

EEE 460 NUCLEAR POWER ENGINEERING

Instructor: Dr. Keith E. Holbert Email: Holbert@asu.edu
Office Hours: Monday – Thursday, 1:30–2:30 p.m. in ERC 581; (480) 965-8594
Exams: Midterm: Monday, April 6; Final: Friday, May 1, 2015

IMPORTANT NOTE: This course is being taught in the second 7-week session of the semester, which means that the course will move at twice the normal speed of a semester course. Please plan your course load appropriately to permit this.

Textbook: R. L. Murray and K. E. Holbert, *Nuclear Energy: An Introduction to the Concepts, Systems, and Applications of Nuclear Processes*, 7th ed., Elsevier Butterworth-Heinemann, 2014.

Course Webpage: Lecture slides, homework and solutions posted on Blackboard. Other useful info at <http://holbert.faculty.asu.edu/eee460/eee460.html>

Course Objective: Provide students with an understanding of the multidisciplinary applications of nuclear concepts in the engineering profession.
The corresponding Course Outcomes are

- Students will have usable knowledge of the physics behind nuclear concepts
- Students will understand the effects and uses of radiation
- Students will understand the principles of power generation via nuclear processes

Course Description: Radioactivity and decay. Radiation interactions and dose. Nuclear reaction, fission and fusion theory. Fission reactors, four factor formula, moderation. Nuclear power, TMI, Chernobyl. Nuclear fuel cycle.
Prerequisites: CHM 114 (or 116); MAT 274 (or 275); PHY 241 (or 361).

Topics: Broken into three basic divisions for the semester as given below:

- I. Nuclear Fundamentals (Chaps. 1–6, 8)
- II. Nuclear Radiation (Chaps. 10–11)
- III. Nuclear Power (Chaps. 16, 18, 20–23)

Grading

“Standard” scale (with \pm) using 90-100 "A", 80-90 "B", 70-80 "C", etc.

Homework	25%
Midterm Exam	35%
Final Exam	40%

Note that each student’s final homework average will be limited to a maximum of 125% of the mean of his/her exam scores.

Homework: The homework assignments will be posted on the course webpage. Homework is expected to be turned in on-time. Presentation and methods for arriving at the answer are just as important as the mathematical answer; solutions should be neat and logical. For complete credit: (1) show all work, and (2) box the answer and include the units. Students may work together on the homework, but copying is unacceptable: the ASU *Academic Integrity Policy* (AIP), see <http://provost.asu.edu/academicintegrity>, is incorporated herein by reference.

EEE 460 TEACHING PLAN

(Online, Session B, Spring 2015)

The schedule below is a recommended pace for viewing the lectures. The textbook sections (given in parenthesis below) should be read **before** viewing the lecture. The homework due dates and test dates are mandatory (highlighted below in yellow and magenta, respectively). Specific course work is not listed for the weekends, so as to provide catch-up and get-ahead opportunities.

Week	Date	Lecture Topics	Homework
1	3/16	Introduction; Energy (1.1–1.7)	
	3/17	Atomic Number Density (2.1–2.2)	
	3/18	Atoms and Nuclei; Binding Energy (2.3–2.8)	Hmwk # 1 Due
	3/19	Nuclear Stability; Radioactive Decay (3.1–3.2)	
	3/20	Decay Quantities; Simple Decay (3.3)	Hmwk # 2 Due
2	3/23	Transmutation; Compound Decay; Radioactive Chains (3.4–3.6)	
	3/24	Nuclear Reactions and Energetics (4.1–4.2)	Hmwk # 3 Due
	3/25	Binary Reactions; Neutron Cross Sections (4.3, 4.6)	
	3/26	Neutron Flux; Reaction Rates (4.4)	Hmwk # 4 Due
	3/27	Particle Attenuation; Neutron Migration (4.5, 4.7–4.8)	
3	3/30	Charged Particle Interactions (5.1–5.3)	Hmwk # 5 Due
	3/31	Neutral Particle Interactions (5.4–5.7)	
	4/ 1	Fission (6.1–6.5)	Hmwk # 6 Due
	4/ 2	Nuclear History (8.1–8.8)	
	4/ 3	Review for Midterm Exam	Hmwk # 7 Due
4	4/ 6	*** Midterm Exam ***	
	4/ 7	Biological Effects of Radiation (10.1–10.6)	
	4/ 8	Radiation Protection (11.1–11.3)	
	4/ 9		Hmwk # 8 Due
	4/10	Criticality; Multiplication Factors (16.1–16.3)	
5	4/13	Four Factor Formula (16.4–16.8)	
	4/14		Hmwk # 9 Due
	4/15	Light Water Reactors (18.1–18.2, 18.4); Thermal Efficiency (17.4)	
	4/16	Economics; Other Power Reactors (18.3, 18.5–18.9)	
	4/17	Reactor Kinetics; Reactivity Feedback (20.1–20.3)	Hmwk # 10 Due
6	4/20	Reactor Control; Fuel Burnup (20.4–20.7)	
	4/21		Hmwk # 11 Due
	4/22	Reactor Safety; PRA (21.1–21.5)	
	4/23	TMI-2; Chernobyl; Fukushima (21.6–21.12)	
	4/24	Nuclear Propulsion; Remote Power (22.1–22.5)	Hmwk # 12 Due
7	4/27	Nuclear Fuel Cycle (23.1–23.5)	
	4/28	Waste Disposal (23.6–23.10)	
	4/29		Hmwk # 13 Due
	4/30	Review for Final Exam	
	5/ 1	*** Final Exam ***	

Email: Important information may be sent to students via their ASU email account. Be sure to read your ASU email or forward it to an email account that you do read regularly.

Emailing Questions: To insure that I can answer your questions most effectively, be sure to state which homework set or lecture slide that you are inquiring about. Please scan and attach a copy of the work that you have done thus far on a problem for which you have a homework question so that I can better assist you.