

# Nuclear Engineering (NUC ENG)

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## Courses

### NUC ENG 24 Freshman Seminars 1 Unit

The Berkeley Seminar Program has been designed to provide new students with the opportunity to explore an intellectual topic with a faculty member in a small-seminar setting. Berkeley Seminars are offered in all campus departments, and topics vary from department to department and semester to semester.

#### Rules & Requirements

**Repeat rules:** Course may be repeated for credit as topic varies. Course may be repeated for credit when topic changes.

#### Hours & Format

**Fall and/or spring:** 15 weeks - 1 hour of seminar per week

#### Additional Details

**Subject/Course Level:** Nuclear Engineering/Undergraduate

**Grading/Final exam status:** The grading option will be decided by the instructor when the class is offered. Final exam required.

### NUC ENG 100 Introduction to Nuclear Engineering 3 Units

The class provides students with an overview of the contemporary nuclear energy technology with emphasis on nuclear fission as an energy source. Starting with the basic physics of the nuclear fission process, the class includes discussions on reactor control, thermal hydraulics, fuel production, and spent fuel management for various types of reactors in use around the world as well as analysis of safety and other nuclear-related issues. This class is intended for sophomore NE students, but is also open to transfer students and students from other majors.

#### Rules & Requirements

**Prerequisites:** PHYSICS 7A (<http://guide.berkeley.edu/search/?P=PHYSICS%207A>) and 7B, PHYSICS 7C (<http://guide.berkeley.edu/search/?P=PHYSICS%207C>) may be taken concurrently. Mathematics 53 and 54 may be taken concurrently

#### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

#### Additional Details

**Subject/Course Level:** Nuclear Engineering/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

### NUC ENG 101 Nuclear Reactions and Radiation 4 Units

Energetics and kinetics of nuclear reactions and radioactive decay, fission, fusion, and reactions of low-energy neutrons; properties of the fission products and the actinides; nuclear models and transition probabilities; interaction of radiation with matter.

#### Rules & Requirements

**Prerequisites:** PHYSICS 7C (<http://guide.berkeley.edu/search/?P=PHYSICS%207C>)

#### Hours & Format

**Fall and/or spring:** 15 weeks - 4 hours of lecture per week

#### Additional Details

**Subject/Course Level:** Nuclear Engineering/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Instructor:** Norman

NUC ENG 102 Nuclear Reactions and Radiation Laboratory 3 Units  
Laboratory course in nuclear physics. Experiments will allow students to directly observe phenomena discussed in Nuclear Engineering 101. These experiments will give students exposure to (1) electronics, (2) alpha, beta, gamma radiation detectors, (3) radioactive sources, and (4) experimental methods relevant for all aspects of nuclear science. Experiments include: Rutherford scattering, x-ray fluorescence, muon lifetime, gamma-gamma angular correlations, Mossbauer effect, and radon measurements.

#### Rules & Requirements

**Prerequisites:** 101

#### Hours & Format

**Fall and/or spring:** 15 weeks - 1 hour of lecture, 1 hour of discussion, and 4 hours of laboratory per week

#### Additional Details

**Subject/Course Level:** Nuclear Engineering/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Instructor:** Norman

### NUC ENG 104 Radiation Detection and Nuclear Instrumentation Laboratory 4 Units

Basic science of radiation measurement, nuclear instrumentation, neutronics, radiation dosimetry. The lectures emphasize the principles of radiation detection. The weekly laboratory applies a variety of radiation detection systems to the practical measurements of interest for nuclear power, nuclear and non-nuclear science, and environmental applications. Students present goals and approaches of the experiments being performed.

#### Rules & Requirements

**Prerequisites:** 101 or equivalent or consent of instructor; 150 or equivalent recommended

#### Hours & Format

**Fall and/or spring:** 15 weeks - 2 hours of lecture and 4 hours of laboratory per week

#### Additional Details

**Subject/Course Level:** Nuclear Engineering/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Instructor:** Vetter

**Formerly known as:** 104A

### NUC ENG 107 Introduction to Imaging 3 Units

Introduction to medical imaging physics and systems, including x-ray computed tomography (CT), nuclear magnetic resonance (NMR), positron emission tomography (PET), and SPECT; basic principles of tomography and an introduction to unfolding methods; resolution effects of counting statistics, inherent system resolution and human factors.

