United States Naval Academy
Mechanical Engineering Department

Catalog Description: EM463 Reactor Physics II **Credit:** 3 (2-2-3)
Designation: Elective, engineering major

The topics covered include neutron generation times, reactor period, delayed neutrons, negative temperature coefficient, xenon poisoning, control rod theory, shielding and a reactor kinetics case problem.

Prerequisites: EM362, Reactor Physics I

Corequisites: **None**

Textbooks: John .R.LaMarsh and Anthony J. Baratta
Introduction to Nuclear Engineering, 3rd Edition
Prentice Hall

Course Director: Professor Martin E. Nelson

Course Content:

No.	Topic or Subtopic	hrs.
1	Reactor criticality with multi-group theory and experimentation	9
2	Heterogeneous reactor analysis	1
3	Reactor kinetics theory and experimentation	7
4	Fission product poisoning	3
5	Temperature coefficients	2
6	Control rods	4
7	Transient reactor simulation	1
8	Fuel isotopic changes	1
9	Shielding	4
10	Nuclear instrumentation and measurement	16
11	Light water reactor design and operation	2

Assessment Methods:

		YES	NO
A	Quizzes	X	
B	Homework	X	
C	Exams	X	
D	Laboratory Reports	X	
E	Oral Presentations		X
F	Design Reports/Notebooks		X
G	Prototypes/Demonstrations		X
H	Projects		X
I	Other		X

Course Outcomes[1]:

1. Formulate a multi-group model of a thermal heterogeneous reactor, solve for system criticality using a multigroup computer code and understand flux distributions related to such a multigroup analysis.
2. Solve reactor dynamic problems using the concepts of reactivity, reactor period, and delayed neutron properties for a step input point reactor model.
3. Understand the effect fission product poisoning, control rods, and temperature coefficients have on the dynamic response of a reactor.
4. Understand how basic nuclear instrumentation and data acquisition systems respond to radiation and how to analyze their output to determine such parameters as system operating voltage, reactor multiplication factor, migration area, or neutron flux.
5. Understand fundamental radiation dose units and calculate the dose from a shielded or unshielded gamma or fast neutron source.
6. Analyze a nuclear power plant's dynamic behavior using a reactor simulation program.
7. Understand light water reactor plant layouts and design, operating and plant construction principles including maximum control rod worth, fuel-burn-up and nuclear proliferation, negative temperature coefficients, and plant safety.

[1] Letters in parenthesis refer to the assessment methods listed in the previous section.

	Course Outcomes						
Program Outcomes	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(a)	X	X	X	X	X	X	X
(b)				X			
(c)						X	X
(d)		X				X	X
(e)	X	X	X	X	X		
(f)							
(g)				X			
(h)							X
(i)							X
(j)		X	X	X	X	X	X
(k)	X			X	X	X	X

Date of Latest Revision: 28 APR 2010, Professor Martin E. Nelson