ECEN3213, ECEN2233, ECEN3314, ECEN3513, ECEN3613, ECEN3714, ENGL3323
- Coreq: ECEN4024

ECEN 4213 Emb Comp Sys 2/2
- Prereq: ECEN2233, ECEN3213, ECEN3714

ECEN 4303 Dig Elec Ckt Des 3/0
- Prereq: ECEN2233, ECEN3314

ECEN 4273 Software Eng Concentration 3/0
- Prereq: ECEN3213, ECEN3714, CS3653

"S" Elective (3)
Note 3,6

Semester 8
16 Credit Hours

ECEN 4024 Capstone Design 1/8
- Prereq: ECEN4013, ECEN4503

ECEN 4493 Artificial Intelligence Concentration 3/0
- Prereq: ECEN3213, ECEN3714

SOFT Elective (3) Concentration 3/0
- Prereq: VARIES

CS 4323 Op Systems 3/0
- Prereq: CS3353, ECEN3213

"H" Elective (3)
Note 3,6

Diversity Attribute (3)

Global Attribute (3)

If Dual degree:

ENSC 2113 Statics (3)

ECEN Junior Elective (3)

ECEN Elective (3)

ECEN Elective (3)

ECEN Elective (3)

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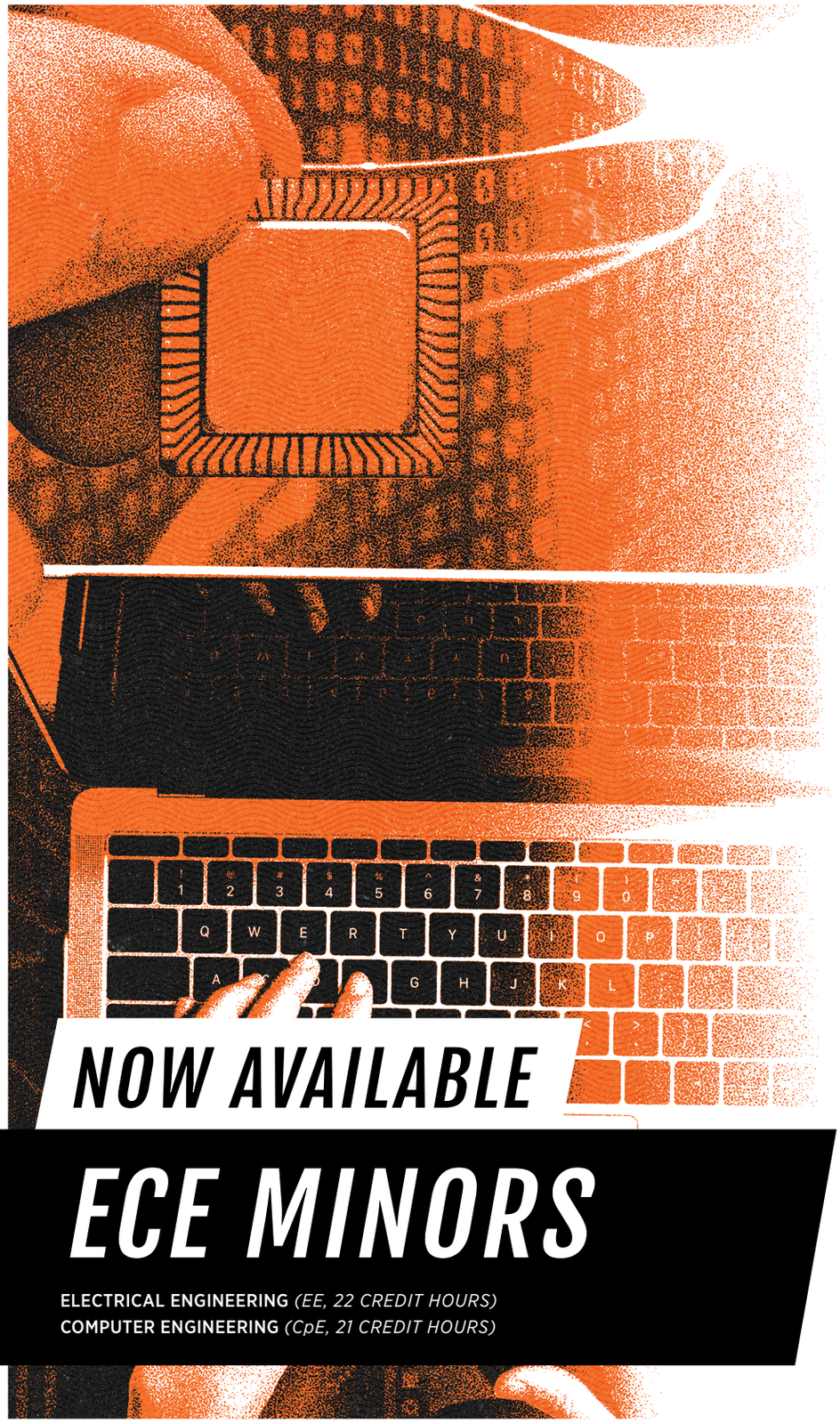
Rev. 1.0 4-9-2025



NOW AVAILABLE

ECE MINORS

ELECTRICAL ENGINEERING *(EE, 22 CREDIT HOURS)*
COMPUTER ENGINEERING *(CpE, 21 CREDIT HOURS)*

ELECTRICAL OR COMPUTER ENGINEERING MINORS MAY ONLY REQUIRE A FEW HOURS OF STUDY BEYOND YOUR DEGREE. TALK TO YOUR ADVISOR FOR DETAILS!

MINOR CORE COURSES *(12 CREDIT HOURS)*

ECEN	2233	*Digital Logic Design*	ENSC	2611	*Electrical Fabrication Lab*
ECEN	2714	*Fundamentals of Circuits*	ECEN	3714	*Network Analysis*

EE MINOR REQUIRED *(4 CREDIT HOURS)*

ECEN	3314	*Electronic Devices and Applications*

CpE MINOR REQUIRED *(3 CREDIT HOURS)*

ECEN	3213	*Computer Based Systems*

EE MINOR ELECTIVE *(6 CREDIT HOURS)*

POWER/ENERGY

ECEN	3113	*Energy, Environment Economics*
ECEN	4133	*Power Electronics*
ECEN	4153	*Power Systems*

COMMUNICATION

ECEN	4523*	*Communication Theory*
ECEN	4533	*Data Communication*
ECEN	3513	*Signal Analysis*

RADIO/MICROWAVE

ECEN	3613	*Applied Fields I*
ECEN	4613	*Microwave Engineering*

CONTROL

ECEN	3723	*System I*
ECEN	4413	*(MAE4053) Automatic Control*
ECEN	4493	*AI for Engineering*

ELECTRONICS/CHIP DESIGN

ECEN	4313	*Linear Electronics*
ECEN	4353	*Communication Electronics*
ECEN	4303	*Digital IC Design*

