Nuclear Engineering (BS): Nuclear Fuels and Materials

Nuclear Engineering is a multidisciplinary field engaged in the development, design, deployment and analysis of methods and devices that utilize fundamental nuclear processes. These processes include natural and induced radioactive decay, the splitting of heavy atomic nuclei (fission), and the merging of light nuclei (fusion). The Bachelor of Science (BS) program prepares graduates for positions in industry, national laboratories, or for graduate study. The curriculum incorporates basic sciences and engineering, with emphasis on mathematics and physics, followed by course work in nuclear science and engineering.

The Nuclear Fuels and Materials concentration allows specialization in experimental and theoretical aspects of materials science related to nuclear reactors. A separate capstone design course is offered in this concentration.

The nuclear engineering program is accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org (http://www.abet.org/), and leads to the degree of Bachelor of Science in Nuclear Engineering. Advanced undergraduates who desire to attend graduate school at NC State may enter a combined 5-year BS/MNE professional program or BS/MS bachelor/master degree program during their senior year which will culminate at the end of their fifth year with both the Bachelor of Science in Nuclear Engineering and the Master of Nuclear Engineering or the Master of Science degrees, respectively.

Plan Requirements

First Year		
Fall Semester		**Hours**
CH 101	Chemistry - A Molecular Science [1]	3
CH 102	General Chemistry Laboratory [1]	1
E 101	Introduction to Engineering & Problem Solving [2]	1
E 115	Introduction to Computing Environments	1
ENG 101	Academic Writing and Research [2]	4
MA 141	Calculus I [1]	4
	Hours	**14**
Spring Semester		
CSC 113	Introduction to Computing - MATLAB	3
MA 241	Calculus II [1]	4
PY 205 & PY 206	Physics for Engineers and Scientists I and Physics for Engineers and Scientists I Laboratory [1]	4
Select one of the following:		3
EC 201	Principles of Microeconomics	
EC 205	Fundamentals of Economics	
E 102	Engineering in the 21st Century	2
	Hours	**16**
Second Year		
Fall Semester		
NE 201	Introduction to Nuclear Engineering	2
MAE 206	Engineering Statics	3
MA 242	Calculus III	4
PY 208 & PY 209	Physics for Engineers and Scientists II and Physics for Engineers and Scientists II Laboratory	4
	Hours	**13**
Spring Semester		
MA 341	Applied Differential Equations I	3
NE 202	Radiation Sources, Interaction and Detection [2]	4
NE 228	Introduction To Fusion Energy	3
NE 309	Introduction to Materials for Nuclear Energy	3
	Hours	**13**
Third Year		
Fall Semester		
NE 205	Thermodynamics for Nuclear Engineering	3
NE 301	Fundamentals of Nuclear Engineering [2]	3
NE 350	Applied Mathematics in Nuclear Engineering	3
MA 401	Applied Differential Equations II	3
NE 409	Nuclear Materials	3
	Hours	**15**
Spring Semester		
NE 360	Continuum Mechanics for Nuclear Engineers	3
NE 400	Nuclear Reactor Energy Conversion	4
NE 401	Reactor Analysis and Design	3
Fuels and Materials Concentration Electives (p. 2)		6
	Hours	**16**
Fourth Year		
Fall Semester		
NE 402	Reactor Engineering	4
NE 404	Radiation Safety and Shielding	3
NE 406	Nuclear Engineering Senior Design Preparation	1
	Hours	**8**
Spring Semester		
NE 403	Nuclear Reactor Laboratory	2
NE 405	Reactor Systems	3
NE 416	Nuclear Materials Design Project	3
Fuels and Materials Concentration Elective (p. 2)		3
	Hours	**11**
	Total Hours	**106**

[1] A grade of C or higher is required.
[2] A grade of C- or higher is required.

Code	Title	Hours
GEP Courses		
GEP Humanities (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-humanities/)		6
GEP Social Sciences (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-social-sciences/)		3

GEP Health and Exercise Studies (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/)	2
GEP Elective (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)	3
GEP Interdisciplinary Perspectives (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-interdisciplinary-perspectives/)	3
GEP Global Knowledge (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-global-knowledge/) (verify requirement)	
GEP Foundations of American Democracy (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-fad/) (verify requirement)	
World Language Proficiency (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/world-language-proficiency/) (verify requirement)	
Total Hours	**17**

Nuclear Fuels and Materials Concentration Electives

Code	Title	Hours
NE 412	Nuclear Fuel Cycles	3
NE 431	Nuclear Waste Management	3
NE 533	Nuclear Fuel Performance	3
NE 550	Introduction to Atomistic Simulations	3