#### Rules & Requirements

**Prerequisites:** 101 and 104A or consent of instructor

#### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

#### Additional Details

**Subject/Course Level:** Nuclear Engineering/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Instructor:** Vetter

### NUC ENG 120 Nuclear Materials 4 Units

Effects of irradiation on the atomic and mechanical properties of materials in nuclear reactors. Fission product swelling and release; neutron damage to structural alloys; fabrication and properties of uranium dioxide fuel.

#### Rules & Requirements

**Prerequisites:** Engineering 45 and an upper division course in thermodynamics

#### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture and 1 hour of discussion per week

#### Additional Details

**Subject/Course Level:** Nuclear Engineering/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Instructor:** Wirth

### NUC ENG 124 Radioactive Waste Management 3 Units

Components and material flowsheets for nuclear fuel cycle, waste characteristics, sources of radioactive wastes, compositions, radioactivity and heat generation; waste treatment technologies; waste disposal technologies; safety assessment of waste disposal.

#### Rules & Requirements

**Prerequisites:** Engineering 117 or equivalent course

#### Hours & Format

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

#### Additional Details

**Subject/Course Level:** Nuclear Engineering/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Instructor:** Ahn

**NUC ENG 130 Analytical Methods for Non-proliferation 4 Units**

Use of nuclear measurement techniques to detect clandestine movement and/or possession of nuclear materials by third parties. Nuclear detection, forensics, signatures, and active and passive interrogation methodologies will be explored. Techniques currently deployed for arms control and treaty verification will be discussed. Emphasis will be placed on common elements of detection technology from the viewpoint of resolution of threat signatures from false positives due to naturally occurring radioactive material. Laboratory will involve experiments conducted in the Nucleonics Laboratory featuring passive and active neutron signals, gamma ray detection, fission neutron multiplicity, and U and Pu isotopic identification and age determination. Students should be familiar with alpha, beta, gamma, and neutron radiation and basic concepts of nuclear fission.

**Rules & Requirements**

**Prerequisites:** 101 or equivalent course in nuclear physics, or consent of instructor

**Hours & Format**

**Fall and/or spring:** 15 weeks - 3 hours of lecture and 1-3 hours of laboratory per week

**Additional Details**

**Subject/Course Level:** Nuclear Engineering/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Instructor:** Morse

**NUC ENG 150 Introduction to Nuclear Reactor Theory 4 Units**

Neutron interactions, nuclear fission, and chain reacting systematics in thermal and fast nuclear reactors. Diffusion and slowing down of neutrons. Criticality calculations. Nuclear reactor dynamics and reactivity feedback. Production of radionuclides in nuclear reactors.

**Rules & Requirements**

**Prerequisites:** 101; Mathematics 53 and 54

**Hours & Format**

**Fall and/or spring:** 15 weeks - 3 hours of lecture and 1 hour of discussion per week

**Additional Details**

**Subject/Course Level:** Nuclear Engineering/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Instructors:** Greenspan, Vujic

**NUC ENG 155 Introduction to Numerical Simulations in Radiation Transport 3 Units**

Computational methods used to analyze radiation transport described by various differential, integral, and integro-differential equations. Numerical methods include finite difference, finite elements, discrete ordinates, and Monte Carlo. Examples from neutron and photon transport; numerical solutions of neutron/photon diffusion and transport equations. Monte Carlo simulations of photon and neutron transport. An overview of optimization techniques for solving the resulting discrete equations on vector and parallel computer systems.

**Rules & Requirements**

**Prerequisites:** Mathematics 53 and 54

**Hours & Format**

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

**Additional Details**

**Subject/Course Level:** Nuclear Engineering/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Instructors:** Vujic, Wirth

**NUC ENG 161 Nuclear Power Engineering 4 Units**

Energy conversion in nuclear power systems; design of fission reactors; thermal and structural analysis of reactor core and plant components; thermal-hydraulic analysis of accidents in nuclear power plants; safety evaluation and engineered safety systems.

