

**Electrical and Computer Engineering
Undergraduate Advising Handbook
for
ECE Undergraduate Students¹**

¹Revision Date: July 15, 2020

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Introduction

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 official degree sheets for the Bachelor of Science (BS) in Electrical Engineering (BSEE) or the BS in Computer Engineering (BSCpE) 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: **“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.”**

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. Once enrolled in ECEN 3714, Network Analysis, 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 and technologies of electrical engineering 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.

Students pursuing the BS degree in Electrical Engineering are required prior to graduation to have taken a set of area courses in a single sub-discipline in ECE. Sub-disciplines include a) communications (Com), control systems, and digital signal processing (DSP), b) electric power and energy, c) computer and digital, d) electronics and solid state, and e) microwaves and photonics. The set of area courses is listed in this handbook and includes one 3000 level course and three 4000 level courses. Students are encouraged to select an area that is closely aligned with

their career goals. ECE faculty can provide advice about the alignment of career goals with any given area. To facilitate a conversation between BSEE students and faculty, the following list provides a brief overview of each area:

- Communications: wireless technologies, internet, information theory, data networks, encryption, security, digital and analog modulation, encoding and decoding, noise, telecommunications, GPS
- Control Systems: Robotics, mechatronics, autonomous vehicles, embedded control, feedback, compensation, stability, neural networks, optimization, intelligent systems
- Digital Signal Processing: Machine vision, pattern and voice recognition, speech synthesis, video and image processing, digital filters, analog/digital interfaces, data mining, graphical processors
- Power and Energy: Generation, transmission, electric machines, protection, smart and micro-grids, power electronics, electric drives, electro-mechanical transducers, sustainability, renewable energy, energy storage, reliability, batteries, energy conversion and transformation
- Computers and Digital: Computer architectures, VLSI design, central and graphical processing units, networking, memory and storage devices, software engineering and coding, embedded controllers, computer arithmetic, internet-of-things, sequential and combinational logic, peripherals
- Electronics and Solid State: Transistors, diodes, semiconductors, microelectronics, transmitters, receivers, amplifiers, mixers, detectors, regulators, mixed-signal devices, filters, operational amplifiers, oscillators, instrumentation, high speed and low power devices, systems-on-a-chip
- Microwaves and Photonics: Radar, lasers, LIDAR, antennas, wireless transmission, fiber optics, THz communications, medical diagnostics and surgery, beamforming, wave scattering, electromagnetic interference, lumped and distributed circuits, optoelectronics, holography, LED's, photodetectors, imaging systems, spectroscopy

Students pursuing the BS degree in Computer Engineering are by default taking a set of area courses in Computers and Digital along with additional topics in computer science, including discrete mathematics, programming, data structures, and operating systems.

Students also have the option to pursue a dual degree in electrical engineering and computer engineering. This dual degree program requires 137 credit hours to complete (i.e., 12 credit hours beyond the BSCpE program). In principle, it can be completed in four years by taking approximately 17 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 highly encouraged to discuss the dual and “4+1” programs with their faculty and school advisers. These value-added programs have been devised to provide students a competitive edge in the workforce by giving them broader and deeper knowledge of the electrical and computer engineering disciplines.

Course advising sheets for the BSEE program, BSCpE program, and the dual degree program are available in this Handbook. Flow charts are also provided to show how these programs can be potentially completed in four years.

This handbook also lists the 2000, 3000, and 4000 level courses offered by the School along with their corresponding course catalog entries. 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 → Power and Energy
- B = 2 → Computers and Digital Electronics
- B = 3 → Analog Electronics and Solid State
- B = 4 → Control Systems
- B = 5 → Communications
- B = 6 → Microwaves and Electromagnetics
- B = 7 → Signal Processing
- B = 8 → Photonics
- 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.

A list of the ECE faculty is provided in this handbook along with their general area of specialization. In general, all faculty will be able to advise any undergraduate student, irrespective of the area of specialization selected by the student. However, students are encouraged to contact any faculty member to get detailed information about any area.

