

**Purdue University**  
**School of Nuclear Engineering**  
**NUCL 501 - Nuclear Engineering Principles**  
**Summer 2018**

Instructor: C. K. Choi      [choi@purdue.edu](mailto:choi@purdue.edu)  
NUCL 112B      (765) 494-6789

Schedule: Distance Learning    MTWRF 11:00-12:00    5/29-6/22 & 7/9-8/3 (8 wks.)

Description:    A first course for graduate students desiring a nuclear engineering sequence and an elective for students in science and engineering. The course is structured in four parts: (1) Nuclear structure and radiation interactions, biological radiation effects and radio isotope applications, (2) Basics of neutron and reactor physics, neutron diffusion and reactor criticality, (3) Reactor systems, heat generation, heat transfer and safety, and (4) Nuclear materials, reactor licensing and waste.

Course Syllabus:

Badge 1 (9 lectures):

1. Atomic structure and nuclear binding energy, radioactivity, nuclear reactions and reaction rates, cross-section and Maxwellian distribution
2. Neutron interactions with matter, neutron attenuation, neutron cross-section, neutron slowing down, fission, radiation and charged particle interactions with matter
3. Methods of radiation detection and biological radiation effects, and radio isotope applications

Badge 2 (9 lectures):

4. Neutron chain reactions, nuclear reactor operations of light water reactor, heavy water and gas-cooled reactors, and breeder and fusion reactors, nuclear fuel cycles, and isotope separation
5. Neutron diffusion theory, group diffusion methods (one group and multi-groups), steady-state reactor behavior, reactor criticality, and applications to thermal and reflected reactors

Badge 3 (9 lectures):

6. Time-dependent reactor kinetics and delayed neutrons, reactor control, reactor heat generation, heat transfer, and direct energy conversion

Badge 4 (8 lectures):

7. Radiation protection (exposure and dose), radiation shielding, reactor materials, reactor licensing, fuel processing and waste disposal

Textbook:    J. Lamarsh and A. Baratta, *Introduction to Nuclear Engineering*, 4<sup>th</sup> edition, Pearson, 2018. pp. 802.

Reference:    *Chart of the Nuclides*, 17<sup>th</sup>/ed., Bechtel and Knolls Atomic Power Lab., 2009.

Grading:

Homework	25%	[A penalty of 5% per day for each day late]
Hour Exams (3)	45%	[Exam I: June 11/ Exam II: July 9/ Exam III: July 23]
Final Exam	30%	[August 3 –comprehensive 2-hr exam]
A	85% or above	
B	70%-84.9%	
C	55%-69.9%	
D, E, F, I	as warranted	