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; industrial plasma physics, such as plasma processing and plasma source ion implantation; 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.

FUNDING

Prospective students should see the program website for funding information.

REQUIREMENTS

MINIMUM DEGREE REQUIREMENTS AND SATISFACTORY PROGRESS

To make progress toward a graduate degree, students must meet the Graduate School Minimum Degree Requirements and Satisfactory Progress (http://guide.wisc.edu/graduate/#policiesandrequirementstext) in addition to the requirements of the program.

DOCTORAL DEGREES

Ph.D.

MINIMUM GRADUATE DEGREE CREDIT REQUIREMENT

51 credits

MINIMUM GRADUATE RESIDENCE CREDIT REQUIREMENT

32 credits

MINIMUM GRADUATE COURSEWORK (50%) REQUIREMENT

26 of the required 30 credits must be in graduate-level coursework from EMA, math, physics, computer science, or any other engineering department except EPD; courses with the Graduate Level Coursework attribute are identified and searchable in the university’s Course Guide (http://my.wisc.edu/CourseGuideRedirect/BrowseByTitle).

PRIOR COURSEWORK REQUIREMENTS: 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.

PRIOR COURSEWORK 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.
PRIOR COURSEWORK 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.

CREDITS PER TERM ALLOWED
15 credits

PROGRAM-SPECIFIC COURSES REQUIRED
The candidate is required to complete one course in each of the following areas: must be taken as a graduate student and be at the 400 level or above: fission reactors; plasma physics and fusion; materials; engineering mathematics and computation.

Must take three 700-level courses; must satisfy Ph.D. technical minor requirement; must satisfy Ph.D. non-technical minor requirement.

DOCTORAL MINOR/BREADTH REQUIREMENTS
Technical minor: 10 credits in either a single department or multiple departments as approved by the advisor.

Non-technical minor: 6 credits following one of the four options described in the student handbook.

OVERALL GRADUATE GPA REQUIREMENT
3.00

OTHER GRADE REQUIREMENTS
Courses in which grades of BC or below are received cannot be counted except as follows:

Credits of C must be balanced by twice as many credits A or by four times as many credits of AB; Credits of BC must be balanced by an equal number of credits of A or by twice as many credits of AB.

PROBATION POLICY
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
All students are required to meet with his or her advisor prior to registration every semester.

ASSESSMENT 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.

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 fourth semester of graduate study, whichever comes first. Students entering the program with a master's degree in EMA, EP or NE from another institution, and taking the qualifying exam in that same major, must take the exam by the beginning of their third semester.

Students must submit the doctoral plan of study one month before the end of the semester following the one in which the qualifying exam is passed.

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.

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.

LANGUAGE REQUIREMENTS
No language requirements.

ADMISSIONS
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/academics/ms-nuclear-engineering) for details.

LEARNING OUTCOMES
KNOWLEDGE AND SKILLS
• demonstrate an ability to synthesize knowledge from a subset of the biological, physical, and social sciences to help frame problems critical to the future of their discipline.
• conduct original research.
• demonstrate an ability to create new knowledge and communicate it to their peers.

PROFESSIONAL CONDUCT
• fosters ethical and professional conduct.

PEOPLE
Faculty: Professors T. Allen, Blanchard (chair), Bisognano, Bonazza, Crone, Drugan, Fonck, Hegna, Henderson, Kammer, Kulcinski, Lakes, Moses, Pfotenhauer, Plesha, Smith, Sovinec, Waleffe, Wilson; Associate Professors M. Allen, Witt; Assistant Professor Schmitz; Affiliate Professors Bednarz, Bier, Deluca, Graham, Ma, Mackie, Miller, Morgan, Nellis, Porter, Robertson, Szlufarska, Thomadsen, Trujillo, Vanderby