

# ENGINEERING PHYSICS, 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 entered the program after fall 2018.

Code	Title	Credits
Mathematics and Statistics		25
Science		28
Engineering Science		25
Focus Area		22
Technical Electives		6
Communication Skills		8
Liberal Studies		16
<b>Total Credits</b>		<b>130</b>

### MATHEMATICS AND STATISTICS

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	4
MATH 319	Techniques in Ordinary Differential Equations	3
MATH 321	Applied Mathematical Analysis	3
MATH 340	Elementary Matrix and Linear Algebra	3
or MATH 341	Linear Algebra	
STAT 324	Introductory Applied Statistics for Engineers	3
or STAT 311	Introduction to Theory and Methods of Mathematical Statistics I	
or STAT/ MATH 431	Introduction to the Theory of Probability	
<b>Total Credits</b>		<b>25</b>

### SCIENCE

Code	Title	Credits
Select one of the following:		5-10
CHEM 109	Advanced General Chemistry	
CHEM 103 & CHEM 104	General Chemistry I and General Chemistry II	
PHYSICS 202	General Physics	5
or PHYSICS 208	General Physics	
PHYSICS 241	Introduction to Modern Physics	3
or PHYSICS 205	Modern Physics for Engineers	
PHYSICS 322	Electromagnetic Fields	3
E P 271	Engineering Problem Solving I	3
or COMP SCI 200	Programming I	
or COMP SCI 220	Data Science Programming I	
or COMP SCI 310	Problem Solving Using Computers	
M S & E 351	Materials Science-Structure and Property Relations in Solids	3
or CBE 440	Chemical Engineering Materials	
N E 305	Fundamentals of Nuclear Engineering	3
or PHYSICS 531	Introduction to Quantum Mechanics	
Computing Elective (select one)		3
COMP SCI 300	Programming II	
COMP SCI 412	Introduction to Numerical Methods (required for students in Scientific Computing Focus Area)	
E P/E M A 471	Intermediate Problem Solving for Engineers	
E P/E M A 476	Introduction to Scientific Computing for Engineering Physics	
<b>Total Credits</b>		<b>28-33</b>

### ENGINEERING SCIENCE

Code	Title	Credits
E M A 201	Statics	3
or PHYSICS 201	General Physics	
or PHYSICS 207	General Physics	

PHYSICS 311	Mechanics	3
or E M A 202	Dynamics	
or M E 240	Dynamics	
E M A 303	Mechanics of Materials	3
or M E 306	Mechanics of Materials	
E M A/M E 307	Mechanics of Materials Lab	1
M E 361	Thermodynamics	3
or M S & E 330	Thermodynamics of Materials	
E C E 376	Electrical and Electronic Circuits	3
or PHYSICS 321	Electric Circuits and Electronics	
M E 363	Fluid Dynamics	3
M E 364	Elementary Heat Transfer	3
or M S & E 331	Transport Phenomena in Materials	
N E 231	Introduction to Nuclear Engineering	3
	1	
<b>Total Credits</b>		<b>25</b>

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This requirement can also be satisfied with a different introductory engineering course

## FOCUS AREA

### Research and Development/Senior Thesis Expectations for Research Projects

Completion of the engineering physics degree program requires satisfactory completion of the E P 468 Introduction to Engineering Research, E P 469 Research Proposal in Engineering Physics, E P 568 Research Practicum in Engineering Physics I, and E P 569 Research Practicum in Engineering Physics II coursework sequence, which culminates in a senior research thesis. The research topic chosen by the student and agreed upon by the advisor should be on a topic connected to the chosen Focus Area. The research conducted should be such that the student participates in the creation of new knowledge, experiences the excitement of the research process, and makes a contribution so that it would be appropriate to include the student's name on a scholarly publication if one results from the research.

