Nuclear Engineering

A Guide for Undergraduate Majors

Last modified August 2020

This guide applies to students entering the program after August 2020. Students admitted prior to this should continue to follow the Undergraduate Student guide in effect when they entered the program. They may petition the department to select features of the new curriculum.

administered by the

Department of Engineering Physics

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Introduction

The **Nuclear Engineering** Program is administered by the **Department of Engineering Physics**. The Department Office is in room 151 of the Engineering Research Building (ERB). The Department Chair's office is room 153. The department also administers the **Engineering Mechanics** (**EM)** and the **Engineering Physics (EP)** undergraduate programs.

This guide is intended to provide **Nuclear Engineering** undergraduate students with information that will facilitate their studies at the University of Wisconsin-Madison. In addition to this guide, you should consult the **Undergraduate Catalog** (http://www.pubs.wisc.edu/ug/) for regulations and course descriptions in engineering.

The **Department of Engineering Physics** website is at https://www.engr.wisc.edu/department/engineering-physics/. From there you can follow links to specific sections for **NE** students. The **College of Engineering** (**COE**) web site (http://www.engr.wisc.edu) also provides information for engineering students.

We welcome you to the **Nuclear Engineering** Program and wish you a successful undergraduate career!

Career Opportunities in Nuclear Engineering

Nuclear engineering is defined as the application of nuclear and radiation processes in technology. An important application is the generation of electricity using nuclear reactors. Another important application is in medicine, where radiation and radioisotopes are used to diagnose and treat illness. Nuclear engineering offers students an important opportunity to help meet the energy needs of our society and to contribute to the improvement of health through medical applications. Further, because the nuclear engineering curriculum is very rich in engineering physics, graduates are prepared to work in a number of technical activities outside the nuclear engineering field.

Nuclear energy, both from fission and fusion, offers a promising approach to meeting the nation's energy needs--an approach that may preserve jobs, raise the standard of living of Americans, help prevent global warming, and alleviate the depletion of natural resources including natural gas, petroleum, and coal. Even more important, nuclear energy offers the only practical, environmentally benign approach to generating electricity on a large scale because it releases no harmful SO_2, NOX, CO_2, or particulate matter into the atmosphere. Nuclear energy has played, and continues to play, an important role in space exploration. Nuclear engineering has enabled the use of isotopic power supplies in deep space probes like the Cassini mission and the mars surface exploratory missions, and may eventually be used to design fission or fusion-based systems for more demanding missions.

Since the discovery of fission many years ago, electricity has been produced commercially in a several hundred-billion-dollar industry. Applications of radioactive tracers have been made in medicine, science, and industry. Radiation from particle accelerators and materials made radioactive in nuclear reactors are used worldwide to treat cancer and other diseases, to provide the power for satellite instrumentation, to preserve food, to sterilize medical supplies, to search for flaws in welds and piping, and to polymerize chemicals. In addition, there is evidence from plasma research laboratories that breakthroughs are imminent in the field of controlled thermonuclear fusion.

The **Nuclear Power** curriculum prepares students for careers in the nuclear industry and government with electric utility companies, in regulatory positions with the federal or state governments, or for major contractors on the design and testing of improved reactors for central-station power generation or for propulsion of naval vessels.

The **Radiation Sciences** curriculum prepares students to pursue careers in health physics and the medical applications of radiation and nuclear processes. Advanced study at the M.S. level in either medical physics or health physics is recommended for students pursuing this option and, increasingly, the PhD is becoming the terminal degree. Medical physicists may participate in the radiation treatment of cancer patients and in advanced medical imaging and diagnostic procedures. Health physicists may operate radiation protection programs at nuclear industrial facilities, hospitals, laboratories, universities and nuclear power plants, or may develop new methods of measuring ionizing radiation.

Because the curriculum provides a strong foundation in math and physics, it also prepares the graduate for work in many areas where a broad technical background is more important than specialization in a specific field. Thus, the graduate is also prepared to work in any area where a broad engineering background is helpful, such as management, marketing, etc. Recent graduates have found opportunities in finance and in consulting services. Deregulation of the electric utility industry is also providing opportunities for students who understand both electricity generation and business principles. There are also opportunities to delve into social sciences, community engagement and energy policy related to nuclear energy.

Finally, the curriculum gives students excellent preparation for graduate study in nuclear engineering as well as allied fields in science and engineering. Recent graduates have elected to pursue graduate study in physics, medicine, and business in addition to nuclear engineering.

Bachelor of Science in Nuclear Engineering

The undergraduate program leads to a Bachelor of Science degree in **Nuclear Engineering** and encompasses a wide range of topics. Because the breadth and rate of change in this field requires that the nuclear engineer have a broad educational background, the curriculum consists of physics, math, materials science, engineering mechanics, electronics, thermodynamics, heat transfer, computers, courses in the humanities and social science areas, and numerous elective courses. Courses of a specific nuclear engineering content are taken primarily in the fourth year.

The undergraduate program appeals to students who have interests in nuclear engineering, and to students who have strong interests in physics, mathematics, and engineering, but do not wish to specialize in a particular field in the early part of their college studies.