**Rules & Requirements**

**Prerequisites:** Course(s) in fluid mechanics and heat transfer; junior-level course in thermodynamics

**Hours & Format**

**Fall and/or spring:** 15 weeks - 3 hours of lecture and 1 hour of discussion per week

**Additional Details**

**Subject/Course Level:** Nuclear Engineering/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Instructor:** Peterson

**NUC ENG 162 Radiation Biophysics and Dosimetry 3 Units**

Interaction of radiation with matter; physical, chemical, and biological effects of radiation on human tissues; dosimetry units and measurements; internal and external radiation fields and dosimetry; radiation exposure regulations; sources of radiation and radioactivity; basic shielding concepts; elements of radiation protection and control; theories and models for cell survival, radiation sensitivity, carcinogenesis, and dose calculation.

**Rules & Requirements**

**Prerequisites:** Upper division standing or consent of instructor

**Hours & Format**

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

**Additional Details**

**Subject/Course Level:** Nuclear Engineering/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Instructor:** Vujic

**NUC ENG 167 Nuclear Reactor Safety 3 Units**

Principles and methods used in the safety evaluation of nuclear power plants. Safety philosophies, design criteria, and regulations. Deterministic and probabilistic models, reliability analysis, nuclear and thermal-hydraulic transients, radiological consequences, and risk assessment. Design-basis and severe accident analysis, role of engineered safety systems, siting, and licensing.

**Rules & Requirements**

**Prerequisites:** 150, 161, or consent of instructor

**Hours & Format**

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

**Additional Details**

**Subject/Course Level:** Nuclear Engineering/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam not required.

**Instructor:** Kastenber

**NUC ENG 170A Nuclear Design: Design in Nuclear Power Technology and Instrumentation 3 Units**

Design of various fission and fusion power systems and other physically based applications. Each semester a topic will be chosen by the class as a whole. In addition to technology, the design should address issues relating to economics, the environment, and risk assessment.

**Rules & Requirements**

**Prerequisites:** Senior standing or consent of instructor

**Hours & Format**

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

**Additional Details**

**Subject/Course Level:** Nuclear Engineering/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Formerly known as:** 170

**NUC ENG 170B Nuclear Design: Design in Bionuclear, Nuclear Medicine, and Radiation Therapy 3 Units**

A systems approach to the development of procedures for nuclear medicine and radiation therapy. Each semester a specific procedure will be studied and will entail the development of the biological and physiological basis for a procedure, the chemical and biochemical characteristics of appropriate drugs, dosimetric requirements and limitations, the production and distribution of radionuclides and/or radiation fields to be applied, and the characteristics of the instrumentation to be used.

**Rules & Requirements**

**Prerequisites:** 107, 161, or consent of instructor

**Hours & Format**

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

**Additional Details**

**Subject/Course Level:** Nuclear Engineering/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Formerly known as:** 167

**NUC ENG 175 Methods of Risk Analysis 3 Units**

Methodological approaches for the quantification of technological risk and risk based decision making. Probabilistic safety assessment, human health risks, environmental and ecological risk analysis.

**Rules & Requirements**

**Prerequisites:** Upper division standing

**Hours & Format**

**Fall and/or spring:** 15 weeks - 4 hours of lecture per week

**Additional Details**

**Subject/Course Level:** Nuclear Engineering/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Instructor:** Kastenber

**NUC ENG 180** Introduction to Controlled Fusion 3 Units  
Introduction to energy production by controlled thermonuclear reactions. Nuclear fusion reactions, energy balances for fusion systems, survey of plasma physics; neutral beam injection; RF heating methods; vacuum systems; tritium handling.

