

# ELECTRICAL ENGINEERING, B.S.

## REQUIREMENTS

### UNIVERSITY GENERAL EDUCATION REQUIREMENTS

All undergraduate students at the University of Wisconsin–Madison are required to fulfill a minimum set of common university general education requirements to ensure that every graduate acquires the essential core of an undergraduate education. This core establishes a foundation for living a productive life, being a citizen of the world, appreciating aesthetic values, and engaging in lifelong learning in a continually changing world. Various schools and colleges will have requirements in addition to the requirements listed below. Consult your advisor for assistance, as needed. For additional information, see the university Undergraduate General Education Requirements (<http://guide.wisc.edu/undergraduate/#requirementsforundergraduatestudytext>) section of the *Guide*.

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|-------------------|--|
| General Education | <ul style="list-style-type: none"> <li>• Breadth—Humanities/Literature/Arts: 6 credits</li> <li>• Breadth—Natural Science: 4 to 6 credits, consisting of one 4- or 5-credit course with a laboratory component; or two courses providing a total of 6 credits</li> <li>• Breadth—Social Studies: 3 credits</li> <li>• Communication Part A &amp; Part B *</li> <li>• Ethnic Studies *</li> <li>• Quantitative Reasoning Part A &amp; Part B *</li> </ul> |
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\* The mortarboard symbol appears before the title of any course that fulfills one of the Communication Part A or Part B, Ethnic Studies, or Quantitative Reasoning Part A or Part B requirements.

### SUMMARY OF REQUIREMENTS

The following curriculum applies to students who were admitted to the electrical engineering degree program (classification changed to EE) in Fall 2017 or later.

Code	Title	Credits
Mathematics		16
Science		17-18
Electrical Engineering Core		33
Electrical Engineering Advanced Electives		24
Professional Electives		9
Communication Skills		6
Liberal Studies		15
<b>Total Credits</b>		<b>120-121</b>

### MATHEMATICS

Code	Title	Credits
MATH 221	Calculus and Analytic Geometry I	5
or MATH 217	Calculus with Algebra and Trigonometry II	
or MATH 275	Topics in Calculus I	

MATH 222	Calculus and Analytic Geometry 2	4
or MATH 276	Topics in Calculus II	
MATH 234	Calculus—Functions of Several Variables <sup>1</sup>	4
Probability and Statistics Elective		3
STAT 311	Introduction to Theory and Methods of Mathematical Statistics I	
STAT/M E 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

<sup>1</sup> MATH 375 and MATH 376 taken in sequence will fulfill the requirement for MATH 234.

### SCIENCE

Code	Title	Credits
COMP SCI 300	Programming II	3
PHYSICS 201	General Physics <sup>1</sup>	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

<sup>1</sup> Students may also fulfill this requirement by taking E M A 201 Statics and E M A 202 Dynamics or E M A 201 Statics and M E 240 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 219	Analytical Methods for Electromagnetics Engineering	2
E C E 220	Electrodynamics I	3
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
<b>Total Credits</b>		<b>33</b>

## ELECTRICAL ENGINEERING ADVANCED ELECTIVES

Students must take 22 credits in at least three of six areas and at least 2 credits in two laboratory courses.

- At least 9 credits must be in courses numbered 400 and above.
- At least one course must be a capstone design course.
- 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.

Laboratory		
Code	Title	Credits
<i>Select at least one course from E C E 301 to E C E 317</i>		
<i>An additional laboratory course must be taken from the following list:</i>		
E C E 303	Introduction to Real-Time Digital Signal Processing	
E C E 304	Electric Machines Laboratory	
E C E 305	Semiconductor Properties Laboratory	
E C E 306	Linear Active Circuits Laboratory	
E C E 308	Nonlinear Electronic Circuits Laboratory	
E C E 313	Optoelectronics Lab	
E C E 315	Introductory Microprocessor Laboratory	
E C E 317	Sensors Laboratory	
E C E 432	Digital Signal Processing Laboratory	
E C E 453	Embedded Microprocessor System Design	
E C E/B M E 462	Medical Instrumentation <sup>1</sup>	
E C E 504	Electric Machine & Drive System Laboratory	
E C E 512	Power Electronics Laboratory	
E C E 545	Advanced Microwave Measurements for Communications	
E C E 549	Integrated Circuit Fabrication Laboratory	
E C E 554	Digital Engineering Laboratory	
E C E/M E 577	Automatic Controls Laboratory	