### Senior Thesis

A senior thesis, completed during enrollment in E P 569 Research Practicum in Engineering Physics II is required. The senior thesis is a written document reporting on a substantial piece of work. It should be written in the style of a graduate thesis. The faculty advisor, in consultation with a research mentor, determines the grade which the student receives for the thesis. A bound copy of the thesis must be submitted to the engineering physics department office.

On or before the Friday of finals week of the semester in which E P 569 Research Practicum in Engineering Physics II is taken, the senior thesis must be presented orally by the student to a committee of three professors in a publicly announced seminar. Interested faculty and students will be invited to attend.

### Research and Development

Code	Title	Credits
<i>Research and Development</i>		8
E P 468	Introduction to Engineering Research	1
E P 469	Research Proposal in Engineering Physics	1

E P 568	Research Practicum in Engineering Physics I	3
E P 569	Research Practicum in Engineering Physics II	3

### Focus Area Electives Nanoengineering

Code	Title	Credits
<i>Focus Area Total Credits:</i>		14
<i>Required:</i>		
PHYSICS 551	Solid State Physics	3
<i>At Least One of:</i>		
E P/E M A 615	Micro- and Nanoscale Mechanics	3
M S & E 553	Nanomaterials & Nanotechnology	3
<i>At Least One of:</i>		
E M A 506	Advanced Mechanics of Materials I	3
E M A 622	Mechanics of Continua	3
E M A 519	Fracture Mechanics	3
<i>At Least One of:</i>		
M S & E 448	Crystallography and X-Ray Diffraction	3
E M A 611	Advanced Mechanical Testing of Materials	3
M E 601	Special Topics in Mechanical Engineering (Micro & Nano Fabrication)	1-3
N E 602	Special Topics in Reactor Engineering (Vacuum Technology Lab)	0-3
PHYSICS 623	Electronic Aids to Measurement	4
PHYSICS 625	Applied Optics	4
M S & E 748	Structural Analysis of Materials	3
<i>Open Electives:</i>		
M S & E 333	Microprocessing of Materials	3
E C E 335	Microelectronic Devices	3
M S & E 434	Introduction to Thin-Film Deposition Processes	3
M S & E 441	Deformation of Solids	3
E C E 445	Semiconductor Physics and Devices	3
M S & E 451	Introduction to Ceramic Materials	3
E M A/M S & E 541	Heterogeneous and Multiphase Materials	3
M S & E 560	Fundamentals of Atomistic Modeling	3
M S & E 570	Properties of Solid Surfaces	3
CHEM 630	Selected Topics in Analytical Chemistry	1-3
M S & E 756	Structure and Properties of Advanced Electronic Materials	3

### Plasma Science and Engineering

Code	Title	Credits
<i>Focus Area Total Credits:</i>		14
<i>Required:</i>		
N E/E C E/ PHYSICS 525	Introduction to Plasmas	3

<i>At Least One of:</i>		
N E/E C E/ PHYSICS 527	Plasma Confinement and Heating	3
N E/E C E 528	Plasma Processing and Technology	3
<i>At Least One of:</i>		
N E 526	Laboratory Course in Plasmas	3
<i>Open Electives:</i>		
N E 408	Ionizing Radiation	3
N E 536	Feasibility St of Power from Controlled Thermonuclear Fusion	3
Any plasma-related special topics course in NE		
PHYSICS 415	Thermal Physics	3
PHYSICS 623	Electronic Aids to Measurement	4
PHYSICS 625	Applied Optics	4
N E/E C E/ PHYSICS 724	Waves and Instabilities in Plasmas	3
N E/E C E/ PHYSICS 725	Plasma Kinetic Theory and Radiation Processes	3
N E/E C E/ PHYSICS 726	Plasma Magnetohydrodynamics	3