The UW-Madison undergraduate **Nuclear Engineering** Program is divided into two focus areas; a power focus area and a radiation sciences focus area. A student interested in the radiation sciences focus area would declare this option during their sixth semester and preferably at the beginning of the semester. Because upper level courses are taken from the department of Medical Physics, students must have 3.0 GPA to enter the focus area. Students with a GPA between 2.7 and 3.0 can petition the department chair for entry into the radiation sciences focus area.

Power Focus area

The power focus area emphasizes power generation applications of nuclear engineering and is designed for students wishing to pursue careers in the nuclear power industry. The curriculum first provides a strong foundation in physics, chemistry, mathematics, computing methods, and the engineering sciences. It then applies this broad science and engineering knowledge to basic principles of nuclear reactors: nuclear reactor analysis, radiation transport and shielding, heat transfer in nuclear reactor systems, nuclear materials, and nuclear reactor design. The student also has the opportunity to choose a number of technical electives he or she finds particularly appealing. This can include courses in radiation damage, power plant technology, advanced fission or fusion power systems, or other suitable courses chosen in consultation with the advisor.

Radiation Sciences focus area

The Radiation Sciences focus area emphasizes the non-power applications of nuclear engineering. Like the Power focus area, it provides the same strong foundation in a broad range of disciplines. This focus area is identical to the Power focus area in the first two years and differs only slightly in the third year. It is in the final year that the Radiation Sciences focus area differs significantly from the Power focus area. It includes courses on biological effects of radiation, radiation detection and instrumentation, shielding of radiation, production and use of radiation sources, the safe handling and disposal of radioactive materials, and a number of medical physics electives. Students can pursue a M.S. degree in either **Nuclear Engineering**, **Medical Physics** or **Health Physics** after obtaining the B.S. degree. Those interested in Medical Physics or Health Physics should also consider a PhD, as this is rapidly becoming the key to entry into the field. There is also interest in the production of radiation sources for patient treatment, and neutron and photon imaging for industrial, commercial and security applications. Students interested in these applications may want to consider the M.S. Nuclear Engineering degree. The curriculum has been developed by a joint effort of the **Engineering Physics** and **Medical Physics** departments.

Focus area Selection

Students wishing to select the **Radiation Sciences** focus area should send an email to the department Chair, Paul Wilson, 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.**

Objectives and Expected Outcomes

Whatever path our graduates choose to pursue, our educational objectives for the nuclear engineering and engineering mechanics programs are to allow them to:

1. Exhibit strong performance and continuous development in problem-solving, leadership, teamwork, and communication, initially applied to nuclear engineering or engineering mechanics, and demonstrating an unwavering commitment to excellence.
2. Demonstrate continuing commitment to, and interest in, his or her training and education, as well as those of others.
3. Transition seamlessly into a professional environment and make continuing, well-informed career choices.
4. Contribute to their communities.

Nuclear Engineering Program students are expected to have…

1. An ability to identify, formulate, and solve engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare. as well as global, cultural, social, environmental, and economic factors.
3. An ability to communicate effectively with a range of audiences.
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgement to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Curriculum Requirements

The curriculum applies to students who entered the program after Fall 2020. Students admitted prior to this may petition the department to select features of the new curriculum. For curriculum requirements prior to Fall 2020, see earlier versions of this document.

Requirements for Progression and for Continued Enrollment for Students Entering in Fall 2020

Students who begin this program after August 2020 will be required to meet the requirements. To continue in the Nuclear Engineering program or any other College of Engineering (CoE) degree program after direct admission or to be considered for admission to a CoE degree program after enrollment at UW-Madison as part of another classification, students must complete progression requirements (College of Engineering Regulations 3.7). Progression requirements and Progression GPA benchmarks can be found at the following weblink: https://progression.engr.wisc.edu/.

Detailed Curriculum Requirements

The following pages begin with detailed course plans that indicate the suggested sequence of courses that will satisfy the requirements of the Nuclear Engineering degree programs in each focus area. Although many students do not follow this sequence precisely, all courses described here are required for successful completion of the degree.

