

NUCLEAR ENGINEERING (NUC ENG)

NUC ENG 5000 Special Problems (IND 0.0-6.0)

Problems or readings on specific subjects or projects in the department. Consent of instructor required.

NUC ENG 5001 Special Topics (IND 0.0-6.0)

This course is designed to give the department an opportunity to test a new course. Variable title.

NUC ENG 5010 Seminar (RSD 0.0-6.0)

Discussion of current topics.

NUC ENG 5203 Reactor Physics I (LEC 3.0)

Study of neutron interactions, fission, chain reactions, neutron diffusion and neutron slowing down; criticality of a bare thermal homogeneous reactor. Prerequisite: Nuc Eng 3205.

NUC ENG 5207 Nuclear Fuel Cycle (LEC 3.0)

Nuclear fuel reserves and resources; milling, conversion, and enrichment; fuel fabrication; in-and-out-of core fuel management; transportation, storage, and disposal of nuclear fuel; low level and high level waste management; economics of the nuclear fuel cycle. Prerequisite: Nuc Eng 3205.

NUC ENG 5241 Nuclear Materials I (LEC 3.0)

Fundamentals of materials selection for components in nuclear applications; design and fabrication of UO₂ fuel; reactor fuel element performance; mechanical properties of UO₂; radiation damage and effects, including computer modeling; corrosion of materials in nuclear reactor systems. Prerequisites: Civ Eng 2210; Nuc Eng 3205; Nuc Eng 3223; Met Eng 2110. (Co-listed with Met Eng 5170).

NUC ENG 5251 Reactor Kinetics (LEC 3.0)

Derivation and solutions to elementary kinetics models. Application of the point kinetics model in fast and thermal reactor dynamics, internal and external feedback mechanisms, rigorous derivation and solutions of the space dependent kinetics model fission product and fuel isotope changes during reactor operation. Prerequisite: Nuc Eng 3205.

NUC ENG 5257 Introduction to Nuclear Thermal Hydraulics (LEC 3.0)

An introductory course in the application of thermal-hydraulic principles to energy systems, with emphasis on nuclear energy issues. Will include the development of constitutive models and applications to power systems, fluid mechanics, and heat transfer problems (including multiphase flows). Prerequisite: Graduate standing.

NUC ENG 5281 Introduction to Probabilistic Risk Assessment (LEC 3.0)

An introduction to advanced techniques for assessing reliability, safety and risk in complex systems. Classification of initiating events, fault tree analysis, consequences, figures of merit, and use of probabilistic risk analysis in regulation are discussed using examples and applied through a simple case study. (Co-listed with Sys Eng 5281).

NUC ENG 5312 Nuclear Radiation Measurements and Spectroscopy (LAB 1.0 and LEC 2.0)

Contemporary radiation detection theory and experiments with high resolution gamma-ray spectroscopy, solid state detectors, neutron detection and conventional gas filled detectors. Neutron activation analysis of unknown material, statistical aspects of nuclear measurements. Prerequisite: Nuc Eng 3205.

NUC ENG 5347 Radiological Engineering (LEC 3.0)

Radiation exposure pathways analysis. Modeling of radionuclides transport through atmosphere, surface and ground water. Human health impact. Transportation of nuclear waste. Nuclear Waste characterization. Regulatory structure and requirements. Scenario case studies and computer simulation of transport. Prerequisite: Nuc Eng 3205.

NUC ENG 5350 Advanced Nuclear Medical Science (LEC 3.0)

Advanced level of technologies involved in medical modalities, such as digital radiography, digital mammography, modern computed tomography, gamma camera, SPECT and PET will be covered. Prerequisites: Nuc Eng 4312 or equivalent.

NUC ENG 5363 Applied Health Physics (LEC 3.0)

Radiation sources; external and internal dosimetry; biological effects of radiation; radiation protection principles; regulatory guides; radioactive and nuclear materials management. Prerequisite: Nuc Eng 3103 or Physics 2305.

NUC ENG 5365 Radiation Protection Engineering (LEC 3.0)

Radiation fields and sources including nuclear reactors, radioactive wastes, x-ray machines, and accelerators. Stopping of radiation (Charges particles, photons, and neutrons) by matter. Radiation transport methods. Radiation shielding design. Dose rate calculations. Biological effects of radiation. Regulatory guides (10CFR20). Prerequisite: Nuc Eng 3205.

NUC ENG 5367 Radioactive Waste Management And Remediation (LEC 3.0)
Sources and classes of radioactive waste, long-term decay, spent fuel storage, transport, disposal options, regulatory control, materials issues, site selection and geologic characterization, containment, design and monitoring requirements, domestic and foreign waste disposal programs, economic and environmental issues, history of disposal actions, and conduct of remedial actions and clean up. Prerequisite: Math 3304. (Co-listed with Geology 4421).

NUC ENG 5370 Plasma Physics I (LEC 3.0)
Single particle orbits in electric and magnetic fields, moments of Boltzmann equation and introduction to fluid theory. Diffusion of plasma in electric and magnetic fields. Analysis of laboratory plasmas and magnetic confinement devices. Introduction to plasma kinetic theory. Prerequisite: Aero Eng 3131 or Mech Eng 3131 or Physics 3211 or Nuc Eng 3221 or Elec Eng 3600. (Co-listed with Aero Eng 5570, Mech Eng 5570, Physics 4543).

