

Nuclear Engineering

<http://www.me.iastate.edu/students/degrees-and-programs/engineering-minors/>

Minor administered by Mechanical Engineering

The nuclear engineering undergraduate minor allows engineering students to acquire a formal background in nuclear engineering topics that will not only benefit them, but also fulfill a societal need for future hiring of engineers. Through this program, students can enroll in a formal minor that enables them to acquire a basic and fundamental knowledge of nuclear sciences and engineering, thus enabling them to pursue employment in any one of a number of fields associated with the construction, operation or regulation of nuclear power generation.

Students completing this minor acquire a body of knowledge in the fundamentals of nuclear science and engineering. The required courses selected ensures that all graduates of the nuclear engineering minor obtain a minimum body of knowledge in nuclear science and engineering that would allow them to apply their specialized field of engineering knowledge to nuclear-related applications, such as nuclear plant and site construction, nuclear power plant operations, nuclear safety and radiation protection.

The supporting courses that are listed in this program provide an opportunity for students to build upon the knowledge gained in the required courses by taking either more advanced courses or more specialized courses dealing with specific areas of nuclear engineering.

Undergraduate Study

Students interested in completing the nuclear engineering minor must be enrolled in the College of Engineering at Iowa State University. They should complete and submit the "Request for Minor" form. The selection process is based on approval by the administering department, Mechanical Engineering.

The course requirements for the undergraduate minor in nuclear engineering are:

Required course:

NUC E 401	Nuclear Radiation Theory and Engineering	3
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Four of the following:		12
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NUC E 402	Nuclear Reactor Engineering	
NUC E 405	Radiation Protection and Shielding	
NUC E 410	Nuclear Reactor Theory	
NUC E 411	Nuclear Reactor Analysis	
NUC E 441	Probabilistic Risk Assessment	
NUC E 461	Radiation Detection, Measurement and Simulation	
NUC E 490	Independent Study	

The minor must include at least nine credits which are beyond the total used to meet curriculum requirements for the bachelors degree in engineering.

Nuclear engineering courses are provided through an inter-institutional distance education program offered through the Web. Some of the courses that comprise this minor are offered at Iowa State University, while others are offered through four of the Big 12 Engineering Consortium universities that have formal nuclear engineering departments or programs. The four universities offering an assortment of nuclear engineering courses via web-based distance education are Texas A & M (TAMU), the University of Missouri Columbia (UMC), Kansas State University (KSU) and the University of Texas at Austin (UTA).

Courses primarily for undergraduates:

NUC E 401. Nuclear Radiation Theory and Engineering.

(3-0) Cr. 3. F. *Prereq:* PHYS 222, MATH 266 or MATH 267

Atomic and nuclear physics. Radioactivity and reaction rates. Cross sections. Introduction to neutron diffusion theory. Engineering applications of radiation theory. Nonmajor graduate credit.

NUC E 402. Nuclear Reactor Engineering.

(3-0) Cr. 3. S. *Prereq:* NUC E 401

WWW only. Fission and chain reactions. Neutron diffusion and moderation. Reactor equations. Fermi Age theory. Multigroup and multiregional analysis.

NUC E 405. Radiation Protection and Shielding.

(3-0) Cr. 3. *Prereq:* NUC E 401

WWW only. Basic principles and concepts of radiation protection and design: dosimetric units and response functions, hazards of radiation dose, radiation sources, basic methods for dose evaluation, and shielding design techniques for photons and neutrons.

NUC E 410. Nuclear Reactor Theory.

(3-0) Cr. 3. F. *Prereq:* NUC E 401

WWW only. An introduction to neutron diffusion theory, neutron moderation, conditions for criticality of nuclear reactors.

NUC E 411. Nuclear Reactor Analysis.

(3-0) Cr. 3. S. *Prereq:* NUC E 410

WWW only. Group diffusion method. Multiregion reactors, heterogeneous reactors. Reactor kinetics, changes in reactivity.

NUC E 430. Nuclear Energy and Society.

(3-0) Cr. 3. Alt. S., offered 2012. *Prereq:* NUC E 401

The relationship between nuclear energy and society is examined from the perspective of significant events in the commercial nuclear power industry. Event analysis includes differences and similarities of technologies along with environmental impact. Political, social, media and regulatory responses for each event are discussed along with the impact on future plant design. Nonmajor graduate credit.

NUC E 441. Probabilistic Risk Assessment.

(3-0) Cr. 3. S. *Prereq:* STAT 305 or equivalent

Methods for analysis of nuclear power systems. Fault tree and event tree analysis methods. Mathematical basics for dealing with reliability data, theory, and analysis. Case studies of accidents in nuclear power systems. Nonmajor graduate credit.

NUC E 461. Radiation Detection, Measurement and Simulation.

(3-0) Cr. 3. S. *Prereq:* NUC E 401

Principles of nuclear radiation safety and detection. Radiation energy spectroscopy. Counting statistics and error analysis. Monte Carlo simulation of radiation transport. Detection system performance parameters. Design projects. Nonmajor graduate credit.

NUC E 490. Independent Study.

Cr. 1-3. Repeatable, maximum of 3 credits. *Prereq:* Junior Classification

Investigation of nuclear engineering topics. Election of course and topic must be approved in advance by supervising faculty.