Nuclear Engineering - Power Focus Area

Suggested Sequence

Fall Semester	Cr	Spring Semester	Cr
Freshman Year			
Chem 109 Advanced Gen. Chemistry[1]	5	EMA 201 Statics[3]	3
Math 221 Calculus & Analytic Geom.	5	Math 222 Calculus & Analytic Geom.	4
Communications "A" Elective	3	MS&E 350 Intro to Materials Science	3
InterEgr 170 Design Practicum[2]	3	ME 231 Graphics	3
		Liberal Studies Electives	3
Total	**16**	**Total**	**16**
Sophomore Year			
Math 234 Calculus-Fn. Of Several Variables	4	Math 320 Linear Algebra & Diff. Eqns.	3
Phys 202 General Physics	5	Physics 241 or Phys. 205 Modern Phys.	3
EMA 202 Dynamics	3	ME 361 Engineering Thermodynamics	3
EP 271 Engr. Prob. Solving I[4]	3	EMA 303 Mechanics of Materials[5]	3
EPD 275 or CA 105 Public Speaking	2	NE 424 Nuclear Materials Laboratory	1
		Liberal Studies Electives	3
Total	**17**	**Total**	**16**
Junior Year			
NE 305 Fund. Of Nuclear Engr.	3	NE 405 Nuclear Reactor Theory	3
Math 321 Applied Math. Analysis	3	NE 408 Ionizing Radiation	3
Statistics 324[6]	3	CBE 320 Intro. Transport Phenom.[7]	4
Technical Elective	2	Computing Elective	3
Liberal Studies Electives	4	ECE 376 Electrical Circuits or Phys 321	3
Total	**15**	**Total**	**16**
Senior Year			
NE 427 Nuclear Instrum. Lab	2	NE 412 Nuclear Engineering Design	5
NE 411 Nuclear Reactor Engr	3	NE 428 Nuclear Reactor Lab	2
Nuclear Engineering Elective	3	NE 571 Econ. & Environ. Aspects of Nuclear Energy	3
NE 423 Nuclear Engineering Materials	3		
Liberal Studies Electives	3	Nuclear Engineering Elective	3
InterEgr 397 Technical Writing	3	Liberal Studies Elective	3
Total	**17**	**Total**	**16**

Courses specific to the Power focus area are shown in Blue

Total credits required for graduation: 129

1. Students should take Chem 109 5 cr.; students with inadequate preparation in high school chemistry may substitute Chem 103 and 104, for a total of 9 credits. Three credits of Chem 103/104 may be counted as Technical Electives credits.
2. Students who were not able to take InterEgr 170 as freshmen may, with the approval of their advisor, substitute 3 credits of electives from courses offered in the College of Engineering or in the Departments of Chemistry, Computer Science, Mathematics, and Physics.
3. Students may substitute Phys 201, 5 cr., for EMA 201, 3 cr., with the approval of their advisor.
4. Computer Science 310 is an acceptable substitute for EP 271.
5. ME 306 is an approved substitution for EMA 303.
6. Stat 311: Intro. to Math. Stat. or Stat 424: Statistical Exper. Design for Engineers are acceptable substitutes.
7. The sequence: ME 363 and ME 364 is an acceptable substitute for CBE 320.

Nuclear Engineering - Radiation Sciences Focus Area

Suggested Sequence

Fall Semester	Cr	Spring Semester	Cr
Freshman Year			
Chem 109 Advanced General Chemistry[1]	5	EMA 201 Statics[3]	3
Math 221 Calc & Analytic Geometry	5	Math 222 Calculus & Analytical Geometry	4
Communications "A" Elective	3	MS&E 350 Intro to Material Science	3
InterEgr 170 Design Practicum[2]	3	ME 231 Graphics	3
		Liberal Studies Electives	3
Total	**16**	**Total**	**16**
Sophomore Year			
Math 234 Calculus-Fn of Several Variables	4	Math 320 Linear Algebra & Diff. Equations	3
Physics 202 General Physics	5	Physics 241 or Physics 205 Modern Phys	3
EMA 202 Dynamics	3	ME 361 Engineering Thermodynamics	3
EP 271 Engr Problem Solving I[4]	3	EMA 303 Mechanics of Materials[5]	3
EPD 275 or CA 105 Public Speaking	2	NE 424 Nuclear Materials Laboratory	1
		Liberal Studies Elective	3
Total	**17**	**Total**	**16**
Junior Year			
NE 305 Fund of Nuclear Engineering	3	NE 405 Nuclear Reactor Theory	3
Math 321 Applied Mathematical Analysis	3	NE 408 Ionizing Radiation	3
Statistics 324[6]	3	Physics 322 Electromagnetic Fields	3
Technical Elective[7]	2	Computing Elective	3
Liberal Studies Electives	4	ECE 376 Electrical Circuits or Physics 321	3
		Free Elective	1
Total	**15**	**Total**	**16**
Senior Year			
NE 427 Nuclear Instrumentation Lab	2	NE 412 Nuclear Engineering Design	5
Med Phys 501 Radiological Physics & Dosimetry	3	NE 571 Economic & Environmental Aspects of Nuclear Energy	3
Medical Physics Electives	6	NE 428 Nuclear Reactor Lab	2
Liberal Studies Electives	3	Medical Physics Elective	3
InterEgr 397 Technical Writing	3	Liberal Studies Elective	3
Total	**17**	**Total**	**16**

Courses specific to the Radiation Sciences focus area are shown in Red

Note: Students interested in the radiation sciences focus area would declare this option (at the department level, see page 3 under **Focus Area Selection** for instructions) during their fifth semester and preferably at the beginning of the semester. Because upper level courses are taken from the department of Medical Physics, students must have 3.0 GPA to enter the focus area. Students with a GPA between 2.7 and 3.0 can petition the department chair for entry into the radiation sciences focus area.

