

NUCLEAR ENGINEERING (NE)

NE 4000 (s) Seminar (1-16 credits, max 99)

Credit arranged

NE 4040 (s) Special Topics (1-16 credits, max 99)

Credit arranged

NE 4370 Radiation Effects on Materials (3 credits)

Cross-listed with MSE 4370

Joint-listed with MSE 5370, NE 5370

Interactions between radiation and solids.

Prereqs: ENGR 2150 or Permission

NE 4380 Fundamentals of Nuclear Materials (3 credits)

Cross-listed with MSE 4380

Joint-listed with MSE 5380, NE 5380

This course is designed for students who wish to learn about nuclear materials and fuels from a materials science viewpoint. Topics to be covered include crystal structure, diffusion, radiation damage processes etc. Term-projects and advanced problems required for graduate credit. Typically Offered: Spring.

Prereqs: ENGR 2150 or NE 4500; or Permission

NE 4500 Principles of Nuclear Engineering (3 credits)

Basic nuclear and atomic processes; radioactive decay, binding energy, radiation interactions, reaction cross sections. Neutron diffusion, radiation sources. Idaho Falls only.

Prereqs: MATH 3100, ENGR 3200, or Permission

NE 4980 (s) Internship (1-16 credits, max 99)

Credit arranged

NE 4990 (s) Directed Study (1-16 credits, max 99)

Credit arranged

NE 5000 Master's Research and Thesis (1-16 credits, max 99)

Credit arranged. Course offered only in Idaho Falls.

NE 5010 (s) Seminar (1-16 credits, max 99)

Credit arranged. Course offered only in Idaho Falls.

NE 5020 (s) Directed Study (1-16 credits, max 99)

Credit arranged

NE 5040 (s) Special Topics (1-16 credits, max 99)

Credit arranged

NE 5050 (s) Professional Development (1-16 credits, max 99)

Credit arranged

NE 5120 Nuclear Components Inspection (3 credits)

Cross-listed with MSE 5120

This course will cover various non-destructive testing techniques to evaluate the environmental degradation of the nuclear structural components. Remnant life estimation of structural components exposed to fatigue, creep, and stress corrosion cracking service conditions will be discussed.

Prereqs: Graduate standing or Permission

NE 5130 Nuclear Security Science (3 credits)

An engineering course on threat and risk informed nuclear security covering topics including physical protection, facility characterization, consequence analysis, access control/delay, insider threats, security culture, transportation security, radiological crime scene, and nuclear forensics.

Prereqs: Science or engineering background or instructor permission

NE 5140 Nuclear Safety (3 credits)

Cross-listed with TM 5140

An in-depth technical study of safety issues within the nuclear fuel cycle and within various reactor types. Evaluation methods, system disturbances, safety criteria, containment, NRC licensing, and codes for safety analysis will be presented. Case studies of reactor accidents and corrective measures included.

Prereqs: Permission

NE 5160 Nuclear Rules and Regulations (3 credits)

Cross-listed with TM 5160

An in-depth examination of nuclear regulatory agencies; major nuclear legislation; current radiation protection standards and organizational responsibility for their implementation.

Prereqs: Permission

NE 5200 Thermodynamics of Nuclear Power Plants (3 credits)

Course covers applications of first law to power nuclear plants: boiling water, pressurized, high temperature gas, small modular and advanced nuclear power plants. Nuclear power plant applications of pressurizers, suppression pools, nuclear containment, and the application of the second law to exergy analysis of advanced fuel cycles.

Prereqs: Permission

NE 5240 Heat Exchanger Design (3 credits)

Cross-listed with ME 5690

This course will cover advanced heat exchanger design and apply that knowledge to the design of the following heat exchangers: tube-in-tube heat exchanger, air cooler, compact heat exchanger, feedwater heater, and condenser. Typically Offered: Spring.

Prereqs: Permission

NE 5270 Nuclear Material Storage, Transportation and Disposal (3 credits)

Cross-listed with TM 5370

There is a wide range of nuclear materials that are stored, transported and disposed of each day. The materials include medical radioisotopes, new fuel pellets, used fuel, and industrial radioisotopes. This course will cover the regulations that govern nuclear material storage, transportation and disposal, as well as the engineering requirements and practical aspects of handling these materials.

NE 5280 Management of Nuclear Facilities (3 credits)

Cross-listed with TM 5380

Nuclear facilities need a sustainable management system to make sure that matters of importance are not dealt with in isolation of other issues in the decision making process. Integrating all relevant issues, ranging from safety, security and safeguards to health and economic and environmental questions, leads to well-informed and balanced decisions. This course addresses from a practical point of view the safety and regulatory issues of operating and planned reactors in the U. S. and other countries.

NE 5290 Risk Assessment (3 credits)

Cross-listed with TM 5290

In-depth evaluation and analysis techniques used to determine the risk of industrial, process, nuclear, and aviation industries; fault tree analysis; human reliability analysis; failure mode and effect analysis.

