

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: TBD

Academic Term: Fall 2021

Instructor:

Nathalie A. Wall

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Office Phone Number: 352-273-0279

Office Hours: TR 1:00 PM – 2:00 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

- Introduction to Nuclear Engineering 4th Edition
- John Lamarsh, Anthony Baratta
- Publisher: Pearson; 4th edition (January 9, 2017)
- ISBN-10: 0134570057
- ISBN-13: 978-0134570051

- Atoms, Radiation, and Radiation Protection 3rd Edition
- James E. Turner
- Publisher: Wiley-VCH; 3rd edition (June 18, 2007)
- ISBN-10: 9783527406067
- ISBN-13: 978-3527406067

Course Schedule

Week/Topic/Corresponding Book Chapters/Quiz/Exam

Week 1: / ELEMENTS OF QUANTUM MECHANICS/ Corresponding Book Chapter 2 /
Week 2: / NUCLEAR PROPERTIES / Corresponding Book Chapter 3 / Quizzes 1, 2 / HW 1
Week 3: / FORCE BETWEEN NUCLEONS / Corresponding Book Chapter 4 / Quizzes 3, 4 / HW 2
Week 4: / NUCLEAR MODELS Corresponding Book Chapter 5 / Quizzes 5, 6 / HW 3
Week 5: / NUCLEAR SPIN AND MOMENTS / Corresponding Book Chapter 16 / Quizzes 7, 8 / HW 4
Week 6: / RADIOACTIVE DECAY / Corresponding Book Chapter 6 / Quizzes 9, 10 / HW 5
Week 7: / ALPHA DECAY / Corresponding Book Chapter 8 / Quizzes 11, 12 / HW 6
Week 8: / ALPHA DECAY / Corresponding Book Chapter 8 / Midterm Exam
Week 9: / BETA DECAY / Corresponding Book Chapter 9 / Quizzes 13, 14 / HW 7
Week 10: / GAMMA DECAY / Corresponding Book Chapter 10 / Quizzes 15, 16/ HW 8
Week 11: / NUCLEAR REACTION / Corresponding Book Chapter 11 / Quizzes 17, 18 / HW 9
Week 12: / NUCLEAR REACTION / Corresponding Book Chapter 11 / Quizzes 19
Week 13: / NEUTRON PHYSICS / Corresponding Book Chapter 12 / Quizzes 20, 21 / HW 10
Week 14: / NUCLEAR FISSION / Corresponding Book Chapter 13 / Quizzes 22
Week 15: / NUCLEAR FUSION / Corresponding Book Chapter 14 / Quizzes 23, 24 / Review paper due

F2F Course Policy in Response to COVID-19

We will have face-to-face instructional sessions to accomplish the student learning objectives of this course. In response to COVID-19, the following policies and requirements are in place to maintain your learning environment and to enhance the safety of our in-classroom interactions.

- You are expected to wear approved face coverings at all times during class and within buildings even if you are vaccinated.
- If you are sick, stay home and self-quarantine. Please visit the UF Health Screen, Test & Protect website about next steps, retake the questionnaire and schedule your test for no sooner than 24 hours after your symptoms began. Please call your primary care provider if you are ill and need immediate care or the UF Student Health Care Center at 352-392-1161 (or email covid@shcc.ufl.edu) to be evaluated for testing and to receive further instructions about returning to campus.
- If you are withheld from campus by the Department of Health through Screen, Test & Protect, you are not permitted to use any on campus facilities. Students attempting to attend campus activities when withheld from campus will be referred to the Dean of Students Office.
- UF Health Screen, Test & Protect offers guidance when you are sick, have been exposed to someone who has tested positive or have tested positive yourself. Visit the UF Health Screen, Test & Protect website for more information.
- Please continue to follow healthy habits, including best practices like frequent hand washing. Following these practices is our responsibility as Gators.

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, 75% for up to 2 days late, 100% beyond 2 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 re-scheduled 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	15%
Quizzes (best 80%)	100 each	15%
Midterm Exam	100	30%
Final Exam	100	30%
Review Paper	100	10%
		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: <http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#grades>

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.ua.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.ua.ufl.edu/public-results/>.

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/policies/student-honor-code-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 broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

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
- Robin Bielling, Director of Human Resources, 352-392-0903, rbielling@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>

Online Course Recording

Our class sessions may be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

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: <http://www.counseling.ufl.edu/cwc>, 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 Resource Center, Reitz Union, 392-1601. Career assistance and counseling. <https://www.crc.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://care.dso.ufl.edu>.

On-Line Students Complaints: <http://www.distance.ufl.edu/student-complaint-process>.