Nuclear Engineering

Overview

The Department of Nuclear Engineering was established in 1958. There are currently about 78 graduate students in the department. Graduates find opportunities for employment and professional careers in the United States and abroad. Recent graduates are employed in academia, industry, national laboratories, and state and federal agencies.

The Nuclear Engineering program is comprised of classroom and laboratory instruction at the undergraduate and graduate levels and has a strong, diverse research program. The projects are part of the department's ongoing mission to provide an education to individuals who will make key contributions and become future leaders serving California and the nation by improving and applying nuclear science and technology. The department's research areas include applied nuclear physics; bionuclear and radiological physics; computational methods; energy systems and the environment; ethics and the impact of technology on society; fission reactor design; fuel cycles and radioactive waste; plasma fusion science and technology; laser, particle beam, and plasma technologies; nuclear materials and chemistry; nuclear thermal hydraulics; risk, safety, and large-scale systems analysis, and nonproliferation.

The department has strong relations with the nearby Ernest Orlando Lawrence Berkeley National Laboratory (http://lbl.gov), Lawrence Livermore National Laboratory (http://www.llnl.gov), and Los Alamos National Laboratory (http://www.lanl.gov). A number of faculty and students collaborate with researchers in these laboratories, and use the facilities of these laboratories in their research projects.

Other Resources

The department hosts a Monday colloquium series during the academic year. For further information and the schedule, please see the department's website (https://www.nuc.berkeley.edu/colloquiums).

The department sponsors the Rad Watch project (http://radwatch.berkeley.edu). It has been performing a large range of radiation measurements starting in March 2011, following the releases of radioactive materials from the Daiichi Nuclear Power Plant in Japan. One of the goals of this activity was to measure the radioactivity in Californian samples that could potentially be associated with the releases in Japan using state-of-the-art experiments, to publish the data without filter or restriction, and to put the results in the context of the radiation we are exposed to in our daily lives. In response to the resurgent interest in radiation levels due to the expected arrival of cesium at the North American west coast, we are increasing our efforts again to measure samples potentially affected by the Pacific Ocean current transport. In addition to measurement samples of fish, seaweed, crab, etc., we are part of the Kelp Watch 2014 initiative (http://kelpwatch.berkeley.edu), which aims at measuring a potential cesium uptake into kelp over the next year.

Undergraduate Programs

Nuclear Engineering (http://guide.berkeley.edu/archive/2018-19/undergraduate/degree-programs/nuclear-engineering): BS, Minor
Chemical Engineering/Nuclear Engineering (http://guide.berkeley.edu/archive/2018-19/undergraduate/degree-programs/chemical-engineering-nuclear-joint-major): BS (Joint Major in conjunction with the College of Chemistry)
Electrical Engineering and Computer Sciences/Nuclear Engineering (http://guide.berkeley.edu/archive/2018-19/undergraduate/degree-programs/electrical-engineering-computer-sciences-nuclear-joint-major): BS (Joint Major)
Materials Science and Engineering/Nuclear Engineering (http://guide.berkeley.edu/archive/2018-19/undergraduate/degree-programs/materials-science-engineering-nuclear-joint-major): BS (Joint Major)
Mechanical Engineering/Nuclear Engineering (http://guide.berkeley.edu/archive/2018-19/undergraduate/degree-programs/mechanical-engineering-nuclear): BS (Joint Major)

Graduate Programs

Nuclear Engineering (http://guide.berkeley.edu/archive/2018-19/graduate/degree-programs/nuclear-engineering): MEng, MS/MPP, PhD

Nuclear Engineering

Expand all course descriptions [+]Collapse all course descriptions [-]

NUC ENG 24 Freshman Seminars 1 Unit

Terms offered: Spring 2020, Fall 2019, Spring 2019
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.
Freshman Seminars: Read More [+]
Rules & Requirements

Repeat rules: 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.

Freshman Seminars: Read Less [-]

NUC ENG 100 Introduction to Nuclear Energy and Technology 3 Units

Terms offered: Fall 2019, Spring 2018, Spring 2017
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.
Introduction to Nuclear Energy and Technology: Read More [+]
Rules & Requirements

Prerequisites: PHYSICS 7A, PHYSICS 7B, and MATH 53

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: Fratoni

Introduction to Nuclear Energy and Technology: Read Less [-]

NUC ENG 101 Nuclear Reactions and Radiation 4 Units

Terms offered: Spring 2020, Fall 2018, Fall 2017
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.
Nuclear Reactions and Radiation: Read More [+]
Rules & Requirements

Prerequisites: PHYSICS 7C and NUC ENG 100

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: Bernstein, L.

