

School of Nuclear Engineering
Purdue University
West Lafayette, IN 47907

NUCL 40200-2 Engineering of Nuclear Power Systems

Fall 2011

Lecture:

Monday, Wednesday, and Friday, 12:30pm. - 1:20pm in HAAS G066.

Instructor:

S.T. Revankar, Office: NUCL 132E, Email: shripad@purdue.edu, Phone: 496-1782
Office Hours: Monday, Friday, 3:30pm - 4:30pm

Texts:

Because the material is very broad, in addition to the main reference (T&K) additional references are used. Class notes will be provided time to time on various topics.

References:

1. N. E. Todreas and M. S. Kazimi, "Nuclear Systems I - Thermal Hydraulics Fundamentals," Hemisphere, 1990.
2. J. R. Lamarsh, "Introduction to Nuclear Engineering," Addison-Wesley, 1983.
3. S. Glasstone and A. Sesonske, "Nuclear Reactor Engineering," Chapman and Hall, 1994.
4. A. Sesonske, "Nuclear Power Plant Design Analysis," Technical Information Center, Office of Information Services, U.S. Atomic Energy Commission, 1973.

Course Objectives:

1. Develop basic concept of nuclear reactor as a power system
2. Understand commercial light water reactor system and components
3. Develop understanding of the engineering and physical principles of a reactor including neutron transport, kinetics, thermodynamics, thermalhydraulics, materials, fuels, radiation, shielding and safety.
4. Learn and perform qualitative analysis and quantitative calculations based on engineering and physical principles
5. Understand reactor safety system and design limits
6. Enhance systematic problem solving skills and sharpen written communication skills through short technical project report.

Computer Usage:

Knowledge of word processing and spreadsheet software will be necessary for laboratory report preparation and some homework assignments. Knowledge of a computer programming language may also be helpful for some assignments.

Attendance and Honesty Policy:

Since many of the topics to be covered can only be adequately treated by class discussion, regular attendance is mandatory to meet the objectives of the course. Excessive unexcused absences will be reflected in the grade. Students are responsible for all material covered during class, including assignments and quizzes. If the instructor is late, students are required to wait 15 minutes before leaving.

The Engineering Honor Code is in effect for all students. Cheating, plagiarism, and other forms of academic dishonesty will be prosecuted according to Purdue University policy.

Campus Emergency: *In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances.*

Here are ways to get information about changes in this course: (i) Check on messages in for this course in Blackboard (ii) My email (shripad@purdue.edu)

Course Grading

A	85% - 100%
B	75% - 84%
C	65% - 74%
D	50% - 64%
F	< 49%

Weighting:

Homework	20%
Tests (3)	65%
Project	15%

Homework:

Homework problems should be turned in at the beginning of the hour on the date due. They will be graded and returned as soon as possible. Problems turned in one day late will be graded on a one-half credit basis. Since these problems are intended to show the application of lecture material and provide preparation for tests, individual work is essential. Solutions should make the approach followed clear to the grader. Collaboration on homework is limited to general discussion of the problems and approaches. Each student must independently complete their own written solution to each homework problem. Copying another person's homework or using old or other existing solutions is considered plagiarism. Each homework problem must contain the following header printed in the upper right corner of each page:

*Last name, First name
NUCL 402 Hwk Assignment #*

Examinations:

All exams will be closed notes and closed book. Depending on exam formula sheets/figures will be provided with the exams. No material other than the formula sheets are to be used during exams. A score of zero will be recorded for a missed exam. Make-up exams will be given only by prior (at least 24 hours before the exam start time) arrangement, or for an illness or serious emergency that can be documented.

Term Project

Team of 3-4 students will each complete a project on the topic chosen related reactor systems or component and submits a report.

NUCL 40200 — Nuclear Reactor Systems — Fall 2011

Period	Date		Topic	Assignment
01	Mo	Aug 22	Introduction, Power reactors	Read TK 1-16, L 119-149
02	We	24	LWR : PWR, BWR	Hwk 1. Due Aug 31
03	Fr	26	HTGR, LMFBR	Project discussion
04	Mo	29	CANDU,	Hwk 2, Due Sep 7
05	We	31	Advanced reactors	
06	Fr	Sep 2	Reactor control-Kinetics review	L 275-328
X	Mo	5	NO CLASS	
07	We	7	Power Excursion	Hwk 3, Due Sep 14
08	Fr	9	Temperature, void coefficients	
09	Mo	12	Fission product poisoning	<i>Project topic due</i>
10	We	14	Radiation protection,	L 397-426, Hwk 4, Due Sep 21
11	Fr	16	Radiation dose rate	
12	Mo	19	Radiation dose calculations	
13	We	21	Reactor shielding	L 498-526
14	Fr	23	Shielding design	
15	Mo	26	Review	
16	We	28	Test 1	
17	Fr	30	Fuels and properties	Hwk 5, Due Oct 7
18	Mo	Oct 3	Fuel Cycle	L 149-153
19	We	5	Spent fuel processing	L 177-178
20	Fr	7	Radioactive waste management	L 178-182, Hwk 6, Due Oct 14
X	Mo	10	NO CLASS	
21	We	12	Thermal design and limits	TK 19-36, 39-70
22	Fr	14	Reactor heat generation	TK 43-64, Hwk 7, Due Oct 21
23	Mo	17	Shutdown power	TK 64-70
24	We	19	Fuel thermal analysis	TK 295-338,
25	Fr	21	Temperature distribution	
26	Mo	24	Thermal resistance	
27	We	26	Review	
28	Fr	28	Test 2	
29	Mo	31	Thermodynamics review	
30	We	Nov 2	Thermodynamics of nuclear plant	TK 186-208,
31	Fr	4	Simplified PWR system	Hwk 8, Due Nov 11
32	Mo	7	Power plant PWR system	TK 208-218,
33	We	9	Brayton cycle	TK 218-233
34	Fr	11	Brayton cycle-	Hwk 9, Due Nov 18
35	Mo	14	Reactor thermal analysis	TK 575-614
36	We	16	Single & Two phase heat transfer	Notes
37	Fr	18	Two phase pressure drop	Hwk 10, Due Nov 28
38	Mo	21	Reactor safety Systems	Notes
X	We	23	NO CLASS	
X	Fr	25	NO CLASS	
39	Mo	28	Reactor Accidents TMI	Notes, Project Report Due
40	We	30	Reactor Accidents Chernobyl	Hwk 11, Due Dec 9
41	Fr	Dec 2	Test 3	
42	Mo	Dec 5	PRA	Notes
43	We	7	Licensing	Notes
44	Fr	9	Decommissioning	Notes

TK: N. E. Todreas and M. S. Kazimi, "Nuclear Systems I - Thermal Hydraulics Fundamentals,"
L: J. R. Lamarsh, "Introduction to Nuclear Engineering," Addison-Wesley, 1983.