(2013-) 2019 Electrical Engineering Program

Electrical Engineering and Computer Science Department
Undergraduate Advising Office
3415 EECS Bldg., eceadvising@umich.edu, 734.763.2305

Getting Advice and Information:
If you are an EE major or considering becoming one, we recommend that you **see an EE advisor every term** even if you know what courses you want to take. Don't rely on rumors and advice from your friends when you have academic questions—**always** check with an advisor first. Frequent meetings with an advisor will help ensure that you get the most out of your education here and that there are no surprises when you apply for your diploma.

- To schedule an appointment with an advisor, visit **http://www.eecs.umich.edu/eecs/undergraduate**
- Check the EECS undergraduate programs web page, **http://www.eecs.umich.edu/eecs/undergraduate** for information about class selection, registration procedures, course offerings, book lists, time schedules, advising hours, and career information.
- You may also e-mail the EECS Undergraduate Advising Office at **eceadvising@umich.edu**, or the EE Chief Program Advisor at **eeadvisor@umich.edu**.

EECS Grading & Repeat Policies
In order to receive EE program credit for any math, physical science, electrical engineering, or flexible technical elective, a student must receive a grade of C or better in the course. Any required course for which a student receives a grade below a C must be repeated. Students are limited to attempting each of the three 200-level courses (EECS 203, EECS 280, EECS 281) at most twice. An attempt includes, but is not limited to, a notation of any letter grade (A-F), withdraw (W), pass/fail (P/F), transfer (T), or incomplete (I) posted on the U-M transcript.

College of Engineering Policies:

- **Intellectual Breadth** The rules about Intellectual Breadth requirements are complex and not always intuitive. If you have questions, please contact an EECS Undergraduate Advising Office. See the CoE Bulletin for details: **https://bulletin.engin.umich.edu/ug-ed/reqs/ - subnav-11**
- **Pass/Fail** is only allowed for intellectual breadth and free electives. The limit on pass/fail is 14 credits total and a maximum of 2 pass/fail courses per term (1 during half-terms like spring or summer).
- **Transfer credit:** The College of Engineering maintains a list of approved transfer courses from many other institutions at **http://apps.engin.umich.edu/equivalencies/**. Courses that do not appear on this list may still transfer but will need to be reviewed. Please contact the EECS Undergraduate Advising Office with questions about EECS transfer credit. *You will need to take 50 credits hours (including 30 hours of 300-level or above of technical credits) on the Ann Arbor campus in order to earn an Electrical Engineering degree from UM-Ann Arbor.*

This handout covers rules and advice for the EE program as of the 2018 - 2019 academic year. Your program is determined by the rules that were in effect when you entered the College of Engineering. Please contact the EECS Undergraduate Advising Office with any questions.

(2013-) 2019 Electrical Engineering Program Sample Schedule

	Credit Hours	Terms							
		1	2	3	4	5	6	7	8
Subjects Required by all programs (55 hrs.)									
[1]Mathematics 115, 116, and 216	12	4	4	4		-	-	-	-
Mathematics 215	4	-	-	-	4	-	-	-	-
ENGR 100	4	4	-	-	-	-	-	-	-
ENGR 101	4	-	4	-	-	-	-	-	-
Chemistry 125/126/130 or Chemistry 210/211	5	5	-	-	-	-	-	-	-
Physics 140 with Lab 141; 240 with Lab 241	10	-	5	5	-	-	-	-	-
Intellectual Breadth	16	4	4	4	4	-	-	-	-
Program Subjects (29 hrs.)									
EECS 215, Introduction to Circuits	4	-	-	4	-	-	-	-	-
EECS 216, Signals and Systems	4	-	-	-	4	-	-	-	-
[2]EECS 230, Electromagnetics I	4	-	-	-	-	4	-	-	-
EECS 280, Programming and Intro. Data Structures	4	-	-	-	4	-	-	-	-
[3]EECS 320, Intro. to Semiconductor Device Theory	4	-	-	-	-	4	-	-	-
[3,4]EECS 301, Probabilistic Methods in Engineering	4	-	-	-	-	-	4	-	-
[5]TCHNCLCM 300	1	-	-	-	1	-	-	-	-
[5]TCHNCLCM 496 and EECS 496	4	-	-	-	-	-	-	-	4
Technical Electives (33 hrs.)									
[6]Flexible Technical Electives	10	-	-	-	-	3	-	4	3
[7]Upper Level EE Technical Electives	19	-	-	-	-	4	8	7	-
[8]Major Design Experience	4	-	-	-	-	-	-	-	4
Free Electives (11 hrs.)	11	-	-	-	-	-	4	4	3
Total	**128**	**17**	**17**	**17**	**17**	**15**	**16**	**15**	**14**