Nuclear Reactions and Radiation: Read Less [-]

NUC ENG 102 Nuclear Reactions and Radiation Laboratory 3 Units

Terms offered: Spring 2016, Spring 2015, Spring 2013
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.
Nuclear Reactions and Radiation Laboratory: Read More [+]
Rules & Requirements

Prerequisites: NUC ENG 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

Nuclear Reactions and Radiation Laboratory: Read Less [-]

NUC ENG 104 Radiation Detection and Nuclear Instrumentation Laboratory 4 Units

Terms offered: Spring 2019, Spring 2018, Spring 2017
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.
Radiation Detection and Nuclear Instrumentation Laboratory: Read More [+]
Rules & Requirements

Prerequisites: NUC ENG 101 or consent of instructor; NUC ENG 150 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

Radiation Detection and Nuclear Instrumentation Laboratory: Read Less [-]

NUC ENG 107 Introduction to Imaging 3 Units

Terms offered: Fall 2018, Fall 2016, Fall 2014
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.
Introduction to Imaging: Read More [+]
Rules & Requirements

Prerequisites: NUC ENG 101 and NUC ENG 104

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

Introduction to Imaging: Read Less [-]

NUC ENG 120 Nuclear Materials 4 Units

Terms offered: Fall 2019, Fall 2018, Fall 2017
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.
Nuclear Materials: Read More [+]
Rules & Requirements

Prerequisites: MAT SCI 45 and one of the following: ENGIN 40, MEC ENG 40, or CHM ENG 141

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

Nuclear Materials: Read Less [-]

NUC ENG 124 Radioactive Waste Management 3 Units

Terms offered: Spring 2020, Spring 2019, Spring 2017
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.
Radioactive Waste Management: Read More [+]
Rules & Requirements

Prerequisites: NUC ENG 100

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

Radioactive Waste Management: Read Less [-]

NUC ENG 130 Analytical Methods for Non-proliferation 3 Units

Terms offered: Spring 2020, Spring 2019, Spring 2018
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. Topics include passive and active neutron signals, gamma ray detection, fission neutron multiplicity, and U and Pu isotopic identification and age determination.
Analytical Methods for Non-proliferation: Read More [+]
Rules & Requirements

Prerequisites: NUC ENG 101 (or similar background in nuclear physics), 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: Morse

Analytical Methods for Non-proliferation: Read Less [-]

NUC ENG 150 Introduction to Nuclear Reactor Theory 4 Units

Terms offered: Spring 2020, Spring 2019, Spring 2018
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.
Introduction to Nuclear Reactor Theory: Read More [+]
Rules & Requirements

Prerequisites: MATH 53, MATH 54, and NUC ENG 100

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

Introduction to Nuclear Reactor Theory: Read Less [-]

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

Terms offered: Fall 2019, Spring 2019, Spring 2018
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.
Introduction to Numerical Simulations in Radiation Transport: Read More [+]
Rules & Requirements

Prerequisites: MATH 53, MATH 54, and ENGIN 7

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

Introduction to Numerical Simulations in Radiation Transport: Read Less [-]

NUC ENG 156 Nuclear Criticality Safety 3 Units

Terms offered: Fall 2019, Fall 2018
This course provides an introduction to the field of nuclear criticality safety. Topics include: a review of basic concepts related to criticality (fission, cross sections, multiplication factor, etc.); criticality safety accidents; standards applicable to criticality safety; hand calculations and Monte Carlo methods used in criticality safety analysis; criticality safety evaluation documents.
Nuclear Criticality Safety: Read More [+]
Objectives Outcomes

Course Objectives: The objective of this course is to acquaint Nuclear Engineering students with the concepts and practice of nuclear criticality safety, and to help prepare them for a future career in this field.

Student Learning Outcomes: At the end of this course, students should be able to:
Explain and define criticality safety factors for operations.
Discuss previous criticality accidents and their causal factors, including parameters involved in solution and metal critical accidents.
Identify and discuss the application of several common hand calculation methods.
Describe the importance of validation of computer codes and how it is accomplished.
Discuss ANSI/ANS criticality safety regulations.
Describe DOE regulations and practices in the nuclear criticality safety field.
Complete a Criticality Safety Evaluation.

Rules & Requirements

Prerequisites: NUC ENG 150 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. Alternate method of final assessment during regularly scheduled final exam group (e.g., presentation, final project, etc.).

Instructor: Fratoni

Nuclear Criticality Safety: Read Less [-]

NUC ENG 161 Nuclear Power Engineering 4 Units

Terms offered: Fall 2019, Fall 2018, Fall 2017
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.
Nuclear Power Engineering: Read More [+]
Rules & Requirements

Prerequisites: Course(s) in fluid mechanics and heat transfer (MEC ENG 106 and MEC ENG 109; or CHM ENG 150A); Course in Thermodynamics (ENGIN 40, MEC ENG 40, or CHM ENG 141)

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

Nuclear Power Engineering: Read Less [-]

NUC ENG 162 Radiation Biophysics and Dosimetry 3 Units

Terms offered: Spring 2020, Spring 2019, Spring 2018
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.
Radiation Biophysics and Dosimetry: Read More [+]
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

Radiation Biophysics and Dosimetry: Read Less [-]

NUC ENG 167 Risk-Informed Design for Advanced Nuclear Systems 3 Units

Terms offered: Fall 2019, Fall 2017, Fall 2015
Project-based class for design and licensing of nuclear facilities, including advanced reactors. Elements of a project proposal. Regulatory framework and use of deterministic and probabilistic licensing criteria. Siting criteria. External and internal events. Identification and analysis of design basis and beyond design basis events. Communication with regulators and stakeholders. Ability to work in and contribute to a design team.
Risk-Informed Design for Advanced Nuclear Systems: Read More [+]
Objectives Outcomes