Electrical Engineering (124 CH): Course Advising Sheet¹

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 3233, ECEN 3314, ECEN 3513, ECEN 3613, ECEN 3714, ECEN 3903, ECEN 4013, ECEN 4024, ECEN 4503

II. EE Area Requirement (12 CH): Choose a set of area courses from columns A, B, C, D, or, E in the table below. (Substitutions may be allowed under extenuating circumstances with ECE approval.)

	A	B	C	D	E
	Com/Controls/ DSP	Power/Energy	Computer/ Digital	Electronics/ Solid State	Microwaves/ Photonics
EE Area Req. 1	ECEN 3723	ECEN 3723 or ECEN 3913	ECEN 3723 or ECEN 3913	ECEN 3913	ECEN 3913
EE Area Req. 2	ECEN 4413	ECEN 3113	ECEN 4213	ECEN 4313	ECEN 3623
EE Area Req. 3	ECEN 4523 or ECEN 4533	ECEN 4133	ECEN 4243	ECEN 4353	ECEN 4613 or ECEN 4823
EE Area Req. 4	ECEN 4763	ECEN 4153	ECEN 4303	ECEN 4613	ECEN 4353 or ECEN 4843

III. EE Breadth Requirement (9 CH): Choose three ECEN 4000 level courses. Exclusions or with ECE approval: ECEN 4010, ECEN 4030. (Other courses, 3000 level or above, in engineering, engineering science, math, physics, chemistry, computer science, or statistics may be allowed with ECE approval.)

IV. Controlled Elective (3 CH): Choose a) ENSC 2123, ENSC 2143, ENSC 2213, ENSC 3233, or ENSC 3313, b) ENGR 4060 (CEAT Study Abroad), 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):

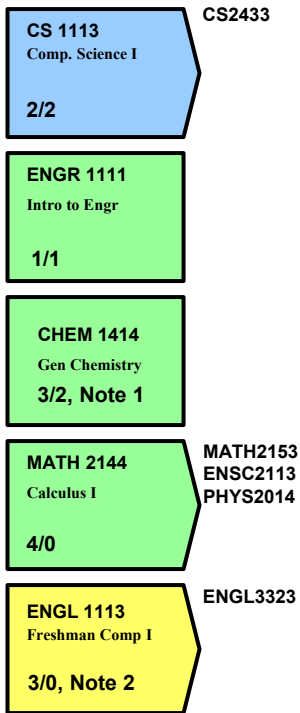
- All ENGR Courses
- ECEN 3020, ECEN 4030

¹ Revision Date: May 1, 2020

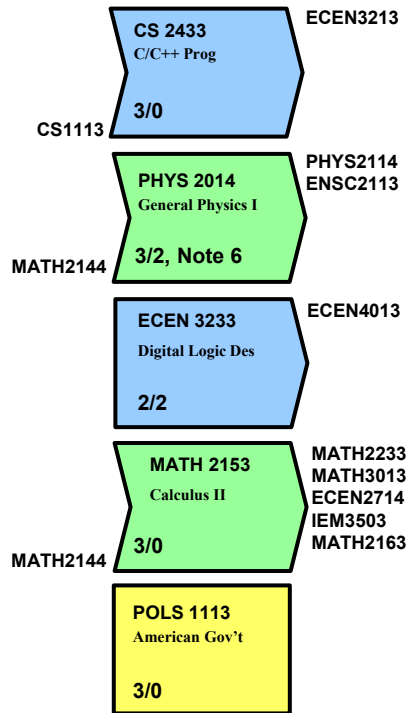
- BAE 4001, BAE 4012, BAE 4400
- CHEM 4990
- CIVE 4010, CIVE 4041, CIVE 4043
- CS 3570, CS 4570, CS 4993
- IEM 4010, IEM 4020, IEM 4913, IEM 4931
- MAE 4010, MAE 4342, MAE 4344, MAE 4353, MAE 4354, MAE 4363, MAE 4374
- MATH 3403, MATH 3603, MATH 3910, MATH 3933, MATH 4033, MATH 4590, MATH 4900, MATH 4910
- PHYS 4010, PHYS 4712, PHYS 4993
- STAT 4053, STAT 4063, STAT 4910, STAT 4981, STAT 4991, STAT 4993

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. Of these, 3 CH must meet the International Dimensions “I” component and 3 CH must meet the Diversity “D” component.

