

Course Syllabus

Course Information

LINEAR ACCELERATOR LABORATORY MANE 4430 Section 1
RPI Spring 2024 3 cr
Lecture W 12:00PM-3:50PM LINAC Classroom

Instructor

Professor Yaron Danon Email: danony
Office Location: NUCENG 1-9 Phone: x4008
Office Hours: W 10-12am via WebEx Site: <https://homepages.rpi.edu/~danony/LinacLab/LinacLab.html>

Teaching Assistant

Benjamin Wang Email: wangb16
Office Location: NES 1-17 Phone:
Office Hours: Tu 2-5pm via WebEx Site:

Course Description

The course will cover measurements using different experimental systems utilizing neutron and gamma sources. It will focus on measurements relating to neutron interactions with matter including the detection of neutrons through interactions in materials, neutron reaction cross-sections, neutron diffusion and slowing down, Doppler broadening of cross-sections and how this applies to nuclear reactors, both neutron and photon activation analysis and its applications, and the fission process and measurement of delayed neutrons.

Course Text(s)

Provided lab manuals.

Course Goals/Objectives

To introduce the students to experimental measurements with neutrons and apply topics learned in previous classes to practical measurements.

Course Content

The course will focus on experimental measurements utilizing various neutron sources. The topics will cover neutron interactions with matter and various methods of neutron detection, neutrons slowing down and neutron diffusion, measurement of neutron cross-sections as well as the temperature dependence and Doppler broadening, neutron and photon activation analysis and its applications, and the fission process and the measurement of delayed neutrons.

Student Learning Outcomes

1. Be able to calculate uncertainty for experimental measurements.
2. Be able to perform experiments with a wide variety of detection systems.
3. Demonstrate understanding of how neutron detectors operate.
4. Demonstrate understanding of neutrons slowing down in media and diffusion theory.
5. Demonstrate understanding of how cross-sections are calculated and measured.
6. Be able to calculate Doppler broadening of a cross-section based on temperature.
7. Demonstrate understanding of neutron and photon activation and its applications.

8. Demonstrate understanding of the fission process.
9. Be able to calculate intensity of fission products through measurement of delayed gammas.

Course Assessment Measures

Assessment	Due Date	Learning Outcomes
Assignment	1 week after assigned	3,4,6,9
Lab Report	1 week after assigned	1, 2, 3, 4, 5, 6, 7, 8, 9
Mid Term Exam	Mid semester	1, 3, 4,
Final Exam	Last day of classes	1, 3, 4, 5, 6, 7, 8, 9

Grading Criteria

Based on a weighted sum of assignments, lab reports, midterm and final examinations as follows:

$$CG = 0.2(\text{Assignment average}) + 0.6(\text{Lab report average}) + 0.1(\text{Midterm exam}) + 0.1(\text{Final exam})$$

CG is the course grade on a scale from 0-100, this will be converted into a corresponding letter grade using the scale below:

From	To	Final Grade
93	100	A
90	92	A-
87	89	B+
83	86	B
80	82	B-
77	79	C+

From	To	Final Grade
73	76	C
70	72	C-
60	69	D+
56	59	D
0	55	F

Attendance Policy

Attendance is strongly encouraged. The student is responsible for obtaining the experimental data measured for labs not attended.

Academic Integrity

Student-teacher relationships are built on trust. For example, students must trust that teachers have made appropriate decisions about the structure and content of the courses they teach, and teachers must trust that the assignments that students turn in are their own. Acts which violate this trust undermine the educational process. The Rensselaer Handbook of Student Rights and Responsibilities defines various forms of Academic Dishonesty, and you should make yourself familiar with these. **In this class, all assignments that are turned in for a grade must represent the student's own work or in the case of group lab reports the work of the group.** In cases where help was received, or teamwork was allowed, a notation on the assignment should indicate your collaboration. Submission of any assignment that is in violation of this policy will result in a grade reduction penalty. Late homework or lab submission will also result in grade reduction penalty if not discussed with the instructor first. If you have any questions concerning this policy before submitting an assignment, please ask for clarification.

Diversity and Inclusion:

At RPI we support an inclusive learning environment where diversity and individual differences are understood, respected, appreciated, and recognized as a source of strength. I expect that students and faculty will respect differences and demonstrate diligence in understanding how other peoples' perspectives, behaviors, and world views may be different from their own. Students in this class are encouraged to speak up and participate during class. Because the class will represent a diversity of individual beliefs, backgrounds, and experiences, every member of this class must show respect for every other member of this class.