NUCLEAR ENGINEERING AND ENGINEERING PHYSICS, PH.D.

A broad program of instruction and research is offered in the principles of the interaction of radiation with matter and their applications, and in several areas of engineering physics. The program has strong engineering and applied science components. It emphasizes several areas of activity, including the research, design, development, and deployment of fission reactors; fusion engineering; plasma physics; radiation damage to materials; applied superconductivity and cryogenics; and large-scale computing in engineering science.

The master’s degree may be pursued as a terminal degree in the fission area and in various engineering physics areas, but it is not generally recommended as a final degree in fusion research; students interested in fusion should plan to pursue the Ph.D. degree. About 40 percent of the current graduate students hold undergraduate degrees in nuclear engineering, about 40 percent in physics, and about 20 percent in other disciplines such as mechanical engineering, electrical engineering, mathematics, and materials science.

The department is considered to have one of the top five nuclear engineering programs in the nation over the last 40 years. It incorporates several research organizations including the Wisconsin Institute of Nuclear Systems, the Pegasus Toroidal Experiment Program, the Fusion Technology Institute, and the Center for Plasma Theory and Computation.

Research may be performed in areas including next generation fission reactor engineering; fluid and heat transfer modeling for transient analysis; reactor monitoring and diagnostics; fuel cycle analysis; magnetic and inertial confinement fusion reactor engineering, including the physics of burning plasmas, plasma-wall interactions, neutron transport, tritium breeding, radiation damage, and liquid-metal heat transfer; experimental and theoretical studies of plasmas including radio frequency heating, magnetic confinement, plasma instabilities, and plasma diagnostics; superconducting magnets and cryogenics; and theoretical and experimental studies of the damage to materials in fission and fusion reactors.

The department places considerable emphasis on establishing research teams or group research, as well as traditional research activity by individual faculty members and their students. The groups frequently involve faculty, scientific staff, and graduate students from several departments, adding a strong interdisciplinary flavor to the research.

Students sometimes perform thesis work at national laboratories such as Argonne National Laboratory, Idaho National Laboratory, Princeton Plasma Physics Laboratory, and Los Alamos National Laboratory.

ADMISSIONS

Please consult the table below for key information about this degree program’s admissions requirements. The program may have more detailed admissions requirements, which can be found below the table or on the program’s website.

Graduate admissions is a two-step process between academic programs and the Graduate School. Applicants must meet the minimum requirements (https://grad.wisc.edu/apply/requirements/) of the Graduate School as well as the program(s).

Once you have researched the graduate program(s) you are interested in, apply online (https://grad.wisc.edu/apply/).

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall Deadline</td>
<td>December 15</td>
</tr>
<tr>
<td>Spring Deadline</td>
<td>October 1</td>
</tr>
<tr>
<td>Summer Deadline</td>
<td>December 15</td>
</tr>
<tr>
<td>GRE (Graduate Record Examinations)</td>
<td>Required.*</td>
</tr>
<tr>
<td>English Proficiency Test</td>
<td>Every applicant whose native language is not English or whose undergraduate instruction was not in English must provide an English proficiency test score and meet the Graduate School minimum requirements (<a href="https://grad.wisc.edu/apply/requirements/#english-proficiency">https://grad.wisc.edu/apply/requirements/#english-proficiency</a>).</td>
</tr>
<tr>
<td>Other Test(s) (e.g., GMAT, MCAT)</td>
<td>n/a</td>
</tr>
<tr>
<td>Letters of Recommendation</td>
<td>3</td>
</tr>
</tbody>
</table>

   b) Due to COVID-19, GRE scores are not required for all applications to Nuclear Engineering and Engineering Physics graduate programs for the spring, summer, and fall 2021 semesters.

The Graduate School sets minimum requirements for admissions (https://grad.wisc.edu/admissions/requirements/) Academic program admission requirements are often more rigorous than those set by the Graduate School. Please check the program website (https://www.engr.wisc.edu/department/engineering-physics/graduate-physics/grad school) for details and admissions deadlines.

FUNDING

GRADUATE SCHOOL RESOURCES

Resources to help you afford graduate study might include assistantships, fellowships, traineeships, and financial aid. Further funding information (https://grad.wisc.edu/funding/) is available from the Graduate School. Be sure to check with your program for individual policies and restrictions related to funding.