SIGNAL PROCESSING

ECEN	3513	*Signal Analysis*
ECEN	4763	*Digital Signal Processing*
ECEN	4743	*Biomedical Modeling*

LASER/OPTICS

ECEN	4823	*Design of Optical Systems*
ECEN	4843	*Design of Lasers and Systems*

CpE MINOR ELECTIVE *(6 CREDIT HOURS)*

EMBEDDED SYSTEMS

ECEN	4213	*Embedded Systems*
ECEN	4223	*Mobile Robotics*

SOFTWARE/NETWORKS

ECEN	4273	*Software Engineering*
ECEN	4283	*Computer Networks*

COMPUTER DESIGN

ECEN	4233	*Computer Arithmetic*
ECEN	4243	*Computer Architecture*

AI PROGRAMMING

ECEN	4293	*Applied Numerical Methods for Python*
ECEN	4493	*AI for Engineering*

ENGAGE
ECE COMMUNITY
EMPOWER
COMMUNICATE

SCHOOL OF
ELECTRICAL AND COMPUTER ENGINEERING
College of Engineering, Architecture and Technology

ELECTR & COMPUTER ENGINEERING (ECEN)

ECEN 2011 Experimental Methods I
Prerequisites: PHYS 2114 with a "C" or better or concurrent enrollment advisor permission required.
Description: Laboratory associated with ECEN 2714 taken mostly by transfer students who have completed a similar course as ECEN 2714 without the accompanying laboratory. Previously offered as ECEN 3013.
Credit hours: 1
Contact hours: Lab: 2 Contact: 2
Levels: Undergraduate
Schedule types: Lab
Department/School: Elec & Computer Engr

ECEN 2233 Fundamentals of Digital Logic Design
Prerequisites: MATH 1813 with a "C" or better or concurrent enrollment.
Description: Introduction to digital logic, logic building blocks, Boolean algebra, two-level realization of logic functions, Karnaugh maps (K-maps) and the Quine-McCluskey method/Heuristics for minimizing the complexity of logic circuits, programmable logic with FPGAs, complex logic building blocks, Finite State Machines (FSMs), FSM design methodology, digital system design, algorithmic design in digital systems, control/datapath partitioning, FSM optimizations, and clocking methodologies. No degree credit for students with credit in ECEN 3233.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2 Contact: 4
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Elec & Computer Engr

ECEN 2714 Fundamentals of Electric Circuits
Prerequisites: MATH 2153 with a "C" or better and (PHYS 2114 and MATH 2233 and ENSC 2611 with a "C" or better or concurrent enrollment).
Description: Circuit analysis techniques including equivalent networks and mesh/node formulation of network equations; operational amplifiers; RL, RC and RLC transient and steady-state circuit analysis; energy and power; electrical measurements and instrumentation.
Credit hours: 4
Contact hours: Lecture: 3 Lab: 2 Contact: 5
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Elec & Computer Engr

ECEN 3020 Supervised Research Project
Prerequisites: Consent of instructor and ECEN department head.
Description: Supervised research project for qualified students. May be repeated no more than three times for a total of three credit hours. Offered for variable credit, 1-3 credit hours, maximum of 3 credit hours.
Credit hours: 1
Contact hours: Contact: 1 Other: 1
Levels: Undergraduate
Schedule types: Independent Study
Department/School: Elec & Computer Engr

ECEN 3113 Energy, Environment and Economics
Prerequisites: ECEN 3714 with a "C" or better.
Description: Topics relevant to understanding the close relationship between energy use, its impact on the environment, and overall economic implications. Green energy technologies (wind, solar, hydro) will be considered along with conventional techniques. Both conventional and non-conventional energy technologies will be discussed.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 3213 Computer Based Systems in Engineering
Prerequisites: CS 2433, ECEN 2714, and (ECEN 2233 or ECEN 3233), all with a "C" or better.
Description: A comprehensive introduction to technology and applications of microcontrollers/microprocessors in solving engineering problems. Topics include computer principle, computer hardware/software, programming, IO interfacing, communication, memory, data acquisition, data representation, and numerical analysis. Previously offered as ENSC 3213.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2 Contact: 4
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Elec & Computer Engr

ECEN 3314 Electronic Devices and Applications
Prerequisites: ECEN 3714 with a "C" or better and (PHYS 3313 or ECEN 3903 with a "C" or better).
Description: Semiconductor electronic components including MOSFETs, BJTs, JFETs, and OpAmps. Emphasis on device models and use of solid state electronic devices to analyze, synthesize and design amplifiers and switching circuits. SPICE simulations are extensively utilized. Basic building blocks for analog and digital applications. Theoretical concepts and methods are demonstrated and reinforced through laboratory exercises. Course previously offered as ECEN 3313.
Credit hours: 4
Contact hours: Lecture: 3 Lab: 2 Contact: 5
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Elec & Computer Engr

ECEN 3513 Signal Analysis
Prerequisites: ECEN 3714 with a "C" or better.
Description: Deterministic signals. Fourier series and Fourier transforms. Impulse response, convolution and correlation. Sampling theorem. Analog modulation techniques.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 3613 Applied Fields and Waves I
Prerequisites: MATH 2163 and ECEN 3714 with a "C" or better.
Description: Circuit model of transmission lines, wave propagation, energy transfer, impedance mismatch, and transients. Field analysis of voltage, current, resistance, capacitance, and inductance. Coupled circuits.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 3623 Applied Fields and Waves II
Prerequisites: ECEN 3613.
Description: Continuation of ECEN 3613. Plane-wave propagation in free space, power flow, reflection and transmission. Guided waves and resonators. Radiation and introduction to antenna systems. Boundary value problem analysis.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 3714 Network Analysis
Prerequisites: MATH 2233 and ECEN 2714 and PHYS 2114 and ENSC 2611 with a grade of "C" or better.
Description: Advanced mathematical analysis techniques used in circuit analysis including Laplace transforms, Fourier transforms, and Fourier series. Circuit frequency response, Bode plots, and filters, including passive, active, low-pass, high-pass, and band-pass filters. Theory of linear circuits; two-port circuit models and parameters. Course previously offered as ECEN 3713.
Credit hours: 4
Contact hours: Lecture: 3 Lab: 2 Contact: 5
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Elec & Computer Engr

