

# NUCLEAR, PLASMA, AND RADIOLOGICAL ENGINEERING

<http://npre.illinois.edu>

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Major: Nuclear, Plasma, and Radiological Engineering  
 Degrees Offered: M.S., Ph.D.

Major: Engineering  
 Degrees Offered: M.Eng.  
 Graduate Concentration: Energy Systems

Medical Scholars Program: Doctor of Philosophy (Ph.D.) in Nuclear, Plasma, and Radiological Engineering and Doctor of Medicine (M.D.) through the Medical Scholars Program (<https://www.med.illinois.edu/mdphd>).

## Graduate Degree Programs

The Department of Nuclear, Plasma, and Radiological Engineering (NPRE) offers programs leading to Master of Science and Doctor of Philosophy degrees in Nuclear, Plasma, and Radiological Engineering. The Master of Science and Doctor of Philosophy degree programs are centered around three theme areas:

- nuclear power engineering
- fusion and plasma science and engineering
- radiological engineering and medical physics

Advanced course work and active research programs are offered in all of these areas.

The NPRE department also administers for the College of Engineering a Master of Engineering degree program with a Concentration in Energy Systems.

The Faculty of the Department are internationally recognized experts in the areas of: nuclear science and engineering, radiation processes and transport, materials science, thermal sciences, systems engineering, energy conversion processes and systems, plasma sciences and processing, fusion energy, radiation-based medical imaging and therapy, dosimetry and radiation protection, radiation detection analysis, reliability and risk analysis, energy systems, and international security. Graduate students in the Department are active participants and contributors to these areas of education and research and typically pursue careers in one of these areas. Graduate students in the Department are also encouraged to take part in course work and research activities in other engineering and science departments to complement their professional development in the nuclear engineering field. Opportunity also exists for specializing in:

1. computational science and engineering via the Computational and Science and Engineering (<http://www.cse.illinois.edu>) (CSE) graduate transcriptable concentration
2. energy and sustainability engineering via the Energy and Sustainability Engineering (<http://ease.illinois.edu>) (EaSE) graduate certificate option.

The Medical Scholars Program (<https://www.med.illinois.edu/mdphd>) permits highly qualified students to integrate the study of medicine with study for a graduate degree in a second discipline, including Nuclear, Plasma, and Radiological Engineering.

## Admission

Application for admissions to the master's and doctoral degree programs is open to all graduates in engineering, mathematics, and the physical sciences with a grade point average of at least 3.00 (A = 4.00) for the last two years of undergraduate work and any graduate work completed. Prerequisites for admission include a course in ordinary differential equations plus one other mathematics course beyond calculus; an intermediate course in atomic and nuclear physics or interaction of radiation with matter; a course in electrical circuit theory; a course in thermodynamics; a course in fluid mechanics or continuum mechanics; and a course introducing nuclear engineering. A student may be admitted before completion of these prerequisites, but he or she must allow additional time to make up for these deficiencies; courses taken to make up such deficiencies will not count toward the number of units required for the graduate degree. Transcripts and letters of recommendation are required. The Graduate Record Exam (GRE) (<http://www.ets.org>) is required. Information such as undergraduate class rank is recommended.

For full consideration of fall admission with financial aid, application receipt deadline is January 15. Students who wish to enter in the spring term should contact the Department before applying.

All applicants whose native language is not English are required to have a minimum TOEFL (<http://www.toefl.org>) score of 79 (iBT), 213 (CBT), or 550 (PBT); or minimum International English Language Testing System (IELTS) (<https://www.ielts.org>) academic exam scores of 6.5 overall and 6.0 in all subsections. Applicants may be exempt from the TOEFL if certain criteria (<http://grad.illinois.edu/admissions/instructions/04c>) are met. For those taking the TOEFL or IELTS, full admission status (<http://grad.illinois.edu/admissions/instructions/04c>) is granted for scores greater than 102 (TOEFL iBT), 253 (TOEFL CBT), 610 (TOEFL PBT), or 6.5 (IELTS). Limited status (<http://grad.illinois.edu/admissions/instructions/04c>) is granted for lesser scores and requires enrollment in English as a Second Language (ESL) courses (<http://linguistics.illinois.edu/students/esl/guidelines>) based on an ESL Placement Test (EPT) taken upon arrival to campus.

Applicants to the joint M.B.A. degree program must meet the admissions standards for both programs and be accepted by both programs.

Students may apply to the Medical Scholars Program prior to beginning graduate school or while in the graduate program. Applicants to the Medical Scholars Program must meet the admissions standards for and be accepted into both Nuclear, Plasma, and Radiological Engineering and the College of Medicine. An application to the Medical Scholars Program will also serve as the application to the Nuclear, Plasma, and Radiological Engineering graduate program. Further information on this program is available by contacting the Medical Scholars Program (125 Medical Sciences Building, (217)-333-8146, [mospo@illinois.edu](mailto:mospo@illinois.edu)).

## Medical Scholars Program

Students in the Medical Scholars program must meet the specific requirements for both the medical (<https://www.med.illinois.edu/mdphd>) and graduate degrees. On average, students take eight years to complete both degrees. The first year of the combined program is typically spent meeting requirements of the Nuclear, Plasma, and Radiological Engineering graduate degree.

## Faculty Research Interests

Faculty research interests cover a wide range including, but not limited to, those listed above under the Graduate Degree Programs section. Faculty in other related fields are available to supervise research for students through formal "affiliate faculty" appointments.

