

ELECTRICAL ENGINEERING, BS

REQUIREMENTS

UNIVERSITY REQUIREMENTS

All undergraduate students must complete both the following Core General Education (Core GenEd) and University Degree and Quality of Work requirements. The requirements below apply to students whose first term at UW-Madison or whose earliest post-high school college attendance at any institution is Summer 2026 or later.

Students whose first term at UW-Madison or whose earliest post-high school college attendance at any institution occurred before Summer 2026 should refer to the archived Guide (<https://guide.wisc.edu/archive/>) for the requirements that apply to them.

CORE GENERAL EDUCATION (CORE GENED) REQUIREMENTS

Civics & Perspectives 3 credits of Civics & Perspectives coursework.

Communication & Literacy 6 credits of Communication & Literacy coursework. This requirement may be partially satisfied by a qualifying placement test score. More information: <https://go.wisc.edu/qualifyingenglishplacement> (<https://go.wisc.edu/qualifyingenglishplacement/>)

Humanities & Arts 6 credits of Humanities & Arts coursework.

Mathematics & Quantitative Reasoning 6 credits of Mathematics & Quantitative Reasoning coursework. This requirement may be partially satisfied by a qualifying placement test score. More information: <https://go.wisc.edu/qualifyingmathplacement> (<https://go.wisc.edu/qualifyingmathplacement/>)

Natural Science & Wellness Complete both:

- 6 credits of Natural Science & Wellness or Natural Science & Wellness + Laboratory coursework.
- one course must be in Natural Science & Wellness + Laboratory coursework.

Social & Behavioral Science 3 credits of Social & Behavioral Science coursework.

Total Credits 30 credits.

For more information see the policy (<https://policy.wisc.edu/library/UW-1095/>).

UNIVERSITY DEGREE AND QUALITY OF WORK REQUIREMENTS

All undergraduate degree recipients must complete the following minimum requirements. Requirements for some programs will exceed these requirements; see program requirements for additional information.

Total Degree 120 degree credits.

Residency Complete 30 credits in residence. A course is considered "in residence" if it is taken when in undergraduate degree-seeking status and:

- is offered by UW-Madison and completed on the UW-Madison campus or at an approved off-site location, or
- is offered by UW-Madison in an online or distance format, or is completed during participation in a UW-Madison study abroad/study away program.

Quality of Work Achieve at least the minimum grade point average specified by the school, college, and/or academic program.

Math Demonstrate minimal mathematics competence by:

- placing above MATH 96, or
- successfully completing MATH 96, or
- successfully completing a more advanced mathematics course such as MATH 112, MATH 113, MATH 114, MATH 141, MATH 211, or MATH 221.

English Language If required to take the UW-Madison English as a Second Language Assessment Test (MSN-ESLAT), demonstrate minimal English language competence by:

- earning credit for ESL 118, or
- achieving a qualifying MSN-ESLAT placement test score.

Language Complete one:

- 2 high school units of a single language other than English, or
- one course with the second semester Language designation.

Major Declaration Declare and complete the requirements for at least one major.

COLLEGE OF ENGINEERING DEGREE GRANTING PROGRAMS' COMMON REQUIREMENTS

The College of Engineering departments collaborated and adopted a common set of guidelines in their degree granting program (major) requirements. Engineering departments incorporate specific coursework within their curricula to meet these guidelines. Students should refer to specific coursework detailed below the Summary of Requirements.

COLLEGE OF ENGINEERING DEGREE GRANTING PROGRAMS' COMMON REQUIREMENTS

Communication All College of Engineering majors require two levels of communication coursework:

- Engineering Communication 1: one course with the Communication A designation or satisfaction of Communication A based on eligible UW Placement Score.
- Engineering Communication 2: each major specifies one course (e.g. INTEREGR 397) which also carries the Communication B designation.