### Scientific Computing

Code	Title	Credits
<i>Focus Area Total Credits:</i>		14
<i>At Least One of:</i>		
N E/MED PHYS 506	Monte Carlo Radiation Transport	3
M E 573	Computational Fluid Dynamics	3
E M A 605	Introduction to Finite Elements	3
E C E 742	Computational Methods in Electromagnetics	3
<i>At Least One of:</i>		
Students must take at least two credits of laboratory experience in the Physical or Biological Sciences beyond the required chemistry and mechanics of materials courses		
<i>Open Electives:</i>		
E P/E M A 476	Introduction to Scientific Computing for Engineering Physics	3
COMP SCI 300	Programming II	3
COMP SCI/ MATH 513	Numerical Linear Algebra	3
COMP SCI/ MATH 514	Numerical Analysis	3
COMP SCI/I SY E/ MATH/STAT 525	Linear Optimization	3
COMP SCI/E C E/ M E 532	Matrix Methods in Machine Learning	3
COMP SCI/E C E/ M E 539	Introduction to Artificial Neural Networks	3
COMP SCI 540	Introduction to Artificial Intelligence	3
COMP SCI/ E C E 561	Probability and Information Theory in Machine Learning	3
COMP SCI 577	Introduction to Algorithms	4
COMP SCI/ MATH 714	Methods of Computational Mathematics I	3

COMP SCI/ MATH 715	Methods of Computational Mathematics II	3
M S & E 560	Fundamentals of Atomistic Modeling	3
M E 459	Computing Concepts for Applications in Engineering	3
M E/COMP SCI/ E C E/E M A/ E P 759	High Performance Computing for Applications in Engineering	3
Any scientific-computing-related special topics course in NE		

### TECHNICAL ELECTIVE

Code	Title	Credits
<i>Select 6 credits from:</i>		6
Co-op (no more than 3 credits)		
Courses numbered 300+ in the CoE except for E P D/ INTEREGR		
Courses numbered 300+ in MATH, PHYSICS, COMP SCI, STAT (except STAT 301), ASTRON, MED PHYS, and CHEM departments		
Students may also propose any class that they feel will benefit their education path with pre-requisite of two physics or calculus classes. For these courses the advisor will review the request and if approved, recommend a DARS substitution.		

### COMMUNICATION SKILLS

Code	Title	Credits
ENGL 100	Introduction to College Composition	3
or COM ARTS 100	Introduction to Speech Composition	
or LSC 100	Science and Storytelling	
or ESL 118	Academic Writing II	
E P D 275	Technical Presentations	2
INTEREGR 397	Engineering Communication	3
<b>Total Credits</b>		<b>8</b>

### LIBERAL STUDIES

Code	Title	Credits
Complete Requirements ( <a href="http://guide.wisc.edu/undergraduate/engineering/#requirements">http://guide.wisc.edu/undergraduate/engineering/#requirements</a> ) <sup>1</sup>		

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Students must take 16 credits that carry H, S, L, or Z breadth designators. These credits must fulfill the following subrequirements:

- 1. A minimum of two courses from the same subject area (<https://registrar.wisc.edu/subjectareas/>) (the description before the course number). At least one of these two courses must be designated as above the elementary level (I, A, or D) in the course listing.
- 2. A minimum of 6 credits designated as humanities (H, L, or Z in the course listing), and an additional minimum of 3 credits designated as social science (S or Z in the course listing). Foreign language courses count as H credits. Retroactive credits for language courses may not be used to meet the Liberal Studies credit requirement (they can be used for subrequirement 1 above).
- 3. At least 3 credits in courses designated as ethnic studies (lower case "e" in the course listing). These courses may help satisfy subrequirements 1 and 2 above, but they only count once toward the total required. Note: Some courses may have "e" designation but not have H, S, L, or Z designation; these courses do not count toward the Liberal Studies requirement.

TOTAL CREDITS: 130–132

For information on credit load, adding or dropping courses, course substitutions, pass/fail, auditing courses, dean's honor list, repeating courses, probation, and graduation, see the College of Engineering Official Regulations (<http://guide.wisc.edu/undergraduate/engineering/#policiesandregulationstext>).

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.