**Rules & Requirements**

**Prerequisites:** PHYSICS 7C (<http://guide.berkeley.edu/search/?P=PHYSICS%207C>)

**Hours & Format**

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

**Additional Details**

**Subject/Course Level:** Nuclear Engineering/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam required.

**Instructor:** Morse

**NUC ENG H194** Honors Undergraduate Research 1 - 4 Units  
Supervised research. Students who have completed three or more upper division courses may pursue original research under the direction of one of the members of the staff. A final report or presentation is required. A maximum of three units of H194 may be used to fulfill a technical elective requirement in the Nuclear Engineering general program or joint major programs.

**Rules & Requirements**

**Prerequisites:** Upper division technical GPA of 3.3, consent of instructor and faculty advisor

**Repeat rules:** Course may be repeated for credit once. Course may be repeated once for credit. Course may be repeated for a maximum of 8 units.

**Hours & Format**

**Fall and/or spring:** 15 weeks - 1-4 hours of independent study per week

**Summer:** 10 weeks - 1.5-6 hours of independent study per week

**Additional Details**

**Subject/Course Level:** Nuclear Engineering/Undergraduate

**Grading/Final exam status:** Letter grade. Final exam not required.

**NUC ENG 199** Supervised Independent Study 1 - 4 Units  
Supervised independent study. Enrollment restrictions apply; see the Introduction to Courses and Curricula section of this catalog.

**Rules & Requirements**

**Prerequisites:** Consent of instructor and major adviser

**Credit Restrictions:** Course may be repeated for credit for a maximum of 4 units per semester.

**Repeat rules:** Course may be repeated for credit when topic changes.

**Hours & Format**

**Fall and/or spring:** 15 weeks - 0 hours of independent study per week

**Summer:**

6 weeks - 1-5 hours of independent study per week

8 weeks - 1-4 hours of independent study per week

**Additional Details**

**Subject/Course Level:** Nuclear Engineering/Undergraduate

**Grading/Final exam status:** Offered for pass/not pass grade only. Final exam not required.

**NUC ENG S199** Supervised Independent Study 1 - 4 Units  
Supervised independent study. Please see section of the for description and prerequisites.

**Rules & Requirements**

**Prerequisites:** Consent of instructor and major adviser

**Credit Restrictions:** Course may be repeated for credit for a maximum of 4 units per semester.

**Repeat rules:** Course may be repeated for credit when topic changes.

**Hours & Format**

**Summer:** 8 weeks - 0 hours of independent study per week

**Additional Details**

**Subject/Course Level:** Nuclear Engineering/Undergraduate

**Grading/Final exam status:** Offered for pass/not pass grade only. Final exam not required.

**NUC ENG 201 Nuclear Reactions and Interactions of Radiation with Matter 4 Units**

Interaction of gamma rays, neutrons, and charged particles with matter; nuclear structure and radioactive decay; cross sections and energetics of nuclear reactions; nuclear fission and the fission products; fission and fusion reactions as energy sources.

**Rules & Requirements**

**Prerequisites:** 101

**Hours & Format**

**Fall and/or spring:** 15 weeks - 4 hours of lecture per week

**Additional Details**

**Subject/Course Level:** Nuclear Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Norman

**NUC ENG 204 Advanced Concepts in Radiation Detection and Measurements 3 Units**

Advanced concepts in the detection of ionizing radiation relevant for basic and applied sciences, nuclear non-proliferation, and homeland security. Concepts of signal generation and processing with advantages and drawbacks of a range of detection technologies. Laboratory comprises experiments to compare conventional analog and advanced digital signal processing, information generation and processing, position-sensitive detection, tracking, and imaging modalities.

**Rules & Requirements**

**Prerequisites:** Graduate standing, 104 or similar course or consent of instructor

**Hours & Format**

**Fall and/or spring:** 15 weeks - 2 hours of lecture and 4 hours of laboratory per week

**Additional Details**

**Subject/Course Level:** Nuclear Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Vetter

**NUC ENG 220 Irradiation Effects in Nuclear Materials 3 Units**

Physical aspects and computer simulation of radiation damage in metals. Void swelling and irradiation creep. Mechanical analysis of structures under irradiation. Sputtering, blistering, and hydrogen behavior in fusion reactor materials.