PROGRAM RESOURCES

Offers of financial support from the Department, College, and University are in the form of research assistantships (RAs), teaching assistantships (TAs), project assistantships (PAs), and partial or full fellowships. Prospective PhD students that receive such offers will have a minimum five-year guarantee of support. The funding for RAs comes from faculty research grants. Each professor decides on his or her own RA offers, and a portion of the top domestic applicants is invited to visit Madison in order to meet faculty members and tour the department facilities. International applicants must secure an RA, TA, PA, fellowship, or independent funding before admission is final. Funded students are expected to maintain full-time enrollment. See the program website (https://www.engr.wisc.edu/department/engineering-physics/academics/ms-nuclear-engineering/) for additional information.
MINIMUM GRADUATE SCHOOL REQUIREMENTS

Review the Graduate School minimum academic progress and degree requirements (http://guide.wisc.edu/graduate/policiesandrequirementstext), in addition to the program requirements listed below.

MAJOR REQUIREMENTS

MODE OF INSTRUCTION

+ **Face to Face**
  - Evening/Weekend: Yes
  - Online: No
  - Hybrid: No
  - Accelerated: No

**Mode of Instruction Definitions**

- **Accelerated**: Accelerated programs are offered at a fast pace that condenses the time to completion. Students are able to complete a program with minimal disruptions to careers and other commitments.
- **Evening/Weekend**: Courses meet on the UW–Madison campus only in evenings and/or on weekends to accommodate typical business schedules. Students have the advantages of face-to-face courses with the flexibility to keep work and other life commitments.
- **Face-to-Face**: Courses typically meet during weekdays on the UW-Madison Campus.
- **Hybrid**: These programs combine face-to-face and online learning formats. Contact the program for more specific information.
- **Online**: These programs are offered 100% online. Some programs may require an on-campus orientation or residency experience, but the courses will be facilitated in an online format.

CURRICULAR REQUIREMENTS

**Requirements Detail**

<table>
<thead>
<tr>
<th>Minimum Credit Requirement</th>
<th>51 credits approved by the student’s faculty advisor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum Residence Credit Requirement</td>
<td>32 credits</td>
</tr>
<tr>
<td>Minimum Graduate Coursework Requirement</td>
<td>26 of the required 51 credits must be in graduate-level coursework from nuclear engineering, math, physics, chemistry, computer science, or any other engineering department except E P D; courses with the Graduate Level Coursework attribute are identified and searchable in the university’s Course Guide (<a href="http://my.wisc.edu/CourseGuideRedirect/BrowseByTitle=http://my.wisc.edu/CourseGuideRedirect/BrowseByTitle/">http://my.wisc.edu/CourseGuideRedirect/BrowseByTitle=http://my.wisc.edu/CourseGuideRedirect/BrowseByTitle/</a>).</td>
</tr>
<tr>
<td>Overall Graduate GPA Requirement</td>
<td>3.00 GPA required.</td>
</tr>
</tbody>
</table>

Other Grade Requirements

Courses in which grades of BC, C, or below are received cannot be counted toward the degree except as follows:

1. Credits of C will be allowed provided they are balanced by twice as many credits of A or by four times as many credits of AB, 2. Credits of BC will be allowed provided they are balanced by twice as many credits of AB or by an equal number of credits of A.

Assessments and Examinations

- **Ph.D. qualifying examination is required of all students.**
- **Final oral examination is required at the end of the thesis work.**

Language Requirements

- **No language requirements.**

REQUIRED COURSES

Students must fulfill the coursework requirements for the nuclear engineering and engineering physics M.S. (http://guide.wisc.edu/graduate/engineering-physics/nuclear-engineering-engineering-physics-ms/) degree whether receiving the M.S. degree or going directly to the Ph.D. They must complete an additional 9 credits of technical coursework at the graduate level, beyond the coursework requirement for the MS. Candidates must take three 700-level courses; must satisfy the Ph.D. technical minor requirement; and must satisfy the Ph.D. non-technical minor requirement.

The candidate is also required to complete, as a graduate student, one course at the 400 level or above in each of the following Areas: fission reactors; plasma physics and fusion; materials; engineering mathematics and computation (see Area Coursework Examples below).

M.S. Coursework Requirements

The following courses, or courses with similar material content, must be taken prior to or during the course of study: N E 427 Nuclear Instrumentation Laboratory; N E 428 Nuclear Reactor Laboratory or N E 526 Laboratory Course in Plasmas; N E 408 Ionizing Radiation or N E/MED PHYS 569 Health Physics and Biological Effects.

