

## EEE 563 NUCLEAR REACTOR SYSTEM DYNAMICS AND DIAGNOSTICS

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, 1:30–2:45 p.m. in SCOB 105  
Semester Exams: Scheduled for February 18 and April 1  
Final Exam: Tuesday, May 11, 2010 from 12:10–2:00 p.m.

Textbook: J. R. Lamarsh and A. J. Baratta, *Introduction to Nuclear Engineering*, 3rd Edition, Prentice Hall, 2001. And additional reading materials that will be posted on Blackboard.

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

Course Objective: Provide students with a working understanding of nuclear reactor kinetics and power plant dynamics, and condition monitoring techniques for the reactor core and related systems.

Course Outcomes: Students

- can solve the point kinetics equations for various reactivity insertions,
- can couple the nuclear steam supply system behavior to reactivity feedback mechanisms,
- are cognizant of the applications of signal processing techniques for nuclear power plant surveillance and diagnostics.

Course Description: Time dependent solution to neutron diffusion equation. Reactor kinetics and reactivity changes. Dynamics, stability and control of reactor systems. Modeling neutronic and thermal processes. System characterization in time and frequency domains. Reactor surveillance and diagnostics. Prerequisite: EEE 562.

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

- I. Reactor kinetics
- II. Reactor dynamics
- III. Surveillance and diagnostics

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. 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 563 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 (7.1); Reactor kinetics without delayed neutrons (7.2)	
	1/21	Delayed neutrons; Reactor kinetics parameters	
2	1/26	Point kinetics with delayed neutrons (7.2)	
	1/28	Point kinetics step response	Hmwk # 1 Due
3	2/ 2	Prompt jump approximation (7.2)	
	2/ 4	Perturbation form of the point kinetics; Zero power reactor	Hmwk # 2 Due
4	2/ 9	Inhour equation; Multiple delay groups (7.2)	
	2/11	Subcritical reactor kinetics; Circulating fuel reactor kinetics	Hmwk # 3 Due
5	2/16	Review for Exam # 1	
	2/18	*** Exam # 1 ***	
6	2/23	Reactivity control (7.3)	
	2/25	Fuel temperature reactivity feedback (7.4)	
7	3/ 2	Moderator reactivity feedback (7.4)	
	3/ 4	Reactor core modeling	Hmwk # 4 Due
8	3/ 9	Fission product poisons (7.5)	
	3/11	Fuel depletion (7.6)	Hmwk # 5 Due
<i>Spring Break</i>			
9	3/23	NSSS dynamics and modeling	
	3/25	Distributed system representation	Hmwk # 6 Due
10	3/30	Review for Exam # 2	
	4/ 1	*** Exam # 2 ***	
11	4/ 6	Instrumentation	
	4/ 8	Reactor system control	
12	4/13	Online monitoring	
	4/15	Surveillance and diagnostic methods	Hmwk # 7 Due
13	4/20	Reactor core vibration monitoring	
	4/22	Moderator temperature coefficient of reactivity	Hmwk # 8 Due
14	4/27	BWR core stability	
	4/29	Reactor protection system	Hmwk # 9 Due
15	5/ 4	Review for Final Exam	
	5/ 5	--- Reading Day ---	
	5/11	*** 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.