

NUCLEAR, PLASMA, AND RADIOLOGICAL ENGINEERING: POWER, SAFETY & ENVIRONMENT, BS

for the degree of Bachelor of Science in Nuclear, Plasma, & Radiological Engineering with a concentration in Power, Safety & Environment

Nuclear, plasma, and radiological engineering encompasses a broad and diverse but complimentary set of engineering disciplines with a wide variety of applications. The first two years of the NPRE curriculum provides a strong foundation in sciences (physics, mathematics, and chemistry), in engineering (mechanics and thermodynamics), in computer use, and in nuclear energy systems. Most of the technical core and concentration coursework takes place in the third and fourth years of the curriculum. Students choose from among three concentrations: power, safety and the environment; plasma and fusion science and engineering; and radiological, medical and instrumentation applications. Each concentration requires students acquire a depth of understanding of the area but with flexibility to develop advanced technical expertise depending upon the student's specific educational and professional interests. Students demonstrate proficiency in the engineering design process in a senior design capstone course.

The power, safety and the environment concentration focuses on continued safe and reliable nuclear energy production. This relies on multifaceted engineering disciplines for design and analysis of large complex systems. Areas of scholarship and research in which students are involved include but are not limited to: advanced reactor design and safety, reactor physics and thermal-hydraulics, nuclear materials, instrumentation and controls, training and education, fuel design and performance, waste management, reactor accident analysis, risk and reliability, probabilistic risk assessment, human factors, validation and verification, uncertainty analysis, energy and security, and nonproliferation. Cross-cutting areas of study and research include modeling and simulation and numerical analysis and computational methods. Students confer with their academic advisor on a chosen course set to ensure that a strong program is achieved. Technical electives are chosen from among NPRE courses and courses outside the department in the subfields of: thermal sciences; power and control systems; solid, fluid and continuum mechanics; computational sciences and engineering, and environmental engineering and science. The program prepares graduates for positions in industry, research laboratories, federal and regulatory agencies, as well for further graduate study.

Current Program Educational Objectives

for the degree of Bachelor of Science in Nuclear, Plasma, & Radiological Engineering with a concentration in Power, Safety & Environment

Graduation Requirements

Minimum hours required for graduation: 128 hours.

Minimum Overall GPA: 2.0

Minimum Technical GPA (<https://go.grainger.illinois.edu/TechnicalGPA/>): 2.0

TGPA is required for NPRE 200 and NPRE 247. See Technical GPA (<https://go.grainger.illinois.edu/TechnicalGPA/>) to clarify requirements.

University Requirements

Minimum of 40 hours of upper-division coursework, generally at the 300- or 400-level. These hours can be drawn from all elements of the degree.

Students should consult their academic advisor for additional guidance in fulfilling this requirement.

The university and residency requirements can be found in the Student Code (<https://studentcode.illinois.edu/article3/part8/3-801/>) (§ 3-801) and in the Academic Catalog (<http://catalog.illinois.edu/general-information/degree-general-education-requirements/>).

General Education Requirements

Follows the campus General Education (Gen Ed) requirements (<https://courses.illinois.edu/gened/DEFAULT/DEFAULT/>). Some Gen Ed requirements may be met by courses required and/or electives in the program.

Code	Title	Hours
	Composition I	4-6
	Advanced Composition	3
	Humanities & the Arts (6 hours)	6
	Natural Sciences & Technology (6 hours)	6
	fulfilled by CHEM 102, PHYS 211, PHYS 212	
	Social & Behavioral Sciences (6 hours)	6
	fulfilled by ECON 102 or ECON 103 and any other courses approved as Social & Behavioral Sciences	
	Cultural Studies: Non-Western Cultures (1 course)	3
	Cultural Studies: US Minority Cultures (1 course)	3
	Cultural Studies: Western/Comparative Cultures (1 course)	3
	Quantitative Reasoning (2 courses, at least one course must be Quantitative Reasoning I)	6-10
	fulfilled by MATH 220 or MATH 221; and MATH 231, MATH 241, MATH 285, PHYS 211, PHYS 212; and CS 101 or CS 124	
	Language Requirement (Completion of the third semester or equivalent of a language other than English is required)	0-15

Orientation and Professional Development

Code	Title	Hours
ENG 100	Grainger Engineering Orientation Seminar (External transfer students take ENG 300.)	1
NPRE 100	Orientation to NPRE	1
Total Hours		2

Introductory Economics Elective

Code	Title	Hours
ECON 102	Microeconomic Principles	3
or ECON 103	Macroeconomic Principles	
Total Hours		3

Foundational Mathematics and Science

Code	Title	Hours
CHEM 102	General Chemistry I	3
CHEM 103	General Chemistry Lab I	1
MATH 221	Calculus I (MATH 220 may be substituted. MATH 220 is appropriate for students with no background in calculus. 4 of 5 credit hours count towards degree.)	4
MATH 231	Calculus II	3
MATH 241	Calculus III	4
MATH 257	Linear Algebra with Computational Applications	3
MATH 285	Intro Differential Equations	3
PHYS 211	University Physics: Mechanics	4
PHYS 212	University Physics: Elec & Mag	4
Total Hours		29