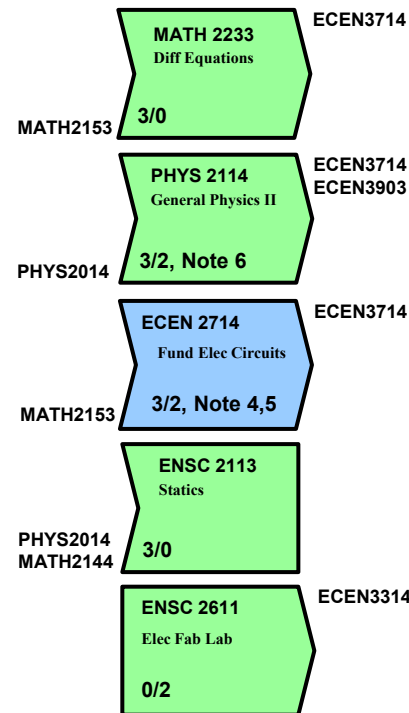
Semester 1 15 Credit Hours



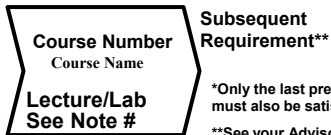
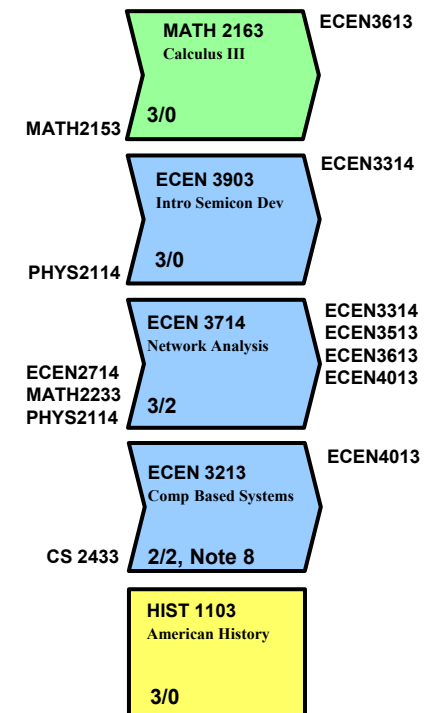
Semester 2 16 Credit Hours



Semester 3 15 Credit Hours



Semester 4 16 Credit Hours



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.

Prerequisites*



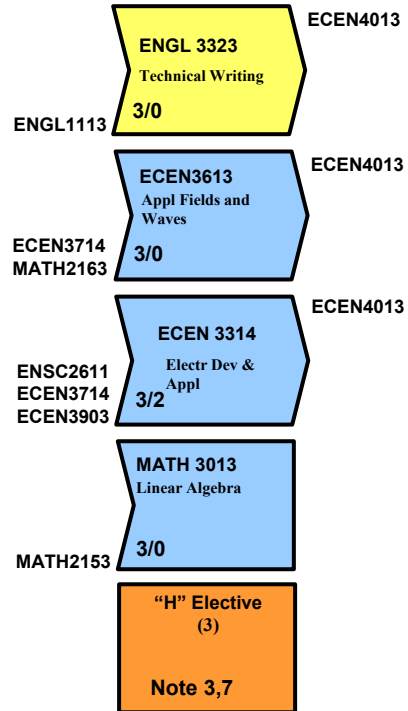
Suggested Course Plan

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.

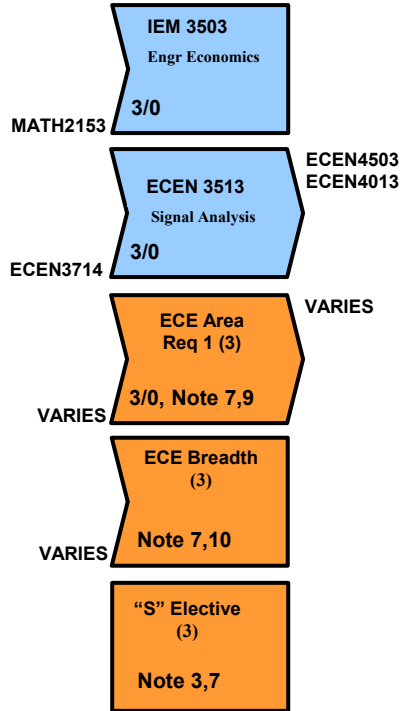
NOTES:

