

# Nuclear Engineering

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**Related Fields:** For other courses offered in the nuclear field, see Phys 465, 565, 585, 586, and 587.

## **NE 404 (s) Special Topics (cr arr)**

### **NE J437/J537 Radiation Effects on Materials (3 cr)**

See MSE J437/J537.

### **NE J438/J538 Fundamentals of Nuclear Materials (3 cr)**

See MSE J438/J538.

### **NE J441/J541 Fundamentals of Nuclear Materials (3 cr)**

Same as MSE J441/J541. A course 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 enrolled in the 500-level course are required to do term-projects and advanced problems.

**Prereq:** MSE 201 or Permission of instructor

### **NE R450 Principles of Nuclear Engineering (3 cr)**

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 R460 Nuclear Reactor Engineering (3 cr)**

Nuclear reactor design problems in thermodynamics, fluid flow, heat transfer, fuel preparation, waste disposal, and material selection.

**Prereq:** Math 310 or Permission

### **NE R462 Nuclear Reactor Codes and Standards (3 cr)**

Codes and standards by NRC, EPA, ASME and others applicable to design, construction, and operation of nuclear facilities.

**Prereq:** Permission

### **NE R470 Nuclear Reactor Safety (3 cr)**

Light water reactor safety, liquid metal reactor safety and high temperature reactor safety; evaluation methods, system disturbances, safety criteria, containment, NRC licensing process, and computer codes for nuclear safety analysis.

**Prereq:** NE 460 or Permission

## **NE 500 Master's Research and Thesis (cr arr)**

## **NE 501 (s) Seminar (cr arr)**

## **NE 502 (s) Directed Study (cr arr)**

## **NE 504 (s) Special Topics (cr arr)**

### **NE R525 Neutron Transport Theory (3 cr)**

Modeling of neutron transport through various media using transport principles and techniques. Emphasis is given to methods used for reactor core and component analysis.

**Prereq:** NE 460, Math 480 or Permission

### **NE R530 Two Phase Flow (3 cr)**

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

**Prereq:** Permission

### **NE R533 Monte Carlo Methods (3 cr)**

Applications of the Monte Carlo method to neutron transport calculations from introductory concepts to advanced simulations of criticality in fissile materials.

**Prereq:** NE 450 or Permission

### **NE R535 Nuclear Criticality Safety I (3 cr)**

Physics of criticality, factors that affect reactivity, hand calculation techniques, experiments and the development of subcritical limits, criticality accidents, standards and regulations, evaluations.

**Prereq:** NE 450 or Permission

**NE 537 Radiation Effects on Materials (3 cr)**

See MSE J437/J537.

**NE 538 Fundamentals of Nuclear Materials (3 cr)**

See MSE J438/J538.

**NE R540 Fusion Energy (3 cr)**

Basic concepts and experimental approaches to fusion, elementary plasma theory, plasma oscillations, heating; fusion reactor technology development and long-range prospects.

**Prereq:** Permission

**NE 541 Fundamentals of Nuclear Materials (3 cr)**

See NE J441/J541.

**NE R544 Reactor Analysis - Statics and Kinetics (3 cr)**

Behavior of nuclear reactors in steady state and transient conditions. Calculation of varying power conditions, fuel burn-up, coolant perturbations, and other reactor parameters.

**Prereq:** NE 460 or Permission

**NE R554 Radiation Detection and Shielding (3 cr)**

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 R555 Nuclear Criticality Safety II (3 cr)**

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 R565 Reactor Engineering (3 cr)**

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

**Prereq:** NE 460, Math 480 or Permission

**NE R570 Nuclear Chemical Engineering (3 cr)**

Chemical engineering processes related to the nuclear industry; metals dissolution, solvent extraction, isotope separation, uranium processing and other topics.

**Prereq:** Permission

**NE R575 Advanced Nuclear Power Engineering (3 cr)**

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

**Prereq:** NE 460 or Permission

**NE R580 Waste Management and Nuclear Fuel Reprocessing (3 cr)**

Head-end processing, solvent extraction processes, ion exchange processes, precipitation processes, and effluent management and disposal.

**Prereq:** Permission

**NE R581 Treatment of Radioactive Waste (3 cr)**

Alternative processes and operations for treatment of radioactive wastes before storage/disposal.

**Prereq:** NE 460 or Permission

**NE R582 Spent Nuclear Fuel Management and Disposition (3 cr)**

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 R585 Nuclear Fuel Cycles (3 cr)**

Processes to support the existing LWR fuel cycle. Alternative fuel cycles including U-233, Pu 239 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 (cr arr)**

**NE 600 Doctoral Research and Dissertation (cr arr)**