Department of Chemical Engineering

Ch E 470 Syllabus – Fall 2013

Introduction to Nuclear Energy

Catalog Description

- Atomic and nuclear structure, nuclear stability and radioactivity, nuclear reactions, detection and measurement of radiation, interaction of radiation with matter, radiation doses and hazard assessment, principles of nuclear reactors, applications of nuclear technology.

Pre-requisites

- Chemistry 111, Mathematics 192

Textbook

- Shultis and Faw (2008). *Fundamentals of Nuclear Science and Engineering*, 2/e (CRC Press).

Course Objectives

- To provide engineering students with a fundamental understanding of the principles of nuclear science and engineering.
- Students successfully completing this course will demonstrate the ability to do the following:

    1. **Basic Concepts.** Write and explain the meanings of the basic balances and equations of nuclear science and engineering. [Outcome 3(a)]
    2. **Problem Solving.** Solve problems involving radioactive decay rates, radiation interactions, rates of nuclear reactions, energies of nuclear transformations, and applications. [3(a)(e)]
    3. **Model Building.** Given a verbal or pictorial description, create useful mathematical models of nuclear engineering systems, such as radiation shields, radiation detectors, nuclear reactors, and energy converters. [3(e)]
    4. **Social and Economic Effects.** Discuss the global environmental, social, and economic effects of nuclear technology. [3(h)]

- This course addresses the following student outcomes from ABET Criterion 3:
    (a) Ability to apply knowledge of mathematics, science, and engineering
    (e) Ability to identify, formulate, and solve engineering problems
    (h) The broad education necessary to understand the impact of engineering solutions in a global, economic, and societal context.

Topics Covered

- The following topics are covered in this course:

    1. Fundamental Concepts
    2. Modern Physics Concepts
    3. Atomic/Nuclear Models

4. Nuclear Energetics
5. Radioactivity
6. Binary Nuclear Reactions
7. Radiation Interactions with Matter
8. Measurement of Radiation
9. Radiation Dosimetry
10. Radiation Hazard Assessment
11. Principles of Nuclear Reactors
12. Nuclear Power*
13. Fusion Reactors*
14. Energy Conversion Devices*
15. Nuclear Technology*

(* = time permitting)

Attendance

- Attendance is required. I will, however, readily accommodate a student who has missed an assignment due to a **legitimate** emergency

Evaluation/Grading Policy

- There will be approximately ten (10) problems sets and four (4) quizzes plus the final exam. The final grade will be a percentage and will be comprised of problem sets (40%), quizzes (40%), and the final exam (20%). The conventional letter-grading system will be used.

90% to 100% A
80% to 89% B
70% to 79% C
60% to 69% D
0% to 59% F

Class/Laboratory Schedule

- Class Meets: 0930-1020 MWF Jett Hall 283

Instructor

- Dr. Donald P. Murphy

Syllabus Preparation Date

- 8/21/13