

EEE 460 NUCLEAR POWER ENGINEERING

Instructor: Dr. Keith E. Holbert Email: Holbert@asu.edu
Office Hours: Monday & Wednesday, 1:15–2:30 p.m. and
Tuesday & Thursday, 10:30–11:30 a.m. in ERC 581; (480) 965-8594
Class Meeting Info: TTh, 9:00–10:15 a.m. in ED 320
Semester Exams: Scheduled for February 16 and March 23
Final Exam: Thursday, May 6, 2010 from 7:30–9:20 a.m.

Textbook: J. K. Shultis and R. E. Faw, *Fundamentals of Nuclear Science and Engineering*, 2nd ed., CRC Press, 2008.

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 Principles (Chaps. 1–5)
- II. Reactions and Radiation (Chaps. 6–7, 9)
- III. Nuclear Power (Chaps. 10–12)

Grading

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

Homework	30%
Semester Exams (2)	40%
Final Exam	30%

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) is incorporated herein by reference.

EEE 460 SEMESTER TEACHING PLAN

(TTh, Spring 2010)

The textbook sections (given in parenthesis below) should be read **before** the class meeting that day.

Week	Date	Lecture Topic	Homework
1	1/19	Introduction; Atoms and Nuclei; Number Density (1.1–1.3)	
	1/21	Relativity; Photons (2.1–2.2); Atomic–Nuclear Models; Nuclear Stability (3.1–3.2)	
2	1/26	Binding Energy; Nuclear Reactions; Q-value (4.1–4.7)	Hmwk # 1 Due
	1/28	Radioactive Decay; Decay Law; Activity (5.1–5.5)	
3	2/ 2	Transmutation; Compound Decay (5.6)	Hmwk # 2 Due
	2/ 4	Decay Chains; Natural Radioactivity (5.7–5.9)	
4	2/ 9	EXTRA: Nuclear History	Hmwk # 3 Due
	2/11	Review for Exam #1	
5	2/16	*** Exam #1 ***	
	2/18	Binary Reactions (6.1–6.4)	
6	2/23	Neutron Reactions; Fission; Fusion (6.5–6.7)	
	2/25	Attenuation; Flux; Cross-sections; Reaction Rates; Point Source (7.1–7.2)	Hmwk # 4 Due
7	3/ 2	Photon Interactions; Neutron Interactions (7.3–7.4)	
	3/ 4	Charged Particle Interactions (7.5)	
8	3/ 9	Radiation Dose; Dose Units; Exposure; Biological Effects (9.1–9.4)	Hmwk # 5 Due
	3/11	Review for Exam #2	
### SPRING BREAK ###			
9	3/23	*** Exam #2 ***	
	3/25	Extra Topic (on-campus only due to extra day this spring semester)	
10	3/30	Moderation; Nuclear Fuel; Criticality; Multiplication Factor; Four Factor Formula (10.1–10.3)	
	4/ 1	Critical Reactor Core (10.4–10.5)	
11	4/ 6	Reactor Kinetics; Delayed Neutrons (10.6)	
	4/ 8	Reactor Dynamics; Reactivity Feedback (10.7–10.8)	Hmwk # 6 Due
12	4/13	Electric Power Generation; Gen II PWRs and BWRs (11.1–11.3)	
	4/15	Nuclear Power Generation; Gen III and IV plants (11.4–11.5)	Hmwk # 7 Due
13	4/20	Nuclear Fuel Cycle; Nuclear Waste and Disposal (11.6)	
	4/22	Nuclear Propulsion (11.7); Fusion (12.1–12.3); Space Reactors (12.10)	Hmwk # 8 Due
14	4/27	Thermoelectric Generators; Thermionics; Direct Energy Conversion; Radioisotopic Power Sources (12.4–12.5, 12.8–12.9)	
	4/29	EXTRA: Three Mile Island; Chernobyl	Hmwk # 9 Due
15	5/ 4	Review for Final Exam	
	5/ 5	--- Reading Day ---	
	5/ 6	*** 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.

Conduct: Thank you in advance for adhering to the ASU *Student Code of Conduct* and preventing *disruptive classroom behavior*, such as cell phone ringing and use, arriving late to class, irrelevant side conversations, and inappropriate computer usage.

Online Students: Please submit homework assignments to GOEE/CPD (see <http://cpd.asu.edu/student/>); feel free to carbon copy me by email. Please keep in mind that CPD prints your assignments out in black & white.