Total credits required for graduation: 129

1. Students should take Chem 109, 5 cr.; students with inadequate preparation in high school chemistry may substitute Chem 103 and 104, for a total of 9 credits. Three credits of Chem 103/104 may be counted as Technical Electives credits.
2. Students who were not able to take InterEgr 170 as freshmen may, with the approval of their advisor, substitute 3 credits of electives from courses offered in the College of Engineering or in the Departments of Chemistry, Computer Science, Mathematics, and Physics.
3. Students may substitute Phys 201, 5 cr., for EMA 201, 3 cr., with the approval of their advisor.
4. Computer Science 310 is an acceptable substitute for EP 271.
5. ME 306 is an approved substitution for EMA 303.
6. Stat 311: Intro. to Math. Stat. or Stat 424: Statistical Exper. Design for Engineers are acceptable substitutes.
7. Physics 623 Electronic Aids to Measurements, is recommended for students in the Radiation Sciences focus area

Electives Requirements

Liberal Studies Electives (16 credits)

Sixteen credits from the College of Engineering, the Institute for Environmental Studies, or the College of Letters and Science that carry H, S, L, or Z Class Search (formerly *Timetable)* breadth designators must be taken to fulfill the Liberal Electives Requirements. These credits must fulfill the following sub- requirements:

I. A minimum of two courses must be from the same department or program. At least one of these two courses must be above the elementary level (i.e. must have I, A, or D level designator), as indicated in Class Search.

II. A minimum of six credits must be in courses designated as humanities (H, L, or Z), and an additional minimum of three other credits designated as social studies (S or Z). Foreign language credits count as H credits.

III. At least three credits must be in courses designated as ethnic studies (lower case "e" in Class Search). These credits may help satisfy regulations I or II as well but may count only once toward the total credits required.

Communications "A" Elective (3 cr)

Students must take one course from the following list:

Eng 100	Freshman Composition	3 credits
Comm Arts	100 Introduction to Speech Composition	3 credits
LSC 100	Science and Storytelling	3 credits

Many students find it useful to take a Communication “A” elective and InterEgr 170 concurrently in the fall semester of their freshmen year.

Communications "B" Elective

This requirement is met by InterEgr 397, which is a required course. Other communication “B” courses may be substituted upon approval of the faculty advisor.

Computing Elective (3 cr)

Students must take one course from the following list:

CS 300	Programming II	3 credits
CS 412	Introduction to Numerical Methods	3 credits
EP/EMA 471	Engineering Problem Solving II	3 credits
EP/EMA 476	Computational Engineering	3 credits

Technical Electives (3 cr)

Technical Electives (not to be confused with Nuclear Engineering Electives or Medical Physics Electives) must be chosen from courses offered by the College of Engineering, or by the departments of Physics, Mathematics, Computer Science, or Chemistry.

Nuclear Engineering Electives (6 credits in the power focus area)

Courses meeting the Nuclear Engineering Electives requirement are all NE courses numbered above 200 that are not part of the required curriculum. No more than 3 credits of NE 699, Independent Study, may be used to meet this requirement. Courses recommended for meeting this requirement are;

Courses	Title	Prerequisite(s)	Offering Frequency[1]
NE 234	Nuclear Reactor Operations	Consent of Instructor	on demand
NE 406	Nuclear Reactor Analysis	NE 405	I, odd
NE 433	Principles of Corrosion	M.S.&E. 350 or 351	I, odd
NE 506	Monte Carlo Radiation Transport	NEEP 305 or equiv AND 1 of NEEP NEEP 405, 408, Med Phys 501 or 569, or consent of instructor	II
NE 520	Two-Phase Flow and Heat Transfer	ME 361 (or CBE 310 or equiv.) CBE 320 (or ME 364 or equiv.)	I, odd
NE 525	Introduction to Plasmas	1 course each in mechanics & E&M (beyond elem. physics)	I, II
NE 536	Feasibility of Controlled Fusion	NE 405, 525	on demand
NE 541	Radiation Damage in Metals	M.S. &E 350 or 351	I, odd
NE 550	Adv Nuclear Power Engineering	NE 405, 411	I, even
NE 555	Nuclear Reactor Dynamics	NE 405	every 3rd sem
NE 565	Power Plant Technology	ME 361 or consent of instructor	I, odd
NE 569	Health Physics	Consent of instructor	II
NE 574	Probabilistic Risk Analysis	Stat 311 or equiv or Math 431	II, even
NE 602	Special Topics: Materials Degradation in Advanced Nucl.Reactor Env.	M.S.&E. 350	I, even

Students are encouraged to access the online NE future course offering grid to plan their future course schedules and to confirm the offering of a course in the table. The course offering grid can be found at the following weblink: https://www.engr.wisc.edu/app/uploads/2019/11/NE-Future-Course-Offering-11.2019.pdf

Medical Physics Electives (9 credits in the radiation sciences focus area)

Courses meeting the Medical Physics Electives requirement are Medical Physics courses numbered 500 and above and selected Physics courses at or above the 400 level. No more than 3 credits of NEEP 699, Independent Study, may be used to meet this requirement. Courses of interest include:

Course	Title	Prerequisite(s)	Offering Frequency [1]
Med Phys 566	Physics of Radiotherapy	Med Phys 501	II
NE/MP 569	Health Physics	Consent of instructor	I
Med Phys 573	Medical Image Science: Mathematical and Conceptual Basis	1 yr each of Physics & Calculus	I
Med Phys 574	Medical Imaging: Applications	Med Phys 573	II
Med Phys 578	Non-Ionizing Diagnostic Imaging	Modern Physics and Calculus	II
Med Phys 580	The Physics of Imaging with Ionizing Rad,	Med Phys 501 and Med Phys 573	II
Med Phys 588	Radiation Production and Detection	Med Phys 501	II
Med Phys 671	(Special Topics) Fundamentals of Cellular, Molecular, and Radiation Biology		I
Med Phys 701	Ethics, Responsible Conduct of Research and Practice of Medical Physics		I

NE/Med Phys 569 and 671 are especially recommended for students in this focus area.

