United States Naval Academy
Mechanical Engineering Department
ER362 Reactor Physics

Catalog Description: ER362 Reactor Physics **Credit:** 3 (2-2-3)
Reactor Physics provides the principles underlying power generation in both a steady state and transient fission reactor. Subject areas include neutron diffusion and slowing down theory, criticality, bare, reflected and heterogeneous reactors, reactor kinetics, and reactor control. Experiments and classroom exercises include the determination of important reactor parameters, the use of computational methods, and the use of plant simulation software.

Prerequisites: ER301 (Fundamentals of Nuclear Engineering),
Corequisites: None

Textbooks: Introduction to Nuclear Engineering, 3rd Ed., LaMarsh & Baratta, Prentice Hall, 2001
Supplemental Material:

Course Director: Asst Prof Marshall Millett

Course Content:

No.	Classroom Material Topic or Subtopic	hrs.
1.	Neutron interactions, slowing down theory, sources, and fission	5
2.	Neutron transport in non-fissioning media	4
3.	One group criticality and buckling	4
4.	Two and multi-group criticality, heterogeneous reactors	7
5.	Reactor kinetics	5
6.	Poisons and temperature coefficients	5
7.	Reactor control and burnup	4

No.	Laboratory Exercises Topic or Subtopic	hrs.
1.	Introduction to computational methods in nuclear engineering	2
2.	Determination of migration area and keff	4
3.	Criticality calculations with MCNP	4
4.	Reactor shielding and fuel burnup with MCNP	4
5.	Determination of control rod worth	2
6.	Transient plant simulation (PCtran)	2
7.	Nuclear reactor site visit	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. Solve problems involving nuclear reactions and neutron interactions with matter.
2. Solve problems involving the fission process to include calculation of parameters for the infinite multiplication factor (k_∞), the effective multiplication factor (k_{eff}) and fuel consumption rates.
3. Solve problems involving diffusion theory applied to several geometries and neutron fluxes.
4. Solve problems involving the calculation of the criticality, critical mass of fuel, and critical size of homogeneous nuclear reactors.
5. Solve problems involving reactor dynamics, including the effect of reactivity changes.
6. Solve problems involving reactor control, temperature coefficients, and the effect of poison buildup.

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

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