## Facilities and Resources

A wide range of major research resources are available for nuclear engineering research. In support of the plasma research area, there are over a dozen ultra-high-vacuum plasma analysis and processing facilities including major Z and Theta Pinches. The flagship device is a mid-size stellarator/tokamak called HIDRA: Hybrid Illinois Device for Research and Applications. It is used for fusion research as well as a variety of plasma-material interaction studies. Graduate students often perform interdisciplinary research work in the Materials Research Laboratory, Micro and Nanotechnology Laboratory, Coordinated Science Laboratory, National Center for Supercomputing Applications, and Beckman Institute for Advanced Science and Technology. The mechanical behavior program provides a variety of facilities for studies of nuclear materials, including the Advanced Materials Testing and Evaluation Laboratory. Other radiological laboratories are also available for environmental studies and nuclear spectroscopy, health physics and radiation studies, nuclear-waste management, thermal hydraulics and reactor safety, reactor physics and reactor kinetics, controlled nuclear fusion, direct energy conversion, and plasma physics. The Department is a participant in the Computational Science and Engineering Program on campus. In addition, a wide array of microcomputers and workstations are available.

## Financial Aid

Most graduate students receive some form of financial aid. Fellowships are available to support the best applicants. Other students are supported as graduate research, teaching, or general assistants. Financial aid includes federally sponsored traineeships and fellowships and University and industry fellowships. The University is approved for several fellowships including those from the Department of Energy, Nuclear Regulatory Commission, the National Science Foundation, and Hertz. Part- and full-time assistantships include exemption from tuition and partial fees. All applicants, regardless of U.S. citizenship, whose native language is not English and who wish to be considered for teaching assistantships must demonstrate spoken English language proficiency (<http://grad.illinois.edu/admissions/taengprof.htm>) by achieving a minimum score of 24 on the speaking subsection of the TOEFL iBT or 8 on the speaking subsection of the IELTS. For students who are unable to take the iBT or IELTS, a minimum score of 4CP is required on the EPI test ([http://cte.illinois.edu/testing/oral\\_eng/ept\\_overview.html](http://cte.illinois.edu/testing/oral_eng/ept_overview.html)), offered on campus. All new teaching assistants are required to participate in the Graduate Academy for College Teaching ([http://cte.illinois.edu/programs/ta\\_train.html](http://cte.illinois.edu/programs/ta_train.html)) conducted prior to the start of the semester.

- Master of Engineering in Engineering, Energy Systems Concentration (<http://catalog.illinois.edu/graduate/graduate-majors/npre/ms-engineering-concentration-energy-systems>)
- Master of Science in Nuclear, Plasma, and Radiological Engineering (<http://catalog.illinois.edu/graduate/graduate-majors/npre/ms-nuclear-plasma-radiological-engineering>)

## Doctor of Philosophy in Nuclear, Plasma, and Radiological Engineering

Course requirements for the Ph.D. degree include at least 24 graduate hours of course credit beyond that required for the M.S. degree. In addition, 40 or more graduate hours of doctoral thesis credit are required and typically take two or more additional years to complete. Students desiring to work toward the Ph.D. degree must pass the departmental qualifying examination to be admitted to doctoral study. The doctoral candidate must complete course work, pass a preliminary doctoral examination, write a doctoral thesis, and successfully defend the thesis at a final examination before a doctoral faculty committee. A doctoral student typically takes several courses in nuclear engineering plus additional courses that support a specialized research area and provide background in mathematics and science. Under exceptional circumstances and by approved petition, doctoral research may be undertaken off campus.

Code	Title	Hours
NPRE 599	Thesis Research (min-max applied toward degree)	40
NPRE 501 & NPRE 521	Fundamentals of Nuclear Engrg and Interact of Radiation w/Matter (if not taken while completing the M.S. degree)	0-8
NPRE 596	Seminar in Nuclear Sci & Engrg (registration for 1 hour every semester while in residence; credit does not apply toward the degree.)	0
Elective Courses (subject to Other Requirements and Conditions below)		16
8 hours of 500-level courses		
4-8 hours of NPRE graduate level courses, not counting 402, 446, 501, 521, 596, or 599		
Total Hours		64

## Other Requirements and Conditions <sup>1</sup>

Other Requirements and Conditions may overlap

Consult department for details of minimum hours required within the unit.

Credit in NPRE 402 or NPRE 446 does not count toward the degree.

A Master's degree or equivalent is required for admission to the Ph.D. program.

Ph.D. exam and dissertation requirements:

Qualifying exam:<sup>2</sup>

Preliminary exam

Final exam or dissertation defense

Dissertation deposit

Minimum GPA:	2.75
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<sup>1</sup> For additional details and requirements refer to the department's printed handbook and the Graduate College Handbook (<http://grad.illinois.edu/gradhandbook>).

<sup>2</sup> *Qualifying Exam Info* (<http://npre.illinois.edu/academics/graduate-program/qualifying-examination>)

- Concentration in Energy Systems, available for M.Eng. degree only (<http://catalog.illinois.edu/graduate/graduate-majors/npre/ms-engineering-concentration-energy-systems>)

## M.B.A. Joint Degree Program

Students in this unit may choose to earn their major degree and simultaneously complete an M.B.A., with 12 fewer required hours than when pursuing both degrees independently. Students must be enrolled in the M.B.A. program for three terms and complete all the requirements of their primary degree. Interested students should see the joint program requirements (<http://catalog.illinois.edu/graduate/graduate-majors/bus-admin-mba/joint-mba>) and contact the M.B.A. program and their major department office for more information.