[1] EE students are advised to take MATH 216 before MATH 215 as EECS 216 is to be preceded or accompanied by MATH 216.

[2] EE students are advised to take EECS 230 no later than the fifth semester.

[3] EE students are advised to take EECS 320 and EECS 301 no later than the sixth semester.

[4] EE students may select only EECS 301 to fulfill this requirement. At most 4 credits of undergraduate probability may be applied towards the BSE-EE degree requirements. *MATH 425 will not suffice as a pre-requisite for any class that requires EECS 301.*

[5] Technical Communication: TCHNCLCM 300 must be taken before EECS 496. It is advised to take TCHNCLCM 496 and EECS 496 concurrently with the Major Design (MDE) course.

[6] Flexible Technical Electives (FTE): The flexible technical elective requirement may be fulfilled by taking *selected* courses in EECS, other engineering departments, biology, chemistry, math or physics. See the FTE section of this document for more information.

[7] Upper Level EE Technical Electives: At least 19 credits from the approved list. Courses must be chosen from at least two categories, and 7 of these credits must be at the 400-level or higher. Categories: (i) Biomedical; (ii) Circuits & Solid State; (iii) Communication, Signals & Systems; (iv) Computers; (v) Electromagnetics & Optics; (vi) Power.

[8] Major Design Experience: Pre-approved courses: EECS 411, 413, 425, 427, 430, 438, 452, 470, 473; other courses that are MDEs in other engineering programs may be acceptable with prior approval of the Chief Program Advisor. EE students pursuing a pre-approved non-EE MDE are required to complete 23 credits of Upper Level EE Electives. It is advised that students enroll concurrently in EECS 496, TCHNCLCM 496 and the MDE course.

(2013-) 2019 Electrical Engineering Program
Program Requirements

B.S. Electrical Engineering Program
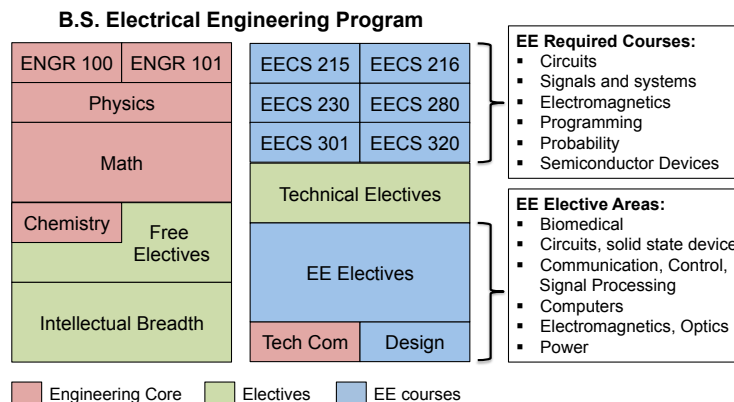
Overview of B.S. E.E. program requirements and approximate representation of credit hours and chronological progression (top to bottom, left to right)

Electrical Engineering Program Requirements:

1. **Program Core Courses:** All of the following courses are required (29 credits total):

   a. Electrical Engineering Core: EECS 215 (Intro. to Electronic Circuits), EECS 216 (Intro. to Signals and Systems), EECS 280 (Programming and Introductory Data Structures), EECS 230 (Electromagnetics I), EECS 320 (Intro. to Semiconductor Devices)

   b. Probabilistic Methods: EECS 301

   c. Technical Communications: TCHNCLCM 300 (1 credit) and TCHNCLCM 496 (2 credits)

   d. Engineering professionalism: EECS 496 (2 credits)

