

NUCLEAR ENGINEERING AND ENGINEERING PHYSICS, PH.D.

REQUIREMENTS

MINIMUM GRADUATE SCHOOL REQUIREMENTS

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

MAJOR REQUIREMENTS

MODE OF INSTRUCTION

| Face to Face | Evening/ Weekend | Online | Hybrid | Accelerated |
|--------------|---------------------|--------|--------|-------------|
| Yes | No | No | No | No |

Mode of Instruction Definitions

Accelerated: Accelerated programs are offered at a fast pace that condenses the time to completion. Students typically take enough credits aimed at completing the program in a year or two.

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

Requirement Detail

| | |
|--------------------------------------|--|
| Minimum Credit Requirement | 51 credits approved by the student's faculty advisor |
| Minimum Residence Credit Requirement | 32 credits |

Minimum Graduate Coursework Requirement 26 credits must be in graduate-level coursework from nuclear engineering, math, physics, chemistry, computer science, or any other engineering department except E P D; Details can be found in the Graduate School's Minimum Graduate Coursework (50%) policy (<https://policy.wisc.edu/library/UW-1244>) (<https://policy.wisc.edu/library/UW-1244/>).

Overall Graduate GPA Requirement 3.00 GPA required. This program follows the Graduate School's policy: <https://policy.wisc.edu/library/UW-1203> (<https://policy.wisc.edu/library/UW-1203/>).

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.

After acceptance of the student's doctoral plan of study, the student must take an oral preliminary examination.

Final oral examination is required at the end of the thesis work.

Language Requirements No language requirements.

Graduate School Breadth Requirements 1. All doctoral students are required to complete a doctoral minor or graduate/professional certificate. In consultation with, and approval by, the graduate faculty advisor/department, students should select one of the following options if they choose the minor:

- Option A (External Minor): Fulfillment of this minor requires approval of the doctoral minor program. This minor must be outside of the student's doctoral major program.
- Option B (Distributed Minor): Fulfillment of this minor requires a minimum of 9 credits, total, from two or more departments outside the major in courses selected for their relevance to a particular area of concentration. No course below the 400 level may be used to satisfy this requirement.

2. All doctoral students are also required to complete a graduate faculty advisor/department approved non-technical minor. Please see the NEEP Graduate Handbook for information regarding the four options to complete the non-technical minor.

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/>) degree whether receiving the M.S. degree or going directly to the PhD. 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 courses numbered 700 or above; must satisfy the Ph.D. technical minor requirement; and must satisfy the PhD non-technical minor requirement.

The candidate is also required to complete, as a graduate student, one course numbered 400 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 pathway¹: maximum of 12 credits for thesis; at least 8 credits of N E courses numbered 400 or above; remaining credits (also numbered 400 or above) must be in appropriate technical areas²; at least 9 credits must be numbered 500 and above; up to 3 credits can be seminar credits.

Non-Thesis pathway¹: at least 15 credits of N E courses numbered 400 or above; remaining 15 credits (also numbered 400 or above) must be in appropriate technical areas²; at least 12 credits must be at numbered 500 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 pathways are internal to the program and represent different curricular paths a student can follow to earn this degree. Pathway names do not appear in the Graduate School admissions application, and they will not appear on the transcript.

2

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:

| Code | Title | Credits |
|------------------------------------|---|---------|
| Fission Reactors | | |
| N E 405 | Nuclear Reactor Theory | 3 |
| N E 408 | Ionizing Radiation | 3 |
| N E 411 | Nuclear Reactor Engineering | 3 |
| N E/MED PHYS 506 | Monte Carlo Radiation Transport | 3 |
| N E/M E 520 | Two-Phase Flow and Heat Transfer | 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/I SY E 574 | Methods for Probabilistic Risk Analysis of Nuclear Power Plants | 3 |
| Plasma Physics & Fusion | | |
| N E/E C E/ PHYSICS 525 | Introduction to Plasmas | 3 |
| N E/E C E/ PHYSICS 527 | Plasma Confinement and Heating | 3 |

| | | |
|---------------|--|---|
| N E/E C E 528 | Plasma Processing and Technology | 3 |
| N E 536 | Feasibility St of Power from Controlled Thermonuclear Fusion | 3 |

Materials

| | | |
|-----------------|-------------------------------|---|
| N E/M S & E 423 | Nuclear Engineering Materials | 3 |
| N E 541 | Radiation Damage in Metals | 3 |
| PHYSICS 551 | Solid State Physics | 3 |

Engineering Mathematics & Computation

| | | |
|--------------------|----------------------------------|---|
| E P/E M A 547 | Engineering Analysis I | 3 |
| E P/E M A 548 | Engineering Analysis II | 3 |
| COMP SCI/ MATH 513 | Numerical Linear Algebra | 3 |
| COMP SCI/ MATH 514 | Numerical Analysis | 3 |
| MATH 703 | Methods of Applied Mathematics 1 | 3 |

Non-Technical Minor Requirements

Ph.D. candidates must complete one of the following four study options prior to receiving dissertator status. As this is a formal Department requirement, the student should select a Non-Technical Minor early in the program, and must complete it to achieve dissertator status (see below). The Non-Technical Minor must be planned with the help of the candidate's advisor and must be approved by the Department NonTechnical Minor Advisor except for Study Option IV which must be approved by the Department faculty. A Non-Technical Minor Approval Form is available from the Graduate Student Coordinator, and must be filed prior to submission of the doctoral plan form. Courses numbered below 400 may be used as a part of the Non-Technical Minor.

Study Option I: Technology-Society Interaction Coursework. This option is intended to increase the student's awareness of the possible effects of technology on society and of 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:

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

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 courses numbered 300 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 has previous knowledge of a language, it is required that either courses beyond the introductory level will be elected or that another language will be elected.

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