Key: I = Fall Semester; II = Spring Semester; SS = Summer Session; even and odd refer to the year in which courses taught in alternate years are given.

Special Programs for Nuclear Engineering Students

The **Honors in Research** Program is designed for students who want to get involved in research and receive recognition on their diploma and transcript. It is highly recommended for students contemplating graduate study.

Undergraduate Honors in Research Program

Expectations for Honors in Research Projects

The student will carry out a research project, which 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 scholarly publications resulting from the research. The research need not be an independent effort by the student, but can be participation in a larger team effort, as long as it meets the criteria above.

Admission Requirement

At least two semesters completed on the Madison campus with a cumulative GPA of **at least 3.5**.

Admission Process

The student should identify and obtain the concurrence of an appropriate professor to serve as the thesis advisor. The student should submit a letter to the Engineering Physics department chair requesting admission, stating the approximate topic of the proposed research, and identifying the proposed thesis advisor under whose guidance the student will be working. The topic should be appropriate to the major. A letter from the proposed thesis advisor supporting the application should be included.

Academic Credit

Students register for credit in Honors in Undergraduate Research (NE 489). Students may register for 1 to 3 credits per semester. A grade of "P" (Progress) will be assigned each semester until the student completes the senior thesis or drops out of the program, at which time a final grade is assigned. This becomes the grade for all credits taken in NE 489.

Senior Thesis

A senior thesis worth 3 credits of NE 489 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 thesis advisor determines the grade the student receives for the thesis. A bound copy of the thesis should be submitted to the Engineering Physics department office.

Before the end of the last semester of undergraduate studies, the senior thesis should be presented by the student to a committee of three professors in a publicly announced seminar. Interested faculty and students will be invited to attend.

Honors Designation

"Honors in Research" designation will be awarded to graduates who meet the following requirements:

1. Satisfaction of requirements for an undergraduate degree in either **Engineering Mechanics** or **Nuclear Engineering**.
2. A cumulative grade-point average of at least 3.3.
3. Completion of a senior honors thesis (3 credits of NE 489) with a grade of B or better.
4. Completion of a total of at least 8 credits in NE 489.

Recognition

The designation, **"Honors in Research"** will be recorded on the student's transcript and diploma.

Advising

First year NE students will be assigned an advisor from the CoE Student Services Center, 1410 Engineering Drive, Suite 170. Continuing students who have fulfilled the progression requirements (page 5) will be assigned an NE faculty advisor starting with their second year. **Students retain the same advisor until graduation, even if they do not progress in class standing at the normal rate.** The list of faculty advisors is available in the Department office. Before enrolling in courses each semester, students must meet with their faculty advisor for assistance in planning courses and meeting degree requirements. **Students are required to consult with their advisor before enrolling for the semester to have their registration hold removed. Students will either receive a signed course advising form for drop off at the Student Services Center or their advisor can forward an email informing the Student Services department advisor to remove the registration hold.**

Wait Listed Courses: In any given semester, courses may fill up quickly depending on demand. Some courses may have a wait-list established through the enrollment system. Students will be notified by email if they have been given permission to enroll from the wait-list. The department will assist students in enrolling for the courses they need. However, there is no guarantee that students will be allowed into a wait-listed section. If it is an EMA, EP, or NE course, contact the Student Services Center to see if additional sections will be opened or if the registration enrollment will be raised. Also, see your advisor about other options available to you.

Grievance Procedure

Students who feel that they have been treated unfairly have the right to a prompt hearing of their grievance. Such complaints may involve course grades, classroom treatment, advising, various forms of harassment, or other issues. Any student or potential student may use these procedures.

The College of Engineering has established policies and procedures for proper accounting of students' grievances. The policies and procedures are described at https://www.engr.wisc.edu/academics/student-services/academic-advising/policies-and-procedures/.

DARS Reports

The DARS (Degree Audit Reporting System) report is a computer-generated record of courses you have taken and where you stand relative to degree requirements. It is an aid to help you and your advisor in tracking your progress towards graduation. This record can be obtained through your **MyUW** webpage. You should be aware that the DARS report is **unofficial** and may contain errors. **You should check your DARS report on a regular basis for errors and bring them to the attention of your advisor**, so that a correction can be made. Your student records will still be subject to an audit at graduation.