ECEN 3723 Systems I
Prerequisites: ECEN 3714 and ENSC 2113 with a "C" or better and (MATH 3013 with a "C" or better or concurrent enrollment).
Description: Physical and mathematical modeling of electrical and mechanical dynamic systems. Transient response of first and second order systems. Laplace transform techniques for solving differential equations, transfer functions, frequency response and resonance. Course previously offered as ECEN 3413.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 3903 Introduction to Semiconductor Devices
Prerequisites: PHYS 2114 and MATH 2233 and ECEN 2714 with a "C" or better.
Description: Crystal structure, the quantum theory of solids. The physics of semiconductor materials and the projunction, with an emphasis on applications to semiconductor devices. Same course as PHYS 3313.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 3913 Solid State Electronic Devices
Prerequisites: ECEN 3714 with a "C" or better and (PHYS 3313 or ECEN 3903 with a "C" or better).
Description: Solid state physics basis of modern electronic devices. Introductory quantum mechanics. Energy bands in solids. Electronic properties of semiconductors. Junction diodes. Bipolar transistors. Field effect transistor.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 4010 Special Topics
Prerequisites: (ECEN 3213 or ENSC 3213), (ECEN 2233 or ECEN 3233), and ECEN 3714, all with a "C" or better or advisor permission.
Description: Engineering topics not normally included in existing courses. Repeat credit may be earned with different course subtitles assigned. Offered for variable credit, 1-12 credit hours, maximum of 12 credit hours.
Credit hours: 1-12
Contact hours: Contact: 1-12 Other: 1-12
Levels: Undergraduate
Schedule types: Independent Study
Department/School: Elec & Computer Engr

ECEN 4013 Design of Engineering Systems
Prerequisites: (ECEN 3213 or ENSC 3213), (ECEN 2233 or ECEN 3233), and ECEN 3714, all with a grade of "C" or better, and ECEN 3613, ECEN 3513, ECEN 3314 and (ENGL 3323 with a grade of "C" or better or concurrent enrollment).
Description: Complete design cycle for several small design projects, each including establishing objectives, synthesis, analysis, construction, testing and evaluation. Use of modern lab equipment and fabrication techniques. Development of communication skills.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2 Contact: 4
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Elec & Computer Engr

ECEN 4024 Capstone Design
Prerequisites: ECEN 4013 and ECEN 4503.
Description: Continuation of ECEN 4013. Student project teams design, build, test and present results for realistic projects from university and industrial sponsors. Formulation of specifications, consideration of alternative solutions, feasibility considerations, detailed system descriptions, economic factors, safety, reliability, aesthetics, ethics and social impact. Course previously offered as ECEN 4023.
Credit hours: 4
Contact hours: Lab: 8 Contact: 8
Levels: Undergraduate
Schedule types: Lab
Department/School: Elec & Computer Engr

ECEN 4030 Undergraduate Professional Practice
Prerequisites: Department Permission Required.
Description: Experience in application of electrical engineering principles to typical problems encountered in industry. Solutions to the problems by student participation in the role of engineer or engineering intern. Offered for variable credit, 1-8 credit hours, maximum of 8 credit hours.
Credit hours: 1-8
Contact hours: Contact: 1-8 Other: 1-8
Levels: Undergraduate
Schedule types: Independent Study
Department/School: Elec & Computer Engr

ECEN 4133 Power Electronics
Prerequisites: ECEN 3714 with a grade of "C" or better.
Description: Power electronic devices, components, and their characteristics; DC to AC conversion; fundamentals of inverters and waveshaping devices; application aspects; control aspects; characteristics and state-of-the-art of advanced power inverter and power conditioning topologies.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 4153 Power System Analysis and Design
Prerequisites: ECEN 3714, "C" or better.
Description: Power system component models from circuit theory. Formulation and design of the load flow model and the optimum economic generator allocation problem utilizing computer methods.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 4213 Embedded Computer Systems Design
Prerequisites: (ECEN 3213 or ENSC 3213), (ECEN 2233 or ECEN 3233) and ECEN 3714, all with a grade of "C" or better.
Description: Design of microcontroller/microprocessor-based systems through proper integration of hardware and software. Topics include development process and methodology, sensor interfacing, motor control, networking and wireless communication, embedded operating systems, and Internet of Things (IoT).
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2 Contact: 4
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Elec & Computer Engr

ECEN 4223 Mobile Robotics
Prerequisites: ECEN 3213 or equivalent.
Description: This electrical and computer engineering course introduces the fundamentals of mobile robots to both undergraduate and graduate students. Mobile robots are integrated mechanical, electrical and computational systems functioning in the physical world. Topics include design, locomotion, perception, control, localization and mapping, path planning, and more. Advanced topics will also be discussed. This course aims to provide theoretical and practical experiences to students through both lectures and projects.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 4233 High Speed Computer Arithmetic
Prerequisites: (ECEN 3213 or ENSC 3213), (ECEN 2233 or ECEN 3233), and ECEN 3714, all with a grade of "C" or better.
Description: Course covers computer arithmetic as applied to general purpose and application-specific processors. Focus is on developing high-speed arithmetic algorithms and understanding their implementation in VLSI technology at the gate level.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 4243 Computer Architecture
Prerequisites: (ECEN 3213 or ENSC 3213), (ECEN 2233 or ECEN 3233), and ECEN 3714, all with a grade of "C" or better.
Description: Functional organization and hardware design of digital computer systems with emphasis on microprocessor-based systems. CPU organization, features of microprocessors including advanced 32-bit CPU's, memory system design including cache, virtual memory, error detection and correction, I/O operations, including direct memory access and peripheral interface design.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2 Contact: 4
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Elec & Computer Engr

