

ENGY340 - Introduction to Nuclear Energy

1. Course/Learning Objectives:

Students successfully completing Introduction to Nuclear Energy will:

- a. have a broad scientific and technological understanding of nuclear energy and the nuclear fuel cycle,
- b. have a broad understanding of economic, environmental, and political issues that influence the nuclear fuel cycle,
- c. be able to analyze a technological societal issue related to the nuclear fuel cycle and to communicate the results of the analysis effectively.

2. Catalog Description:

ENGY340. Introduction to Nuclear Energy (II). Survey of nuclear energy and the nuclear fuel cycle including the basic principles of nuclear fission and an introduction nuclear reactor design and operation. Nuclear fuel, uranium resources, distribution, and fuel fabrication, conversion and breeding. Nuclear safety, nuclear waste, nuclear weapons and proliferation as well economic, environmental and political impacts of nuclear energy. Prerequisite: ENGY200. 3 hours lecture; 3 semester hours.

3. Course Outline/Topics:

- a. Nuclear radiation, nuclear reactions, nuclear fission and fusion
- b. Nuclear chain reactions, criticality, nuclear reactor core design fundamentals, neutron moderation, nuclear reactor control
- c. Nuclear fuel cycle, resource and resource distribution, mining, milling, enrichment, fuel element fabrication, fuel utilization, burn up
- d. Types and features of different nuclear reactors, including current models, next-generation designs and advanced reactor concepts
- e. In-core fuel management, refueling, nuclear fuel reprocessing and recycling
- f. Nuclear Waste Disposal, categories of nuclear waste, handling and disposal of nuclear waste, policy and political issues, risk quantification and social equity
- g. Reactor Safety, history of nuclear reactor and fuel cycle accidents, criticality events, scope and nature of risks
- h. Nuclear non-proliferation history, activities, and relationships
- i. Economic considerations related to nuclear power, direct costs, externals, levelized cost, comparative costs

4. **Delivery Mode/Pedagogy:** Since this course is an introductory survey course, the material will delivered primarily in the lecture mode augmented with active learning exercises employing group problem solving, discussion of open-ended problems and/or personal response (PRS) questions for large class sizes.