2. **Technical Electives:** A minimum of 33 additional credits of technical electives are required:

   a. At least 19 credits from the approved *Upper Level EE Technical Electives.* Courses must be chosen from at least two categories, and 7 of these credits must be at the 400-level or higher. Categories: (i) Biomedical; (ii) Circuits & Solid State; (iii) Communication, Control & Signal Processing; (iv) Computers; (v) Electromagnetics & Optics; (vi) Power.

   b. *Major Design Experience (MDE):* The MDE is a capstone design project taken during one of your final two terms. It is comprised of three courses, which should be taken concurrently: an MDE design project course, EECS 496 and TCHNCLCM 496.

   The following is a list of approved MDE courses: EECS 411, EECS 413, EECS 425, EECS 427, EECS 430, EECS 438, EECS 452, EECS 470, EECS 473.

   In addition to the above list of approved MDE courses, you may request special permission from the Chief Program Advisor (CPA) to use a senior design project course from another program, including ENGR 455. If approved, you will need to complete an additional 4 credits of Upper Level EE Electives for a total of 23 credits of Upper Level EE Electives.

   c. The remainder of the 33 technical elective credits (10 if the minimum number of Upper Level Electives are taken) may be chosen from the approved *Flexible Technical Electives.* These are courses in engineering, mathematics, or science that are approved as appropriate for EE students.

(2013-) 2019 Electrical Engineering Program
Upper Level EE Technical Electives

Upper-Level EE Electives – minimum 19 credits. Courses must be chosen from at least two categories; at least 7 credits must be at the 400-level or higher. EE students pursuing a pre-approved non-EE MDE are required to complete six Upper-Level EE Technical Electives.

Select from the following list of approved courses. EECS 498 will be considered on a case-by-case basis by the CPA. Courses with an asterisk (*) are among the list of MDE courses, where credit may be received as either and Upper-Level EE Elective OR an MDE course.

Biomedical
EECS 417: Electrical Biophysics
EECS 458: Biomedical Instrumentation and Design

Circuits & Solid State
EECS 311: Electronic Circuits
EECS 312: Digital Integrated Circuits
EECS 413*: Monolithic Amplifier Circuits
EECS 414: Introduction to MEMS
EECS 421: Properties of Transistors
EECS 423: Solid-State Device Laboratory
EECS 425*: Integrated Microsystems Laboratory
EECS 427*: VLSI Design I
EECS 428: Introduction to Quantum Nanotechnology
EECS 429: Semiconductor Optoelectronic Devices

Communication, Control & Signal Processing
EECS 351: Intro. Digital Signal Processing
EECS 442: Computer Vision
EECS 444: Analysis of Societal Networks
EECS 452*: Digital Signal Processing Design Lab.
EECS 453: Appl. Matrix Algorithms for Sig. Proc.
EECS 455: Wireless Communication Systems
EECS 460: Control Systems Analysis & Design
EECS 461: Embedded Control Systems
EECS 464: Hands-on Robotics

Computers
EECS 270: Introduction to Logic Design
EECS 370: Computer Architecture
EECS 373: Design of Microprocessor Based Systems
EECS 376: Foundations of Computer Science
EECS 445: Introduction to Machine Learning
EECS 470*: Computer Architecture
EECS 473*: Advanced Embedded Systems
EECS 475: Introduction to Cryptography
EECS 477: Introduction to Algorithms
EECS 478: Logic Circuit Synthesis and Optimization

Electromagnetics & Optics
EECS 330: Electromagnetics II
EECS 334: Principles of Optics
EECS 411*: Microwave Circuits I
EECS 430*: Wireless Link Design
EECS 434: Principles of Photonics
EECS 438*: Advanced Lasers and Optics Laboratory

Power
EECS 418: Power Electronics
EECS 419: Electric Machinery and Drives
EECS 463: Power Systems Design and Operation

Note: If you have declared EE before September 1, 2015, and were intending to use EECS 451 to satisfy the 4XX level EE degree requirements, you will be allowed to count EECS 351 towards satisfying 4 credits of 4XX upper-level EE course work.