Course Objectives: * Introduce students to the methods and models for event identification, accident analysis, and risk assessment and management for internally and externally initiated events.
* Introduce students to the regulatory requirements for design, construction and operation of nuclear facilities licensed by the U.S. Nuclear Regulatory Commission.
* Introduce students to the safety principles and methods used to design, construct and operate a safe nuclear facility, for a specific site and application.
* Provide a basic understanding of similarities and differences in regulation of nuclear facilities versus other technologies (biotech, commercial aviation, commercial space launch, civil infrastructure).
* Provide a basic understanding the risk-informed design process and an opportunity to experience contributing in a focused area to a design project.
* Provide students with experiential knowledge in developing schedules, allocating work responsibilities, and working in teams.
* Provide students with experiential knowledge in the preparation and evaluation a Safety Analysis Report for meeting USNRC regulatory requirements, including response to Requests for Additional Information (RAIs).

Student Learning Outcomes: * Develop a broad understanding of safety principles and methods used in design, construction and licensing of nuclear facilities.
* Develop a broad understanding of the U.S. Nuclear Regulatory Commission's regulatory requirements for nuclear facilities.
* Have awareness of key similarities and differences in regulation of nuclear facilities versus other technologies (biotech, commercial aviation, commercial space launch, civil infrastructure).
* Have awareness of the major topics covered in a Safety Analysis Report (SAR) and experience in developing and writing at least one element of a SAR.
* Have developed experience and skills in communication with the business community, the public, and regulators.
* Have developed experience and skills in establishing a project schedule, allocating work responsibilities, and working in teams.
* Have understanding of application of event identification, event frequency and consequence analysis, risk assessment and management for internally and externally initiated events in the design process.

Rules & Requirements

Prerequisites: Completion of at least two upper division engineering courses providing relevant skills. Choose from the following: CHM ENG 150A, CHM ENG 180, CIV ENG 111, CIV ENG 120, CIV ENG 152, CIV ENG 166, CIV ENG 175, ENGIN 120, IND ENG 166, IND ENG 172, MEC ENG 106, MEC ENG 109, MEC ENG C134 / EL ENG C128, MEC ENG 146, NUC ENG 120, NUC ENG 124, NUC ENG 150, and NUC ENG 161

Hours & Format

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

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

Terms offered: Spring 2020, Spring 2019, Spring 2018
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.
Nuclear Design: Design in Nuclear Power Technology and Instrumentation: Read More [+]
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

Nuclear Design: Design in Nuclear Power Technology and Instrumentation: Read Less [-]

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

Terms offered: Spring 2010, Spring 2009, Spring 2008
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.
Nuclear Design: Design in Bionuclear, Nuclear Medicine, and Radiation Therapy: Read More [+]
Rules & Requirements

Prerequisites: Senior standing

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

Nuclear Design: Design in Bionuclear, Nuclear Medicine, and Radiation Therapy: Read Less [-]

NUC ENG 175 Methods of Risk Analysis 3 Units

Terms offered: Fall 2018, Fall 2013, Fall 2011
Methodological approaches for the quantification of technological risk and risk based decision making. Probabilistic safety assessment, human health risks, environmental and ecological risk analysis.
Methods of Risk Analysis: Read More [+]
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: Kastenberg

Methods of Risk Analysis: Read Less [-]

NUC ENG 180 Introduction to Controlled Fusion 3 Units

Terms offered: Fall 2019, Fall 2018, Fall 2017
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.
Introduction to Controlled Fusion: Read More [+]
Rules & Requirements

Prerequisites: PHYSICS 7C

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

Introduction to Controlled Fusion: Read Less [-]

NUC ENG H194 Honors Undergraduate Research 1 - 4 Units

Terms offered: Summer 2020 10 Week Session, Spring 2020, Fall 2019
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.
Honors Undergraduate Research: Read More [+]
Rules & Requirements

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

Repeat rules: Course may be repeated for credit up to a total 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.

Honors Undergraduate Research: Read Less [-]

NUC ENG 198 Group Study for Advanced Undergraduates 1 - 4 Units

Terms offered: Spring 2020, Fall 2019, Spring 2019
Group studies of selected topics.
Group Study for Advanced Undergraduates: Read More [+]
Rules & Requirements

Prerequisites: Upper division standing

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 1-4 hours of directed group 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.

Group Study for Advanced Undergraduates: Read Less [-]

NUC ENG 199 Supervised Independent Study 1 - 4 Units

Terms offered: Spring 2020, Fall 2019, Spring 2019
Supervised independent study. Enrollment restrictions apply; see the Introduction to Courses and Curricula section of this catalog.
Supervised Independent Study: Read More [+]
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 without restriction.

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.

Supervised Independent Study: Read Less [-]

NUC ENG S199 Supervised Independent Study 1 - 4 Units

Terms offered: Prior to 2007
Supervised independent study. Please see section of the for description and prerequisites.
Supervised Independent Study: Read More [+]
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 without restriction.

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.

