

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: FLG0275

Academic Term: Fall 2023

Instructor:

Nathalie A. Wall

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Office Phone Number: 352-273-0279

Office Hours: TR 1:30 PM – 2:20 PM; MAE (building #719), Room 323

Teaching Assistant/Peer Mentor/Supervised Teaching Student:

Please contact through the Canvas website

- N/A

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 knowledge of mathematics, science, and engineering 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

Recommended Materials

- N/A

Course Schedule

Week 1: / ELEMENTS OF QUANTUM MECHANICS/ Corresponding Book Chapter 2 /
 Week 2: / ELEMENTS OF QUANTUM MECHANICS/ Corresponding Book Chapter 2 / Quiz 1
 Week 3: / NUCLEAR RADIUS / Corresponding Book Section 3.1 / Quizzes 2, 3 / HW 1
 Week 4: / MASS ABUNDANCE / Corresponding Book Sections 3.2-3.6 / Quizzes 4, 5 / HW 2
 Week 5: / FORCE BETWEEN NUCLEONS / Corresponding Book Chapter 4 / Quizzes 6, 7 / HW 3
 Week 6: / NUCLEAR MODELS Corresponding Book Chapter 5 / Quizzes 8, 9 / HW 4
 Week 7: / Midterm examination
 Week 8: / RADIOACTIVE DECAY / Corresponding Book Chapter 6 / Quizzes 10, 11 / HW 5
 Week 9: / ALPHA DECAY / Corresponding Book Chapter 8 / Quizzes 12, 13 / HW 6
 Week 10: / BETA DECAY / Corresponding Book Chapter 9 / Quizzes 14, 15 / HW 7
 Week 11: / GAMMA DECAY / Corresponding Book Chapter 10 / Quizzes 16, 17/ HW 8
 Week 12: / NUCLEAR REACTION / Corresponding Book Chapter 11 / Quizzes 18, 19 / HW 9
 Week 13: / NUCLEAR FISSION / Corresponding Book Chapter 13 / Quizzes 20, 21 / HW 10
 Week 14: / NUCLEAR Fusion / Corresponding Book Chapter 14 /
 Week 15: / NUCLEAR Fusion / Corresponding Book Chapter 14 / Quizzes 22, 23

Attendance Policy, Class Expectations, and Make-Up Policy

Attendance will not be monitored, nor will it be considered in the grade. However, quizzes will be given at the beginning of lecture and some materials covered during lecture will not be covered in the references or in the notes provided online. Students are responsible for obtaining these materials. If a student arrives late or leaves early, he/she is expected to do so with minimum level of disruption to the class in progress.

Students will take their quiz on the electronic medium of their choice, including their phone. Students can take notes on laptops. However, the use of phone is prohibited during class after the quiz is completed and phone will be muted during lecture. A student using their phone or having their phone ringing will be told to leave the room for the duration of the lecture - the same principle applies to office hours or appointments.

Excused absences must be in compliance with university policies in the Graduate Catalog (<http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#attendance>) and require appropriate documentation.

Missed quizzes for reasons outside compliance with university policies in the Graduate Catalog (see above) will receive a zero grade.

Missed homework for reasons outside compliance with university policies in the Graduate Catalog (see above) will be granted extension with penalty: the grade will be reduced by 50% for homework received up to 1 day late, 100% beyond 1 days late.

Students who know in advance they will be absent for a scheduled exam and for reasons in compliance with university policies in the Graduate Catalog (see above) will inform the instructor in written as soon as they know about it and no later than one week before the exam. The student will take the exam in advance, no sooner than the Friday immediately *before* the scheduled exam. Students missing an exam, without prior knowledge of the absence and for reasons in compliance with university policies in the Graduate Catalog (see above), will be allowed to take *another version* of that exam within the week of the scheduled exam; if this is not possible, that exam grade will be calculated at the end of the semester as the average of the remaining exam. Any additional missed exam that cannot be rescheduled will received a zero grade.

Professional: Reasonable extensions for job/internship interviews, technical conferences, or other professional / career development reasons should be requested. Requests are typically granted, at my discretion, unless they would

grant a student or group of students an unfair advantage over their peers, cause significant disruption to the course or grading schedule, or violate some UF policy.

Medical: Extensions will also be granted for (your own) medical reasons – please do not come to class if you are ill. Per UF policy, in the case of medical absences that are frequent or suspiciously- timed (*e.g.*, repeatedly, suddenly ill at deadlines), the instructor may request a signed note from a physician or similar professional practitioner.

Personal: In addition, UF policies require accommodation for several non-academic, non- medical reasons. Extensions for these personal issues are strictly limited to those mandated by the letter of UF policies.

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](#)

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.bluer.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, clinical presentations such as patient history, 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.

Publication without permission of 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 Student Honor Code and Student Conduct Code.

University Honesty Policy

UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Honor Code (<https://sccr.dso.ufl.edu/process/student-conduct-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Commitment to a Safe and Inclusive 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, including the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of race, creed, color, religion, age, disability, sex, sexual orientation, gender identity and expression, marital status, national origin, political opinions or affiliations, genetic information, and veteran status.

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 Program Coordinator
- HWCoe Human Resources, 352-392-0904, student-support-hr@eng.ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

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.

Student Privacy

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

Campus Resources:

Health and Wellness

U Matter, We Care:

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: <https://counseling.ufl.edu>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)

Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

Academic Resources

E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu.
<https://lss.at.ufl.edu/help.shtml>.

Career Connections Center, Reitz Union, 392-1601. Career assistance and counseling; <https://career.ufl.edu>.

Library Support, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.
<https://teachingcenter.ufl.edu/>.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers.
<https://writing.ufl.edu/writing-studio/>.

Student Complaints Campus: <https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>; <https://care.dso.ufl.edu>.

On-Line Students Complaints: <https://distance.ufl.edu/getting-help/>; <https://distance.ufl.edu/state-authorization-status/#student-complaint>.