Major Design Experience (one course) – minimum 4 credits
Technical Communications 496 AND EECS 496 should be elected concurrently with one of the MDE courses listed below. Note that some courses are not offered every semester.

Number	Title	Pre-Requisites	Semester
EECS 411	Microwave Circuits I	EECS 230 & [311 or 330]	Fall
EECS 413	Monolithic Amplifier Circuits	EECS 311 & EECS 320	Fall
EECS 425	Integrated Microsystems Lab	EECS 311 or EECS 312 or EECS 414	Winter
EECS 427	VLSI Design I	EECS 270 & EECS 312	Fall & Winter
EECS 430	Wireless Link Design	EECS 330 & senior standing	Winter
EECS 438	Advanced Lasers and Optics Lab	EECS 334 or EECS 434	Winter
EECS 452	Digital Signal Processing Lab	EECS 280 & EECS 216 & [351 or 455]	Fall & Winter
EECS 470	Computer Architecture	EECS 270 & EECS 370	Fall & Winter
EECS 473	Advanced Embedded Systems	EECS 373 & [215 or 281]	Fall

(2013-) 2019 Electrical Engineering Program
Flexible Technical Electives

Flexible Technical Electives – minimum 10 credits

Other courses may be acceptable with prior approval of the Chief Program Advisor. The basic standard is that a class which you are proposing as an FTE should involve at least as much technical content as the classes on this list. A rough guideline is that it should involve the use of college-level mathematics. If little mathematics beyond arithmetic or basic algebra is involved, it is unlikely to be approved. Courses that involve only qualitative reasoning are not likely to be approved. For 500-level courses, see CPA. **All tutoring and seminar courses are excluded.**

*Directed Study Rule: Up to 4 credit hours of independent study (EECS 399, EECS 499, ENGR 355, ENGR 455 or other technical department's independent study courses) may be used as Flexible Technical Electives. The ENGR 455 credits approved to fulfill the Major Design Experience requirement are exempt from this Directed Study Rule.

Aerospace Engineering

AEROSP 215	Intro to Solid Mechanics & Aerospace Structures	300-level & above except 495 (see Directed Study Rule)
AEROSP 225	Intro to Gas Dynamics	

Astronomy

ASTRO 404	Galaxies and the Universe (3 cr.)

Biology

BIOLOGY 305	Genetics	Any 400-level & above (see Directed Study Rule)

Biomedical Engineering

BIOMEDE 221	Biophysical Chemistry	400-level & above (see Directed Study Rule)
BIOMEDE 231	Intro to Biomechanics	

Chemical Engineering

CHE 230	Material & Energy Balances	300-level & above, CHE 490 subject to Directed Study Rule

Chemistry

CHEM 210	Structure and Reactivity I	CHEM 241	Introduction to Chemical Analysis (2 cr.)
CHEM 211	Investigations in Chemistry (1 cr.)	CHEM 242	Intro. to Chemical Analysis Lab. (2 cr.)
CHEM 215	Structure and Reactivity II (3 cr.)	CHEM 260	Chemical Principles (3 cr.)
CHEM 216	Synth. & Characterization of Org. Compounds (2 cr.)	300-level or higher (see Directed Study Rule)	
CHEM 230	Physical Chemical Principles and Applications (3 cr.)		

