

NUCLEAR ENGINEERING (NE)

NE 400 (s) Seminar
Credit arranged.

NE 404 (s) Special Topics
Credit arranged.

NE 437 Radiation Effects on Materials
3 credits

Joint-listed with NE 537. Cross-listed with MSE 437.
Interactions between radiation and solids.
Prereq: MSE 201 or Permission.

NE 438 Fundamentals of Nuclear Materials
3 credits

Joint-listed with NE 538. Cross-listed with MSE 438.
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. Students who wish to receive credit for the 500 level course are required to do term-projects and advanced problems. (Spring only)
Prereq: MSE 201 or NE 450; or Permission .

NE 450 Principles of Nuclear Engineering
3 credits

Course offered only in Idaho Falls.
Basic nuclear and atomic processes; radioactive decay, binding energy, radiation interactions, reaction cross sections. Neutron diffusion, radiation sources.
Prereq: MATH 310, ENGR 320, or Permission.

NE 498 (s) Internship
Credit arranged.

NE 499 (s) Directed Study
Credit arranged.

NE 500 Master's Research and Thesis
Credit arranged

Course offered only in Idaho Falls.

NE 501 (s) Seminar
Credit arranged

Course offered only in Idaho Falls.

NE 502 (s) Directed Study
Credit arranged.

NE 504 (s) Special Topics
Credit arranged.

NE 511 Nuclear Degradation Mechanisms
3 credits

Cross-listed with MSE 511.
Topics include various degradation mechanisms as applicable to nuclear structural components, including corrosion, creep, radiation damage etc.
Prereq: Graduate standing or Permission .

NE 512 Nuclear Components Inspection
3 credits

Cross-listed with MSE 512.
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.

Prereq: Graduate standing or Permission .

NE 513 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. **Prereq:** Science or Engineering background or instructor permission .

NE 514 Nuclear Safety
3 credits

Cross-listed with TM 514. 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.
Prereq: Permission.

NE 516 Nuclear Rules and Regulations
3 credits

Cross-listed with TM 516.
An in-depth examination of nuclear regulatory agencies; major nuclear legislation; current radiation protection standards and organizational responsibility for their implementation.
Prereq: Permission.

NE 520 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, the application of the Second Law to exergy analysis of advanced fuel cycles.
Prereq: Permission .

NE 524 Heat Exchanger Design
3 credits

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.
Prereq: Permission .

NE 527 Nuclear Material Storage, Transportation, and Disposal
3 credits

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 528 Management of Nuclear Facilities
3 credits

Cross-listed with TM 538.
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 529 Risk Assessment

3 credits

Cross-listed with TM 529.

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 530 Two-Phase Flow

3 credits

Course offered only in Idaho Falls.

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

Prereq: Permission.

NE 535 Nuclear Criticality Safety

3 credits

Cross-listed with TM 513.

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.

Prereq: NE 450 or Permission.

NE 536 Electrochemical Engineering

3 credits

Cross-listed with CHE 536

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

NE 537 Radiation Effects on Materials

3 credits

Joint-listed with NE 437. Cross-listed with MSE 537.

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Prereq: MSE 201 or Permission.

NE 538 Fundamentals of Nuclear Matrls

3 credits

Joint-listed with NE 438. Cross-listed with MSE 538.

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Prereq: MSE 201 or NE 450; or Permission .

NE 551 Nuclear Reactor Fuels

3 credits

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

Prereq: Permission .

NE 554 Radiation Detection and Shielding

3 credits

Cross-listed with TM 535.

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

Prereq: MATH 310 or Permission.

NE 555 Nuclear Criticality Safety II

3 credits

Course offered only in Idaho Falls.

Applications of criticality safety techniques to facility design and review, requirements for unique isotopes, criticality safety evaluations, connections to nuclear materials management, applications of monte carlo analysis.

Prereq: NE 535 or Permission .

NE 565 Reactor Engineering

3 credits

Course listed only in Idaho Falls.

Radiation shielding, materials, instrumentation and controls, separation of stable isotopes, chemical separation and processing, special techniques.

Prereq: MATH 480 or Permission.

NE 567 Advanced Nuclear Systems and Modeling

3 credits

Comprehensive information about nuclear systems (such as, nuclear steam supply systems, safety systems, etc) and analytical modeling of nuclear systems. Description of reactor technologies (such as, Boiling Water Reactor –BWR- and Pressurized Water Reactor –PWR- systems and corresponding modeling and performance of the systems. Reactor thermal hydraulics models/tools are used to model the systems. Course projects are defined for practicing modeling techniques.

Prereq: NE 565 .

NE 575 Advanced Nuclear Power Engineering

3 credits

Course offered only in Idaho Falls.

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

Prereq: Permission.

NE 582 Spent Nuclear Fuel Management and Disposition

3 credits

Cross-listed with CHE 582

Course offered only in Idaho Falls.

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.

Prereq: Permission.

NE 585 Nuclear Fuel Cycles

3 credits

Cross-listed with MSE 585

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.

Prereq: Permission .

NE 598 (s) Internship

Credit arranged.

NE 599 (s) Research

Credit arranged.

NE 600 Doctoral Research & Dissertation

Credit arranged.