- 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) ECEN 2714 replaces ENSC 2613 effective fall 2018.
- 5) MATH 2233 and PHYS 2114 must be taken prior to or at the same time as ECEN 2714.
- 6) General Physics I and II are key prerequisites and should be taken at the earliest possible time.
- 7) Must be at least 3 SCH.
- 8) ECEN 3213 replaces ENSC 3213.
- 9) 12 SCH during the junior/senior year to meet ECE Area Requirement (Area Req) on the EE Course Advising Sheet.
- 10) 9 SCH during the junior/senior year to meet the ECE Breadth requirement on the EE Course Advising Sheet.
- 11) 3 SCH during the junior/senior year to meet the Controlled Elective requirement on the EE Course Advising Sheet.

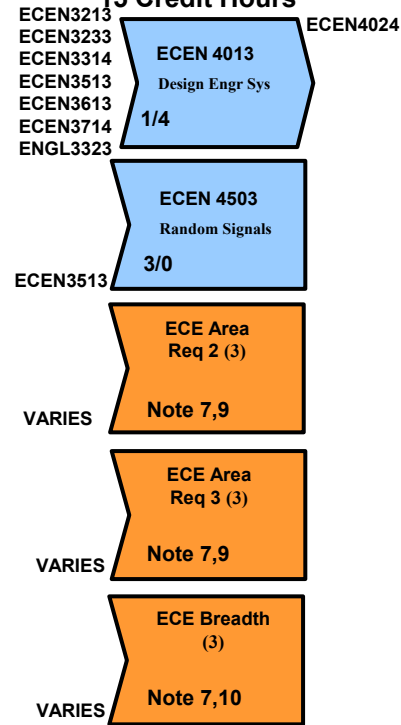
Semester 5 16 Credit Hours



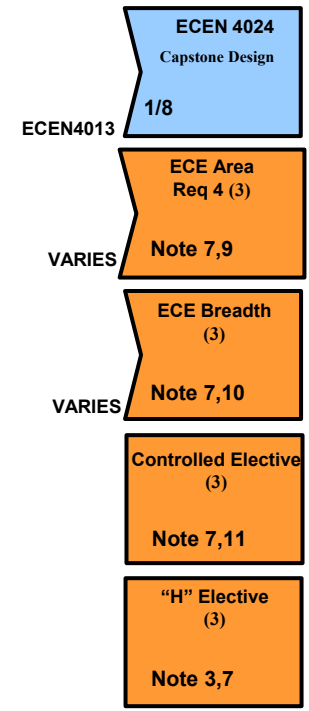
Semester 6 15 Credit Hours



Semester 7 15 Credit Hours



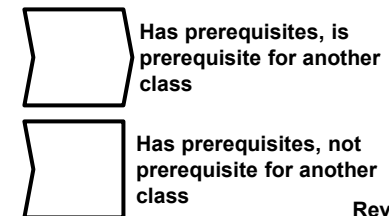
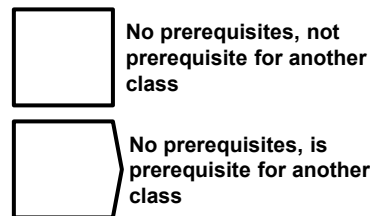
Semester 8 16 Credit Hours



• **This flowchart is only an advising instrument.** When conflicts occur, the official 2020-2021 Degree Requirement Sheet takes precedence. Always check for the most current version of this flowchart.

• Be sure to pay careful attention to the prerequisite requirements, grade requirements, and other official information on Banner. Some prerequisites also have minimum grade requirements. Grade requirements are not shown on this flowchart.

• Consult your Advisor if you have any questions or need clarification.