ECEN 4273 Software Engineering
Prerequisites: (ECEN 3213 or ENSC 3213), (ECEN 2233 or ECEN 3233), CS 3653, and ECEN 3714, all with a grade of "C" or better.
Description: Fundamental characteristics of the software life cycle. Tools, techniques, and management controls for development and maintenance of large software systems. Software metrics and models. Human factors and experimental design. Same course as CS 4273.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 4283 Computer Networks
Prerequisites: (ECEN 3213 or ENSC 3213), (ECEN 2233 or ECEN 3233), and ECEN 3714, all with a grade of "C" or better.
Description: Computer networks, distributed systems and their systematic design. Introduction to the use, structure, and architecture of computer networks. Networking experiments to describe network topology. ISO reference model. Same course as CS 4283.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 4293 Applied Numerical Methods for Python for Electrical Engineers
Prerequisites: None. This course is suitable for any student in CEAT who has a basic understanding of programming (CS 1113 Computer Science I) and is willing to spend the time necessary to learn.
Description: This course is an introduction to numerical linear algebra and related numerical methods. Topics include direct and iterative methods for linear systems, eigenvalue decompositions and QR/SVD factorizations, stability and accuracy of numerical algorithms, the IEEE floating-point standard, sparse and structured matrices, and an introduction to machine learning/AI and linear algebra software. Other topics may include nonlinear optimization, numerical integration and differentiation, FFTs, and sensitivity analysis. Problem sets will involve heavy use of the Python environment (little or no prior experience required; you will learn as you go).
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 4303 Digital Integrated Circuit Design
Prerequisites: ECEN 3314 and (ECEN 2233 or ECEN 3233 with a "C" or better).
Description: Theory of digital and electronics circuits. Digital logic families TTL, IIL, ECL, NMOS, CMOS, GaAs. Large signal models for transistors. Implementation at RAM and ROM. Circuit design for LSI and VLSI.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 4313 Linear Electronics Circuit Design
Prerequisites: ECEN 3314.
Description: Overview of semiconductor device physics (MOSFETs and BJTs) and integrated-circuit design environment. Building blocks for analog systems (differential amplifiers, operational amplifiers, output stages, and voltage references). Understanding of frequency response (Bode plot, transfer function, pole-zero analysis, feedback, and stability). Extensive SPICE-based design for performance optimization and design tradeoffs.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 4353 Communication Electronics
Prerequisites: ECEN 3314.
Description: Introduction to radio-frequency (RF) communication systems with a primary focus on transistor- and circuit-level analysis. Investigations of RF system properties (noise, linearity, and matching) modulation schemes, and transceiver architectures. Operation principles and basic design of low-noise amplifiers, mixers, power amplifiers, and oscillators.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 4413 Automatic Control Systems
Prerequisites: ECEN 3723 or (MAE 3723 or MAE 3724).
Description: Properties of feedback control systems, mathematical models of basic components, state-variable models of feedback systems, time-domain analysis, stability, transform analysis, frequency domain techniques, root-locus design of single input single output systems and simple compensation techniques. Same course as MAE 4053.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 4493 Artificial Intelligence in Engineering
Prerequisites: ECEN 3714 with a "C" or better.
Description: Elementary concepts of artificial intelligence and its applications in engineering, including but not limited to automation, manufacturing, computer vision, robotics and mechatronics. Emphasis is on deep neural network architectures and learning algorithms along with topics related to machine learning, computer vision and data analytics. Online computer programs, such as Python and AI Libraries, collated from open-source repositories will be given along with hands-on experience.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 4503 Applications of Probability and Statistics to Random Signals
Prerequisites: ECEN 3513.
Description: Concepts of probability, statistics, and random variables necessary for study of signals and systems involving uncertainty and randomness. Applications of probability and statistics to practical problems in electrical and computer engineering including communications, signal processing, image processing, and control systems.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 4523 Communication Theory
Prerequisites: ECEN 4503.
Description: Noise in modulation systems. Digital data transmission. Design of optimal receivers. Introduction to information theory.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 4533 Data Communications
Prerequisites: ECEN 4503 prerequisite or concurrent enrollment.
Description: Signal detection in noise. Tradeoffs between bandwidth signal-to-noise ratio and rate of information transfer. Transmission multiplexing and error handling. Elements of computer network design. Data link protocols.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 4613 Microwave Engineering
Prerequisites: ECEN 3613.
Description: Review of EM and transmission line theory. Microwave network theory: Impedance and admittance matrices, scattering matrix and S-parameters, ABCD and transfer matrices. Signal-flow diagrams. Matching circuits and microwave filters. Passive microwave devices: power dividers, hybrids, couplers, resonators, isolators, and circulators. Class projects such as radar, communication, imaging, or sensing systems.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 4743 Introduction to Biomedical Engineering Modeling and Systems
Prerequisites: ECEN 4763.
Description: An overview of the field of biomedical engineering and an introduction of the modeling approaches implemented in biomedical engineering. Topics include bio-electronics, biomechanics, compartmental modeling, bio-signal processing, biomedical optics, etc. The course will demonstrate a few of major fields of activity in which biomedical engineers are engaged and modeling approaches are implemented.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 4763 Introduction to Digital Signal Processing
Prerequisites: ECEN 3513.
Description: Introduction to discrete linear systems using difference equations and z-transforms. Discrete Fourier analysis. Design of digital filters. Sampling theorem. Applications of digital signal processing.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 4773 Real Time Digital Signal Processing
Prerequisites: ECEN 4763.
Description: DSP Processor architectures and programming. A/D, D/A, polled and interrupt-driven I/O. Realtime implementation of FIR/IIR filters, the FFT, and other DSP algorithms on special purpose DSP hardware from Motorola, Texas Instruments and others. Link between DSP theory and practical implementation.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Undergraduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 4823 Design of Optical Systems
Prerequisites: ECEN 3714 with a "C" or better.
Description: Introduction to optics through the design, construction, and characterization of optical systems. Emphasis on geometrical optics and spectroscopy. Course previously offered as ECEN 3813.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2 Contact: 4
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Elec & Computer Engr

ECEN 4843 Design of Lasers and Systems
Prerequisites: ECEN 3613.
Description: Introduction of the design of lasers and optical systems based on lasers including the design, construction, and characterization of lasers. Gaussian beams and optics, laser gain materials, laser cavities, advanced topics. Course previously offered as ECEN 4813.
Credit hours: 3
Contact hours: Lecture: 2 Lab: 2 Contact: 4
Levels: Undergraduate
Schedule types: Lab, Lecture, Combined lecture and lab
Department/School: Elec & Computer Engr

ECEN 5000 Thesis
Description: A student studying for the master's degree will enroll in this course for a maximum of six credit hours. Offered for variable credit, 1-6 credit hours, maximum of 6 credit hours.
Credit hours: 1-6
Contact hours: Contact: 1-6 Other: 1-6
Levels: Graduate
Schedule types: Independent Study
Department/School: Elec & Computer Engr

ECEN 5030 Professional Practice
Prerequisites: Department Permission Required.
Description: Experience in application of electrical engineering principles to typical problems encountered in industry and government engineering design and development projects. Solutions to the problems require participation by the student in the role of junior engineer or engineer-intern. Offered for variable credit, 1-8 credit hours, maximum of 8 credit hours.
Credit hours: 1-8
Contact hours: Contact: 1-8 Other: 1-8
Levels: Graduate
Schedule types: Independent Study
Department/School: Elec & Computer Engr

ECEN 5060 Special Topics
Prerequisites: Advisor permission.
Description: Engineering topics not normally included in existing courses. Repeat credit may be earned with different course subtitles assigned. Offered for variable credit, 1-6 credit hours, maximum of 6 credit hours.
Credit hours: 1-6
Contact hours: Contact: 1-6 Other: 1-6
Levels: Graduate
Schedule types: Independent Study
Department/School: Elec & Computer Engr

ECEN 5070 Directed Studies
Prerequisites: Consent of instructor.
Description: Investigation outside of the classroom of topics not normally covered in lecture courses. Offered for variable credit, 1-6 credit hours, maximum of 6 credit hours.
Credit hours: 1-6
Contact hours: Contact: 1-6 Other: 1-6
Levels: Graduate
Schedule types: Independent Study
Department/School: Elec & Computer Engr

