

# NUCLEAR AND RADIOLOGICAL ENGINEERING

Not all courses are offered every semester. Refer to the schedule of courses for each term's specific offerings.

More Info (<http://registrar.ufl.edu/soc/>)

*Courses at the University of Florida, with the exception of specific foreign language courses and courses in the online Master of Arts in Mass Communication program, are taught in English.*

## Department Information

The Department of Materials Science and Engineering strives to serve the scientific and engineering community of the state and nation by providing quality education in the field, conducting basic and applied research to enhance science in the field, and supplying short courses, technology transfer, industrial consulting, and distance learning to promote engineering in the field.

Website (<https://mse.ufl.edu/>)

### CONTACT

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Map (<http://campusmap.ufl.edu/#/index/0184>)

### Curriculum

- Advanced Engineering Ceramics Certificate
- Biomaterials Certificate
- Combination Degrees
- Materials Science and Engineering
- Materials Science and Engineering Minor
- Metallurgical Engineering Certificate
- Nuclear and Radiological Engineering Minor
- Nuclear and Radiological Sciences
- Nuclear Engineering
- Nuclear Radiation and Reactor Analysis Certificate
- Nuclear Thermal Systems Analysis Certificate
- Polymer Science and Engineering Certificate
- Semiconductor Materials Certificate

## Courses

### EGN 4912 Engineering Directed Independent Research 0-3 Credits

**Grading Scheme:** S/U

Provides firsthand, supervised research with a faculty advisor or postdoctoral or graduate student mentor. Projects may involve inquiry, design, investigation, scholarship, discovery or application. (S-U)

### EGS 1005 Prep for Success 1-4 Credits

**Grading Scheme:** S/U

Freshman success course that includes academic preparation in calculus, chemistry, student success and technical communications. (S-U)

**Prerequisite:** EG student.

### ENU 1000 Introduction to Nuclear Engineering 1 Credit

**Grading Scheme:** Letter Grade

Introduction to the nuclear engineering field and careers in the nuclear industry. Topics include engineering ethics, nuclear history, elementary nuclear and reactor physics, reactor types, nuclear safety, nuclear fuel cycle and radiation protection.

### ENU 4001 Nuclear Engineering Analysis 1 4 Credits

**Grading Scheme:** Letter Grade

Four one-hour lectures discussing continuous and discrete variable solution methods for the statistical, algebraic, differential and integral equations important in nuclear engineering. Problems involving neutron, photon, fluid and temperature distributions in configuration, time and velocity are mathematically modeled, solved and interpreted.

**Prerequisite:** MAP 2302;

**Corequisite:** COP 2271.

### ENU 4103 Reactor Analysis and Computation 1: Statics 4 Credits

**Grading Scheme:** Letter Grade

Three one-hour lectures discussing neutron reactions, fission chain and criticality and neutron transport/diffusion for nuclear reactors. Neutron thermalization and thermal scattering kernels. Dynamic analysis of reactors including point and space-time models. Feedback and reactor dynamics and control. Short-term transient analysis and long-term time-dependence.

**Prerequisite:** ENU 4001 and ENU 4605 with minimum grades of C.

### ENU 4104 Reactor Analysis and Computation 2: Dynamics 3 Credits

**Grading Scheme:** Letter Grade

A continuation of ENU 4103. Three one-hour lectures discussing neutron thermalization and thermal scattering kernels. Treatment of resonances and Doppler broadening. Dynamic analysis of reactors including point model and space-time models. Feedback and reactor dynamics and control. Short-term transient analysis and long-term time dependence.

**Prerequisite:** ENU 4103.

### ENU 4133 Reactor Thermal Hydraulics 1 3 Credits

**Grading Scheme:** Letter Grade

Fundamentals of thermodynamics, fluid mechanics and heat transfer with application to design and safety of nuclear power plants. Thermal hydraulic characteristics of nuclear power plants, energy conversion cycles, applications of first and second law of thermodynamics, nuclear heat generation, fluid mechanics, conservation laws and governing equations for inviscid and viscous single-phase flow, conduction and convection heat transfer and thermal design of fuel elements.