Supervised Independent Study: Read Less [-]

NUC ENG 200M Introduction to Nuclear Engineering 3 Units

Terms offered: Fall 2019, Spring 2018, Spring 2017
Overview of the elements of nuclear technology in use today for the production of energy and other radiation applications. Emphasis is on nuclear fission as an energy source, with a study of the basic physics of the nuclear fission process followed by detailed discussions of issues related to the control, radioactivity management, thermal energy management, fuel production, and spent fuel management. A discussion of the various reactor types in use around the world will include analysis of safety and nuclear proliferation issues surrounding the various technologies. Case studies of some reactor accidents and other nuclear-related incidents will be included.
Introduction to Nuclear Engineering: Read More [+]
Objectives Outcomes

Course Objectives: (1) To give students an understanding of the basic concepts of nuclear energy and other radiation applications, together with an overview of related aspects such as proliferation and waste management.
(2) To provide students an overview of the elements of nuclear technology in use today for the production of energy and to set those elements in the broader contest of nuclear technology.

Student Learning Outcomes: At the end of the course, students should be able to:
- understand basic theoretical concepts of nuclear physics, reactor physics, and energy removal
- describe radiation damage mechanisms in materials and biological tissue, estimate radiation dose, understand radiation shielding
- understand the concepts of chain reaction, neutron balance, criticality, reactivity, and reactivity control
- describe the main nuclear power reactor designs and identify their major components
- describe core components and understand their function
- calculate cost of electricity based on simple economic principles
- describe the difference between PWR and BWR in terms of core design, steam cycle, and operation
- understand the concept of design-basis accidents, their causes, and their consequences
- identify the main steps and related facilities of fuel cycle
- understand the fundamental aspects of used fuel reprocessing and disposal

Rules & Requirements

Prerequisites: Students taking the class should have completed the equivalents of the Physics 7 sequence and the Mathematics 50 sequence or consent of instructor

Credit Restrictions: This course is restricted to students enrolled in the Master of Engineering degree program.

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: Fratoni

Introduction to Nuclear Engineering: Read Less [-]

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

Terms offered: Spring 2020, Spring 2018, Spring 2016
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.
Nuclear Reactions and Interactions of Radiation with Matter: Read More [+]
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

Nuclear Reactions and Interactions of Radiation with Matter: Read Less [-]

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

Terms offered: Fall 2018, Fall 2015, Fall 2013
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.
Advanced Concepts in Radiation Detection and Measurements: Read More [+]
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

Advanced Concepts in Radiation Detection and Measurements: Read Less [-]

NUC ENG 210M Nuclear Reactions and Radiation 4 Units

Terms offered: Spring 2020, Fall 2018, Fall 2017
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.
Nuclear Reactions and Radiation: Read More [+]
Objectives Outcomes

Course Objectives: Provide the students with a solid understanding of the fundamentals of those aspect of low-energy nuclear physics that are most important to applications in such areas as nuclear engineering, nuclear and radiochemistry, geosciences, biotechnology, etc.

Student Learning Outcomes: Calculate estimates of nuclear masses and energetics based on empirical data and nuclear models.
Calculate estimates of the lifetimes of nuclear states that are unstable to alpha-,beta- and gamma decay and internal conversion based on the theory of simple nuclear models.
Calculate the consequences of radioactive growth and decay and nuclear reactions.
Calculate the energies of fission fragments and understand the charge and mass distributions of the fission products, and prompt neutron and gamma rays from fission
Calculate the kinematics of the interaction of photons with matter and apply stopping power to determine the energy loss rate and ranges of charged particles in matter
Use nuclear models to predict low-energy level structure and level energies.
Use nuclear models to predict the spins and parities of low-lying levels and estimate their consequences with respect to radioactive decay
Use nuclear models to understand the properties of neutron capture and the Breit-Wigner single level formula to calculate cross sections at resonance and thermal energies.

Rules & Requirements

Prerequisites: Physics 7C or consent of instructor

Credit Restrictions: This course is restricted to students enrolled in the Master of Engineering degree program.

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/Graduate

Grading: Letter grade.

Instructor: Bernstein

Nuclear Reactions and Radiation: Read Less [-]

NUC ENG 215M Introduction to Nuclear Reactor Theory 4 Units

Terms offered: Spring 2020
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. General aspects of nuclear core designs.
Introduction to Nuclear Reactor Theory: Read More [+]
Rules & Requirements

Prerequisites: 101; Mathematics 53 and 54

Credit Restrictions: This course is restricted to students enrolled in the Master of Engineering degree program.

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/Graduate

Grading: Letter grade.

Instructors: Vujic, Fratoni, Slaybaugh

Introduction to Nuclear Reactor Theory: Read Less [-]

NUC ENG 220 Irradiation Effects in Nuclear Materials 3 Units

Terms offered: Spring 2019, Spring 2017, Spring 2015
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.
Irradiation Effects in Nuclear Materials: Read More [+]
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

Irradiation Effects in Nuclear Materials: Read Less [-]

NUC ENG 220M Nuclear Materials 4 Units

Terms offered: Fall 2019
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.
Nuclear Materials: Read More [+]
Objectives Outcomes

Course Objectives: Develop an understanding of failure mechanism in materials and their impact in nuclear technology.