Quantitative Reasoning	All College of Engineering majors require a math sequence that incorporates two levels of quantitative reasoning.
Humanities or Literature	All College of Engineering majors require a minimum of 6 credits with the Humanities or Literature breadth designations. See major Liberal Studies Electives Requirement below.
Social Sciences	All College of Engineering majors require a minimum of 3 credits with the Social Sciences breadth designation. See major Liberal Studies Electives Requirement below.
Natural Sciences	All College of Engineering majors require specific coursework that incorporates a minimum of 6 credits with the Biological, Natural, or Physical Science breadth designations.
Ethnic Studies	All College of Engineering majors require at least one course of at least 3 credits with the Ethnic Studies designation. This course may also be used to satisfy the Social Sciences or Humanities or Literature requirement.

ELECTRICAL ENGINEERING, BS CURRICULUM

This curriculum applies to students admitted to the degree program this Guide academic year. Curricular requirements for students admitted in previous semesters are available in the Archive (<https://guide.wisc.edu/archive/>) section of Guide.

SUMMARY OF REQUIREMENTS

Code	Title	Credits
	Mathematics	16
	Science	17-18
	Electrical Engineering Core	32
	Electrical Engineering Advanced Electives	24
	Professional Electives	9
	Communication Skills	6
	Liberal Studies Electives	15
	Free Elective	1
	Total Credits	120-121

MATHEMATICS¹

Code	Title	Credits
MATH 221	Calculus and Analytic Geometry 1	5
MATH 222	Calculus and Analytic Geometry 2	4
MATH 234	Calculus--Functions of Several Variables ²	4
	Probability and Statistics Elective	3
STAT 311	Introduction to Theory and Methods of Mathematical Statistics I	
STAT 424	Statistical Experimental Design	
MATH/STAT 431	Introduction to the Theory of Probability	
E C E 331	Introduction to Random Signal Analysis and Statistics	
	Total Credits	16

¹ In addition to the courses listed in the Mathematics Requirement at least one additional course must be completed for the advanced mathematics auxiliary condition. Choose: MATH 319 Techniques

in Ordinary Differential Equations, MATH 320 Linear Algebra and Differential Equations, MATH 340 Elementary Matrix and Linear Algebra, MATH 341 Linear Algebra, MATH 345 Linear Algebra and Optimization, E C E 334 State Space Systems Analysis, or E C E/COMP SCI/M E 532 Matrix Methods in Machine Learning to satisfy the advanced math auxiliary condition. These credits count toward either professional electives or advanced elective credit depending on the course.

² MATH 375 and MATH 376 taken in sequence will fulfill the requirement for MATH 234, professional elective credit, and advanced math auxiliary condition.

SCIENCE

Code	Title	Credits
COMP SCI 300	Programming II	3
PHYSICS 201	General Physics ¹	5
or PHYSICS 207	General Physics	
or PHYSICS 247	A Modern Introduction to Physics	
PHYSICS 202	General Physics	5
or PHYSICS 208	General Physics	
or PHYSICS 248	A Modern Introduction to Physics	
	Select one of the following:	4-5
CHEM 109	Advanced General Chemistry	
CHEM 103	General Chemistry I	
CHEM 104	General Chemistry II	
	Total Credits	17-18

¹ Students may also fulfill this requirement by taking E M A 201 Statics and E M A 202 Dynamics.

ELECTRICAL ENGINEERING CORE

Code	Title	Credits
E C E 203	Signals, Information, and Computation	3
E C E 210	Introductory Experience in Electrical Engineering	2
E C E 222	Electrodynamics I	4
E C E 230	Circuit Analysis	4
E C E/PHYSICS 235	Introduction to Solid State Electronics	3
E C E/COMP SCI 252	Introduction to Computer Engineering	3
E C E 270	Circuits Laboratory I	1
E C E 271	Circuits Laboratory II	1
E C E 330	Signals and Systems	3
E C E 340	Electronic Circuits I	3
E C E/COMP SCI 352	Digital System Fundamentals	3
E C E 370	Advanced Laboratory	2
	Total Credits	32

ELECTRICAL ENGINEERING ADVANCED ELECTIVES

Students must take 24 credits of advanced electives. A minimum of 21 credits must be from at least three of the six areas. A minimum of two laboratory courses must be taken.