Computer Engineering (125 CH): Course Advising Sheet¹

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 4283.
- MATH 2144, MATH 2153, MATH 2233, MATH 2163, MATH 3013
- CHEM 1414, PHYS 2014, PHYS 2114
- ECEN 2714, ECEN 3213, ECEN 3233, ECEN 3314, ECEN 3513, ECEN 3613, ECEN 3714, ECEN 3903, ECEN 4013, ECEN 4024, ECEN 4213, ECEN 4243, ECEN 4303, ECEN 4503

II. CpE Breadth Requirement (6 CH): Choose any two ECEN 4000 level courses. Exclusions or with ECE approval: ECEN 4010, ECEN 4030. (Other courses, 3000 level or above, in engineering, engineering science, math, physics, chemistry, computer science, or statistics may be allowed with ECE approval.)

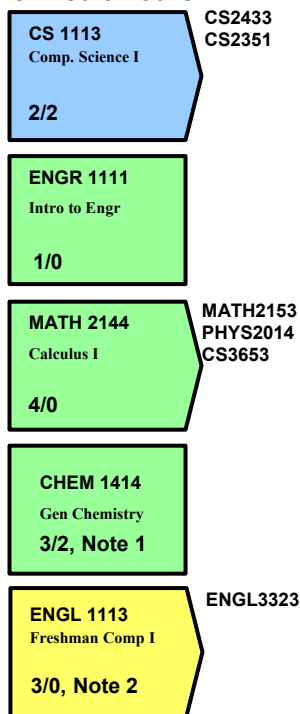
III. Controlled Elective (3 CH): Choose a) ENSC 2113, ENSC 2123, ENSC 2143, ENSC 2213, ENSC 3233, or ENSC 3313, b) ENGR 4060 (CEAT Study Abroad), or c) any course, 3000 level or above from ECEN, BAE, MAE, CIVE, IEM, PHYS, MATH, CHEM, STAT, or CS. Exclusions or with ECE approval (and in some cases, approval from other departments):

- All ENGR Courses
- ECEN 3020, ECEN 4030
- 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

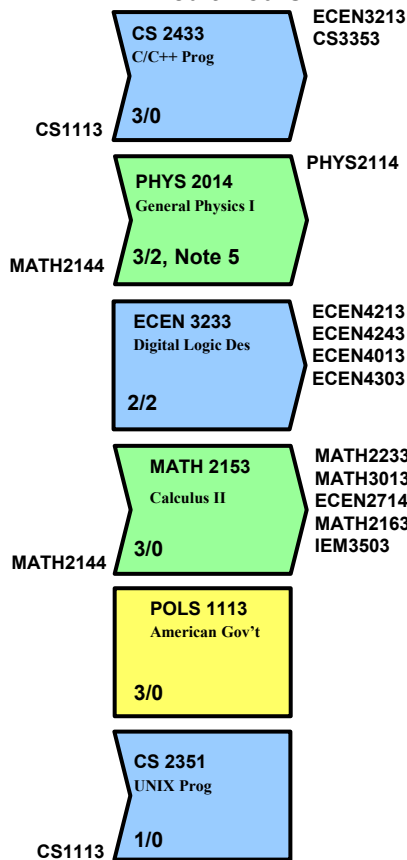
IV. Humanities, Social Science, International, & Diversity Electives (9 CH): A total of at least 6 credits designated as “H” and 3 credits designated as “S” is required. Of these, 3 CH must meet the International Dimensions “I” component and 3 CH must meet the Diversity “D” component.