**Rules & Requirements**

**Prerequisites:** 120 or consent of instructor

**Hours & Format**

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

**Additional Details**

**Subject/Course Level:** Nuclear Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Wirth

**NUC ENG 221 Corrosion in Nuclear Power Systems 3 Units**

Structural metals in nuclear power plants; properties and fabrication of Zircaloy; aqueous corrosion of reactor components; structural integrity of reactor components under combined mechanical loading, neutron irradiation, and chemical environment.

**Rules & Requirements**

**Prerequisites:** 120, Materials Science and Mineral Engineering 112 recommended

**Hours & Format**

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

**Additional Details**

**Subject/Course Level:** Nuclear Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Wirth

**NUC ENG 224 Safety Assessment for Geological Disposal of Radioactive Wastes 3 Units**

Multi-barrier concept; groundwater hydrology, mathematical modeling of mass transport in heterogeneous media, source term for far-field model; near-field chemical environment, radionuclide release from waste solids, modeling of radionuclide transport in the near field, effect of temperature on repository performance, effect of water flow, effect of geochemical conditions, effect of engineered barrier alteration; overall performance assessment, performance index, uncertainty associated with assessment, regulation and standards.

**Rules & Requirements**

**Prerequisites:** 124 or upper division course in differential equations

**Hours & Format**

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

**Additional Details**

**Subject/Course Level:** Nuclear Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Ahn

**NUC ENG 225 The Nuclear Fuel Cycle 3 Units**

This course is intended for graduate students interested in acquiring a foundation in nuclear fuel cycle with topics ranging from nuclear-fuel reprocessing to waste treatment and final disposal. The emphasis is on the relationship between nuclear-power utilization and its environmental impacts. The goal is for graduate engineering students to gain sufficient understanding in how nuclear-power utilization affects the environment, so that they are better prepared to design an advanced system that would result in minimized environmental impact. The lectures will consist of two parts. The first half includes mathematical models for individual processes in a fuel cycle, such as nuclear fuel reprocessing, waste solidification, repository performance, and nuclear transmutation in a nuclear reactor. In the second half, these individual models are integrated, which enables students to evaluate environmental impact of a fuel cycle.

**Rules & Requirements**

**Prerequisites:** Graduate standing or consent of instructor; 124 and 150 are recommended

**Hours & Format**

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

**Additional Details**

**Subject/Course Level:** Nuclear Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Ahn

**NUC ENG 230 Analytical Methods for Non-Proliferation 4 Units**

Use of nuclear measurement techniques to detect clandestine movement and/or possession of nuclear materials by third parties. Nuclear detection, forensics, signatures, and active passive interrogation methodologies will be explored. Techniques currently deployed for arms control and treaty verification will be discussed. Emphasis will be placed on common elements of detection technology from the viewpoint of resolution of threat signatures from false positives due to naturally occurring radioactive material. Laboratory will involve experiments conducted in the Nucleonics Laboratory featuring passive and active neutron signals, gamma ray detection, fission neutron multiplicity, and U and Pu isotopic identification and age determination. Students should be familiar with alpha, beta, gamma, and neutron radiation and basic concepts of nuclear fission.

**Rules & Requirements**

**Prerequisites:** 101, PHYSICS 7C (<http://guide.berkeley.edu/search/?P=PHYSICS%207C>), or equivalent course in nuclear physics

**Hours & Format**

**Fall and/or spring:** 15 weeks - 3 hours of lecture and 3 hours of laboratory per week

**Additional Details**

**Subject/Course Level:** Nuclear Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Morse

**NUC ENG 250 Nuclear Reactor Theory 4 Units**

Fission characteristics; neutron chain reactions, neutron transport and diffusion theory; reactor kinetics; multigroup methods, fast and thermal spectrum calculations, inhomogeneous reactor design, effects of poisons and fuel depletion.