Explain quantitatively the production of damage, in materials.

Give an understanding of the behavior of fission products in ceramic fuel, how they are formed, how they migrate, and how they affect properties of the fuel.

Review those aspects of fundamental solid state physics that are pertinent to understanding the effects of radiation on crystalline solids. Show how radiation, particularly by fast neutrons, affects the mechanical properties of fuel, cladding, and structural materials in a reactor core.

Student Learning Outcomes: Analyze the processes of fission gas release and swelling of reactor fuel.
Deal with point defects in solids; how they are produced at thermal equilibrium and by neutron irradiation; how they agglomerate to form voids in metals or grow gas bubbles in the fuel. Kinchin-Pease model.
Know the principal effects of radiation on metals: dislocation loops, voids, precipitates, and helium bubbles.
Solve diffusion problems beginning from Fick's law; understand how the diffusion coefficient is related to the mobility of atoms in the crystalline lattice.
Understand how the grain structure influences properties such as creep rate and fission product release (ceramic UO_2).
Understand the concept and quantitative properties of dislocations, and how irradiation-produced point defects influences their motion and hence material properties.

Rules & Requirements

Prerequisites: Introductory course on properties of materials (Engin. 45) Upper division course in thermodynamics (Engin. 115, or ChemE 141)

Credit Restrictions: This course is restricted to students enrolled in the Master of Engineering degree program.

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/Graduate

Grading: Letter grade.

Instructor: Hosemann

Nuclear Materials: Read Less [-]

NUC ENG 221 Corrosion in Nuclear Power Systems 3 Units

Terms offered: Spring 2018, Spring 2016, Spring 2014
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.
Corrosion in Nuclear Power Systems: Read More [+]
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

Corrosion in Nuclear Power Systems: Read Less [-]

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

Terms offered: Spring 2014, Spring 2013, Spring 2012
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.
Safety Assessment for Geological Disposal of Radioactive Wastes: Read More [+]
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

Safety Assessment for Geological Disposal of Radioactive Wastes: Read Less [-]

NUC ENG 225 The Nuclear Fuel Cycle 3 Units

Terms offered: Spring 2015, Spring 2013, Spring 2011
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.
The Nuclear Fuel Cycle: Read More [+]
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

The Nuclear Fuel Cycle: Read Less [-]

NUC ENG C226 Modeling and Simulation of Advanced Manufacturing Processes 3 Units

Terms offered: Spring 2020, Spring 2019, Spring 2018
This course provides the student with a modern introduction to the basic industrial practices, modeling techniques, theoretical background, and computational methods to treat classical and cutting edge manufacturing processes in a coherent and self-consistent manner.,Terms offered: Prior to 2007
This course provides the student with a modern introduction to the basic industrial practices, modeling techniques, theoretical background, and computational methods to treat classical and cutting edge manufacturing processes in a coherent and self-consistent manner.
Modeling and Simulation of Advanced Manufacturing Processes: Read More [+]
Objectives Outcomes

Course Objectives: An introduction to modeling and simulation of modern manufacturing processes.

Rules & Requirements

Prerequisites: An undergraduate course in strength of materials or 122

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/Graduate

Grading: Letter grade.

Instructor: Zohdi

Also listed as: MAT SCI C286/MEC ENG C201

Modeling and Simulation of Advanced Manufacturing Processes: Read Less [-]

NUC ENG C226 Modeling and Simulation of Advanced Manufacturing Processes 3 Units

Terms offered: Spring 2020, Spring 2019, Spring 2018
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This course provides the student with a modern introduction to the basic industrial practices, modeling techniques, theoretical background, and computational methods to treat classical and cutting edge manufacturing processes in a coherent and self-consistent manner.
Modeling and Simulation of Advanced Manufacturing Processes: Read More [+]

Objectives Outcomes

Course Objectives: An introduction to modeling and simulation of modern manufacturing processes.

Rules & Requirements

Prerequisites: An undergraduate course in strength of materials or 122

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/Graduate

Grading: Letter grade.

Instructor: Zohdi

Also listed as: MAT SCI C286/MEC ENG C201

Modeling and Simulation of Advanced Manufacturing Processes: Read Less [-]

NUC ENG C226 Modeling and Simulation of Advanced Manufacturing Processes 3 Units

Terms offered: Spring 2020, Spring 2019, Spring 2018
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This course provides the student with a modern introduction to the basic industrial practices, modeling techniques, theoretical background, and computational methods to treat classical and cutting edge manufacturing processes in a coherent and self-consistent manner.
Modeling and Simulation of Advanced Manufacturing Processes: Read More [+]

Objectives Outcomes

Course Objectives: An introduction to modeling and simulation of modern manufacturing processes.

Rules & Requirements

Prerequisites: An undergraduate course in strength of materials or 122

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/Graduate

Grading: Letter grade.