Thesis track

1. maximum of 12 credits for thesis; at least 8 credits of N E courses 400 level or above; remaining credits (also 400 level or above) must be in appropriate technical areas; at least 9 credits must be 500 level and above; up to 3 credits can be seminar credits.

Non-Thesis track

1. at least 15 credits of N E courses at the 400 level or above; remaining 15 credits (also 400 level or above) must be in appropriate technical areas; at least 12 credits must be at the 500 level or above; up to 3 credits can be seminar credits.

For both the thesis and non-thesis options, only one course (maximum of 3 credits) of independent study (N E 699 Advanced Independent Study, N E 999 Advanced Independent Study) is allowed.

1 These tracks are internal to the program and represent different pathways a student can follow to earn this degree. Track names do not appear in the Graduate School admissions application, and they will not appear on the transcript.
Appropriate technical areas are: Engineering departments (except Engineering and Professional Development), Physics, Math, Statistics, Computer Science, Medical Physics, and Chemistry. Other courses may be deemed appropriate by a student’s faculty advisor.

**Area Coursework Examples**

These courses are examples that would meet the requirement and are not meant to be a restricted list of possible courses. The candidate is required to complete one course in each of the following areas:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 703</td>
<td>Mathematical Methods</td>
<td>3</td>
</tr>
<tr>
<td>MATH 604</td>
<td>Advanced Engineering Mathematics</td>
<td>3</td>
</tr>
<tr>
<td>MATH 513</td>
<td>Numerical Analysis</td>
<td>3</td>
</tr>
<tr>
<td>MATH 510</td>
<td>Numerical Methods</td>
<td>3</td>
</tr>
<tr>
<td>MATH 509</td>
<td>Numerical Analysis</td>
<td>3</td>
</tr>
</tbody>
</table>

### Study Option I: Technology-Society Interaction Coursework

This option is designed to increase the student’s awareness of the possible effects of technology on society and the professional responsibilities of engineers and scientists in understanding such side effects. These effects could, for example, involve the influence of engineering on advancement of human welfare, on the distribution of wealth in society, or on environmental and ecological systems.

Suggested courses for fulfilling Option I include:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIV ENGR 320</td>
<td>Environmental Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CIV ENGR 423</td>
<td>Air Pollution Effects, Measurement and Control</td>
<td>3</td>
</tr>
<tr>
<td>ECON/A A E 474</td>
<td>Economic Problems of Developing Areas</td>
<td>3</td>
</tr>
<tr>
<td>GEOG/URB R PL 305</td>
<td>Introduction to the City</td>
<td>3-4</td>
</tr>
<tr>
<td>GEOG/URB R PL 505</td>
<td>Urban Spatial Patterns and Theories</td>
<td>3</td>
</tr>
<tr>
<td>HIST SCI/MED HIST/RELIG ST 331</td>
<td>Science, Medicine and Religion</td>
<td>3-4</td>
</tr>
</tbody>
</table>

### Study Option II: Humanistic Society Studies Coursework

The basic objectives of this option are to help prepare the student to bridge the gap between C.P. Snow’s “Two Cultures.” Snow’s 1959 lecture thesis was that the breakdown of communication between the “two cultures” of modern society - the sciences and the humanities - was a major hindrance to solving the world’s problems. Study might be designed to give a greater appreciation of the arts such as the classics, music, or painting, or it might be designed, for example, as preparation for translating technical information to the non-technical public.

Suggested areas of study to fulfill Option II include Anthropology, Area Studies, Art, Art History, Classics, Comparative Literature, Contemporary Trends, English (literature), Foreign Languages (literature), Social Work, Sociology, and Speech. Under either Option I or II, the student must take 6 credits of coursework. The courses must be approved by the student’s advisor and the non-technical minor advisor, and the 6 credits should be concentrated in one topical area. Grades in these courses need not meet the Departmental Grade Policy. However, note that all grades in 300 level or above courses (including grades for Non-Technical Minor courses) are calculated in the Graduate School minimum 3.0 graduation requirement.

