

# NUCLEAR 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.

### NUCLEAR ENGINEERING CURRICULUM

The nuclear engineering curriculum is divided into two focus areas, one emphasizing nuclear power and one emphasizing medical and other non-power applications of radiation sciences. The power focus area is more appropriate for students seeking careers in the nuclear power industry, while the radiation sciences focus area is better suited for students interested in medical and non-power applications.

### POWER FOCUS AREA CURRICULUM

The following curriculum applies to students who entered the program starting in Fall 2020.

### SUMMARY OF REQUIREMENTS

Code	Title	Credits
	Mathematics and Statistics	22
	Science	13
	Engineering Science	31
	Nuclear Engineering Core	28
	Nuclear Engineering Electives	8
	Introduction to Engineering	3
	Communication Skills	8

Liberal Studies	16
<b>Total Credits</b>	<b>129</b>

### MATHEMATICS AND STATISTICS

Code	Title	Credits
MATH 221 or MATH 217 or MATH 275	Calculus and Analytic Geometry 1 Calculus with Algebra and Trigonometry II Topics in Calculus I	5
MATH 222 or MATH 276	Calculus and Analytic Geometry 2 Topics in Calculus II	4
MATH 234	Calculus—Functions of Several Variables	4
MATH 320	Linear Algebra and Differential Equations	3
MATH 321	Applied Mathematical Analysis	3
STAT 324	Introductory Applied Statistics for Engineers	3
<b>Total Credits</b>		<b>22</b>

### SCIENCE

Code	Title	Credits
Select one of the following:		5-9
CHEM 109	Advanced General Chemistry	
CHEM 103 & CHEM 104	General Chemistry I and General Chemistry II	
PHYSICS 202 or PHYSICS 208	General Physics General Physics	5
PHYSICS 241 or PHYSICS 205	Introduction to Modern Physics Modern Physics for Engineers	3
<b>Total Credits</b>		<b>13-17</b>

### ENGINEERING SCIENCE

Code	Title	Credits
E M A 201	Statics	3
E M A 202 or M E 240	Dynamics Dynamics	3
E M A 303 or M E 306	Mechanics of Materials Mechanics of Materials	3
E P 271 or COMP SCI 310	Engineering Problem Solving I Problem Solving Using Computers	3
M S & E 350	Introduction to Materials Science	3
M E 231	Geometric Modeling for Design and Manufacturing	3
M E 361	Thermodynamics	3
Select one of the following:		4-6
CBE 320	Introductory Transport Phenomena	
M E 363 & M E 364	Fluid Dynamics and Elementary Heat Transfer	
E C E 376	Electrical and Electronic Circuits <sup>1</sup>	3
Computing Elective (select one of the following):		3
COMP SCI 300	Programming II	
COMP SCI 412	Introduction to Numerical Methods	
E M A/E P 471	Intermediate Problem Solving for Engineers	

E M A/E P 476	Introduction to Scientific Computing for Engineering Physics	
<b>Total Credits</b>		<b>31-33</b>

<sup>1</sup> PHYSICS 321 Electric Circuits and Electronics is an acceptable substitute for E C E 376 Electrical and Electronic Circuits.

## NUCLEAR ENGINEERING CORE

Code	Title	Credits
N E 305	Fundamentals of Nuclear Engineering	3
N E 405	Nuclear Reactor Theory	3
N E 408	Ionizing Radiation	3
N E 411	Nuclear Reactor Engineering	3
N E 412	Nuclear Reactor Design	5
N E/M S & E 423	Nuclear Engineering Materials	3
N E 424	Nuclear Materials Laboratory	1
N E 427	Nuclear Instrumentation Laboratory	2
N E 428	Nuclear Reactor Laboratory	2
N E 571	Economic and Environmental Aspects of Nuclear Energy	3
<b>Total Credits</b>		<b>28</b>

## NUCLEAR ENGINEERING ELECTIVES

Code	Title	Credits
<i>Technical Electives (not to be confused with Nuclear Engineering Electives or Medical Physics Electives) choose 2 credits from:</i>		2
N E 1	Cooperative Education Program (no more than 3 credits)	
300+ level courses in the CoE except for E P D/ INTEREGR		
300+ level courses in MATH, PHYSICS, COMP SCI, STAT (except STAT 301), ASTRON, MED PHYS, and CHEM departments		
<i>Nuclear Engineering Electives</i>		6
Select credits from Nuclear Engineering Electives Course List below		
<b>Total Credits</b>		<b>8</b>