¹ Revision Date: May 1, 2020

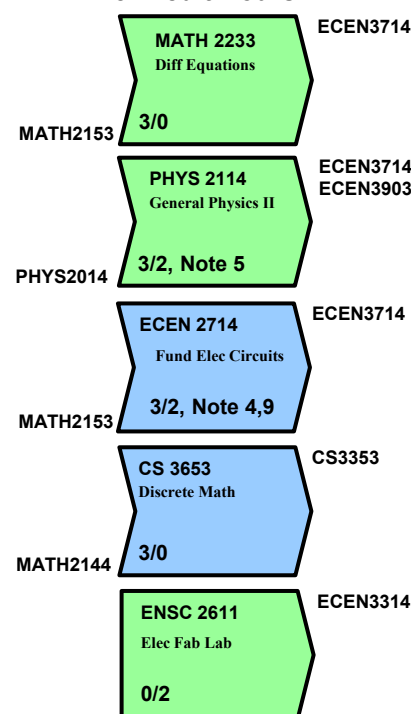
Semester 1 15 Credit Hours



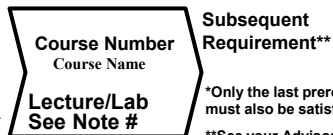
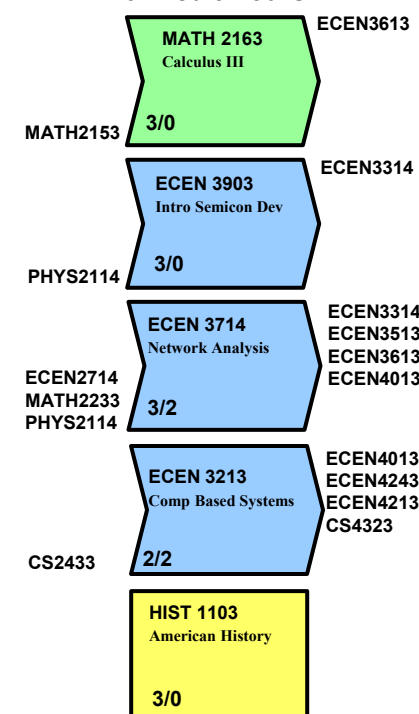
Semester 2 17 Credit Hours



Semester 3 15 Credit Hours



Semester 4 16 Credit Hours



*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.

Prerequisites*



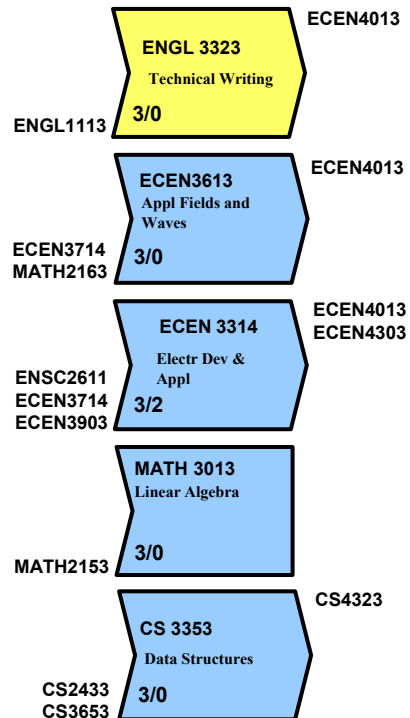
NOTES:

- 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" are required. Of these, 3 hrs must meet the International Dimension "I" component and 3 hrs must meet the Diversity "D" component.
- 4) ECEN 2714 replaces ENSC 2613 effective fall 2018.
- 5) General Physics I and II are key prerequisites and should be taken at the earliest possible time.
- 6) 6 SCH during the junior/senior year to meet the CpE Breadth requirement on the CpE Course Advising Sheet.
- 7) Must be at least 3 SCH.
- 8) 3 SCH during the junior/senior year to meet the Controlled Elective requirement on the CpE Course Advising Sheet.
- 9) MATH 2233 and PHYS 2114 must be taken prior to or at the same time as ECEN 2714.
- 10) Either CS 4323 or ECEN 4283 (if not previously used) is acceptable. Refer to the CpE Course Advising Sheet.

