NRE 4208 Nuclear Reactor Physics II (Required)

Catalog Description:	NRE 4208 Nuclear Reactor Phys II (4-0-4) Prerequisite: NRE 3208 (Intro Reactor Phys.), MATH 2403 (Differential Equations) This course covers the physical theory of nuclear reactors.
Textbook:	J. Duderstadt and L.J. Hamilton, *"Nuclear Reactor Analysis"*, Wiley (1976)
References:	W.M. Stacey, *"Nuclear Reactor Physics"*, Wiley (2007)

Topics Covered:

1. Review of neutron cross sections, differential cross sections, resonances, Doppler effect
2. Review of 4- and 6-factor formulas
3. Introduction to transport theory: Boltzmann-equation; solutions in 1-D geometry; derivation of diffusion equation from transport theory.
4. One-speed diffusion theory, expansion functions and criticality.
5. Point kinetics without / with feedback, stability of feedback systems
6. Multi-group theory
7. Slowing down and resonance treatment
8. Thermal spectrum and cross sections
9. Cell calculations
10. Reactivity control
11. Xenon and samarium poisoning, depletion.
12. Mathematics relevant for reactor physics, including 1st and 2nd order ODEs, Laplace transform,etc.

Course Outcomes:

1. Students will be able to explain the relationships among variables underlying the theory of nuclear fission reactors using mathematical models and their associated physical behaviors.
2. Students will be able to solve static reactor physics problems in one-speed and multi-group diffusion theory and the concepts related to group cross sections in the thermal, resonance, and fast energy regions.
3. Students will be able to analyze reactor kinetic and dynamic problems using point kinetics and quantify the cause and effect of core composition changes.
4. Students will be knowledgeable of numerical tools to solve differential equations.

Correlation between Course Outcomes and Program Educational Outcomes:

NRE 4208 Nuclear Reactor Phys II	Outcome a			Outcome b	Outcome c	Outcome d	Outcome e	Outcome f	Outcome g	Outcome h	Outcome i	Outcome j	Outcome k
Course Outcomes	i	ii	iii										
Course Outcome 1	X	X					X						
Course Outcome 2	X	X					X						
Course Outcome 3	X	X					X						
Course Outcome 4													X

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