

NUCL 511 Reactor Theory and Kinetics CRN: 24748

1. 3 Credit Hours
2. **Instructor(s):** Yunlin Xu

Lecture time: TTh: 9:00-10:15 AM

Office hour: W: 9:00-10:15 AM

Webex <https://purdue.webex.com/purdue>

Meeting number (access code): 120 877 2616

Meeting password: ivXqWBm38s8

3. **Textbook(s):**
Introductory Nuclear Reactor Dynamics,
by Karl O. Ott and Robert J. Neuhold
ISBN-10: 0894480294

4. Course Description

Advanced methodologies for neutron flux calculation, nodal methods, transport correction, multi-group theory, and introduction to the generation of group constants. Reactor kinetics, perturbation theory, adjoint fluxes, reactivity calculation from perturbation theory, reactivity coefficients due to Doppler effect, temperature and density changes, void coefficient, and energy and power coefficients. Micro-kinetics, theory of reactivity measurements, approximate methods: prompt jump approximation, and prompt kinetics. Transients with feedback, safety implications, and spatial kinetics.

5. **Pre-requisite:** NUCL 310 or NUCL501

6. **Classification:** Required

7. Learning Objectives

- a. To build neutron kinetics equation.
- b. To explain perturbation theory and adjoint flux.
- c. To derive neutron point kinetics equation.
- d. To evaluate reactivity and other kinetics parameters
- e. To solve point kinetics equation analytically for simplified cases.
- f. To solve point kinetics equation with approximate methods such as prompt jump approximation, and prompt kinetics
- g. To solve point kinetics equation with numerical methods
- h. To explain reactivity feedback mechanisms such as Doppler, coolant density or void feedbacks
- i. To explain different methods for reactivity measurement
- j. To solve spatial kinetics and feedbacks.

8. ABET Student Outcomes

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
3. An ability to communicate effectively with a range of audiences.
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

9. Grades Policies:

Home works: 40% of total score

Exams: Midterm, 20% of total score, no final exam

Project: There will be projects, 30% of total score

Attendance and Participation: 10% of total score

Guaranteed floors for letter grade

F	D-	D	D+	C-	C	C+	B-	B	B+	A-	A	A+
60	63.33	66.67	70	73.33	76.67	80	83.33	86.67	90	93.33	96.67	

No curve with percentage

Possible Adjustments:

Whole class adjustment if there are unreasonable requirements in home works/exams/projects

Minor adjustment (≤ 5 points) for students who made significant effort and improvement for the course

Home works are at midnight of due day, can be submitted earlier. Late submissions will have 5% per day reduction in score, and not accepted after a week from due day.

Regrade requests must be submitted with a written justification within a week after grade released to students.