- At least 9 credits must be in E C E courses numbered 400 and above.
- At least one course must be a capstone design course from the following list: E C E 453 Embedded Microprocessor System Design, E C E 454 Mobile Computing Laboratory, E C E 455 Capstone Design in Electrical and Computer Engineering, E C E 554 Digital Engineering Laboratory. These courses are also indicated in the areas below with a *.
- At least one course must be MATH 319 Techniques in Ordinary Differential Equations, MATH 320 Linear Algebra and Differential Equations, MATH 340 Elementary Matrix and Linear Algebra, MATH 341 Linear Algebra, MATH 345 Linear Algebra and Optimization, E C E 334 State Space Systems Analysis, or E C E/COMP SCI/M E 532 Matrix Methods in Machine Learning to satisfy the advanced math auxiliary condition. MATH 319, MATH 320, MATH 340, and MATH 341, and MATH 345 count toward professional electives. E C E 334 and E C E/COMP SCI/M E 532 count as advanced electives.
- Students can count 1 credit of E C E 1 Cooperative Education Program toward advanced electives.
- Students can count up to 6 credits of E C E 399 Independent Study, E C E 489 Honors in Research or E C E 699 Advanced Independent Study towards advanced electives.
- Students can take E C E 379 Special Topics in Electrical and Computer Engineering and E C E 601 Special Topics in Electrical and Computer Engineering as advanced electives.
- Students can count up to 5 credits of COMP SCI courses numbered 500 and above (not including independent study)
- E C E courses numbered 300 and above that are not specified in an area can count toward the total number of advanced elective credits required.

Laboratory

Code	Title	Credits
Select at least one course from E C E 301 to E C E 317		
An additional laboratory course must be taken from the following list:		
E C E 303	Introduction to Real-Time Digital Signal Processing	2
E C E 304	Electric Machines Laboratory	1
E C E 305	Semiconductor Properties Laboratory	1
E C E 313	Optoelectronics Lab	1
E C E 315	Introductory Microprocessor Laboratory	1
E C E 317	Sensors Laboratory	1
E C E 432	Digital Signal Processing Laboratory	3
E C E/B M E 462	Medical Instrumentation	3
E C E 504	Electric Machine & Drive System Laboratory	3
E C E 512	Power Electronics Laboratory	3
E C E 545	Advanced Microwave Measurements for Communications	3

E C E 549	Integrated Circuit Fabrication Laboratory	4
E C E/M E 577	Automatic Controls Laboratory	4

Fields & Waves

Code	Title	Credits
E C E 320	Electrodynamics II	3
E C E 420	Electromagnetic Wave Transmission	3
E C E 434	Photonics	3
E C E/N E/PHYSICS 525	Introduction to Plasmas	3
E C E/N E/PHYSICS 527	Plasma Confinement and Heating	3
E C E/N E 528	Plasma Processing and Technology	3
E C E 535	Introduction to Quantum Sensing	3
E C E 536	Integrated Optics and Optoelectronics	3
E C E 547	Advanced Communications Circuit Design	3

Systems & Control

Code	Title	Credits
E C E 332	Feedback Control Systems	3
E C E 334	State Space Systems Analysis	3
E C E/M E 439	Introduction to Robotics	3
E C E/M E 577	Automatic Controls Laboratory	4

Power & Machines

Code	Title	Credits
E C E 355	Electromechanical Energy Conversion	3
E C E 356	Electric Power Processing for Alternative Energy Systems	3
E C E 411	Introduction to Electric Drive Systems	3
E C E 412	Power Electronic Circuits	3
E C E 427	Electric Power Systems	3
E C E 504	Electric Machine & Drive System Laboratory	3
E C E 511	Theory and Control of Synchronous Machines	3
E C E 512	Power Electronics Laboratory	3