NUC ENG 5428 Advanced Reactor Laboratory I (LAB 1.0 and LEC 2.0)
Acquaints the student with neutron flux measurement, reactor operation, control rod calibration, reactor power measurement and neutron activation experiments. Experiments with the thermal column and neutron beam port are also demonstrated. Prerequisites: Nuc Eng 4312, Nuc Eng 3205.

NUC ENG 5438 Advanced Reactor Laboratory II (LAB 1.0 and LEC 1.0)
A continuation of Nuclear Engineering 4428 with experiments of a more advanced nature. Prerequisite: Nuc Eng 4428 or Nuc Eng 5428.

NUC ENG 5456 Reactor Operation II (LAB 1.0)
The operation of the training reactor. The program is similar to that required for the NRC Reactor Operator's license. Students from other disciplines will also benefit from the course. Prerequisite: Nuc Eng 2105, 2406.

NUC ENG 5507 Nuclear Policy (LEC 3.0)
This course introduces nuclear security and safeguards policy. It explores the following topics: history of domestic and international nuclear policy, evolution of U.S. nuclear weapons policy, factors influencing policy, the IAEA, nuclear deterrence policy, nuclear safeguards policy, policy in non-proliferation issues, and various international agreements. Prerequisites: Graduate Standing or enrolled in the Nuclear Nonproliferation certificate program.

NUC ENG 5509 Nuclear Nonproliferation (LEC 3.0)
This course will introduce IAEA mission specific to nonproliferation. The class will provide discussion of essential elements of a nuclear weapon, followed by a brief historical over of nonproliferation treaties in place to deter proliferation. Methods of fissile material production will be discussed followed by a survey of tool and techniques available an Prerequisites: Graduate Standing or enrolled in the Nuclear Nonproliferation certificate program.

NUC ENG 5577 Advanced Nuclear Forensics and Radiochemistry (LEC 3.0)
Fundamentals of radiochemistry, including nuclear science, cosmochemistry, spent fuel reprocessing, with details on solvent extraction. We will review case studies in Nuclear Forensics. This advanced section also includes experiments on radiochemistry and demonstrate experimental nuclear forensics techniques. Dual listed with Nuc Eng 4577.

NUC ENG 6000 Special Problems (IND 0.0-6.0)
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NUC ENG 6001 Special Topics (LEC 0.0-6.0)
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NUC ENG 6010 Seminar (RSD 0.0-6.0)
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NUC ENG 6040 Oral Examination (IND 0.0)
After completion of all other program requirements, oral examinations for on-campus M.S./Ph.D. students may be processed during intersession. Off-campus M.S. students must be enrolled in oral examination and must have paid an oral examination fee at the time of the defense/comprehensive examination (oral/ written). All other students must enroll for credit commensurate with uses made of facilities and/or faculties. In no case shall this be for less than three (3) semester hours for resident students.

NUC ENG 6050 Continuous Registration (IND 1.0)
Doctoral candidates who have completed all requirements for the degree except the dissertation, and are away from the campus must continue to enroll for at least one hour of credit each registration period until the degree is completed. Failure to do so may invalidate the candidacy. Billing will be automatic as will registration upon payment.

NUC ENG 6085 Internship (IND 0.0-15)

Students working toward a doctor of engineering degree will select with the advice of their committees, appropriate problems for preparation of a dissertation. The problem selected and internship plan must conform to the purpose of providing a high level engineering experience consistent with the intent of the doctor of engineering degree.

NUC ENG 6099 Research (IND 0.0-15)

Investigations of an advanced nature leading to the preparation of a thesis or dissertation. Consent of instructor required.

NUC ENG 6203 Advanced Reactor Physics (LEC 3.0)

Transport and diffusion theory; multigroup approximation; criticality calculations; cross-section processing; buildup and depletion calculations; delayed neutrons and reactor kinetics; lattice physics calculations; full core calculations; analysis and measurement of reactivity coefficients. Prerequisite: Math 5325.

NUC ENG 6205 Linear Transport Theory (LEC 3.0)

Monoenergetic Boltzmann equation for neutral particles by the method of singular eigen-functions and polynomial expansions. Prerequisites: Nuc Eng 4203, Math 5358.

NUC ENG 6223 Nuclear Reactor Safety (LEC 3.0)

Study of safety criteria; reactor characteristics pertinent to safety; reactor transient behavior; loss of coolant accident analysis; emergency core cooling; fuel behavior during accident conditions; reactor risk analysis; current reactor safety issues. Prerequisites: Nuc Eng 4203 and 3229.

NUC ENG 6241 Effects Of Radiation On Solids (LEC 3.0)

The theories of the interaction of nuclear radiation with matter. Experimental approaches to radiation studies, including the sources and dosimetry. Nature and properties of crystal imperfections. The influence of radiation on physical, mechanical and surface properties of metals and alloys. Radiation effects on materials other than those incorporated in nuclear reactors. The annealing of defects. Prerequisite: Met Eng 5170.

NUC ENG 6257 Advanced Nuclear Thermal Hydraulics (LEC 3.0)

Treatment of advanced topics in nuclear reactor thermal-hydraulics including analysis of fuel elements and fuel melting, multiphase flow dynamics and two-fluid models, interfacial transfer of mass, momentum, and energy, multiphase flow scaling, and numerical applications. Prerequisite: Math 5325.

NUC ENG 6331 Radiation Shielding (LEC 3.0)

Radiation sources; interactions of radiation with matter; dosimetry and radiation protection guidelines. The particle transport equation and methods of solving it; the Monte Carlo Method; special computational methods for neutron and gamma attenuation. Computer codes used in shielding. Shielding materials, shield design. Prerequisite: Nuc Eng 4203.