**Rules & Requirements**

**Prerequisites:** 101, 150; Engineering 117 recommended

**Hours & Format**

**Fall and/or spring:** 15 weeks - 4 hours of lecture per week

**Summer:** 6 weeks - 10 hours of lecture per week

**Additional Details**

**Subject/Course Level:** Nuclear Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Greenspan



**NUC ENG 255 Numerical Simulation in Radiation Transport 3 Units**  
Computational methods used to analyze nuclear reactor systems described by various differential, integral, and integro-differential equations. Numerical methods include finite difference, finite elements, discrete ordinates, and Monte Carlo. Examples from neutron and photon transport, heat transfer, and thermal hydraulics. An overview of optimization techniques for solving the resulting discrete equations on vector and parallel computer systems.

**Rules & Requirements**

**Prerequisites:** 150

**Hours & Format**

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

**Additional Details**

**Subject/Course Level:** Nuclear Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Vujic

**NUC ENG 260 Thermal Aspects of Nuclear Reactors 4 Units**  
Fluid dynamics and heat transfer; thermal and hydraulic analysis of nuclear reactors; two-phase flow and boiling; compressible flow; stress analysis; energy conversion methods.

**Rules & Requirements**

**Prerequisites:** Mechanical Engineering 106 and 109 or Chemical Engineering 150B

**Hours & Format**

**Fall and/or spring:** 15 weeks - 4 hours of lecture per week

**Additional Details**

**Subject/Course Level:** Nuclear Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Peterson

**NUC ENG 265 Design Analysis of Nuclear Reactors 3 Units**  
Principles and techniques of economic analysis to determine capital and operating costs; fuel management and fuel cycle optimization; thermal limits on reactor performance, thermal converters, and fast breeders; control and transient problems; reactor safety and licensing; release of radioactivity from reactors and fuel processing plants.

**Rules & Requirements**

**Prerequisites:** 150 and 161

**Hours & Format**

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

**Additional Details**

**Subject/Course Level:** Nuclear Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Greenspan

**NUC ENG 267 Nuclear Reactor Safety 3 Units**

Principles and methods used in the safety evaluation of nuclear power plants. Safety philosophies, design criteria and regulations. Deterministic and probabilistic models, reliability analysis, nuclear and thermal-hydraulic transients, radiological consequences, and risk assessment. Design-basis and severe accident analysis, role of engineered safety systems, siting, and licensing. Case studies of accidents.

**Rules & Requirements**

**Prerequisites:** 150 and 161

**Hours & Format**

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

**Additional Details**

**Subject/Course Level:** Nuclear Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Peterson

**NUC ENG 275 Principles and Methods of Risk Analysis 4 Units**  
Principles and methodological approaches for the quantification of technological risk and risk-based decision making.

**Rules & Requirements**

**Prerequisites:** Consent of instructor. Civil Engineering 193 and Industrial Engineering 166 recommended

**Hours & Format**

**Fall and/or spring:** 15 weeks - 4 hours of lecture per week

**Additional Details**

**Subject/Course Level:** Nuclear Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Kastenber

**NUC ENG 280 Fusion Reactor Engineering 3 Units**  
Engineering and design of fusion systems. Introduction to controlled thermonuclear fusion as an energy economy, from the standpoint of the physics and technology involved. Case studies of fusion reactor design. Engineering principles of support technology for fusion systems.

**Rules & Requirements**

**Prerequisites:** 120 and 180

**Hours & Format**

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

**Additional Details**

**Subject/Course Level:** Nuclear Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Morse



**NUC ENG 281 Fully Ionized Plasmas 3 Units**

Introduction to warm and hot magnetized plasmas. Single particle motion in electric and magnetic fields. Collective particle oscillations, waves and instabilities. Magnetohydrodynamic equilibria, stability and transport. Magnetically confined plasmas for controlled fusion. Space plasmas.

**Rules & Requirements**

**Prerequisites:** Consent of instructor

**Hours & Format**

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

**Additional Details**

**Subject/Course Level:** Nuclear Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** Morse

**Formerly known as:** Electrical Engineering 239B

**NUC ENG C282 Charged Particle Sources and Beam Technology 3 Units**

Topics in this course will include the latest technology of various types of ion and electron sources, extraction and formation of charge particle beams, computer simulation of beam propagation, diagnostics of ion sources and beams, and the applications of beams in fusion, synchrotron light source, neutron generation, microelectronics, lithography, and medical therapy. This is a general accelerator technology and engineering course that will be of interest to graduate students in physics, electrical engineering, and nuclear engineering.