Tips to Help You

Course Planning

There are several sequences of courses in the program in which one course is a prerequisite for the next course in the sequence. Because some courses are only taught one semester each year, if you do not plan your program in advance you may find your graduation delayed by as much as a year. Although it is common for students to deviate from the suggested four-year program sequence, it is important to check with your advisors who can help ensure that your personal course plan keeps you on track for a timely graduation. Any deviation from the four-year plan should be carefully considered with respect to prerequisites and course offering frequencies.

Course Recommendations

1. Mathematics 322 and 340 are additional useful courses beyond the required mathematics courses and may be of particular interest for students interested in graduate study.
2. Statistics 324 is the suggested statistics course for the curriculum. NE students are encouraged to take a

more challenging course such as Statistics 311 or 431. These courses are very desirable for students interested in reactor safety and operation. Statistics 311 or 431 is a prerequisite for NE 574.

3. Physics 322 is recommended for students interested in plasma physics, fusion, or applied superconductivity. It is a prerequisite for NE 525.
4. Physics 311, a more advanced course in dynamics, may be used to replace EMA 202. Students planning to enter graduate school, especially in the areas of plasmas, fusion, or radiation damage should take Physics 311.
5. Physics 623, Electronic Aids to Measurement, is recommended for students in the **Radiation Sciences** focus area.

Summer School Course Offerings

Currently, the department plans to offer NE 412 during the eight-week summer session.

Independent Study – NE 699

Undergraduate students are strongly encouraged to enroll in NE 699, Independent Study, to gain exposure to research. This will broaden the mental horizons of the student participants, will help those wondering about graduate study to make a decision, and will help those aimed towards graduate study to compare areas of research. Students work on research projects under the guidance of a professor. Together they agree on the work to be done and the credits earned (usually 1-3) per semester. No more than 3 credits of NE 699 can be used towards the Nuclear Engineering elective requirement.

Co-op/Internship Program

The Co-op/Internship program is an excellent way to get engineering experience while working in a company, either for a summer or a semester. Many students have found these programs extremely valuable in enhancing their education and are frequently in a favored position to gain employment with the company after graduation. Due to the sequences of courses that are only offered annually, students should meet with their faculty advisor to carefully develop a course plan that is compatible with the co-op experience. Consult with the department chair, faculty advisor, the Engineering Career Services office, Engineering Hall, room 1150, and the following web link: https://ecs.wisc.edu/students/co-op-and-internship/ for further information on co-ops and internships.

Study Abroad

Research is an increasingly global activity and developing global competency is important for engineers. One way to improve global competency is to take part in a Study Abroad experience. Roughly a quarter of EP majors take part in a study or work abroad experience prior to graduation. More detailed information about opportunities can be found at:
https://www.engr.wisc.edu/academics/beyond-the-classroom/study-abroad/

Hourly Work

Working on research with a faculty member in the Department is a very valuable experience for undergraduates. A number of undergraduates are employed by faculty members either under the work- study program or on research grants. Students are encouraged to explore such opportunities by talking to members of the faculty.

Reactor Operations

Students interested in reactor operations may wish to become involved in the operation of the 1 MW TRIGA reactor located in the Department. Successful completion of the course may lead to a reactor operating license and subsequent employment in the reactor laboratory. Many employers view such experience very favorably. Interested students should contact the Reactor Director, Mr. Agasie (1209 ME, 262-3392), in their freshman or sophomore years.

Letters of Recommendation

The letters of recommendation you will request as a senior will have a significant effect on your job opportunities, salary offers, graduate fellowship opportunities, admission to graduate schools, and so on. It is important that the writers of such letters be able to say that they know you well. Therefore, it can be very much worth your effort to ensure that one or two of your instructors, advisors, or faculty employers know you really well. For example, you might do an extra project for an instructor in a course, you might work as a student hourly employee in a

laboratory, you might take independent-study courses, or you might volunteer for Engineering Expo or other activities which will favorably call you to the attention of faculty. Participating in class discussions and asking many intelligent questions is also helpful.

Professional Registration

Most states license professional engineers. Registration as a professional engineer is a requirement for some jobs and generally increases the earning power and responsibility of the licensed individual. The registration process requires exams on Fundamentals of Engineering (FE) and on the principles and practice of engineering. Seniors can usually pass these exams easily and are urged to take them.
Information may be obtained from: Wisconsin Department of Safety and Professional Services, 55 N. Dickinson St., Madison, WI 53703, phone 608-266-2112, http://dsps.wi.gov/Home; NCEES, http://ncees.org/; NCEES, (http://www.ncees.org/) has information and study guides for the FE exam. Be aware that the FE exam is given only in April and October, and the deadline for filing applications is typically a few months earlier. Therefore, students should begin planning for the exam while they are still juniors.

Graduation Requirements

Students should particularly note the requirements for graduation given in 38b, c, and f of the "Official Regulations Regarding Enrollment, Scholarship, and Graduation for Undergraduates in The College of Engineering of University of Wisconsin-Madison." This can be found under the "graduation" tab in the Student Services section of the College of Engineering webpage https://www.engr.wisc.edu/academics/student-services/academic-advising/undergraduate-engineering-students/rules-and-regulations/. Among other requirements paragraph 38 specifies GPA requirements for the last 60 credits, for courses taken in your major, and for the student's last semester and last two semesters.