**Prerequisite:** EML 3100.

### ENU 4134 Reactor Thermal Hydraulics 4 Credits

**Grading Scheme:** Letter Grade

Nuclear applications of fluid mechanics, heat transfer and thermodynamics. Two-phase flow and boiling heat transfer. Heat transfer mechanisms in reactor core and sub-channel thermal hydraulics. Steam generator, power cycles, and balance of plant. Introduction to thermal design for reactors.

**Prerequisite:** EML 4140 and (ENU 4133 or EGN 3353C).

### ENU 4144 Nuclear Power Plant Reactor Systems 1 3 Credits

**Grading Scheme:** Letter Grade

Three one-hour lectures discussing the basis for light water reactor (LWR) design; the NRC design criteria for LWRs. Study of the major systems, components and performance characteristics of LWRs including fuels, primary and secondary coolant systems, emergency and auxiliary systems.

**Prerequisite:** EML 3100 and ENU 4605 and ENU 4001 with minimum grades of C.

**ENU 4145 Risk Assessment for Radiation Systems 3 Credits****Grading Scheme:** Letter Grade

Three one-hour lectures discussing the study of radiation management systems, including reliability and probabilistic risk assessment.

**Prerequisite:** ENU 4144 and STA 3032.**ENU 4191 Elements of Nuclear and Radiological Engineering Design 1 Credit****Grading Scheme:** Letter Grade

The first of a two-course capstone design sequence. A one-hour lecture that provides preparatory work for ENU 4192. Identification of initial design project(s) and areas of work, selection/assignment of groups to areas of work/tasks, accumulation of reference materials and computer codes and development of initial timelines/milestones.

**Prerequisite:** ENU 4144;**Corequisite:** ENU 4134, ENU 4612 and ENU 4630.**ENU 4192 Nuclear and Radiological Engineering Design 3 Credits****Grading Scheme:** Letter Grade

Continuation of ENU 4191. Nuclear reactor theory and engineering as applied to design synthesis of reactors. Nuclear, material, thermo-fluid and/or mechanical design considerations of nuclear reactors with particular emphasis on design characteristics. Analytical methods and application of computer codes for design analysis and evaluation. Individual and/or group design involving integration of reactor neutronics, dynamics and control, thermal hydraulics, transient analysis and safety, power production, instrumentation, control, radiation shielding and protection, fuel cycle, fuel behavior and/or cost.

**Prerequisite:** ENU 4134 and ENU 4191 with a minimum grade of C and ENU 4612 and ENU 4630.**Corequisite:** ENU 4641.**ENU 4194 Control of Nuclear Reactors and Power Plants 3 Credits****Grading Scheme:** Letter Grade

Three one-hour lectures discussing the analysis of the control and dynamic characteristics of nuclear reactors, including the effects of feedback. Analysis of the control and dynamic characteristics of the integrated nuclear power plant.

**Prerequisite:** ENU 4104.**ENU 4505L Nuclear and Radiological Engineering Laboratory 1 3 Credits****Grading Scheme:** Letter Grade

Two one-hour lectures discussing experimental procedures used in reactor operation, personnel monitoring, radiation detection devices and the statistics of nuclear counting systems. Also includes a four-hour laboratory experience that integrates practical applications of radiation sources, radiation interactions, radiation transport and radiation detection. (WR)

**Prerequisite:** ENU 4612.**Attributes:** Satisfies 4000 Words of Writing Requirement**ENU 4605 Radiation Interactions and Sources 1 4 Credits****Grading Scheme:** Letter Grade

Three one-hour lectures discussing interaction of ionizing radiation with matter; cross sections and radiation fields with emphasis on photons, heavy charged particles and electrons.

**ENU 4606 Radiation Interactions and Sources 2 3 Credits****Grading Scheme:** Letter Grade

Continuation of ENU 4605. Three one-hour lectures discussing the study of photon-charged particle and electron interactions with matter, attenuation, energy transfer and energy absorption in matter. X-ray production, accelerators and neutron sources, and applications in nuclear and radiological engineering.