ECEN 5080 Fundamental Topics
Prerequisites: Advisor permission.
Description: Fundamental topics that are typically introduced in the senior year curriculum with additional depth and breadth commensurate with the graduate program. Repeat credit may be earned with difference course subtitles assigned. Offered for variable credit, 1-6 credit hours, maximum of 9 credit hours.
Credit hours: 1-6
Contact hours: Lecture: 1-6 Contact: 1-6
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5113 Power Systems Analysis by Computer Methods
Prerequisites: ECEN 4153 or Departmental Permission.
Description: Quasi-static control of power systems and analysis of power systems under abnormal operating conditions. Transient stability studies. Models formulated and solutions outlined for implementation on the computer.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5123 Engineering Systems Reliability Evaluation
Prerequisites: ECEN 4503 or Departmental Permission.
Description: Techniques and concepts needed for evaluating the long-term and short-term reliability of a system. Topics include static and spinning generation capacity; transmission, composite, interconnected, and dc system reliability evaluations; and power system security. Applications to systems other than power systems included. For students with little or no background in probability or statistics.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5133 Power Electronics and Renewables
Prerequisites: ECEN 3314 or Departmental Permission.
Description: Modeling and control aspects of power electronics for integrating renewable energy systems. Topics covered here will focus on power converter dynamics, indirect converter topologies, PWM technique, sliding mode control of converters, game theory based control, Maximum power point tracking, control of generators for different renewable energy systems. Simulation tools will be discussed as appropriate.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5153 Direct Energy Conversion
Prerequisites: Departmental Permission.
Description: Energy conversion techniques and applications; thermo-electrics, thermionics, fuel cells, MHD and other processes involving electrical, mechanical and thermal energies. State-of-the-art developments in direct energy conversion using selected papers from journals and other publications. Gives the student a proper perspective of the possibilities and problems associated with satisfying future energy requirements.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5163 Cyber Physical Systems and Smart Grid
Prerequisites: ECEN 4503 or Departmental Permission.
Description: A comprehensive overview of advanced cyber-physical technologies and ideas that make the power grid smart. Topics covered include: basics of electric power systems; fundamentals of smart grids; the role of measurement, communications and monitoring technologies in smart grids; integrated applications of control and information advancements in a smart grid; Distributed Energy Resources (DERs) including renewable energy resources, energy storage systems, electric vehicles, and demand response; various functions and tools for managing smart grids; and interoperability, standards, and cyber security in smart grids.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5193 Power Economics and Regulation
Prerequisites: ECEN 3113 or Departmental Permission.
Description: Natural monopoly, regulated mono-polities. Power pricing. Deregulation and the Energy Policy Act of 1992. Bulk power markets, transmission access and wheeling. Economic dispatch and system operations. Security and reliability. Environmental externalities and Clean Air Act compliance. Procurement of new capacity and integrated resource planning. Co-generators and independent power producers.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5223 Digital Systems Testing
Prerequisites: Departmental Permission.
Description: Testing of combinational and sequential circuits. Test generation techniques. Design of reliable and testable circuits and systems. Testing for LSI and VLSI.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5233 Embedded Sensor Networks
Prerequisites: Departmental Permission.
Description: Analysis and design of wireless networks, including the integration of sensing, computation, and wireless communication within an embedded system. Mobile sensor networks and body sensor networks. Real world application and new innovations.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5253 Digital Computer Design
Prerequisites: ECEN 4233 or ECEN 4243 or Departmental Permission.
Description: Arithmetic algorithms and the design of the arithmetic/logic unit (ALU). Serial and parallel data processing; control and timing systems; microprogramming; memory organization alternatives; input/output interfaces. Same course as CS 5253.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5263 VLSI Digital Systems Design
Prerequisites: ECEN 4303 or Departmental Permission.
Description: Design of very large-scale digital systems on a single chip. Review of MOS technology. Design rules imposed by fabrication techniques. Systematic structures for control and data flow; system timing; highly concurrent systems. Experimental opportunities available.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5283 Computer Vision
Prerequisites: ECEN 4763 or Departmental Permission.
Description: Fundamental concepts and tools in computer vision. Image formation and camera calibration. Early vision: edge detection, feature extraction, texture analysis. Mid-level vision: clustering, segmentation and object detection. High-level vision: object recognition using principal component analysis (PCA) and video analysis by hidden Markov models (HMMs).
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5313 Analog Integrated Circuits
Prerequisites: ECEN 3314 or Departmental Permission.
Description: Advanced studies of analog CMOS IC design with an emphasis on EDA. Topics include bandgap reference, oscillators, PLL, linear regulators, DC-OC converters, low voltage, low power, and energy harvesting techniques.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5333 Semiconductor Devices
Prerequisites: ECEN 3314 or Departmental Permission.
Description: Semiconductor crystal structure and device fabrication, carrier distribution and transport, pn junction and diode, metal-semiconductor heterojunction, MOSFET, BJT and optoelectronic devices.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5363 Mixed-Signal Integrated Circuits
Prerequisites: ECEN 3314 or Departmental Permission.
Description: Analysis and design of CMOS mixed-signal IC for VLSI systems. Topics include comparators, switched-capacitor circuits, sample-and-hold, Nyquist and oversampling ADC/DAC, delta-sigma modulation, and digital calibration techniques.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5373 RF Microwave Circuit Design
Prerequisites: ECEN 4613 or Departmental Permission.
Description: Smith chart, single- and multi-port network, filter design, RF/microwave components and modeling, matching and biasing network, amplifier, oscillators and mixers.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5413 Optimal Control
Prerequisites: ECEN 4413 or Departmental Permission.
Description: Optimal control theory for modern systems design. Specification of optimum performance indices. Dynamic programming, calculus of variations and Pontryagin's minimum principle. Iterative numerical techniques for trajectory optimization. Same course as MAE 5413.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5433 Robotics Kinematics, Dynamics and Control
Prerequisites: ECEN 4413 or Departmental Permission.
Description: Kinematic and dynamic analysis of robot manipulators. Inverse kinematics, motion planning and trajectory generation. Industrial practice in robot servo control. Dynamics and control in the presence of constraints. Actuators and sensors. Force sensors and vision systems. Robotic force control and its applications in industry. Passivity-based control algorithms. Advanced control techniques for motion and force control. Same course as MAE 5433.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5463 Nonlinear System Analysis and Control
Prerequisites: ECEN 4413 or Departmental Permission.
Description: Failure of superposition of effects; phase-plane analysis; limit-cycles; Lyapunov stability; hyperstability and input-output stability; controllability and observability of nonlinear systems; feedback linearization; robust nonlinear control system design. Same course as MAE 5463. Course previously offered as ECEN 5723.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5473 Digital Control Systems
Prerequisites: ECEN 4413 or Departmental Permission.
Description: Input-output and state-space representation of linear discrete-time systems. Approximate methods in discrete-time representation. Stability methods. Controllability, observability, state estimation, and parameter identification. Design and analysis of feedback control system using frequency-domain and state-space methods. Introduction to optimal control. Same course as MAE 5473. Course previously offered as ECEN 6413.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5483 Advanced Mechatronics Design
Prerequisites: MAE 4733 or Departmental Permission.
Description: Optimizing C programming code for microcontrollers using the assembly language instruction set. RS-232 microcontroller communication protocol. Controller Area Network (CAN) communication protocol plus hands-on CAN bus development boards, advanced topics which could include but are not limited to sensor design, real time operating systems, and advanced communication protocols. Same course as MAE 5483.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5513 Stochastic Systems
Prerequisites: ECEN 4503 or Departmental Permission.
Description: Theory and applications involving probability, random variables, functions of random variables, and stochastic processes, including Gaussian and Markov processes. Operations on random variables, transformation of random variables, single and multiple random variables, correlation, power spectral density, and stationary and non-stationary random processes. Random sums and sequences. Response of linear systems to stochastic processes. State-space formulation and covariance analysis. Same course as MAE 5513.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5533 Modern Communication Theory