**Hours & Format**

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

**Additional Details**

**Subject/Course Level:** Nuclear Engineering/Graduate

**Grading:** Letter grade.

**Instructors:** Leung, Steier

**Also listed as:** ENGIN C282

**NUC ENG C285 Nuclear Security: The Nexus Between Policy and Technology 4 Units**

The course will review the origins and evolution of nuclear energy, how it has been applied for both peaceful and military purposes, and the current and prospective challenges it presents. The purpose of the course is to educate students on the policy roots and technological foundations of nuclear energy and nuclear weapons so they are positioned to make original contributions to the field in their scholarly and professional careers.

**Hours & Format**

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

**Additional Details**

**Subject/Course Level:** Nuclear Engineering/Graduate

**Grading:** Letter grade.

**Instructors:** Nacht, Prussin

**Also listed as:** PUB POL C285

**NUC ENG 290A Special Topics in Applied Nuclear Physics 3 Units**

Special topics in applied nuclear physics. Topics may include applied nuclear reactions and instrumentation, bionuclear and radiological physics, and subsurface nuclear technology, among other possibilities. Course content may vary from semester to semester depending upon the instructor.

**Rules & Requirements**

**Prerequisites:** Graduate standing or consent of instructor

**Repeat rules:** Course may be repeated for credit when topic changes.

**Hours & Format**

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

**Additional Details**

**Subject/Course Level:** Nuclear Engineering/Graduate

**Grading:** Letter grade.

**Instructor:** van Bibber

**NUC ENG 290B Special Topics in Nuclear Materials and Chemistry 3 Units**

Special topics in nuclear materials and chemistry. Topics may include advanced nuclear materials and corrosion. Course content may vary from semester to semester depending upon the instructor.

**Rules & Requirements**

**Repeat rules:** Course may be repeated for credit when topic changes.

**Hours & Format**

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

**Additional Details**

**Subject/Course Level:** Nuclear Engineering/Graduate

**Grading:** Letter grade.

**NUC ENG 290C Special Topics in Nuclear Energy 3 Units**  
Special topics in nuclear energy. Topics may include fission reactor analysis and engineering, nuclear thermal hydraulics, and risk, safety and large-scale systems analysis. Course content may vary from semester to semester depending on the instructor.

**Rules & Requirements**

**Prerequisites:** Graduate standing or consent of instructor

**Repeat rules:** Course may be repeated for credit when topic changes.

**Hours & Format**

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

**Additional Details**

**Subject/Course Level:** Nuclear Engineering/Graduate

**Grading:** Letter grade.

**NUC ENG 290D Special Topics in Nuclear Non-Proliferation 3 Units**  
Special topics in nuclear non-proliferation. Topics may include homeland security and nuclear policy, and nuclear fuel cycle and waste management. Course content may vary from semester to semester depending on the instructor.

**Rules & Requirements**

**Prerequisites:** Graduate standing or consent of instructor

**Repeat rules:** Course may be repeated for credit when topic changes.

**Hours & Format**

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

**Additional Details**

**Subject/Course Level:** Nuclear Engineering/Graduate

**Grading:** Letter grade.

**NUC ENG 290E Special Topics in Environmental Aspects of Nuclear Energy 3 Units**  
Special topics in environmental aspects of nuclear energy. Lectures on special topics of interest in environmental impacts of nuclear power utilizations, including severe accidents. The course content may vary from semester to semester, and will be announced at the beginning of each semester.

**Rules & Requirements**

**Prerequisites:** Graduate standing or consent of instructor

**Repeat rules:** Course may be repeated for credit when topic changes.

**Hours & Format**

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

**Additional Details**

**Subject/Course Level:** Nuclear Engineering/Graduate

**Grading:** Letter grade.

**NUC ENG 290F Special Topics in Fusion and Plasma Physics 3 Units**  
Special topics in fusion and plasma physics. Topics may include laser, particle beam and plasma technologies, fusion science and technology, and accelerators. Course content may vary from semester to semester depending upon the instructor.