Instructor: Zohdi

Also listed as: MAT SCI C286/MEC ENG C201

Modeling and Simulation of Advanced Manufacturing Processes: Read Less [-]

NUC ENG C226 Modeling and Simulation of Advanced Manufacturing Processes 3 Units

Terms offered: Spring 2020, Spring 2019, Spring 2018
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This course provides the student with a modern introduction to the basic industrial practices, modeling techniques, theoretical background, and computational methods to treat classical and cutting edge manufacturing processes in a coherent and self-consistent manner.
Modeling and Simulation of Advanced Manufacturing Processes: Read More [+]
Objectives Outcomes

Course Objectives: An introduction to modeling and simulation of modern manufacturing processes.

Rules & Requirements

Prerequisites: An undergraduate course in strength of materials or 122

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/Graduate

Grading: Letter grade.

Instructor: Zohdi

Also listed as: MAT SCI C286/MEC ENG C201

Modeling and Simulation of Advanced Manufacturing Processes: Read Less [-]

NUC ENG 230 Analytical Methods for Non-Proliferation 3 Units

Terms offered: Spring 2020, Spring 2019, Spring 2018
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. Topics include passive and active neutron signals, gamma ray detection, fission neutron multiplicity, and U and Puisotopic identification and age determination.
Analytical Methods for Non-Proliferation: Read More [+]
Rules & Requirements

Prerequisites: 101, Physics 7C, or equivalent course in nuclear physics

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

Analytical Methods for Non-Proliferation: Read Less [-]

NUC ENG 250 Nuclear Reactor Theory 4 Units

Terms offered: Fall 2017, Fall 2015, Fall 2013
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.
Nuclear Reactor Theory: Read More [+]
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

Nuclear Reactor Theory: Read Less [-]

NUC ENG 255 Numerical Simulation in Radiation Transport 3 Units

Terms offered: Fall 2019, Fall 2018, Fall 2016
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.
Numerical Simulation in Radiation Transport: Read More [+]
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

Numerical Simulation in Radiation Transport: Read Less [-]

NUC ENG 256M Nuclear Criticality Safety 3 Units

Terms offered: Fall 2019, Fall 2018
This course provides an introduction to the field of nuclear criticality safety. Topics include: a review of basic concepts related to criticality (fission, cross sections, multiplication factor, etc.); criticality safety accidents; standards applicable to criticality safety; hand calculations and Monte Carlo methods used in criticality safety analysis; criticality safety evaluation documents.
Nuclear Criticality Safety: Read More [+]
Objectives Outcomes

Course Objectives: The objective of this course is to acquaint Nuclear Engineering students with the concepts and practice of nuclear criticality safety, and to help prepare them for a future career in this field.

Student Learning Outcomes: At the end of this course, students should be able to:
Explain and define criticality safety factors for operations.
Discuss previous criticality accidents and their causal factors, including parameters involved in solution and metal critical accidents.
Identify and discuss the application of several common hand calculation methods.
Describe the importance of validation of computer codes and how it is accomplished.
Discuss ANSI/ANS criticality safety regulations.
Describe DOE regulations and practices in the nuclear criticality safety field.
Complete a Criticality Safety Evaluation

Rules & Requirements

Prerequisites: Nuc Eng 150, or instructor consent

Credit Restrictions: This course is restricted to students enrolled in the Master of Engineering degree program.

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: Fratoni

Nuclear Criticality Safety: Read Less [-]

NUC ENG 260 Thermal Aspects of Nuclear Reactors 4 Units

Terms offered: Fall 2016, Fall 2014, Fall 2012
Fluid dynamics and heat transfer; thermal and hydraulic analysis of nuclear reactors; two-phase flow and boiling; compressible flow; stress analysis; energy conversion methods.
Thermal Aspects of Nuclear Reactors: Read More [+]
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

Thermal Aspects of Nuclear Reactors: Read Less [-]

NUC ENG 261M Nuclear Power Engineering 4 Units

Terms offered: Fall 2019
The class covers a wide range of topics applicable to nuclear power plant engineering. 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. The instructor has 30 years’ experience in the commercial power industry.
Nuclear Power Engineering: Read More [+]
Rules & Requirements

Prerequisites: Course(s) in fluid mechanics and heat transfer; junior-level course in thermodynamics. Must be enrolled in the Master of Engineering degree program

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/Graduate

Grading: Letter grade.

Instructor: Berger

Nuclear Power Engineering: Read Less [-]

NUC ENG 262 Radiobiology 3 Units

Terms offered: Spring 2020, Spring 2019
Radiobiology is concerned with the action of ionizing radiation on biological tissues and living organisms. It combines two disciplines: radiation physics and biology. Radiobiology combines our understanding of ionizing radiation and molecular biology, and is a required knowledge for health physicists, radiation biologists and medical physicists. This course will provide such knowledge for a diverse group of students with need in either disciplines. This course represents one of the requisites for the Joint UC Berkeley-UC San Francisco Medical Physics Certificate Program.
Radiobiology: Read More [+]
Objectives Outcomes

Course Objectives: A group project will be expected from students and computer models will be turned in at the end of the semester, either focusing on cancer risk tools, epidemiologic analysis, radiation cancer models or cancer treatment by radiation. The project should give students strong foundation to tackle more advanced risk models or dynamic cancer models.
They will be exposed to the multi-scale complexity of the tissue response to ionizing radiation from the whole organism to individual cells and down to the DNA. Molecular biology describing the cellular response and the DNA repair mechanisms will be covered, with an emphasis on cell kinetics such as recovery processes and cell cycle sensitivity. The overall tissue response will also be discussed with an effort to distinguish acute and delayed effects. Radiation risk models and their impact on limits will be introduced and described in the context of past and current research. This course is designed for Nuclear Engineering students and in particular those pursuing a Medical Physics Certificate with knowledge essential to radiobiology. Students will learn about the history of radiation effects, epidemiology of radiation and evidence of cancer in populations.

