Radiation Interaction Basics and Applications I

ENU 6051

Class Periods: T period 8-9 (3:00 PM - 4:55 PM); R Period 9 (4:05 PM - 4:55 PM)

Location: T: WEIL 0273; R: WEIM 1094

Academic Term: Fall 2025

Instructor:

Nathalie A. Wall
Please contact through the Canvas website
Office Hours: T 10:00 AM – 10:50 AM, Th 10:00 AM – 10:50 AM; MAE (building #719), Room 323

Teaching Assistant/Peer Mentor/Supervised Teaching Student:

Nadia Vogt
Please contact through the Canvas website
office location, office hours: TBD

Course Description

3 credit hours

Interaction of X-rays, gamma rays, neutrons, and charged particles with matter, radioactive decay, nuclear moments, and nuclear transitions. Application to basic problems in nuclear engineering sciences.

Course Pre-Requisites / Co-Requisites

None

Course Objectives

Following successful completion of this course, the student will have developed an understanding of ionizing radiation, atomic and nuclear structure, radioactive decay, and ionizing radiation interaction with matter, including the concept of cross sections for charged particles (electrons and heavy charged particles) as well as uncharged particles (neutrons and photons). Specific objectives are as follows:

• Demonstrate an ability to apply mathematics, science, and engineering knowledge for problem-solving in engineering related to radiation interaction with matter.

• Demonstrate an ability to identify, formulate, and solve engineering problems related to radiation interaction with matter.

• Demonstrate an ability to apply advanced mathematics, science, atomic and nuclear physics, and engineering to nuclear and radiological systems and processes

Objectives will be accomplished through lectures, discussions, and problem-solving.

Materials and Supply Fees

None

Required Textbooks and Software

- Introductory Nuclear Physics.
- Kenneth S. Krane
- Publisher: Wiley; 3rd edition (October 22, 1987)
- ISBN-10: 047180553X
- ISBN-13: 978-0471805533

- Chart of nuclides
- Bechtel Marine Propulsion Corporation
- 2010, 17th edition
- ISBN 978-0-9843653-0-2
- *Alternatively, the phone app will work*

Lecture slides will be posted on CANVAS before the class period.

Software Use
All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Recommended Materials
N/A

Required Computer
Recommended Computer Specifications: https://it.ufl.edu/get-help/student-computer-recommendations/
HWCOE Computer Requirements: https://www.eng.ufl.edu/students/advising/fall-semester-checklist/computer-requirements

Course Schedule
Week 0: / 1-2. ELEMENTS OF QUANTUM MECHANICS/ Corresponding Book Section 2.1 /
Week 1: / 2. ELEMENTS OF QUANTUM MECHANICS/ Corresponding Book section 2.2 / Quiz 1
Week 2: / 3. NUCLEAR RADIUS / Corresponding Book Section 3.1 / Quizzes 2, 3 / HW 1
Week 3: / 4. MASS ABUNDANCE / Corresponding Book Sections 3.2-3.6 / Quizzes 4, 5 / HW 2
Week 4: / 5. FORCE BETWEEN NUCLEONS / Corresponding Book Ch. 4 / Quizzes 6, 7 / HW 3
Week 5: / 5. FORCE BETWEEN NUCLEONS (cont.) / Quiz 8 / HW 4
Week 6: / Midterm examination
Week 7: / 6. NUCLEAR MODELS Corresponding Book Ch. 5 / Quizzes 9, 10
Week 8: / 7. RADIOACTIVE DECAY / Corresponding Book Ch. 6 / Quizzes 11, 12 / HW 5
Week 9: / 7. RADI. DECAY (cont.) and 8. ALPHA DECAY / Corresponding Book Ch. 6, 8 / Quizzes 13, 14 / HW 6
Week 10: / 8. ALPHA DECAY (Cont.) and 9. BETA DECAY / Corresponding Book Ch. 8. 9 / Quizzes 15, 16 / HW 7
Week 11: / 9. BETA DECAY (cont.) and 10. GAMMA DECAY / Corresponding Book Ch. 9, 10 / Quizzes 17, 18 / HW 8
Week 12: / Holiday and 10. GAMMA DECAY (cont.)
Week 13: / 11. NUCLEAR REACTION / Corresponding Book Ch. 11 / Quizzes 19, 20 / HW 9
Week 14: / Thanksgiving break
Week 15: / Review and Reading days

Important Dates
Week 6: Midterm examination (WEIL0273)
12/09/2025 Final Exam 3:00 PM - 5:00 PM (WEIL0273)

11/11/2025: Holiday
11/24-28/2025: Holiday

Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade
Homework Sets (best 80%)	100 each	20%
Quizzes (best 80%)	100 each	20%
Midterm Exam	100	30%
Final Exam	100	30%
Total		100%

Grading Policy

Percent	Grade	Grade Points
93.0 - 100	A	4.00
90.0 – 92.9	A-	3.67
87.0 - 89.9	B+	3.33
83.0 - 86.6	B	3.00
80.0 - 82.9	B-	2.67
77.0 - 79.9	C+	2.33
73.0 - 76.9	C	2.00
70.0 - 72.9	C-	1.67
67.0 - 69.9	D+	1.33
63.0 - 66.9	D	1.00
60.0 - 62.9	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at:
UF Graduate Catalog
Grades and Grading Policies

There are federal laws protecting your privacy with regard to grades earned in courses and on individual assignments. For more information, please see: https://registrar.ufl.edu/ferpa.html

Students Requiring Accommodations
Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting https://disability.ufl.edu/students/get-started/. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation
Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/.

In-Class Recording
Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A "class lecture" is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Material publication without permission from the instructor is prohibited. To "publish" means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third-party note/tutoring services. *A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 of the Student Honor Code and Student Conduct Code.*

Academic Policies & Resources

UF General Academic Policies & Resources (Honor Policy, DRC, Academic and Health Resources):
https://go.ufl.edu/syllabuspolicies
Graduate Level Academic Policies and Regulations (Attendance and Grading policy):
https://gradcatalog.ufl.edu/graduate/regulations/

Commitment to a Positive Learning Environment

The Herbert Wertheim College of Engineering values varied perspectives and lived experiences within our community and is committed to supporting the University's core values.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Coordinator
- HWCOE Human Resources, 352-392-0904, student-support-hr@eng.ufl.edu
- Pam Dickrell, Associate Dean of Student Affairs, 352-392-2177, pld@ufl.edu