Prerequisites: ECEN 5513 or Departmental Permission.
Description: Noise as a random process, analog and digital signal detection in the presence of noise, optimum receiver design using signal space concepts and introduction to information theory. Trade-offs between bandwidth, signal-to-noise ratio and the rate of information transfer. Example system designs include earth satellite, deep space and terrestrial communication systems and computer communication networks.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5543 Data Transportation and Protection
Prerequisites: Departmental Permission.
Description: Data and its representation; finite field matrices, pseudorandom sequences; information protection; space division networks; synchronization; and channel and error control.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5553 Telecommunications Systems
Prerequisites: Departmental Permission.
Description: Surveys the ways and means that voice, data and video are moved long distances. Covers computer networks (Ethernet LAN's, Internet WAN's); telephone systems (PSTN, VoIP and cellular telephony); video (MPEG, H.323, and IPTV); and last mile delivery systems.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5573 Wireless Communication
Prerequisites: ECEN 5533 or Departmental Permission.
Description: Wireless channel characterization: large-scale and small scale fading. Techniques to combat fading; diversity techniques, coding techniques, CDMA, OFDM, MIMO. Advanced communication systems such as 5G and Beyond cellular systems, mmWave and Teraherz communications, massive MIMO, and UAV-assisted communications.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5613 Electromagnetic Theory
Prerequisites: ECEN 3623 or Departmental Permission.
Description: First graduate level treatment of classical electromagnetic theory. Wave equation, potential theory, boundary conditions. Rectangular, cylindrical and spherical wave functions. Conducting and dielectric guiding structures. Scattering and radiation. Introduction to numerical techniques.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5623 Antenna Theory
Prerequisites: ECEN 3623 or Departmental Permission.
Description: Fundamental antenna parameters, including directivity, efficiency, radiation resistance, and pattern. Analysis of dipole, loop, aperture, broad- band, and traveling wave antennas. Array theory. Introduction to numerical techniques used in modern antenna design.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5633 Radar Theory
Prerequisites: ECEN 4503 or Departmental Permission.
Description: Theoretical treatment of radar principles. Overview of radar systems and techniques, radar equation, integration of signals. Radar cross-section of single and multiple targets. Waveform design, resolution, ambiguities and accuracy. Range, speed and angular measurements. Detection of targets in noise. Statistical description of clutter. Signal processing techniques.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5643 Antennas and Propagation for Wireless Communications
Prerequisites: ECEN 4503 or Departmental Permission.
Description: Aspects of radiowave propagation for fixed and mobile communication systems. Review of Maxwell's equations and plane wave propagation, antenna principles. Reflection, refraction, diffraction, fading and scintillation, attenuation, ducting, diversity. Propagation in a cellular environment. Satellite communications.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5683 Biomedical Optics
Prerequisites: ECEN 4843 or Departmental Permission.
Description: Biomedical optics, also often termed as biophotonics, is highly interdisciplinary subject on applying light for diagnostic detection and manipulation of biological tissue. This course introduces fundamental concepts and principal technologies of biomedical optics or biophotonics to graduate students and upper-level undergraduate students. The course includes three parts: The first part discusses light-tissue interaction. The second part introduces approaches to modeling photon propagation in tissue. The third part details several representative light-based sensing and imaging technologies for probing biological tissues at different spatial, spectral, and temporal scales for either morphological or functional diagnosis. Topics of therapeutic use of light will also be discussed.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5713 Linear Systems
Prerequisites: ECEN 4413 or Departmental Permission.
Description: Introduction to the fundamental theory of finite-dimensional linear systems with emphasis on the state-space representation. Mathematical representations of systems; linear dynamic solutions; controllability, observability, and stability; linearization and realization theory; and state feedback and state observer. Same course as MAE 5713.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5733 Neural Networks
Prerequisites: ECEN 5713 or Departmental Permission.
Description: Introduction to mathematical analysis of networks and learning rules, and on the application of neural networks to certain engineering problems in image and signal processing and control systems. Same course as CHE 5733 and MAE 5733.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5743 Deep Learning
Prerequisites: ECEN 5733 or equivalent and Departmental Permission.
Description: Analysis, design, training and applications of deep neural networks. Topics include: fundamental deep network architectures, such as multilayer perceptrons, convolutional neural networks, recurrent neural networks and transformers; deep learning software frameworks, such as TensorFlow and PyTorch; application areas, such as image processing (e.g., object detection, object classification, image segmentation) and sequence processing (e.g., language translation, voice assistants, speech recognition, time series prediction).
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5763 Digital Signal Processing
Prerequisites: ECEN 4763 or Departmental Permission.
Description: Discrete-time signals and systems; transform analysis of linear systems; design and implementation of digital filters; analog to digital conversion, quantization effects, and oversampling; discrete Fourier transform and the FFT; Fourier analysis using the DFT; introduction to parametric signal modeling; and practical applications of digital signal processing.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5773 Intelligent Systems
Prerequisites: ECEN 5713 or Departmental Permission.
Description: Introduction to the state-of-the art intelligent control and system successfully deployed to industrial and defense applications. Emerging intelligent algorithms (e.g., NN, FS, GA, EP, DES); intelligent control architecture (e.g., bottom-up, top-down, seminotics); reinforcement learning and hybrid systems; and case studies and design projects. Same course as MAE 5773.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5783 Medical Imaging
Prerequisites: ECEN 4743 or ECEN 4763 or Departmental Permission.
Description: A comprehensive introduction to the physics and engineering foundations of the standard medical imaging modalities used today. Topics include radiation, radiation-interaction with matter, X-ray radiography, ultrasonography, X-ray computed tomography, image reconstruction and analysis, magnetic resonance imaging, nuclear radiation based imaging, and image monitoring aspects of radiation therapy. The fundamental mathematics underlying each imaging modality is reviewed and the hardware needed to implement each system is examined.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5793 Digital Image Processing
Prerequisites: ECEN 4763 or Departmental Permission.
Description: Digital image processing including image acquisition, enhancement, restoration, color image processing, morphological processing, segmentation, representation and description.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5803 Geometrical Optics
Prerequisites: PHYS 3213 or Departmental Permission.
Description: Foundations of geometrical optics, geometrical theory of optical imaging, geometrical theory aberrations, image forming instruments. Same course as PHYS 5123.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5823 Physical Optics
Prerequisites: PHYS 3213 or ECEN 4823 or ECEN 4843 or Departmental Permission.
Description: Multiple beam interference, diffractions, imaging, near field optical probes of matter, surface plasmons, light scattering from random media, optical coherence tomography- biomedical applications, negative materials, perfect lenses and super resolution. Same course as PHYS 5303.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5833 Fiber-Optic Communication Systems
Prerequisites: ECEN 4533 or Departmental Permission.
Description: The fundamentals of fiber-optic communication systems are described in detail. Fiber electromagnetic behaviors, laser and LED transmitters, photodetectors and semiconductor receivers and other hardware components are covered. System level design and integration concepts are covered including modulation schemes, multiplexing, dispersion and power budget, sampling, incoherent and coherent detection, error control, and network distribution. A historical framework shows how technical capabilities and growing communication needs forced fiber systems evolution.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5843 Microelectronic Fabrication
Prerequisites: ECEN 3314 or Departmental Permission.
Description: Contamination control and clean-room, vacuum systems, wafer manufacturing. Photolithography and alternative lithographic techniques. Physical and chemical vapor deposition, oxidation, etching, doping, packaging, formation of semiconductor devices and circuits. A series of Fabrication lab projects is conducted starting from bare silicon wafers to fabricate Optoelectronic circuits.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr
Additional Fees: ECEN Consummable Materials fee of $120 applies.