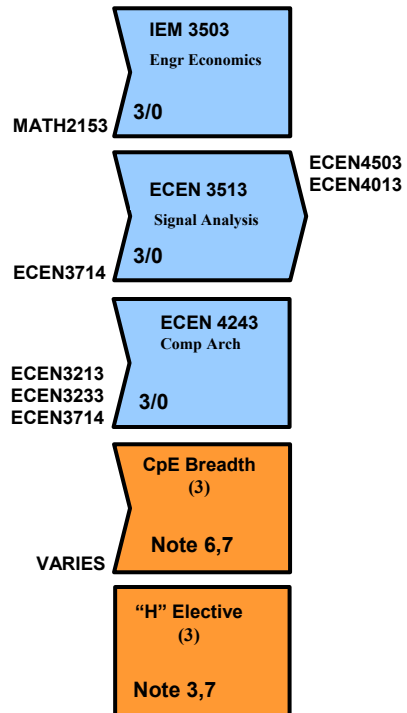
Suggested Course Plan

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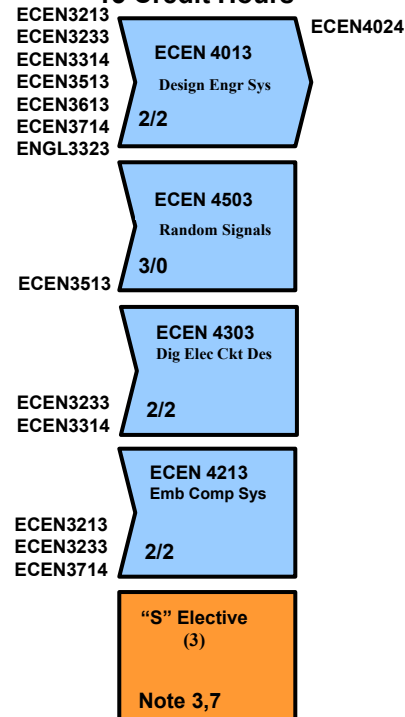
Semester 5 16 Credit Hours



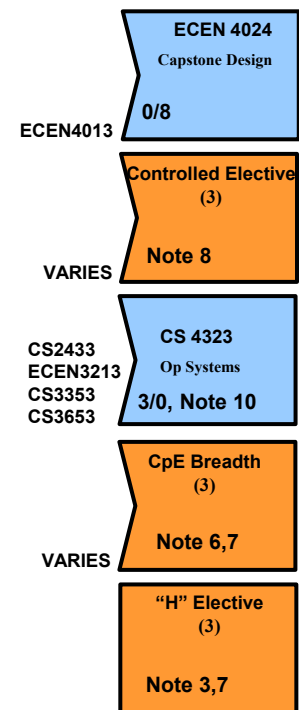
Semester 6 15 Credit Hours



Semester 7 15 Credit Hours



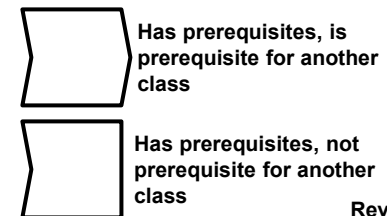
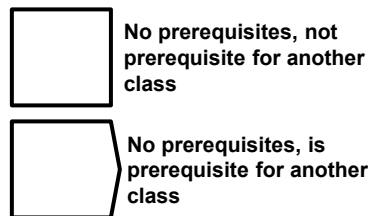
Semester 8 16 Credit Hours



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• Be sure to pay careful attention to the prerequisite requirements, grade requirements, and other official information on Banner. Some prerequisites also have minimum grade requirements. Grade requirements are not shown on this flowchart.

• Consult your Advisor if you have any questions or need clarification.



Computer Engineering and Electrical Engineering Dual Degree (137 CH)

Course Advising Sheet¹

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 4283.
- MATH 2144, MATH 2153, MATH 2233, MATH 2163, MATH 3013
- CHEM 1414, PHYS 2014, PHYS 2114
- ECEN 2714, ECEN 3213, ECEN 3233, ECEN 3314, ECEN 3513, ECEN 3613, ECEN 3714, ECEN 3903, ECEN 4013, ECEN 4024, ECEN 4213, ECEN 4243, ECEN 4303, ECEN 4503

II. EE Area Requirement (12 CH): Choose a set of area courses from columns A, B, D, or, E in the table below. (Substitutions, except ECEN 32XX and ECEN 42XX computer engineering courses, may be allowed under extenuating circumstances with ECE approval.)