Credit for Previous Work

Students who have done college level work elsewhere can usually transfer credits earned at other colleges. Contact the Student Services Center, 1410 Engineering Drive, Suite 170, to discuss a transfer of credits. In addition, there is the possibility of having prerequisites waived, of having course requirements waived, or of receiving course credit. Generally, prerequisites can be waived by the instructor teaching the course. The Department Chair can waive course requirements, and the department that offers a course can give credit for one of its courses either by examination or on the basis of evidence of equivalent work.

Scholarships and Financial Aid

Most financial assistance is awarded through the Office of Student Financial Aid (333 East Campus Mall #9701, 262-3060). Some financial assistance is also available from the College of Engineering. Please see your academic advisor or Student Services Center, 1410 Engineering Drive, Suite 170, for more information. The Department has a limited amount of scholarship funds awarded on a merit basis. An application for departmental scholarships is not necessary; all students are automatically considered in the competition for departmental scholarships. The Department of Energy and the American Nuclear Society award nuclear engineering scholarships. Scholarship information is available using the Wisconsin Scholarship Hub (WiSH): https://wisc.academicworks.com/.

Graduate Study

M.S. and Ph.D. in Nuclear Engineering and Engineering Physics

The Department offers the **Master's of Science** and **Doctor of Philosophy** degrees in **Nuclear Engineering and Engineering Physics**. Students interested in graduate work in **NEEP** can find more information at the **NEEP Graduate Program** website, https://www.engr.wisc.edu/department/engineering-physics/academics/ms-nuclear-engineering/ or from The Academic Policies and Procedures for Graduate Work in Nuclear Engineering and Engineering Physics is available in the Department Office. Additional information about opportunities and financial aid may be obtained from the Department Administrator, Mr. Dennis Manthey in 146 ERB. Information from other graduate schools is available on the bulletin board outside the Department Office, in the library, and in the

Graduate School in Bascom Hall.

M.S. in Medical Physics-Health Physics Option

A bachelor's degree in **Nuclear Engineering** provides an excellent background for an **M.S.** degree in **Medical Physics** with a Health Physics option. The **Radiation Sciences** focus area is especially designed for students wishing to pursue this path. NE courses which are required for this **M.S.** degree are: NE 305, NE 427, 569, and 571. **Medical Physics** courses which are required for the **M.S.** and can be taken by undergraduates are: Med Phys 501, 566, 573, 578, 671, 580, 588 and 701. In addition to these requirements, **M.S.** candidates must take Med Phys 663, one of 661, 662, or 665, and also one credit of 699 and four credits of 900.

Graduate Record Examination

Students planning to enter graduate school should take the GRE in the fall of their senior year. This exam is required by many graduate schools and for most graduate fellowships. Details may be obtained from the Graduate School Fellowships Office, 217 Bascom Hall.

Special Programs

There are several Certificates available in the College of Engineering:

- Biology in Engineering Certificate
- Certificate in Energy for Energy Sustainability
- Certificate for Engineering Thermal Energy Systems
- Certificate in Integrated Studies in Science, Engineering and Society
- Certificate in International Engineering
- Certificate in Japanese Studies for Engineering Majors
- Certificate in nuclear Engineering Materials
- Certificate in Technical Communications

Some of the available options are highlighted below.

Engineering Honors in the Liberal Arts

The Engineering Honors in the Liberal Arts program is designed for engineering students with unusual ability and interest in the liberal arts and who desire access to the special honors sections open to L&S honors students. For further information, see https://www.engr.wisc.edu/academics/undergraduate-academics/honors/ or contact Dr. Andrew Greenberg, EHLA program Director, andrew.greenberg@wisc.edu, telephone 608-890-1534.

Certificate in Nuclear Engineering Materials

The goal of this certificate is to combine a comprehensive set of course curricula that will provide students with an understanding of the challenges and remedial measures associated with materials in nuclear energy systems. It includes courses in radiation damage, nuclear fuel performance, corrosion, and Joining/Welding. A laboratory course will provide hands-on experimental analysis in the areas of corrosion, welding, radiation damage, and non-destructive evaluation. Contact Professor Adrien Couet, Department of Engineering Physics, 921 Engineering Research Building, for further information.

Certificate in Technical Communications

The completion of approximately 15 elective credits in oral communication and technical writing leads to a Certificate of Technical Communication; the award is noted on the student's transcript. Representative courses include EPD 397 "Technical Writing," EPD 398 "Technical Communications Internship," EPD 275 "Technical Presentations," EPD 395 "Elements of Computer-Assisted Publishing," and CA 464 "Theory and Practice of Persuasion." The program will help students become better communicators as engineers or will prepare them to pursue careers in technical writing. For further information, see http://tc.engr.wisc.edu/certificate/ or contact the Department of Engineering Professional Development (432 North Lake Street, Madison, WI, phone 800-462-0876) for further information.