ECEN 5853 Ultrafast Optoelectronics
Prerequisites: ECEN 5833 or Departmental Permission.
Description: Principles in ultrafast lasers and terahertz radiation are discussed. Topics include generation, propagation, amplification, and measurement of femtosecond optical pulses. Generation, detection, and manipulation of terahertz waves as fundamentals to understand how time-domain spectroscopy and imaging work will be described. Selected advanced topics in ultrafast metamaterials and plasmonics will also be discussed.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 5923 Introduction to MEMS
Prerequisites: ECEN 5843 or Departmental Permission.
Description: Fundamentals of Microsystems. Topics include: energy transduction mechanisms, energy dissipation modeling, energy methods, mechanics of small scale, fabrication process design, micromachining, electronic interface.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 6000 Dissertation
Prerequisites: Consent of major professor.
Description: Independent research for students continuing graduate study beyond the level of the MS degree. Offered for variable credit, 1-12 credit hours, maximum of 36 credit hours.
Credit hours: 1-12
Contact hours: Contact: 1-12 Other: 1-12
Levels: Graduate
Schedule types: Independent Study
Department/School: Elec & Computer Engr

ECEN 6001 PhD Seminar Series
Prerequisites: Approval of ECEN department head.
Description: Seminar series for PhD studies and research.
Credit hours: 1
Contact hours: Lecture: 1 Contact: 1
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 6050 Preliminary PhD Research and Proposal
Prerequisites: Consent of adviser.
Description: Independent research and report of an advanced electrical engineering problem. Work performed serves as foundation of the oral PhD preliminary exam. Offered for fixed credit, 3 credit hours.
Credit hours: 3
Contact hours: Contact: 3 Other: 3
Levels: Graduate
Schedule types: Independent Study
Department/School: Elec & Computer Engr

ECEN 6060 Special Topics
Prerequisites: Advisor permission.
Description: Advanced engineering topics not normally included in existing courses. Repeat credit may be earned with different course subtitles assigned. Offered for variable credit, 1-6 credit hours, maximum of 6 credit hours.
Credit hours: 1-6
Contact hours: Contact: 1-6 Other: 1-6
Levels: Graduate
Schedule types: Independent Study
Department/School: Elec & Computer Engr

ECEN 6070 Advanced Directed Studies
Prerequisites: Admission into PhD program and consent of instructor.
Description: Investigation outside of the classroom of topics not normally covered in lecture courses. Offered for variable credit, 1-6 credit hours, maximum of 12 credit hours.
Credit hours: 1-6
Contact hours: Contact: 1-6 Other: 1-6
Levels: Graduate
Schedule types: Independent Study
Department/School: Elec & Computer Engr

ECEN 6123 Special Topics in Power Systems
Prerequisites: ECEN 5113.
Description: Selected relevant current topics related to power system operation and planning.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 6253 Advanced Topics in Computer Architecture
Prerequisites: ECEN 5253 or CS 5253.
Description: Innovations in the architecture and organization of computers, with an emphasis on parallelism. Topics may include pipelining, multiprocessors, data flow, and reduction machines. Same course as CS 6253.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 6263 Advanced VLSI Design and Applications
Prerequisites: ECEN 5223 and ECEN 5263.
Description: System timing. Designing testable integrated circuits. Specialized parallel processing architectures. Application examples.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 6453 Adaptive Control
Prerequisites: ECEN 5473 or ECEN 5713 or MAE 5473 or MAE 5713.
Description: Analysis and design of control techniques that modify their performance to adapt to changes in system operation. Review of systems analysis techniques, including state variable representations, linearization, discretization, covariance analysis, stability, and linear quadratic Gaussian design. On-line parameter estimation, model reference adaptive systems, self-tuning regulators, stable adaptive systems. Same course as MAE 6453. Course previously offered as ECEN 6450.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 6483 Robust Multivariate Control Systems
Prerequisites: ECEN 5713 or MAE 5713.
Description: Introduction to multivariable systems: SISO robustness vs. MIMO robustness; multivariable system poles and zeros; MIMO transfer functions; multivariable frequency response analysis; multivariable Nyquist theorem; performance specifications; stability of feedback systems; linear fractional transformations (LFT's); parameterization of all stabilizing controllers; structured singular value; algebraic ricatti equations; H2 optimal control; H-infinity controller design. Same course as MAE 6483.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 6523 Information Theory
Prerequisites: ECEN 5513 or consent of instructor.
Description: Mathematical theory of information (Shannon theory) including information measure and transmission rates and capacities. Source coding theory including algebraic and error-correcting codes. Design of waiver-forms for noise immunity. Information transfer in learning systems.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 6803 Photonics I: Advanced Optics
Prerequisites: ECEN 3813 or PHYS 3213 or consent of instructor.
Description: Advanced optics including spectral and time characteristics of detectors, characteristics of lasers, time, spectral and spatial parameters of laser emission, interferometric techniques, and nonlinear effects such as two-photon absorption and second and third harmonic generations. Emphasis on ultrashort laser pulses. Same course as CHEM 6803 & PHYS 6803.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 6810 Photonics II: THz Photonics and THz-TD
Prerequisites: ECEN 6803.
Description: Concepts and techniques of driving electronic circuitry with ultra short laser pulses to generate and detect freely propagating pulses of THz electromagnetic radiation using several operational research systems. Same course as CHEM 6810 & PHYS 6810. Course previously offered as ECEN 6811. Offered for fixed credit, maximum of 4 credit hours.
Credit hours: 1
Contact hours: Lab: 2 Contact: 2
Levels: Graduate
Schedule types: Lab
Department/School: Elec & Computer Engr