	A	B	C	D	E
	Com/Controls/ DSP	Power/Energy	Computer/ Digital	Electronics/ Solid State	Microwaves/ Photonics
EE Area Req. 1	ECEN 3723	ECEN 3723 or ECEN 3913	ECEN 3723 or ECEN 3913	ECEN 3913	ECEN 3913
EE Area Req. 2	ECEN 4413	ECEN 3113	ECEN 4213	ECEN 4313	ECEN 3623
EE Area Req. 3	ECEN 4523 or ECEN 4533	ECEN 4133	ECEN 4243	ECEN 4353	ECEN 4613 or ECEN 4823
EE Area Req. 4	ECEN 4763	ECEN 4153	ECEN 4303	ECEN 4613	ECEN 4353 or ECEN 4843

III. EE/CpE Breadth Requirement (6 CH): Choose one ECEN 4000 level courses. Exclusions or with ECE approval: ECEN 4010, ECEN 4030. (Other courses, 3000 level or above, in engineering, engineering science, math, physics, chemistry, computer science, or statistics may be allowed with ECE approval.)

IV. Controlled Elective: Automatically satisfied under the EE requirement when ENSC 2113 is completed; see Section I.

¹ Revision Date: July 15, 2020

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. Of these, 3 CH must meet the International Dimensions “I” component and 3 CH must meet the Diversity “D” component.

ECEN Courses for the BSEE and BSCpE Degrees

- ECEN 2714 - Fundamentals of Electric Circuits
- ECEN 3113 - Energy, Environment and Economics
- ECEN 3213 – Computer Based Systems in Engineering
- ECEN 3233 - Digital Logic Design
- ECEN 3314 - Electronic Devices and Applications
- ECEN 3513 - Signal Analysis
- ECEN 3613 – Applied Fields and Waves I
- ECEN 3623 – Applied Fields and Waves II
- ECEN 3714 - Network Analysis
- ECEN 3723 - Systems I
- ECEN 3903 - Introduction to Semiconductor Devices
- ECEN 3913 - Solid State Electronic Devices
- ECEN 4013 - Design of Engineering Systems
- ECEN 4024 - Capstone Design
- ECEN 4133 - Power Electronics
- ECEN 4153 - Power System Analysis and Design
- ECEN 4213 - Embedded Computer Systems Design
- ECEN 4233 - High Speed Computer Arithmetic
- ECEN 4243 - Computer Architecture
- ECEN 4273 - Software Engineering
- ECEN 4283 - Computer Networks
- ECEN 4303 - Digital Integrated Circuit Design
- ECEN 4313 - Linear Electronics Circuit Design
- ECEN 4353 - Communication Electronics
- ECEN 4413 - Automatic Control Systems
- ECEN 4503 - Random Signals and Noise
- ECEN 4523 - Communication Theory
- ECEN 4533 - Data Communications
- ECEN 4613 - Microwave Engineering
- ECEN 4703 - Active Filter Design
- 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

ECE Faculty Contact List

Power and Energy

- Prof. Nishantha Ekneligoda, 204 GAB (nishantha.ekneligoda@okstate.edu)
- Prof. Hamidreza Nazaripouya, 219 GAB

Computer Engineering

- Prof. Cal Latino, 209 GAB (carl.latino@okstate.edu)
- Prof. Bingzhe Li, 206 GAB
- Prof. Weihua Sheng, 211 GAB (weihua.sheng@okstate.edu)
- Prof. James Stine, 215B GAB (james.stine@okstate.edu)

Electronics

- Prof. Wooyeol Choi, 210 GAB (wchoi@okstate.edu)
- Prof. John Hu, 222 GAB (john.hu@okstate.edu)
- Prof. Ickhyun Song, 203 GAB (isong@okstate.edu)

Control Systems, Communications and Signal Processing

- Prof. Sabit Ekin, 223 GAB (sabit.ekin@okstate.edu)
- Prof. Guoliang Fan, 220 GAB (guoliang.fan@okstate.edu)
- Prof. Keith Teague, 217 GAB (teague@okstate.edu)
- Prof. Gary Yen, 205 GAB (gyen@okstate.edu)

Microwaves and Photonics

- Prof. Chuck Bunting, 206 GAB (reverb@okstate.edu)
- Prof. John O'Hara, 224 GAB (oharaj@okstate.edu)
- Prof. Daqing Piao, 218 GAB (daqing.piao@okstate.edu)
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