Student Learning Outcomes: By the end of the class, students should:

-
Be proficient in the main mechanisms describing the interaction of ionizing radiation with tissue;
-
Be able to know the existing gaps in this field and where more research is needed;
-
Understand how radiation affects DNA and leads to gene mutation
-
Understand how cancer rises from various radiation damage in the tissue (targeted and non-targeted effects)
-
Able to write computer model for radiation risk assessment
-
Able to write computer model for cancer formation
-
Understand the main methods to treat cancer with radiation
-
Can differentiate tissue effect between low and high LET
-
Understand the various risk issues dealing with radiation: occupational (medical, nuclear worker, astronauts ...), vs population (accident, terrorism ...)
-
Be able to read scientific articles in the radiation biology field

Rules & Requirements

Prerequisites: Students are expected to have completed a course in basic radiology, radiation protection, and dosimetry (NE162 or equivalent). In addition, a class in radiation detection and instrumentation (e.g. NE104 or equivalent) and in introductory programming (Engineering

NUC ENG 265 Design Analysis of Nuclear Reactors 3 Units

Terms offered: Fall 2016, Fall 2015, Fall 2013
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.
Design Analysis of Nuclear Reactors: Read More [+]
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

Design Analysis of Nuclear Reactors: Read Less [-]

NUC ENG 267 Risk-Informed Design for Advanced Nuclear Systems 3 Units

Terms offered: Fall 2019, Fall 2017, Fall 2015
Project-based class for design and licensing of nuclear facilities,including advanced reactors. Elements of a project proposal. Regulatory framework and use of deterministic and probabilistic licensing criteria. Siting criteria. External and internal events. Identification and analysis of design basis and beyond design basis
events. Communication with regulators and stakeholders. Ability to work in and contribute to a design team.
Risk-Informed Design for Advanced Nuclear Systems: Read More [+]
Rules & Requirements

Prerequisites: Completion of at least two upperdivision engineering courses providing relevant skills: ChemE 150A, ChemE 180, CE 111, CE 120,CE152, CE 166, CE 175, E 120, IEOR 166, IEOR 172, ME 106, ME 109, ME 128, ME 146, Nuc Eng 120, Nuc Eng 124, Nuc Eng 150, Nuc Eng 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

Risk-Informed Design for Advanced Nuclear Systems: Read Less [-]

NUC ENG 270 Advanced Nuclear Reactors 3 Units

Terms offered: Spring 2019
The scope of this class is to provide students with a broad overview of Gen IV and beyond reactor systems, advanced fuel cycles, and new trends in reactor design (e.g., small modular, load following, etc.).
Advanced Nuclear Reactors: Read More [+]
Objectives Outcomes

Course Objectives: The main objective of this course is to provide students with an understanding of how advanced nuclear reactors work, their mission, their benefits, and the challenges that remain to be addressed.
This class is intended for all graduate students (PhD, MS, and MEng) at any stage in their academic career.

Student Learning Outcomes: By the end of this course students are expected to be able:
– to identify the main advanced reactor concepts and recognize their main features;
– to discuss the benefits and challenges associated with each concept;
– to understand the difference between fuel cycle options and associated characteristics such as resource utilization, waste generation, non-proliferation and safeguards;
– to recognize the contribution and limitation of advanced reactors towards various applications (i.e., load-following, hydrogen generation, etc.).

Rules & Requirements

Prerequisites: Students will benefit the most from this class if they have basic knowledge of light water reactor design, reactor physics, and reactor thermal-hydraulics (these topics are covered in NE150 and NE161). Students are expected to be familiar with the following topics (mostly related to LWR): – main reactor components and function; – reactor layout, auxiliary systems; – criticality, reactivity and reactivity feedbacks; – heat transfer, fluid flow

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: Fratoni

Advanced Nuclear Reactors: Read Less [-]

NUC ENG 275 Principles and Methods of Risk Analysis 4 Units

Terms offered: Fall 2018, Fall 2013, Fall 2011
Principles and methodological approaches for the quantification of technological risk and risk-based decision making.
Principles and Methods of Risk Analysis: Read More [+]
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: Kastenberg

Principles and Methods of Risk Analysis: Read Less [-]

NUC ENG 280 Fusion Reactor Engineering 3 Units

Terms offered: Spring 2019, Spring 2017, Spring 2015
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.
Fusion Reactor Engineering: Read More [+]
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

Fusion Reactor Engineering: Read Less [-]

NUC ENG 281 Fully Ionized Plasmas 3 Units

Terms offered: Spring 2020, Spring 2018, Spring 2016
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.
Fully Ionized Plasmas: Read More [+]
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