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 536	Integrated Optics and Optoelectronics	3
E C E/PHYSICS 546	Lasers	2-3
E C E 547	Advanced Communications Circuit Design <sup>1</sup>	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 <sup>1</sup>	3
E C E/M E 577	Automatic Controls Laboratory <sup>1</sup>	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 <sup>1</sup>	3
E C E 427	Electric Power Systems	3
E C E 504	Electric Machine & Drive System Laboratory	2-3
E C E 511	Theory and Control of Synchronous Machines	3
E C E 512	Power Electronics Laboratory <sup>1</sup>	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 <sup>1</sup>	3
E C E 432	Digital Signal Processing Laboratory <sup>1</sup>	3
E C E/COMP SCI/ MATH 435	Introduction to Cryptography	3
E C E 436	Communication Systems I <sup>1</sup>	3
E C E 437	Communication Systems II <sup>1</sup>	3
E C E 447	Applied Communications Systems <sup>1</sup>	3
E C E/COMP SCI/ M E 532	Matrix Methods in Machine Learning <sup>1</sup>	3
E C E/COMP SCI 533	Image Processing <sup>1</sup>	3
E C E 537	Communication Networks <sup>1</sup>	3
E C E/COMP SCI/ M E 539	Introduction to Artificial Neural Networks <sup>1</sup>	3
E C E/MATH 641	Introduction to Error-Correcting Codes	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 <sup>1</sup>	3
E C E 466	Electronics of Solids	3
E C E 541	Analog MOS Integrated Circuit Design <sup>1</sup>	3
E C E 542	Introduction to Microelectromechanical Systems <sup>1</sup>	3
E C E 545	Advanced Microwave Measurements for Communications <sup>1</sup>	3
E C E 548	Integrated Circuit Design <sup>1</sup>	3
E C E 549	Integrated Circuit Fabrication Laboratory <sup>1</sup>	3
E C E 555	Digital Circuits and Components <sup>1</sup>	3

**Computers & Computing**

Code	Title	Credits
E C E 353	Introduction to Microprocessor Systems	3
E C E 453	Embedded Microprocessor System Design <sup>1</sup>	4
E C E 454	Mobile Computing Laboratory <sup>1</sup>	4
E C E/B M E 463	Computers in Medicine	3
E C E 551	Digital System Design and Synthesis <sup>1</sup>	3
E C E/COMP SCI 552	Introduction to Computer Architecture	3
E C E 553	Testing and Testable Design of Digital Systems <sup>1</sup>	3
E C E 554	Digital Engineering Laboratory <sup>1</sup>	4
E C E 556	Design Automation of Digital Systems <sup>1</sup>	3

<sup>1</sup> Designated as a capstone course. Students can also take E C E 491 Senior Design Project for capstone credit.

**PROFESSIONAL ELECTIVES**

Code	Title	Credits
		9

*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	
E C E 204	Data Science & Engineering	
E C E 320	Electrodynamics II	
E C E 331	Introduction to Random Signal Analysis and Statistics	
E C E 332	Feedback Control Systems	
E C E 334	State Space Systems Analysis	
E C E 335	Microelectronic Devices	

E C E 342	Electronic Circuits II	
E C E 353	Introduction to Microprocessor Systems	
E C E/ COMP SCI 354	Machine Organization and Programming	
E C E 355	Electromechanical Energy Conversion	
E C E 356	Electric Power Processing for Alternative Energy Systems	
E C E courses numbered 399 and higher		
COMP SCI courses numbered 400 and higher		
MATH 319	Techniques in Ordinary Differential Equations	
MATH 320	Linear Algebra and Differential Equations <sup>1</sup>	
MATH 321	Applied Mathematical Analysis	
MATH 322	Applied Mathematical Analysis	
MATH 340	Elementary Matrix and Linear Algebra <sup>1</sup>	
MATH 341	Linear Algebra	
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.		
DS 501	Special Topics (Wearable Technologies)	
DANCE 560	Current Topics in Dance: Workshop (Making Digital Lighting Controls)	

<sup>1</sup> 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
ENGL 100	Introduction to College Composition	3
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	
INTEREGR 397	Engineering Communication (was EPD 397 before Fall 2020)	3

**Total Credits** 6

## LIBERAL STUDIES ELECTIVES

Code	Title	Credits
<b>College of Engineering Liberal Studies Requirements</b>		
Complete requirements ( <a href="http://guide.wisc.edu/undergraduate/engineering/#requirements">http://guide.wisc.edu/undergraduate/engineering/#requirements</a> ) <sup>1</sup>		15
<b>Total Credits</b>		<b>15</b>

<sup>1</sup> All liberal studies credits must be identified with the letter H, S, L, or Z. Language courses are acceptable without the letter and are considered humanities. **Note:** See an E C E advisor and/or the EE Curriculum Guide for additional information.

## NAMED OPTION

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- ELECTRICAL ENGINEERING: MACHINE LEARNING AND DATA SCIENCE, B.S. ([HTTP://GUIDE.WISC.EDU/UNDERGRADUATE/ENGINEERING/ELECTRICAL-COMPUTER-ENGINEERING/ELECTRICAL-ENGINEERING-BS/ELECTRICAL-ENGINEERING-MACHINE-LEARNING-DATA-SCIENCE-BS/](http://guide.wisc.edu/undergraduate/engineering/electrical-computer-engineering/electrical-engineering-bs/electrical-engineering-machine-learning-data-science-bs/))

## TOTAL DEGREE CREDITS: 120

## UNIVERSITY DEGREE REQUIREMENTS

**Total Degree** To receive a bachelor's degree from UW–Madison, students must earn a minimum of 120 degree credits. The requirements for some programs may exceed 120 degree credits. Students should consult with their college or department advisor for information on specific credit requirements.

**Residency** Degree candidates are required to earn a minimum of 30 credits in residence at UW–Madison. "In residence" means on the UW–Madison campus with an undergraduate degree classification. "In residence" credit also includes UW–Madison courses offered in distance or online formats and credits earned in UW–Madison Study Abroad/Study Away programs.

**Quality of Work** Undergraduate students must maintain the minimum grade point average specified by the school, college, or academic program to remain in good academic standing. Students whose academic performance drops below these minimum thresholds will be placed on academic probation.