**Prerequisite:** ENU 4001 with a minimum grade of C and ENU 4605.**ENU 4612 Nuclear Radiation Detection and Instrumentation 3 Credits****Grading Scheme:** Letter Grade

Three one-hour lectures discussing the physics and electronics of radiation detection and instrumentation systems for application to nuclear energy, radiological sciences, radiation protection, medical physics and imaging, and industrial safety and control systems.

**Prerequisite:** ENU 4605 with a minimum grade of C and EEL 3003.**ENU 4612L Nuclear Radiation Detection and Instrumentation Laboratory 1 Credit****Grading Scheme:** Letter Grade

Laboratory experiments related to the physics and electronics of radiation detection and instrumentation systems for application to nuclear energy, radiological sciences, radiation protection, medical physics and imaging, and industrial safety and control systems.

**Prerequisite:** ENU 4605 with a minimum grade of C and EEL 3003;**Corequisite:** ENU 4612.**ENU 4630 Fundamental Aspects of Radiation Shielding 3 Credits****Grading Scheme:** Letter Grade

Three one-hour lectures discussing basic principles of radiation shielding. Study of radiation sources and shielding design for radiation facilities.

**Prerequisite:** ENU 4605 with a minimum grade of C.**ENU 4641C Applied Radiation Protection 2 Credits****Grading Scheme:** Letter Grade

Two one-hour lectures of introduction to practical radiation protection techniques and practices, including laboratory experiences. Examination of pertinent regulations, current practice, ethics and instrumentation/measurement practices. Design of facilities and controls to optimize benefits of radiation applications and minimize exposure risks. (WR)

**Prerequisite:** ENU 4605 with a minimum grade of C and ENU 4630.**Attributes:** Satisfies 2000 Words of Writing Requirement**ENU 4800 Introduction to Nuclear Reactor Materials 3 Credits****Grading Scheme:** Letter Grade

Provides a comprehensive knowledge on the types of materials used in nuclear reactors, their response to the reactor environments and most of the materials problems encountered in the operation of nuclear power reactors for energy production.

**Prerequisite:** EMA 3010.**ENU 4905 Special Problems in Nuclear and Radiological Engineering 1-6 Credits****Grading Scheme:** Letter Grade

Individually selected problems or projects in the students' major field of engineering study.

**Prerequisite:** department chair recommendation.**ENU 4906 Special Problems in Nuclear and Radiological Engineering Design 1-6 Credits****Grading Scheme:** Letter Grade

Individually selected design problems or design projects in the student's major field of engineering study.

**Prerequisite:** department chair recommendation.**ENU 4930 Special Topics in Nuclear and Radiological Engineering 1-4 Credits****Grading Scheme:** Letter Grade

Special courses covering selected topics in nuclear engineering.

**Prerequisite:** instructor permission.

**ENU 4934 Fundamentals of Nuclear and Radiological Engineering 1****Credit**

**Grading Scheme:** Letter Grade

Presentations and discussions on topics of current and continuing interest in nuclear engineering sciences.

**Prerequisite:** Nuclear Engineering major of junior standing or higher.

**ENU 4944 Practical Work in Nuclear and Radiological Engineering 1-5****Credits**

**Grading Scheme:** Letter Grade

Practical engineering work under industrial supervision, as set forth in the Herbert Wertheim College of Engineering regulations.

**ENU 4949 Co-op Work Experience 1 Credit**

**Grading Scheme:** S/U

Three-hour laboratory of practical engineering work under industrial supervision, as set forth in the Herbert Wertheim College of Engineering regulations. (S-U)

**Prerequisite:** 4EG classification and one term of industrial employment, including extra work according to a pre-approved outline.

**ENV 4212 Nuclear Power Radioactive Waste Technology 3 Credits**

**Grading Scheme:** Letter Grade

Characterization and description of low and high level radwastes, regulatory requirements and method of treatment. Transportation, burial and surveillance of radwaste. Decommissioning of nuclear facilities.

**Prerequisite:** refer to the department.