### Nuclear Engineering Electives Course List <sup>1</sup>

Code	Title	Credits
N E 234	Principles and Practice of Nuclear Reactor Operations	4
N E 406	Nuclear Reactor Analysis	3
N E/M S & E 433	Principles of Corrosion	3
N E/MED PHYS 506	Monte Carlo Radiation Transport	3
M E/N E 520	Two-Phase Flow and Heat Transfer	3
N E/E C E/ PHYSICS 525	Introduction to Plasmas	3
N E 536	Feasibility St of Power from Controlled Thermonuclear Fusion	3
N E 541	Radiation Damage in Metals	3
N E 545	Materials Degradation in Advanced Nuclear Reactor Environments	3

N E 550	Advanced Nuclear Power Engineering	3
N E 555	Nuclear Reactor Dynamics	3
N E/M E 565	Power Plant Technology	3
N E/MED PHYS 569	Health Physics and Biological Effects	3-4
N E/I SY E 574	Methods for Probabilistic Risk Analysis of Nuclear Power Plants	3
N E 602	Special Topics in Reactor Engineering	3

Students are encouraged to access the online N E future course offering grid to plan their future course schedules and to confirm the offering of a course in the table.

<sup>1</sup> Courses meeting the Nuclear Engineering Electives requirement are all N E courses numbered above 200 that are not part of the required curriculum. No more than 3 credits of N E 699 Advanced Independent Study may be used to meet this requirement. (Refer to the NE handbook under Degree Information on the NE department website (<https://www.engr.wisc.edu/department/engineering-physics/academics/bs-nuclear-engineering/>)).

## INTRODUCTION TO ENGINEERING

Code	Title	Credits
INTEREGR 170	Design Practicum	3
<b>Total Credits</b>		<b>3</b>

## 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 ESL 118	Academic Writing II	
E P D 275	Technical Presentations	2
INTEREGR 397	Engineering Communication (was EPD 397 before Fall 2020)	3
<b>Total Credits</b>		<b>8</b>

## LIBERAL STUDIES ELECTIVES

Code	Title	Credits
<b>College of Engineering Liberal Studies Requirements</b>		
Complete Requirements ( <a href="http://guide.wisc.edu/undergraduate/engineering/#requirementstext">http://guide.wisc.edu/undergraduate/engineering/#requirementstext</a> ) <sup>1</sup>		16
<b>Total Credits</b>		<b>16</b>

<sup>1</sup> 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 department or program. 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.

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>).

## RADIATION SCIENCES FOCUS AREA CURRICULUM

The following curriculum applies to students who entered the program starting in Fall 2020. Students wishing to select the Radiation Sciences focus area must have a 3.0 GPA and should send an email to the department Chair, Paul Wilson, [chair@ep.wisc.edu](mailto:chair@ep.wisc.edu) including a copy of their transcript to show that they meet the GPA requirement and stating that they desire to declare the Radiation Sciences focus area; they should copy their academic advisor. Until this is done, the Power focus area is assumed.

### SUMMARY OF REQUIREMENTS

Code	Title	Credits
	Mathematics and Statistics	22
	Science	16
	Engineering Science	28
	Nuclear Engineering Core Requirement	24
	Radiation Sciences Electives	11
	Introduction to Engineering	3
	Communication Skills	8
	Liberal Studies	16
	Free Elective	1
	<b>Total Credits</b>	<b>129</b>

### MATHEMATICS AND STATISTICS

Code	Title	Credits
MATH 221	Calculus and Analytic Geometry 1	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 320	Linear Algebra and Differential Equations	3
MATH 321	Applied Mathematical Analysis	3
STAT 324	Introductory Applied Statistics for Engineers	3
	<b>Total Credits</b>	<b>22</b>

### SCIENCE

Code	Title	Credits
	Select one of the following:	5-10
CHEM 109	Advanced General Chemistry	
CHEM 103	General Chemistry I	
& CHEM 104	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
<b>Total Credits</b>		<b>16-21</b>

### ENGINEERING SCIENCE

Code	Title	Credits
E C E 376	Electrical and Electronic Circuits	3
or PHYSICS 321	Electric Circuits and Electronics	
E M A 201	Statics	3
E M A 202	Dynamics	3
or M E 240	Dynamics	
E M A 303	Mechanics of Materials	3
or M E 306	Mechanics of Materials	
E P 271	Engineering Problem Solving I	3
or COMP SCI 310	Problem Solving Using Computers	
M E 231	Geometric Modeling for Design and Manufacturing	3
M E 361	Thermodynamics	3
M S & E 350	Introduction to Materials Science	3
N E 424	Nuclear Materials Laboratory	1
	Computing Elective (select one of the following):	3
COMP SCI 300	Programming II	
COMP SCI 412	Introduction to Numerical Methods	
E M A/E P 471	Intermediate Problem Solving for Engineers	
E M A/E P 476	Introduction to Scientific Computing for Engineering Physics	
<b>Total Credits</b>		<b>28</b>

