

ENU 4144 – Nuclear Power Reactor Systems (3 cr), Required Course, Spring 2006

Description: Codes, standards and criteria (general design, quality assurance, etc.) for nuclear power plants; the organizational structure and functions of the NRC; and the nuclear power plant licensing process. The major components and systems of PWR and BWR nuclear power plants. This course is primarily a descriptive engineering course wherein the prospective nuclear engineer begins to become familiar with the technology and regulation of the nuclear power industry.

Co-requisite: EML 3100

Objectives: The central theme of this course is to study: 1) basis of light water reactor (LWR) designs including the major systems, components and performance, primary and secondary coolant systems, emergency and auxiliary systems, and 2) the NRC design criteria for LWRs.

Program Educational Objectives / Professional Components Supported by Course:

1. Provide students with the ability to apply mathematical, physical, and computational skills to analyze and solve nuclear and radiological engineering problems.
2. Provide students with the fundamental knowledge of the BWR and PWR systems and the NRC design criteria for LWRs.
3. Provide students with the skills needed to communicate effectively, work collaboratively and understand their professional and ethical responsibilities and the impact of engineering solutions in a societal and economic context so they can pursue successful, productive careers in nuclear and radiological engineering.

Program Outcomes Supported by Course:

Outcome a: an ability to apply knowledge of mathematics, science and engineering.

Outcome e: an ability to identify, formulate and solve engineering problems.

Outcome k: an ability to use the techniques, skills and modern engineering tools necessary for engineering practice

Outcome l: an ability to apply advanced mathematics, science and engineering sciences, including atomic and nuclear physics, to nuclear and radiological systems and processes

Outcome n: an ability to work professionally in one or more of the areas of nuclear power systems, nuclear instrumentation and measurement, radiation protection and shielding and radiation sources and applications

References

1. K. C. Lish, *Nuclear Power Plant Systems and Equipment*, Industrial Press, Inc., 1972.
2. A. Sesonske, *Nuclear Power Plant Design Analysis*, TID-26241, USAEC, 1973.

3. J. H. Rust, *Nuclear Power Plant Engineering*, Haralson Publishing Company, 1979.
4. Code of Federal Regulations, Title 10, Energy.
5. *Licensing New Nuclear Power Plants*, Nuclear Energy Institute, September 2005.
6. W. D. Travers, *Use of Design Acceptance Criteria for the AP1000 Standard Plant Design*, SECY-02-0059, April 1, 2002.
7. ABWR Design URD Compliance, Safety & PSA Analysis, NSSS Technology Transfer & Design Q/A, GE Nuclear Energy, April 1999.
8. J. J. Duderstadt and L. J. Hamilton, *Nuclear Reactor Analysis*, Wiley & Sons, Inc., 1976.

Grading:

All students are required to write a term paper on a topic related to the subjects covered in this course. Each student is required to give an oral presentation on a term paper topic.

Grading will be divided as follows:

Problem Sets	10%
Mid-term Exam	25%
Final Exam	30%
Term Paper Writing	25%
Term Paper Presentation	10%

Course Outline

1. Introduction -- Status of nuclear power reactors and nuclear industry
2. LWR Systems
3. Code of Federal Regulations Relating to Nuclear Power Plants
4. NRC Design Criteria for Nuclear Power Plants
5. Basis of BWR Designs
6. Basis of PWR Designs
7. Use of Design Acceptance Criteria for AP1000 Standard Plant Design