Civil and Environmental Engineering

CEE 211	Statics and Dynamics	CEE 230	Energy and Environment
CEE 212	Solid and Structural Mechanics	CEE 265	Sustainable Engineering Practices
		300-level & above (CEE 490, see Directed Study Rule)	

Climate and Space Sciences

AOSS 320	Earth System Evolution	AOSS 323	Earth System Analysis
AOSS 321	Earth System Dynamics		

Economics

ECON 401	Intermediate Microeconomic Theory	ECON 409	Game Theory
ECON 402	Intermediate Macroeconomic Theory	ECON 452	Intro. to Statistics and Econometrics II

Electrical Engineering and Computer Science

EECS 203	Discrete Mathematics	EECS 281	Data Structures and Algorithms
EECS 250 (NA 202)	Electronic Sensing Systems	EECS 285	A Programming Language or Computer System (2 cr)
		300-level & above (except EECS 314, 402, 403, 406, 409, 410, and 495), 399 and 499 subject to Directed Study Rule	

Engineering

ENGR 355*	Multidisciplinary Engineering Design I	ENGR 455*	Multidisciplinary Engineering Design II

Entrepreneurship

ENTR 390*	*Section 013 only* TechLab MCity (Volker Sick) (see Directed Study Rule)

Industrial and Operations Engineering

IOE 201	Economic Decision Making (2 cr.) [not open to students with senior standing]	IOE 202	Operations Modeling (2 cr.) [not open to students with senior standing]
		300-level & above, except 373 & 422 (490 subject to Directed Study Rule)	

Materials Science and Engineering

MATSCIE 220	Intro to Materials & Manufacturing	MATSCIE 250	Principles of Engineering Materials
MATSCIE 242	Physics of Materials	300-level & above (MATSCIE 490, see Directed Study Rule)	

Mathematics

MATH 217	Linear Algebra*	MATH 450	Advanced Mathematics for Engineers I
MATH 354	Fourier Analysis and its Applications (3 cr)	MATH 451	Advanced Calculus I (3 cr)
MATH 395	Honors Analysis I	MATH 452	Advanced Calculus II (3 cr)
MATH 396	Honors Analysis II	MATH 454	Boundary Value Problems for Partial Differential Equations (3 cr)
MATH 404	Intermed. Diff. Equations and Dynamics (3 cr)	MATH 462	Mathematical Models (3 cr)
MATH 412	Introduction to Modern Algebra (3 cr)	MATH 463	Mathematical Modeling in Biology (3 cr)
MATH 416	Theory of Algorithms (3 cr)	MATH 471	Introduction to Numerical Methods (3 cr)
MATH 417	Matrix Algebra I (3 cr)*	MATH 475	Elementary Number Theory (3 cr)
MATH 419	Linear Spaces and Matrix Theory (3 cr)*	MATH 476	Computational Lab. in Number Theory (1 cr)
MATH 423	Mathematics of Finance (3 cr)	MATH 481	Introduction to Mathematical Logic (3 cr)
MATH 424	Compound Interest and Life Insurance (3 cr)	MATH 490	Introduction to Topology (3 cr)
MATH 433	Introduction to Differential Geometry (3 cr)	Tutoring classes are excluded.	

Mechanical Engineering

MECHENG 211	Introduction to Solid Mechanics	MECHENG 240	Introduction to Dynamics and Vibrations
MECHENG 235	Thermodynamics I (3 cr.)	MECHENG 250	Design and Manufacturing I
		300-level & above (MECHENG 490 & 491 see Directed Study Rule)	

Naval Architecture and Marine Engineering

NAVARCH 270	Marine Design	300-level & above (NAVARCH 490, see Directed Study Rule)

Nuclear Engineering and Radiological Sciences Engineering

NERS 211	Introduction to Nuclear Engineering	NERS 250	Fundamentals of Nuclear Engineering
		300-level & above (499 subject to Directed Study Rule)	

Performing Arts Technology (PAT dual majors ONLY)

PAT 452	Interactive Media Design II (3 cr.)	PAT 462	Digital Sound Synthesis (3 cr.)

Physics

Any 300-level course or above (except 333, 334, and 420). Tutoring classes are excluded

Statistics

STATS 406	Introduction to Statistical Computing	STATS 430	Applied Probability
STATS 415	Data Mining and Statistical Learning	STATS 470	Introduction to the Design of Experiments
STATS 426	Introduction to Theoretical Statistics (3 cr.)		

*Credit will only be given for ONE of the following courses: MATH 214, 217, 417, 419, and 513