### NUCLEAR ENGINEERING CORE REQUIREMENT

Code	Title	Credits
	<b>Radiation Sciences Core</b>	
N E 305	Fundamentals of Nuclear Engineering	3
N E 405	Nuclear Reactor Theory	3
N E 408	Ionizing Radiation	3
N E 412	Nuclear Reactor Design	5
N E 427	Nuclear Instrumentation Laboratory	2
N E 428	Nuclear Reactor Laboratory	2
MED PHYS/ B M E/H ONCOL/ PHYSICS 501	Radiation Physics and Dosimetry	3
N E 571	Economic and Environmental Aspects of Nuclear Energy	3
<b>Total Credits</b>		<b>24</b>

### RADIATION SCIENCES ELECTIVES

Code	Title	Credits
	<i>Technical Electives (not to be confused with Nuclear Engineering Electives or Medical Physics Electives) choose 2 credits from:</i>	2

N E 1	Cooperative Education Program (no more than 3 credits)	
	300+ level courses in the CoE except for E P D/ INTEREGR	
	300+ level courses in MATH, PHYSICS, COMP SCI, STAT (except STAT 301), ASTRON, MED PHYS and CHEM departments	
	<i>Medical Physics Electives</i>	9
	Select credits from Medical Physics Electives Course List below	
<b>Total Credits</b>		<b>11</b>

### Medical Physics Electives Course List <sup>1</sup>

Code	Title	Credits
MED PHYS/ B M E 566	Physics of Radiotherapy	3
MED PHYS/N E 569	Health Physics and Biological Effects <sup>2</sup>	3-4
MED PHYS/ B M E 573	Medical Image Science: Mathematical and Conceptual Foundations	3
MED PHYS/ B M E 574	Imaging in Medicine: Applications	3
MED PHYS/ B M E 578	Non-Ionizing Diagnostic Imaging	4
MED PHYS/ B M E 580	The Physics of Medical Imaging with Ionizing Radiation	4
MED PHYS/ PHYSICS 588	Radiation Production and Detection	4
MED PHYS 671	Selected Topics in Medical Physics <sup>2</sup>	1-4
MED PHYS 701	Ethics and the responsible conduct of research and practice of Medical Physics	1

Students are encouraged to access the online N E future course offering grid to plan their future course schedules and to confirm the offering of a course in the table.

<sup>1</sup> Courses meeting the Medical Physics Electives requirement are MED PHYS courses numbered 500 and above and selected PHYSICS courses at or above the 400 level. No more than 3 credits of N E 699 Advanced Independent Study may be used to meet this requirement. (Refer to the NE handbook under Degree Information on the NE department website (<https://www.engr.wisc.edu/department/engineering-physics/academics/bs-nuclear-engineering/>.)

<sup>2</sup> N E/MED PHYS 569 Health Physics and Biological Effects and MED PHYS 671 Selected Topics in Medical Physics are especially recommended for students in this focus area.

### INTRODUCTION TO ENGINEERING

Code	Title	Credits
INTEREGR 170	Design Practicum	3
<b>Total Credits</b>		<b>3</b>

### 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 ESL 118	Academic Writing II	
E P D 275	Technical Presentations	2
INTEREGR 397	Engineering Communication (was EPD 397 before Fall 2020)	3
<b>Total Credits</b>		<b>8</b>

### LIBERAL STUDIES ELECTIVES

Code	Title	Credits
<b>College of Engineering Liberal Studies Requirements</b>		
Complete Requirements ( <a href="http://guide.wisc.edu/undergraduate/engineering/#requirementstext">http://guide.wisc.edu/undergraduate/engineering/#requirementstext</a> ) <sup>1</sup>		16
<b>Total Credits</b>		<b>16</b>

- <sup>1</sup> 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 department or program. 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.

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>).

### HONORS IN UNDERGRADUATE RESEARCH PROGRAM

Qualified undergraduates may earn an Honor in Research designation on their transcript and diploma by completing 8 credits of undergraduate honors research, including a senior thesis. Further information is available in the department office.

### 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.