ECEN 6820 Photonics II: Spectroscopy II
Prerequisites: ECEN 6803.
Description: Operating principles and applications of laser spectroscopy of atoms, molecules, solids and complex fluids. Absorption, emission, photon correlation, coherence, time resolved Fourier transform. Raman spectroscopy and non-linear optical. Same course as CHEM 6820 & PHYS 6820. Course previously offered as ECEN 6821. Offered for fixed credit, maximum of 4 credit hours.
Credit hours: 1
Contact hours: Lab: 2 Contact: 2
Levels: Graduate
Schedule types: Lab
Department/School: Elec & Computer Engr

ECEN 6823 Advanced Optical Techniques
Prerequisites: ECEN 5853.
Description: State-of-the-art optical devices and research methodologies. Investigation and discussion of contemporary developments in non-linear optical devices and laser applications. Includes both analytical and experimental techniques.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 6830 Photonics II: Spectroscopy III
Prerequisites: ECEN 6803.
Description: Advanced spectroscopic instruments and methods used for investigation of semi-conductors and solid state material. Stimulated emission characterized both in wavelength and in time. Time-resolved fluorescence measurements. Multiphotonic excitations. Fast measuring techniques, including subnanosecond detectors, picosecond streak cameras, and ultra fast four-wave mixing and correlation techniques. Time-dependent photoconductivity measurements. Same course as CHEM 6830 & PHYS 6830. Course previously offered as ECEN 6831. Offered for 1 fixed credit hour, maximum of 4 credit hours.
Credit hours: 1
Contact hours: Lab: 2 Contact: 2
Levels: Graduate
Schedule types: Lab
Department/School: Elec & Computer Engr

ECEN 6840 Photonics III: Microscopy I
Prerequisites: CHEM 3553 or consent of instructor.
Description: The structure and imaging of solid surfaces. Basics of scanning probe microscopy (SPM). Contact and non-contact atomic force microscopy (AFM). Scanning tunneling microscopy (STM) in air. Same course as CHEM 6840 & PHYS 6840. Course previously offered as ECEN 6841. Offered for fixed credit hours, maximum of 4 credit hours.
Credit hours: 1
Contact hours: Lab: 2 Contact: 2
Levels: Graduate
Schedule types: Lab
Department/School: Elec & Computer Engr

ECEN 6843 Advanced Microelectronic Fabrication
Prerequisites: ECEN 5843.
Description: Photolithography, wet and dry etching, thermal and electron beam evaporation, photomask design using L-Edit, silicon devices processing, quartz devices processing, silicon-on-sapphire devices processing. GaAs devices processing and MEMS devices processing.
Credit hours: 3
Contact hours: Lecture: 3 Contact: 3
Levels: Graduate
Schedule types: Lecture
Department/School: Elec & Computer Engr

ECEN 6850 Photonics III: Microscopy II
Prerequisites: CHEM 3553 or consent of instructor.
Description: Advanced techniques of scanning probe microscopy (SPM). Magnetic force microscopy, Kelvin force microscopy, scanning probe microscopy (STM) in vacuum. Characterization of materials with SPM. Nanolithography with SPM. Device manufacturing and analysis. Same course as CHEM 6850 & PHYS 6850. Course previously offered as ECEN 6851. Offered for 1 fixed credit hour, maximum of 4 credit hours.
Credit hours: 1
Contact hours: Lab: 2 Contact: 2
Levels: Graduate
Schedule types: Lab
Department/School: Elec & Computer Engr

ECEN 6860 Photonics III: Microscopy III and Image Processing
Prerequisites: ECEN 5793.
Description: Digital image processing, including projects. Image acquisition and display, image enhancement, geometric operations, linear and nonlinear filtering, image restoration, edge detection, image analysis, morphology, segmentation, recognition, and coding/compression. Same course as CHEM 6860 & PHYS 6860. Offered for fixed credit hours, maximum of 4 credit hours.
Credit hours: 1
Contact hours: Lab: 2 Contact: 2
Levels: Graduate
Schedule types: Lab
Department/School: Elec & Computer Engr

ECEN 6870 Photonics IV: Synthesis and Devices I
Prerequisites: ECEN 6803 and ECEN 6840.
Description: Preparation of functional nanostructures and related optical/electronic devices. Physical and chemical methods of thin film deposition. Engineering of prototypes of light emitting diodes, sensors, optical limiting coatings, lithographic patterns. Same course as CHEM 6870 & PHYS 6870. Course previously offered as ECEN 6871. Offered for 1 fixed credit hour, maximum of 4 credit hours.
Credit hours: 1
Contact hours: Lab: 2 Contact: 2
Levels: Graduate
Schedule types: Lab
Department/School: Elec & Computer Engr

ECEN 6880 Photonics IV: Semiconductor Devices, Testing and Characterization
Prerequisites: ECEN 6803 and ECEN 6840.
Description: Test and characterization of semiconductor and optoelectronic devices. Hall effect, four point probe, CV and IV measurements, optical pump-probe, photoluminescence and electro-optics sampling. Same course as CHEM 6880 & PHYS 6880. Course previously offered as ECEN 6881. Offered for 1 fixed credit hour, maximum of 4 credit hours.
Credit hours: 1
Contact hours: Lab: 2 Contact: 2
Levels: Graduate
Schedule types: Lab
Department/School: Elec & Computer Engr

ECEN 6890 Photonics IV: Semiconductor Synthesis and Devices III
Prerequisites: ECEN 6803.
Description: Processing, fabrication and characterization of semiconductor optoelectronic devices in class 100/10000 cleanrooms. Cleanroom operation including general procedure for material processing and device fabrication. Device processing using a variety of processing such as mask aligner, vacuum evaporators and rapid thermal annealer. Testing using optical and electrical testing apparatus such as I-V, C-V, Hall, and optical spectral measurement systems. Same course as CHEM 6890 & PHYS 6890. Course previously offered as ECEN 6891. Offered for fixed 1 credit hour, maximum of 4 credit hours.
Credit hours: 1
Contact hours: Lab: 2 Contact: 2
Levels: Graduate
Schedule types: Lab
Department/School: Elec & Computer Engr