First Year		
Fall Semester		**Hours**
CH 101	Chemistry - A Molecular Science [1]	3
CH 102	General Chemistry Laboratory [1]	1
E 101	Introduction to Engineering & Problem Solving [2]	1
E 115	Introduction to Computing Environments	1
ENG 101	Academic Writing and Research [2]	4
MA 141	Calculus I [1]	4
GEP Health and Exercise Studies (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/)		1
	Hours	**15**
Spring Semester		
CSC 113	Introduction to Computing - MATLAB	3
MA 241	Calculus II [1]	4
PY 205	Physics for Engineers and Scientists I [1]	3
PY 206	Physics for Engineers and Scientists I Laboratory	1
Select one of the following Economics courses:		3
EC 205	Fundamentals of Economics	
EC 201	Principles of Microeconomics	
E 102	Engineering in the 21st Century	2
	Hours	**16**
Second Year		
Fall Semester		
NE 201	Introduction to Nuclear Engineering	2
MAE 206	Engineering Statics	3
MA 242	Calculus III	4
PY 208	Physics for Engineers and Scientists II	3
PY 209	Physics for Engineers and Scientists II Laboratory	1
GEP Requirement (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		3
	Hours	**16**
Spring Semester		
MA 341	Applied Differential Equations I	3
NE 202	Radiation Sources, Interaction and Detection [2]	4
NE 228	Introduction To Fusion Energy	3
NE 309	Introduction to Materials for Nuclear Energy	3
GEP Requirement (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		3
	Hours	**16**
Third Year		
Fall Semester		
NE 205	Thermodynamics for Nuclear Engineering	3
NE 301	Fundamentals of Nuclear Engineering [2]	3
NE 350	Applied Mathematics in Nuclear Engineering	3
MA 401	Applied Differential Equations II	3
NE 409	Nuclear Materials	3
	Hours	**15**
Spring Semester		
NE 360	Continuum Mechanics for Nuclear Engineers	3
NE 400	Nuclear Reactor Energy Conversion	4
NE 401	Reactor Analysis and Design	3
Fuels and Materials Concentration Elective (p. 2)		3
Fuels and Materials Concentration Elective (p. 2)		3
	Hours	**16**
Fourth Year		
Fall Semester		
NE 402	Reactor Engineering	4
NE 404	Radiation Safety and Shielding	3
NE 406	Nuclear Engineering Senior Design Preparation	1
GEP Requirement (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		3
GEP Requirement (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)		3
GEP Health and Exercise Studies (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/gep-health-exercise-studies/)		1
	Hours	**15**
Spring Semester		
NE 403	Nuclear Reactor Laboratory	2
NE 405	Reactor Systems	3
NE 416	Nuclear Materials Design Project	3
Fuels and Materials Concentration Elective (p. 2)		3

GEP Requirement (http://catalog.ncsu.edu/undergraduate/gep-category-requirements/)	3
Hours	**14**
Total Hours	**123**

[1] A grade of C or higher is required.
[2] A grade of C- or higher is required.

Career Opportunities

Nuclear power reactor operation continues with ninety eight reactors operating in the nation, increasing our reliance upon nuclear energy as a substitute for energy from fossil fuels. Development of advanced fission and fusion reactors offers the potential of vast new energy sources. Industrial and medical applications of radiation continue to increase in diverse industries. Demand for nuclear engineers is on the rise within the electric power industry and national laboratories, naval reactors, and other industries. According to the National Society of Professional Engineers, nuclear engineers are among the top five best compensated of the engineering disciplines.

Career Titles

- Energy Engineer
- Engineering Professor
- Nuclear Engineer
- Nuclear Fuels Research Engineer
- Radiation Protection Engineer

Learn More About Careers

NCcareers.org (https://nccareers.org/)
Explore North Carolina's central online resource for students, parents, educators, job seekers and career counselors looking for high quality job and career information.

Occupational Outlook Handbook (https://www.bls.gov/ooh/)
Browse the Occupational Outlook Handbook published by the Bureau of Labor Statistics to view state and area employment and wage statistics. You can also identify and compare similar occupations based on your interests.

Career One Stop Videos (https://www.careeronestop.org/)
View videos that provide career details and information on wages, employment trends, skills needed, and more for any occupation. Sponsored by the U.S. Department of Labor.

Focus 2 Career Assessment (https://careers.dasa.ncsu.edu/explore-careers/career-assessments/) (NC State student email address required)
This career, major and education planning system is available to current NC State students to learn about how your values, interests, competencies, and personality fit into the NC State majors and your future career. An NC State email address is required to create an account. Make an appointment with your career counselor (https://careers.dasa.ncsu.edu/about/hours-appointments/) to discuss the results.

Focus 2 Apply Assessment (https://www.focus2career.com/Portal/Register.cfm?SID=1929) (Available to prospective students)
A career assessment tool designed to support prospective students in exploring and choosing the right major and career path based on your unique personality, interests, skills and values. Get started with Focus 2 Apply and see how it can guide your journey at NC State.

American Nuclear Society (http://www.ans.org/)
Nuclear Energy Institute (https://www.nei.org/home/)
National Association of Power Engineers (https://www.powerengineers.com/)
National Society of Professional Engineers (https://www.nspe.org/)