Communications & Signal Processing

Code	Title	Credits
E C E 331	Introduction to Random Signal Analysis and Statistics	3
E C E 401	Electro-Acoustical Engineering	3
E C E 431	Digital Signal Processing	3
E C E 432	Digital Signal Processing Laboratory	3
E C E/COMP SCI/MATH 435	Introduction to Cryptography	3
E C E 436	Communication Systems I	3
E C E 437	Communication Systems II	3
E C E 447	Applied Communications Systems	3

E C E/COMP SCI/ M E 532	Matrix Methods in Machine Learning	3
E C E/ COMP SCI 533	Image Processing	3
E C E 537	Communication Networks	3
E C E/COMP SCI/ M E 539	Introduction to Artificial Neural Networks	3
E C E/ISY E 570	Ethics of Data for Engineers	3

Circuits & Devices

Code	Title	Credits
E C E 335	Microelectronic Devices	3
E C E 342	Electronic Circuits II	3
E C E 445	Semiconductor Physics and Devices	3
E C E/B M E 462	Medical Instrumentation	3
E C E 466	Electronics of Solids	3
E C E 541	Analog MOS Integrated Circuit Design	3
E C E 542	Introduction to Microelectromechanical Systems	3
E C E 545	Advanced Microwave Measurements for Communications	3
E C E 548	Integrated Circuit Design	3
E C E 549	Integrated Circuit Fabrication Laboratory	4
E C E 555	Digital Circuits and Components	3
E C E/M E 576	Printed and Flexible Electronics: Manufacturing, Devices, and Applications	3

Computers & Computing

Code	Title	Credits
E C E 353	Introduction to Microprocessor Systems	3
E C E/ COMP SCI 354	Machine Organization and Programming	3
E C E 453	Embedded Microprocessor System Design *	4
E C E 454	Mobile Computing Laboratory *	4
E C E/B M E 463	Computers in Medicine	3
E C E/ COMP SCI 506	Software Engineering	3
E C E 551	Digital System Design and Synthesis	3
E C E/ COMP SCI 552	Introduction to Computer Architecture	3
E C E 553	Testing and Testable Design of Digital Systems	3
E C E 554	Digital Engineering Laboratory *	4
E C E 556	Design Automation of Digital Systems	3

* Course is designated as a Capstone Course

PROFESSIONAL ELECTIVES

Code	Title	Credits
Classes to be taken in an area of professional interest. The following courses are acceptable as professional electives if the courses are not used to meet any other degree requirements.		
MATH/ COMP SCI 240	Introduction to Discrete Mathematics	3
E C E 204	Data Science & Engineering	3
E C E 320	Electrodynamics II	3
E C E 331	Introduction to Random Signal Analysis and Statistics	3
E C E 332	Feedback Control Systems	3
E C E 334	State Space Systems Analysis	3
E C E 335	Microelectronic Devices	3
E C E 342	Electronic Circuits II	3
E C E 353	Introduction to Microprocessor Systems	3
E C E/ COMP SCI 354	Machine Organization and Programming	3
E C E 355	Electromechanical Energy Conversion	3
E C E 356	Electric Power Processing for Alternative Energy Systems	3
E C E courses numbered 399 and higher		
COMP SCI courses numbered 400 and higher		
MATH 319	Techniques in Ordinary Differential Equations	3
MATH 320	Linear Algebra and Differential Equations ¹	3
MATH 321	Applied Mathematical Analysis 1: Vector and Complex Calculus	3
MATH 322	Applied Mathematical Analysis 2: Partial Differential Equations	3
MATH 340	Elementary Matrix and Linear Algebra ¹	3
MATH 341	Linear Algebra	3
MATH 345	Linear Algebra and Optimization	3
MATH courses numbered 400 and higher		
STATS courses numbered 400 and higher		
Any biological science course that is designated as intermediate or advanced		
Any physical science course that is designated as intermediate or advanced (except PHYSICS 241)		
Any natural science course that is designated as advanced except that Math, Computer Sciences, and Statistics courses must follow the above criteria		
Engineering courses numbered 300 and higher that are not E C E or cross-listed with E C E		
Up to six credits of Professional Electives can be taken from School of Business classes numbered 300 and higher.		
DANCE 560	Current Topics in Dance: Workshop (Making Digital Lighting Controls)	3