Fully Ionized Plasmas: Read Less [-]

NUC ENG C282 Charged Particle Sources and Beam Technology 3 Units

Terms offered: Spring 2020, Spring 2018, Fall 2015, Fall 2013, Fall 2011
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.
Charged Particle Sources and Beam Technology: Read More [+]
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

Charged Particle Sources and Beam Technology: Read Less [-]

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

Terms offered: Spring 2020, Spring 2019, Spring 2018
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.
Nuclear Security: The Nexus Between Policy and Technology: Read More [+]
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

Nuclear Security: The Nexus Between Policy and Technology: Read Less [-]

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

Terms offered: Fall 2017, Spring 2016, Fall 2014
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.
Special Topics in Applied Nuclear Physics: Read More [+]
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

Special Topics in Applied Nuclear Physics: Read Less [-]

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

Terms offered: Spring 2016, Spring 2015, Spring 2013
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.
Special Topics in Nuclear Materials and Chemistry: Read More [+]
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.

Special Topics in Nuclear Materials and Chemistry: Read Less [-]

NUC ENG 290C Special Topics in Nuclear Energy 3 Units

Terms offered: Summer 2002 10 Week Session
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.
Special Topics in Nuclear Energy: Read More [+]
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.

Special Topics in Nuclear Energy: Read Less [-]

NUC ENG 290D Special Topics in Nuclear Non-Proliferation 3 Units

Terms offered: Fall 2014, Summer 2005 10 Week Session, Summer 2004 10 Week Session
Special topics in nuclear non-proliferation. Topics may include homeland security and nuclear policy, and nuclear fuel cycle and waster management. Course content may vary from semester to semester depending on the instructor.
Special Topics in Nuclear Non-Proliferation: Read More [+]
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.

Special Topics in Nuclear Non-Proliferation: Read Less [-]

NUC ENG 290E Special Topics in Environmental Aspects of Nuclear Energy 1 - 3 Units

Terms offered: Spring 2019, Fall 2015, Fall 2014
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.
Special Topics in Environmental Aspects of Nuclear Energy: Read More [+]
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 - 1-3 hours of lecture per week

Additional Details

Subject/Course Level: Nuclear Engineering/Graduate

Grading: Letter grade.

Special Topics in Environmental Aspects of Nuclear Energy: Read Less [-]

NUC ENG 290F Special Topics in Fusion and Plasma Physics 3 Units

Terms offered: Summer 2007 10 Week Session, Summer 2007 3 Week Session
Special topics in fusion and plasma physics. Topics may include laser, particle bean and plasma technologies, fusion science and technology, and accelerators. Course content may vary from semester to semester depending upon the instructor.
Special Topics in Fusion and Plasma Physics: Read More [+]
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.

Special Topics in Fusion and Plasma Physics: Read Less [-]

NUC ENG 295 Nuclear Engineering Colloquium 0.0 Units

Terms offered: Spring 2020, Fall 2019, Spring 2019
Presentations on current topics of interest in nuclear technology by experts from government, industry and universities. Open to the campus community.
Nuclear Engineering Colloquium: Read More [+]
Rules & Requirements

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

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

Additional Details

Subject/Course Level: Nuclear Engineering/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

Instructor: van Bibber

Nuclear Engineering Colloquium: Read Less [-]

NUC ENG 298 Group Research Seminars 1 Unit

Terms offered: Spring 2020, Fall 2019, Spring 2019
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.
Group Research Seminars: Read More [+]
Rules & Requirements

Repeat rules: Course may be repeated for credit without restriction.

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.

Group Research Seminars: Read Less [-]

NUC ENG 299 Individual Research 1 - 12 Units

Terms offered: Spring 2020, Fall 2019, Spring 2019
Investigation of advanced nuclear engineering problems.
Individual Research: Read More [+]
Rules & Requirements

Prerequisites: Graduate standing

Repeat rules: Course may be repeated for credit without restriction.

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.

Individual Research: Read Less [-]

NUC ENG N299 Individual Research 1 - 6 Units

Terms offered: Summer 2009 10 Week Session, Summer 2006 10 Week Session, Summer 2005 10 Week Session
Investigation of advanced nuclear engineering problems.
Individual Research: Read More [+]
Rules & Requirements

Prerequisites: Graduate standing

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Summer: 8 weeks - 1-6 hours of independent study per week

Additional Details

Subject/Course Level: Nuclear Engineering/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

Individual Research: Read Less [-]

NUC ENG 375 Teaching Techniques in Nuclear Engineering 1 - 3 Units

Terms offered: Fall 2018, Fall 2017, Fall 2016
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.
Teaching Techniques in Nuclear Engineering: Read More [+]
Rules & Requirements

Prerequisites: Graduate standing or ASE status

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 1-3 hours of lecture and 1-3 hours 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 Enginering 301

Teaching Techniques in Nuclear Engineering: Read Less [-]

NUC ENG 602 Individual Study for Doctoral Students 1 - 8 Units

Terms offered: Fall 2017, Spring 2017, Fall 2016
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.
Individual Study for Doctoral Students: Read More [+]
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 without restriction.

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.

Individual Study for Doctoral Students: Read Less [-]