

EEE 562 NUCLEAR REACTOR THEORY AND DESIGN

Instructor: Dr. Keith E. Holbert Email: Holbert@asu.edu
Office Hours: MW, 1:15–2:30 p.m. and TTh, 1:30–2:30 p.m. in ERC 581; (480) 965-8594
Class Meeting Info: TTh, 12:00–1:15 p.m. in ECG 215
Semester Exams: Scheduled for September 21 and October 26
Final Exam: Thursday, December 9, from 9:50–11:40 a.m.

Textbook: J. R. Lamarsh and A. J. Baratta, *Introduction to Nuclear Engineering*, 3rd Edition, Prentice Hall, 2001. Textbook errata available at <http://holbert.faculty.asu.edu/eee562/eee562.html>

Course Webpage: Lecture slides, homework and solutions posted on Blackboard.

Course Objective: Teach students to apply advanced mathematics to solve problems in neutron diffusion, and unite the neutronic processes and the thermal-hydraulics for reactor core design.

Course Outcomes: Students can

- solve the one-speed neutron diffusion equation for a variety of situations,
- can analyze nuclear reactor fuel and core steady-state thermal performance,
- can couple the reactor neutronics to the core thermal-hydraulics in a design environment.

Course Description: Principles of neutron chain reacting systems. Neutron diffusion and moderation. One, two and multi group diffusion equation solution methods. Heterogeneous reactors. Nuclear fuel steady-state performance. Core thermal-hydraulics. Core thermal design. Prerequisite: EEE 460.

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

- I. Neutron Diffusion
- II. Reactor Theory
- III. Reactor Design

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

Homework	20%
Semester Exams (2)	50%
Final Exam	30%

Homework: The homework assignments will be posted online. 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 562 SEMESTER TEACHING PLAN

(TTh, Fall 2010)

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

Week	Date	Lecture Topic	Homework
1	8/19	Intro; Neutron Interactions; Cross-sections; Flux (3.1–3.2, 3.4–3.5)	
2	8/24	Scattering Energy Loss; Fission (3.6–3.7)	
	8/26	Fick's Law; Neutron Continuity Equation (5.1–5.3)	
3	8/31	Diffusion Equation; Boundary Conditions (5.4–5.6)	Hmwk # 1 Due
	9/ 2	Diffusion Equation Solutions; Diffusion Length (5.6–5.7)	
4	9/ 7	Thermal Neutron Diffusion (5.9)	Hmwk # 2 Due
	9/ 9	Two-Group Neutron Diffusion (5.10)	
5	9/14	Multigroup Neutron Diffusion (5.8)	Hmwk # 3 Due
	9/16	Review for Exam #1	
6	9/21	*** Exam #1 ***	
	9/23	One-Group Reactor Equation; Slab Reactor (6.1–6.2)	
7	9/28	Three-Dimensional Reactor Shapes (6.3)	
	9/30	One-Group Critical Equation (6.4)	
8	10/ 5	Thermal Reactors (6.5)	Hmwk # 4 Due
	10/ 7	Thermal Reactors (6.5)	
9	10/12	Reflected Reactors (6.6)	Hmwk # 5 Due
	10/14	Heterogeneous Reactors (6.8)	
10	10/19	Multigroup Calculations (6.7)	Hmwk # 6 Due
	10/21	Review for Exam #2	
11	10/26	*** Exam #2 ***	
	10/28	Nuclear Plant Thermodynamics (4.3, 8.1)	
12	11/ 2	Reactor Heat Generation (8.2)	
	11/ 4	Fuel Rod Heat Conduction (8.3)	Hmwk # 7 Due
13	11/ 9	Single-Phase Fuel Channel Heat Convection (8.4)	
	11/11	### Veteran's Day Holiday ###	
14	11/16	Boiling Heat Transfer (8.5)	Hmwk # 8 Due
	11/18	Reactor Thermal Design (8.6)	
15	11/23	EXTRA: PWR vs. BWR: Nonflow vs. Flow System Quantities	Hmwk # 9 Due
	11/25	### Thanksgiving ###	
16	11/30	EXTRA: Hydrodynamic Core Analysis	
	12/ 2	EXTRA: Nuclear Power Plant and Reactor Core Design Procedures	Hmwk # 10 Due
17	12/ 7	Review for Final Exam	
	12/ 8	--- Reading Day ---	
	12/ 9	*** 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. Please keep in mind that CPD prints your assignments out in black & white.