### Study Option III: Foreign Culture Coursework

This option is intended for the student who desires to live and work in a foreign nation or work with people of a foreign culture. Examples include studies of the history of a foreign nation, of the political stability of a region of the world, of the culture of a particular group within a nation, or of the spoken language of a foreign nation. For Option III the student must take six credits of courses under all of the same conditions and requirements as for Option I and II unless choosing language study. For the latter case, the student must attain a grade of C or better in all courses. If the student chooses language study. For the latter case, the student must take six credits of coursework. The courses must be approved by the student’s advisor and the non-technical minor advisor, and the 6 credits should be concentrated in one topical area. Grades in these courses need not meet the Departmental Grade Policy. However, note that all grades in 300 level or above courses (including grades for Non-Technical Minor courses) are calculated in the Graduate School minimum 3.0 graduation requirement.

### Study Option IV: Technology-Society Interactions Experience

There are many possible technology-society interactions that might be more educational and meaningful for the student as an actual experience than coursework. For example, the student might run for and be elected to a position of alderperson in the city government. Consequently, this option...
allows the student to pursue a particular aspect of the interaction using his own time and resources.

Study Option IV activity must be planned with the student’s advisor and be approved by the faculty. The effort required should be equivalent to 6 credits of coursework. Upon completion of this program, the student will prepare a written or oral report.

Note: Foreign students from countries in which English is not the native tongue have inherently fulfilled these non-technical study goals and are exempt from these formal requirements.

POLICIES

GRADUATE SCHOOL POLICIES

The Graduate School’s Academic Policies and Procedures (https://grad.wisc.edu/acadpolicy/) provide essential information regarding general university policies. Program authority to set degree policies beyond the minimum required by the Graduate School lies with the degree program faculty. Policies set by the academic degree program can be found below.

MAJOR-SPECIFIC POLICIES

PRIOR COURSEWORK

Graduate Work from Other Institutions

With program approval, students are allowed to count no more than 6 credits of graduate coursework from other institutions toward the minimum graduate degree credit requirement and the minimum graduate coursework (50%) requirement. Coursework earned ten years or more prior to admission to a doctoral degree is not allowed to satisfy requirements.

Graduate Coursework from Previous M.S.

Students may apply up to 15 credits of prior coursework that led to an MS degree in a relevant field, provided:

• The student’s faculty advisor agrees that the prior coursework proposed by the student satisfies the NEEP Ph.D. program requirements in terms of subject area and rigor.
• A member of the EP Graduate Studies Committee who is familiar with the NEEP Ph.D. program confirms the advisor’s recommendation.

A student applying the 15 graduate credits from a previous M.S. is not eligible for applying previous undergraduate credits or other graduate credits (described above) toward the Ph.D. Coursework earned ten years or more prior to admission to a doctoral degree is not allowed to satisfy requirements.

UW–Madison Undergraduate

With faculty approval, students who have received their undergraduate degree from UW–Madison may apply up to 7 credits numbered 400 or above toward the minimum graduate degree credit requirement. This work would not be allowed to count toward the 50% graduate coursework minimum unless taken at the 700 level or above. No credits can be counted toward the minimum graduate residence credit requirement. Coursework earned ten years or more prior to admission to a doctoral degree is not allowed to satisfy requirements.

With faculty approval, students who have received an ABET-accredited undergraduate degree (not including UW–Madison) may be eligible to apply up to 7 credits of their undergraduate coursework toward the Minimum Graduate Degree Credit Requirement. No credits can be counted toward the Minimum Graduate Residence Credit Requirement, nor the Minimum Graduate Coursework (50%) Requirement.

Coursework earned five or more years prior to admission to a master’s degree is not allowed to satisfy requirements.

UW–Madison University Special

With program approval, students are allowed to count up to 15 credits of coursework numbered 400 or above taken as a UW–Madison special student toward the minimum graduate residence credit requirement, and the minimum graduate degree credit requirement. UW–Madison coursework taken as a University Special student would not be allowed to count toward the 50% graduate coursework minimum unless taken at the 700 level or above. Coursework earned ten years or more prior to admission to a doctoral degree is not allowed to satisfy requirements.

PROBATION

A semester GPA below 3.0 will result in the student being placed on academic probation. If a semester GPA of 3.0 is not attained during the subsequent semester of full time enrollment (or 12 credits of enrollment if enrolled part-time) the student may be dismissed from the program or allowed to continue for one additional semester based on advisor appeal to the Graduate School.

ADVISOR / COMMITTEE

Each student is required to meet with his or her advisor prior to registration every semester.