NE 5300 Two-Phase Flow (3 credits)

Treatment of fluid mechanics and heat transfer in conjunction with nuclear reactors where two-phase flow problems are found. Typically Offered: Varies.

NE 5350 Nuclear Criticality Safety (3 credits)

Cross-listed with TM 5130

Nuclear criticality safety including nuclear physics, fusion and neutron multiplication, moderation and reflection of neutrons, criticality issues in the fuel cycle, critical experiments and sub-critical limits, calculations of criticality, nuclear criticality safety practices, emergency procedures, and nuclear regulations and standards.

Prereqs: NE 4500 or Permission

NE 5360 Electrochemical Engineering (3 credits)

Cross-listed with CHE 5360

Application of chemical engineering principles to electrochemical systems; thermodynamics, kinetics, and mass transport in electrochemical systems; electrochemical process design.

Recommended preparation: graduate engineering standing.

NE 5370 Radiation Effects on Materials (3 credits)

Cross-listed with MSE 5370

Joint-listed with MSE 4370, NE 4370

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NE 5380 Fundamentals of Nuclear Materials (3 credits)

Cross-listed with MSE 5380

Joint-listed with MSE 4380, NE 4380

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NE 5440 Reactor Analysis - Statics and Kinetics (3 credits)

The purpose of this course is to study nuclear theory in the context of nuclear reactor engineering. Concepts relating to the design and operation of nuclear reactors will be discussed. Mathematical expressions describing the relevant nuclear processes as well as their physical implications will be developed. This course will involve the application of several common analytical and computational tools used for the design and evaluation of nuclear systems. Typically Offered: Spring.

Prereqs: NE 5850 or instructor permission

NE 5480 Modeling of Thermal and Chemical Systems (3 credits)

The course introduces students to methods, techniques, and process modeling software for modeling of thermal and chemical systems. The basic concepts and principles include power generation, refrigeration, cooling towers, air separation, hydrogen, and ammonia production. Components such as compressors, turbines, pumps, heat exchangers, piping, fluid and gas mixtures, and chemical reactors are modeled. Economics and dynamic systems modeling are also covered. Typically Offered: Varies.

Prereqs: ME 3220, ME 3450, ME 4200, or permission

NE 5510 Nuclear Reactor Fuels (3 credits)

Selection of materials and design of nuclear fuels, light water reactor fuels, metal and oxide dispersed fuels, and high-temperature ceramic fuels.

Prereqs: Permission

NE 5540 Radiation Detection and Shielding (3 credits)

Cross-listed with TM 5350

Radiation transport and shielding concepts. Methods for quantifying attenuation of nuclear particles and electromagnetic radiation. Radiation detection methods, data acquisition and processing.

Prereqs: MATH 3100 or Permission

NE 5550 Advanced Nuclear Criticality Safety (3 credits)

Applications of criticality safety techniques to facility design and review, requirements for unique isotopes, criticality safety evaluations, connections to nuclear materials management, and applications of Monte Carlo analysis. Typically Offered: Varies.

Prereqs: NE 5350 or Permission

NE 5700 Nuclear Chemical Engineering (3 credits)

Course offered only in Idaho Falls. Chemical engineering processes related to the nuclear industry; metals dissolution, solvent extraction, isotope separation, uranium processing and other topics.

Prereqs: Permission

NE 5750 Advanced Nuclear Power Engineering (3 credits)

Present and advanced nuclear power plant descriptions and analysis. Engineering aspects of converting nuclear fission energy to useful work. Group project design. Idaho Falls only.

Prereqs: Permission

NE 5820 Spent Nuclear Fuel Management and Disposition (3 credits)

Cross-listed with CHE 5820

The management of nuclear fuel after removal from a nuclear reactor; storage options, recycle and recovery of uranium and other radionuclides, geological repositories, and related topics.

Prereqs: Permission

NE 5850 Nuclear Fuel Cycles (3 credits)

Cross-listed with MSE 5850

Processes to support the existing LWR fuel cycle. Alternative fuel cycles including U-233, Pu239 and mixed oxide fuels, and advanced reactor concepts. Recycling and recovery of nuclear materials, with emphasis on traditional fast reactor recycle. Typically Offered: Fall.

Prereqs: Permission

NE 5860 Industrial Control Systems (3 credits)

Cross-listed with ECE 5860

Combines control systems theory and implementation topics. Theory topics include process dynamics and modeling; instrumentation, sensors and measurements; feedback and feedforward concepts; and basic control design methods. Implementation topics include programmable logic controllers, fundamentals of ladder logic, network configuration, and basic security concepts. Typically Offered: Fall.

NE 5870 Nuclear Decommissioning (3 credits)

Concepts and strategies for decommissioning nuclear facilities, including project and program management, waste management, and site environmental restorations.

Prereqs: NE 4500

NE 5980 (s) Internship (1-16 credits, max 99)

Credit arranged

NE 5990 (s) Research (1-16 credits, max 99)

Credit arranged

NE 6000 Doctoral Research & Dissertation (1-45 credits, max 99)

Credit arranged