¹ Students may only earn degree credit for MATH 320 Linear Algebra and Differential Equations or MATH 340 Elementary Matrix and Linear Algebra, not both.

COMMUNICATION SKILLS

Code	Title	Credits
Engr Comm 1		
INTEREGR 156	Introduction to Writing, Speaking, and Ethics for Engineers	3
or ENGL 100	Introduction to College Composition	
or LSC 100	Science and Storytelling	
or COM ARTS 100	Introduction to Speech Composition	
or COM ARTS 181	Elements of Speech-Honors Course	
or ESL 118	Academic Writing II	
Engr Comm 2		
INTEREGR 397	Engineering Communication	3
Total Credits		6

LIBERAL STUDIES ELECTIVES

Code	Title	Credits
College of Engineering Liberal Studies Electives Requirements		
Complete requirements (https://guide.wisc.edu/undergraduate/engineering/#requirementstext)		15
Total Credits		15

HONORS IN RESEARCH PROGRAM

Qualified undergraduates may earn an Honors in Research designation in their transcript. The Honors in Research program gives an undergraduate the opportunity to participate in a research project under the direction of a faculty member. It is expected that the student will be actively involved in research that could lead to new knowledge. The project can be independent or a component of a larger team effort.

Admission Requirements include:

1. Complete at least one semester on the UW-Madison campus,
2. Have a cumulative GPA of at least 3.5,
3. Major in Computer Engineering (CMPE) or Electrical Engineering (EE),
4. Identify an ECE faculty advisor who is willing to supervise the research project.

Students admitted to the program should register for one to three credits of E C E 489 Honors in Research. A thesis worth three credits of E C E 489 Honors in Research is required. The thesis is a written document that details the objectives of the project, the methods used to carry out the research, and the results of the research activity. The thesis must be approved by the faculty advisor and the student is encouraged to present a seminar.

The "Honors in Research" designation will be awarded to graduates who:

1. Complete either the CMPE or EE degree requirements.
2. Have a cumulative GPA of at least 3.3 at graduation.

3. Complete a total of at least six credits of E C E 489 Honors in Research.
4. Receive a final grade of at least B in E C E 489 Honors in Research.

NAMED OPTION

View as listView as grid

- **ELECTRICAL ENGINEERING: MACHINE LEARNING AND DATA SCIENCE, BS ([HTTPS://GUIDE.WISC.EDU/UNDERGRADUATE/ENGINEERING/ELECTRICAL-COMPUTER-ENGINEERING/ELECTRICAL-ENGINEERING-BS/ELECTRICAL-ENGINEERING-MACHINE-LEARNING-DATA-SCIENCE-BS/](https://guide.wisc.edu/undergraduate/engineering/electrical-computer-engineering/electrical-engineering-bs/electrical-engineering-machine-learning-data-science-bs/))**
- **ELECTRICAL ENGINEERING: SEMICONDUCTOR ENGINEERING, BS ([HTTPS://GUIDE.WISC.EDU/UNDERGRADUATE/ENGINEERING/ELECTRICAL-COMPUTER-ENGINEERING/ELECTRICAL-ENGINEERING-BS/ELECTRICAL-ENGINEERING-SEMICONDUCTOR-ENGINEERING-BS/](https://guide.wisc.edu/undergraduate/engineering/electrical-computer-engineering/electrical-engineering-bs/electrical-engineering-semiconductor-engineering-bs/))**