CREDITS PER TERM ALLOWED

15 credits

TIME CONSTRAINTS

The Ph.D. qualifying examination should be first taken no later than completion of the M.S. requirements, or the beginning of the fifth semester of graduate study, whichever comes first. Students entering the program with a master’s degree in E M A, E P or N E from another institution, and taking the qualifying exam in that same major, must take the exam by the beginning of their third semester.

Candidates are expected to pass the Ph.D. preliminary examination no later than the end of the third year of graduate study, or by the end of the second regular semester following the one in which the Ph.D. qualifying examination was passed, whichever is later. A candidate who fails to take the preliminary examination within four years of passing the qualifying examination must retake the qualifying examination.

An oral examination on the findings of the Ph.D. research is required at the end of the thesis work. The candidate must apply for a warrant from the Graduate School through the student services office at least three weeks before the exam. The final oral examination must be taken within five years of passing the preliminary examination.

GRIEVANCES AND APPEALS

These resources may be helpful in addressing your concerns:

• Bias or Hate Reporting (https://doso.students.wisc.edu/bias-or-hate-reporting/)
NEEP Grievance Procedures

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.

1. The student should speak first with the person toward whom the grievance is directed. In most cases, grievances can be resolved at this level.

2. Should a satisfactory resolution not be achieved, the student should contact the program’s Grievance Advisor to discuss the grievance. The Graduate Student Coordinator can provide students with the name of this faculty member, who facilitates problem resolution through informal channels. The Grievance Advisor is responsible for facilitating any complaints or issues of students. The Grievance Advisor first attempts to help students informally address the grievance prior to any formal complaint. Students are also encouraged to talk with their faculty advisors regarding concerns or difficulties if necessary. University resources for sexual harassment concerns can be found on the UW Office of Equity and Diversity website.

3. If the issue is not resolved to the student’s satisfaction, the student can submit the grievance to the Grievance Advisor in writing, within 60 calendar days of the alleged unfair treatment.

4. On receipt of a written complaint, a faculty committee will be convened by the Grievance Advisor to manage the grievance. The program faculty committee will obtain a written response from the person toward whom the complaint is directed. The response will be shared with the person filing the grievance.

5. The faculty committee will determine a decision regarding the grievance. The Grievance Advisor will report on the action taken by the committee in writing to both the student and the party toward whom the complaint was directed within 15 working days from the date the complaint was received.

6. At this point, if either party (the student or the person toward whom the grievance is directed) is unsatisfied with the decision of the faculty committee, the party may file a written appeal. Either party has 10 working days to file a written appeal to the College of Engineering.

The Assistant Dean for Graduate Affairs (engr-dean-graduateaffairs@engr.wisc.edu) provides overall leadership for graduate education in the College of Engineering (CoE) and is a point of contact for graduate students who have concerns about education, mentoring, research, or other difficulties.

The Graduate School has procedures for students wishing to appeal a grievance decision made at the college level. These policies are described in the Academic Policies and Procedures at https://grad.wisc.edu/academic-policies/.

OTHER

n/a

PROFESSIONAL DEVELOPMENT

GRADUATE SCHOOL RESOURCES

Take advantage of the Graduate School’s professional development resources (https://grad.wisc.edu/pd/) to build skills, thrive academically, and launch your career.

LEARNING OUTCOMES

1. Demonstrate an extraordinary, deep understanding of mathematical, scientific, and engineering principles in the field

2. Demonstrate an ability to formulate, analyze, and independently solve advanced engineering problems

3. Apply the relevant scientific and technological advancements, techniques, and engineering tools to address these problems

4. Recognize and apply principles of ethical and professional conduct

5. Demonstrate an ability to synthesize knowledge from a subset of the biological, physical, and/or social sciences to help frame problems critical to the future of their discipline

6. Demonstrate an ability to conduct original research and communicate it to their peers

PEOPLE

PROFESSORS

Paul Wilson (Chair)
Matt Allen
Riccardo Bonazza
Curt A. Bronkhorst
Wendy Crone
Chris Hegna
Douglass Henderson
Roderic Lakes
Oliver Schmitz
Carl Sovinec
Kumar Sridharan
Fabian Waleffe

ASSISTANT PROFESSORS
Jennifer Choy
Adrien Couet
Stephanie Diem
Jennifer Franck
Benedikt Geiger
Ben Lindley
Jacob Notbohm
Ramathasan Thevamaran
Yongfeng Zhang

See also Engineering Physics Faculty Directory (https://directory.engr.wisc.edu/ep/faculty/).