Certificate in Japanese Studies for Engineering Majors

The completion of the following courses leads to a Certificate in Japanese Studies for Engineering Majors; the award is noted on the student's transcript: East Asian 253 "Introduction to Japanese Civilization" (3 cr.); East Asian 103 and 104 "First and Second Semester Japanese" (12 cr.); Engineering Professional Development 374 and 375 "Technical Japanese I and II (6 cr.); History 455 "Japan's Modern Century" (4 cr.); and Business 461 "Comparative Management in Asia" (3 cr.) or other courses in Japanese studies. The student should note that, of the total of 28 credits, at least 17 may qualify as Liberal Electives. For further information, see http://tjc.engr.wisc.edu/certificate/ or contact Professor James L. Davis (Room M1056D Engineering Centers Building, 262-4810) for further information.

Letters & Science Second Major or Certificate for Engineering Students

Many **NE** students can easily satisfy the requirements of the Mathematics or Physics Departments for a second major by choosing appropriate electives. Such a second major or certificate is recorded on the transcript. Second majors or certificates must be approved in advance, first by the appropriate L&S department (by approval of a "Declaration of Major" form) and then by the Associate Dean of the College of Engineering. For more information,

see the appropriate Letters & Sciences department's website.

The requirements of the Physics Department for a second major are **30 credits** of Physics courses plus a laboratory requirement that is automatically satisfied by NE students who take NE 427 and NE 428.
There are two options by which a student may satisfy the requirements of the Mathematics Department for a second major. For a **NE** student the simplest option requires six courses beyond Math 234, and the six must include Math 320 or 340 and at least two math courses numbered above 500. Consult with the appropriate department office for the latest requirements.

Additional Information

Institute for Nuclear Energy Systems (INES) Seminars

The Institute for Nuclear Energy Systems (INES) seminar series presents the work of experts outside of the university to the faculty and students, broadening the understanding of the current scientific cutting edge, while presenting the university capability to the visitor. These lectures are announced on the Department bulletin board outside 153 ERB, in the weekly department e-newsletter, and the campus events calendar (http//today.wisc.edu/). Seminars are usually held on Tuesdays at 12:00 noon. Undergraduates are encouraged to attend.

ANS Student Section

Undergraduates are urged to join the Student Section of the American Nuclear Society. This gives them an opportunity to meet other students, take an active part in organizing activities, meet visiting speakers, and hear talks in their fields presented on a level appropriate for undergraduates. There are technical, organizational, and social meetings, including fall and spring picnics and an annual regional meeting at which students present papers. The ANS advisor is Prof. Adrien Couet (921 ERB, 265-7955, couet@wisc.edu). The ANS website is http://www.atomicbadger.org/

Society of Women Engineers (SWE)

The society of Women Engineers (SWE), founded in 1950, is a not-for-profit educational and service organization. SWE is the driving force that establishes engineering as a highly desirable career aspiration for women. SWE empowers women to succeed and advance in those aspirations and be recognized for their life-changing contributions and achievements as engineers and leaders. Contact 1410 Engineering Drive, Room 145B, sweofficersuw@gmail.com. The SWE web site is at http://swe.slc.engr.wisc.edu.

Engineering Expo

The Engineering Expo is an annual event (held in spring) that gives the public a unique opportunity to learn about engineering. It is also a great learning experience for students, one that is highly regarded by employers. Students can contribute a few hours per semester or several hours per week - from working on an exhibit to planning publicity. You might consider joining with the ANS section and other students in preparing exhibits that demonstrate nuclear engineering concepts. Interested students should speak with their advisor.

Some Friendly Advice

An alumnus who currently has the title of Manager at an important government facility expressed a view supported by others:

> *Engineers must be well rounded; a tremendous amount is expected of us by employers and the public. Communication skills, interpersonal relationships, team building, and positive attitude are essential for success.*
>
> *Tolerance for others' opinions (regardless of how misguided we may feel they are) is also extremely important.*
>
> *Transcending this there must be an inner commitment to excellence. I don't think this can be taught, but everyone must be challenged to excellence.*
>
> *Mediocrity should be sneered at, disdained - - - and never accepted. The faculty has a real challenge to motivate young engineers to not accept anything "half-way," anything less than excellence.*

Departmental Contacts

EP Department Staff & Faculty - https://www.engr.wisc.edu/department/engineering-physics/people-in-ep/

Student Services Center, 1410 Engineering Drive, Suite 170, Phone: (608) 262-3471

Frequently Asked Questions

Where is my Professor's/TA's office and mailbox?

The faculty members have offices in Engineering Research Building (ERB). Mailboxes are located on the first floor near the loading dock. The department TAs are also in the ERB, and their mailboxes near the loading dock as well. Check your course syllabus for your Professor's and TA's office number and office hours.

Where is the lost & found?

The Engineering Hall Lost & Found office is located in Room 1150 Engineering Hall, phone 263-5586. The ERB Lost and Found office is located in Room 132C ERB, 263-1624 (mailroom).

Does the department have a website?

Yes. The following websites provide helpful information;

Engineering Physics:	http://www.engr.wisc.edu/ep/
College of Engineering:	http://www.engr.wisc.edu/
AIAA chapter:	http://aiaa.coerso.wisc.edu/
ANS section:	http://www.atomicbadger.org/