**Rules & Requirements**

**Prerequisites:** Graduate standing or consent of instructor

**Repeat rules:** Course may be repeated for credit when topic changes.

**Hours & Format**

**Fall and/or spring:** 15 weeks - 3 hours of lecture per week

**Additional Details**

**Subject/Course Level:** Nuclear Engineering/Graduate

**Grading:** Letter grade.

**NUC ENG 295 Nuclear Engineering Colloquium 0.0 Units**  
Presentations on current topics of interest in nuclear technology by experts from government, industry and universities. Open to the campus community.

**Rules & Requirements**

**Repeat rules:** Course may be repeated for credit when topic changes.

**Hours & Format**

**Fall and/or spring:** 15 weeks - 1.5 hours of lecture per week

**Additional Details**

**Subject/Course Level:** Nuclear Engineering/Graduate

**Grading:** Offered for satisfactory/unsatisfactory grade only.

**Instructor:** Peterson

**NUC ENG 298 Group Research Seminars 1 Unit**  
Seminars in current research topics in nuclear engineering: Section 1 - Fusion; Section 2 - Nuclear Waste Management; Section 3 - Nuclear Thermal Hydraulics; Section 4 - Nuclear Chemistry; Section 6 - Nuclear Materials; Section 7 - Fusion reaction design; Section 8 - Nuclear Instrumentation.

**Rules & Requirements**

**Repeat rules:** Course may be repeated for credit. Course may be repeated for credit when topic changes.

**Hours & Format**

**Fall and/or spring:** 15 weeks - 1.5 hours of seminar per week

**Additional Details**

**Subject/Course Level:** Nuclear Engineering/Graduate

**Grading:** Offered for satisfactory/unsatisfactory grade only.

NUC ENG 299 Individual Research 1 - 12 Units  
Investigation of advanced nuclear engineering problems.

**Rules & Requirements**

**Prerequisites:** Graduate standing

**Repeat rules:** Course may be repeated for credit. Course may be repeated for credit when topic changes.

**Hours & Format**

**Fall and/or spring:** 15 weeks - 0 hours of independent study per week

**Additional Details**

**Subject/Course Level:** Nuclear Engineering/Graduate

**Grading:** Offered for satisfactory/unsatisfactory grade only.

NUC ENG 375 Teaching Techniques in Nuclear Engineering 1 - 3 Units  
This course is designed to acquaint new teaching assistants with the nature of graduate student instruction in courses in the department of Nuclear Engineering. Discussion, practice, and review of issues relevant to the teaching of nuclear engineering. Effective teaching methods will be introduced by experienced GSIs and faculty.

**Rules & Requirements**

**Prerequisites:** Graduate standing or ASE status

**Repeat rules:** Course may be repeated for credit. Course may be repeated for credit when topic changes.

**Hours & Format**

**Fall and/or spring:** 15 weeks - 1 hour of lecture and 1 hour of discussion per week

**Additional Details**

**Subject/Course Level:** Nuclear Engineering/Professional course for teachers or prospective teachers

**Grading:** Offered for satisfactory/unsatisfactory grade only.

**Formerly known as:** Nuclear Engineering 301

NUC ENG 602 Individual Study for Doctoral Students 1 - 8 Units  
Individual study in consultation with the major field adviser, intended to provide an opportunity for qualified students to prepare themselves for the various examinations required of candidates for the Ph.D.

**Rules & Requirements**

**Prerequisites:** For candidates for doctoral degree

**Credit Restrictions:** Course does not satisfy unit or residence requirements for doctoral degree.

**Repeat rules:** Course may be repeated for credit. Course may be repeated for credit when topic changes.

**Hours & Format**

**Fall and/or spring:** 15 weeks - 0 hours of independent study per week

**Additional Details**

**Subject/Course Level:** Nuclear Engineering/Graduate examination preparation

**Grading:** Offered for satisfactory/unsatisfactory grade only.