Nuclear, Plasma, and Radiological Engineering Technical Core

Code	Title	Hours
CS 101	Intro Computing: Engrg & Sci (CS 124 may be taken instead of CS 101.)	3
ECE 205	Electrical and Electronic Circuits	3
ME 200	Thermodynamics	3
ME 310 or TAM 335	Fundamentals of Fluid Dynamics Introductory Fluid Mechanics	4
NPRE 200	Mathematics for Nuclear, Plasma, and Radiological Engineering	2
NPRE 247	Modeling Nuclear Energy System	3
NPRE 321	Introduction to Plasmas and Applications	3
NPRE 330	Materials in Nuclear Engineering	3
NPRE 349	Introduction to NPRE Heat Transfer	2
NPRE 441	Radiation Protection	4
NPRE 445	Interaction of Radiation with Matter	4
NPRE 449	Nuclear Systems Engineering and Design	3
NPRE 451	NPRE Laboratory	3
NPRE 455	Neutron Diffusion & Transport	4
NPRE 458	Design in NPRE	4
TAM 210	Introduction to Statics (TAM 211 may be taken instead of TAM 210. The extra hour may be applied towards the Professional Concentration Area electives.)	2
TAM 212	Introductory Dynamics (PHYS 325 may be taken instead of TAM 212 for students pursuing the PHYS minor.)	3
Total Hours		53

Professional Concentration Area

Code	Title	Hours
Required Course		2
NPRE 432	Nuclear Engrg Materials Lab	2
Technical Electives		15

From Departmentally Approved List of Technical Electives - students are to take at least 6 hours from the NPRE Power Concentration Electives list. The remaining hours may be taken from any course on the Technical Electives list. The student is to confer with their academic adviser on a chosen course set to ensure that a strong program is achieved.

NPRE Power Concentration Electives List

NPRE 412	Nuclear Power Econ & Fuel Mgmt	3 or 4
NPRE 413	Nuclear Separations and Fuel Reprocessing	2 or 3
NPRE 430	Advanced Materials in Nuclear Engineering	3
NPRE 442	Radioactive Waste Management	3
NPRE 457	Safety Anlys Nucl Reactor Syst	3 or 4
NPRE 461	Probabilistic Risk Assessment	3 or 4
NPRE 480	Energy and Security	3
NPRE 498	Special Topics	1 to 4

Other Technical Electives

Technical Electives from NPRE or from other departments in the subfields: Thermal Sciences; Power and Control Systems; Solid, Fluid and Continuum Mechanics; Computational Sciences and Engineering; Environmental Engineering and Science.

NPRE 199	Undergraduate Open Seminar (May be repeated in separate terms to a maximum of 2 times.)	1
NPRE 201	Energy Systems	2 or 3
NPRE 398	Special Topics	1 to 4
NPRE 470	Fuel Cells & Hydrogen Sources	3
NPRE 475	Wind Power Systems	3 or 4
NPRE 481	Writing on Technol & Security	3 or 4
NPRE 483	Seminar on Security	1

Thermal Sciences

ME 320	Heat Transfer	4
ME 400	Energy Conversion Systems	3 or 4
ME 402	Design of Thermal Systems	3 or 4
ME 404	Intermediate Thermodynamics	4
ME 410	Intermediate Gas Dynamics	3 or 4
ME 411	Viscous Flow & Heat Transfer	4
ME 420	Intermediate Heat Transfer	4

Power and Control Systems

ECE 329	Fields and Waves I	3
ECE 310	Digital Signal Processing	3
ECE 330	Power Ckts & Electromechanics	3
ECE 476	Power System Analysis	3
ECE 486	Control Systems	4

Solid, Fluid and Continuum Mechanics

TAM 251	Introductory Solid Mechanics	3
TAM 252	Solid Mechanics Design	1
TAM 424	Mechanics of Structural Metals	3 or 4
TAM 435	Intermediate Fluid Mechanics	4
TAM 445	Continuum Mechanics	4
TAM 451	Intermediate Solid Mechanics	4
TAM 456	Experimental Stress Analysis	3

Computational Sciences and Engineering

General Education course (choose a Humanities or Social/Behavioral Science course with Cultural Studies designation)	3 Technical elective course	3
	17	15

Fourth Year

First Semester	Hours	Second Semester	Hours
NPRE 321 (or NPRE 330)		3 NPRE 441	4
NPRE 432		2 NPRE 458	4
Technical Elective		3 Technical elective course	3
NPRE 449		3 Technical elective course	3
Technical elective course		3	
Free elective course		2	
	16		14

Total Hours 128

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Nuclear, Plasma, & Radiological Website

Nuclear, Plasma, & Radiological Engineering Faculty (<https://npre.illinois.edu/directory/faculty/>)

The Grainger College of Engineering Admissions (<https://grainger.illinois.edu/admissions/>)

The Grainger College of Engineering