

NUCL 310, Introduction to Neutron Physics

1. 3 Credit Hours.

Class Time: M, W, F 9:30-10:20 – Classroom GRIS 134

2. **Instructor:** Hany Abdel-Khalik, Ph.: 69718, abdelkhalik@purdue.edu

Office hours: NUCL 132D, 400 Central Drive, W. Lafayette, IN, M, W 11:30a – 12:30p.

3. **Textbook(s):** Fundamentals of Nuclear Reactor Physics, E. E. Lewis, 1st Editions

4. **Course Description:**

Introductory to neutron physics calculations in thermal fission reactors. Basic introduction and development of cross-sections energy dependencies, scattering cross-section, capture cross-section, Doppler Broadening. Derivation of neutron balance equation in one variable, e.g., time for point kinetics equation, space for diffusion theory, and energy for basic slowing down theory. Introduction of depletion calculations, and basic introduction to reactivity balance equation and reactivity coefficients.

List of Topics: Radioactive decay law, neutron distribution in energy, space, time, depletion calculations, reactivity balance, and reactivity coefficients, neutron diffusion equation, neutrons point kinetics equation, Doppler broadening, neutron feedback, etc.

5. **Prerequisites:** Introductory calculus course and introductory ordinary differential equations course, and introduction to nuclear physics. If you don't meet prerequisites, please see me after class.

6. **Classification:** Required

7. **Learning Objectives:**

- a. Students to learn about the collective meaning of the terms/subjects listed in the course description, how they interact, and how the interaction is optimized for reactor design and operation.
- b. Students to develop an understanding of basic premise and need for reactor physics calculations, to learn and understand concepts of neutron balance equation over time, energy, and space, and to introduce to basic physical principles affecting design decisions for nuclear fission reactors.
- c. Students to learn how to develop a computer code to solve a reactor physics problem.

8. **ABET Student Outcomes:**

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of Nuclear engineering, science, and mathematics.

- Grading:** Exam 1: 30%, Exam 2: 30%, Project: 10%; Homework: 15%, Classroom interactions: 10%, Oral Examination: 5%, Bonus Assignments: Up to 10%.
No makeup assignments, and No grade curving.
Following Code of Integrity (PASS or FAIL)
- Grades:** A+>=96, A>=90, B>=80, C>=70, D>=60, F<60
- Exams:** Take Home to be completed individually, collaboration with other individuals is prohibited. May be hand-written
- Homework:** To be done individually but collaboration is recommended.
All homework assignments are to be typed digitally, with hardcopies presented in class.
Excluding the two examinations, all assignments are to be typed electronically. Hand-written assignments will receive ZERO grade. Use provided cover page for all your assignments. A print out of your assignment is to be returned at the beginning of the class. Don't send me your assignments electronically unless I request/approve that (PDF format only)
- Class Structure:** Each class consists of three segments, revision of previous class material (be ready for quizzes), new material will be presented following a problem-based learning approach (students discussion/interactions required), and wrap-up on material presented and directions for next class.
- Attendance:** Excused absence is either anticipated such as university duty, military, etc. or due to emergency such as Illness, or family death. Repeated unexcused absence will be punished. You will lose 3% of total class credit for each unexcused absence with the first two allowed.
- Disability:** If you have disability requiring special attention, please notify me immediately to take appropriate measures
- Expectations:** All assignments should state clearly any references you have used. No references means it's your OWN work. Return assignments on time. Late assignments will be subjected to 20% penalty for each day after due date without a valid excuse (up to two days only).
Cheating/Copying/Plagiarism will be severely punished. Any assignment (including HW, projects, exams, etc.) containing a SINGLE cheating incident will receive zero grade for entire assignment. More than two cheating incidents will be reported to your academic advisor and student conduct office and will receive an F grade in the course. Take pride in your work. SILENCE your cell phones and other electronics while you are in class and when you come see me in the office
- Class Material:** The textbook, Class notes, all assignments, class schedule, notes if any, assignments, examinations, etc. will be emailed to you. Make sure your spam-filter is functioning properly. You will be receiving emails primarily from me and occasionally from the teaching assistants. 'My-email-is-not-working', or 'I-have-not-received-this-email' type excuses will not be accepted. Check with your classmates regularly.