

## **NRE 3208 Nuclear Reactor Physics I (Required)**

<b>Catalog Description:</b>	NRE3208 Nuclear Reactor Phys I (3-0-3) Prerequisites: NRE3301 (Rad. Phys.), MATH2403 (Diff. Eq.) Introductory treatment of reactor physics
<b>Textbook:</b>	Lamarsh, J.R. and Baratta, A.J., <i>“Introduction to Nuclear Engineering”</i> , 3rd edition, Prentice-Hall (2001)
<b>Reference:</b>	E.E. Lewis, <i>“Fundamentals of nuclear reactor physics”</i> , 1st edition, Elsevier (2008)

NRE3208 provides an introduction to Reactor Physics and is a prerequisite for the senior-year Reactor Physics course NRE4208.

### **Topics Covered:**

1. Nuclear cross sections, overview of neutron interactions [short]
2. Nuclear reactors and nuclear power, including recent developments in reactor design<sup>1</sup>
3. Neutron diffusion and moderation, including one-speed diffusion equation, two-group calculations
4. Nuclear reactor theory, including criticality and eigenfunctions, four-factor formula, six-factor formula
5. Reactor kinetics and dynamics, including reactivity and feedbacks, reactivity worth of control rods
6. Reactor licensing, safety and the environment, including recent developments in plant licensing<sup>2</sup>
7. Mathematics relevant to reactor physics modeling<sup>3</sup>

### **Course outcomes:**

1. The student will acquire a working understanding of the range of technical topics that constitute the discipline of reactor physics, including steady state and time-dependent diffusion theory
2. The student will understand the relationship between basic Reactor Physics concepts and actual reactor characteristics
3. Students will be knowledgeable of the major nuclear power reactor types
4. Students will be able to solve simple differential equations relevant to reactor physics

<sup>1</sup> This material should be updated to the latest “state of the art” (i.e. those being considered for NRC certification)

<sup>2</sup> Use of “Nuclear News” or equivalent sources is encouraged for reactor design and licensing to cover “contemporary issues”.

<sup>3</sup> Use of numerical exercises using appropriate software packages

**Correlation between Course Outcomes and Program Educational Outcomes:**

NRE 3208 Nuclear Reactor Phys I	Outcome a			Outcome b	Outcome c	Outcome d	Outcome e	Outcome f	Outcome g	Outcome h	Outcome i	Outcome j	Outcome k
	i	ii	iii										
Course Outcome 1	X	X											
Course Outcome 2							X						
Course Outcome 3												X	
Course Outcome 4	X						X						

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 Revised: October 2008