Radiation Interactions and Sources 1
ENU 4605, Class 20694, Section HTNT ,Fall 2025
MW 0830-1025 (UF Periods 2 and 3)
FAC 0120
Final Exam 12/11/2025 0730-0930 in FAC 0120

1 Instructor

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Office Hours: TBD, and by appointment. Beginning and end times of office hours will be enforced strictly. If you would like to meet on Zoom, please send me a message on Teams.

2 Course Description

Four one-hour lectures discussing interaction of ionizing radiation with matter; cross sections and radiation fields with emphasis on photons, heavy charged particles, and electrons.

3 Course Prerequisites

PHY 2049

4 Course Objectives

The course objectives include comprehension and proficiency in the following topics:

- Atomic and nuclear structures, nuclear reactions, and radioactive decay
- Characteristics of different types of radiation
- Interactions between radiation and matter and characterization of radiation fields
- Solving problems that are representative of issues found in the nuclear field

5 Professional Component (ABET)

4 credits of engineering topics

6 Relation to Program Outcomes (ABET)

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics (medium coverage)
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare as well as global, cultural, social, environmental, and economic factors (low coverage)

3. n/a
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts (low coverage)
5. n/a
6. n/a
7. n/a

7 Recommended Textbook

Atoms, Radiation and Radiation Protection
James E. Turner
2007, 3rd edition
ISBN 978-3-527-40606-7
Free PDF available at https://onlinelibrary.wiley.com/doi/book/10.1002/9783527616978
Must be on UF network or UF VPN.
Referred to as (T) in course materials

8 References

Chart of the Nuclides app on iOS/iPadOS or Android
https://apps.apple.com/us/app/chart-of-the-nuclides/id1529624218
https://play.google.com/store/apps/details?id=io.cordova.echart&hl=en_US

Live Chart of the Nuclides
https://www-nds.iaea.org/relnsd/vcharthtml/VChartHTML.html

Fundamentals of Nuclear Engineering
J. Kenneth Shultis and Richard E. Faw
Marcel Dekker, Inc. New York, 2016
ISBN 978-1-498-76929-7
Referred to as (S&F) in course materials

Introduction to Radiological Physics and Radiation Dosimetry
Frank H. Attix
Wiley & Sons, 1986
ISBN 978-0-471-01146-0
Free PDF available at https://onlinelibrary.wiley.com/doi/book/10.1002/9783527617135
Must be on UF network or UF VPN.
Referred to as (A) in course materials

Physics for Radiation Protection

James E. Martin
Wiley & Sons, 2000
ISBN 978-3-527-41176-4
Referred to as (M) in course materials

Nuclear Reactor Physics
Weston M. Stacey
Wiley & Sons, 2018
ISBN: 978-3-527-81230-1
Referred to as (S) in course materials

9 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/

10 Lecture Schedule

Module 1: Introduction
Module 2: Nuclear Physics
Module 3: Radioactive Decay
Module 4: Photon Interactions
Module 5: Charged Particle Interactions
Module 6: Neutron Interactions
Module 7: Dosimetry and Radiation Protection

Date	**Module**	**Due**	**(Lecture #) Topic**	**Reading**
Aug 25	1		(1) Introduction to course	
Aug 27	1		(2) Atomic structure & atomic radiation	(T) Ch. 1 & 2
Sep 1			**Labor Day (No Class)**	
Sep 3	2	HW 1	(3) Flux, nuclear structure, chart of nuclides	(T) Ch. 2 & 3
Sep 8			**UPRM Visit (No Class)**	
Sep 10	2		(4) Binding energy & Q-values	(T) Ch. 3
Sep 15	2		(5) Nuclear equations & α, β, and γ radiation	(T) Ch. 3
Sep 17	3	HW 2	(6) Activity	(T) Ch. 4
Sep 22	3		(7) Radioactive series decay & equilibrium	(T) Ch. 4
Sep 24			(8) Photon attenuation	(T) Ch. 8
Sep 29	4	HW 3	(9) Photoelectric effect	(T) Ch. 8
Oct 1			Exam 1 Review	
Oct 6			**Exam 1 (Modules 1-3)**	
Oct 8			Exam 1 Discussion	
Oct 13	4		(11) Compton scattering	(T) Ch. 8
Oct 15	4		(12) Pair production	(T) Ch. 8
Oct 20	5	HW 4	(13) Heavy charged particles	(T) Ch. 5
Oct 22	5		(14) Electron interactions	(T) Ch. 6
Oct 27	5		(15) Charged particle track phenomena	(T) Ch. 7
Oct 29	6	HW 5	(16) Neutron sources & interactions	(T) Ch. 9
Nov 3	6		(17) Neutron moderation & reactions	(T) Ch. 9
Nov 5	6		(18) Fission & criticality	(T) Ch. 9
Nov 10			(19) Six-factor equation	(T) Ch. 9
Nov 12		HW 6	Exam 2 Review	
Nov 17			(20) Dosimetry and radiation protection	(T) Ch 12 & 13
Nov 19			(21) Dosimetry and radiation protection	(T) Ch 12 & 13
Nov 24 & 26			**Thanksgiving (No Class)**	
Dec 1			**Exam 2 (Modules 4-5)**	
Dec 3			Final Exam Review	
Dec 11			**Final Exam (7:30 am to 9:30 am)**	

10.1 Module Reference Guide

Sometimes you may want to read how more than one reference explains a topic. This section helps you quickly find the relevant topic in other references that I have found useful over the years.

Module 1

- (A) Ch. 1
- (M) Ch. 1 and parts of Ch. 2 and Ch. 3
- (S&F) Ch. 1 and Sections 2.1 through 2.3 and 3.1

Module 2

- (A) Ch. 5
- (M) Parts of Ch. 2, 3, and 4
- (S&F) Ch. 4, Section 3.2, Sections 5.1 through 5.3
- Chart of the nuclides

Module 3

- (A) Ch. 6
- (M) Ch. 5 and Ch. 6
- (S&F) Sections 5.4 through 5.7 and Ch. 9

Module 4

- (A) Ch. 2 and Ch. 3
- (M) Parts of Ch. 7 and Ch. 8
- (S&F) Sections 7.1 and 7.2 and Sections 9.1 through 9.3

Module 5

- (A) Ch. 7
- (M) Parts of Ch. 4 and Ch. 7
- (S&F) Section 7.3

Module 6

- (T) Ch. 9
- (S) Ch. 1 and Ch. 2
- (A) Ch. 16
- (M) Parts of Ch.4 and Ch. 14
- (S&F) Ch. 6 and Sections 7.4 and 10.1 through 10.3

11 Grading

Assessments in this course are worth a total of 1000 points broken down as follows:

- (10) In-Class Quizzes – 250 points (25 each; highest 10 quizzes count)
- (2) During Term Exams – 500 points (250 each)

- (1) Final Exam – 250 points

Grades will be assigned based on the following scale:

- A: 920+ points
- A-: 900 - 919 points
- B+: 880 - 899 points
- B: 800 - 879 points
- C: 700 - 799 points
- E: $<$ 700 points

12 Course Policies

12.1 Attendance

Skip at your own risk. Attendance is not required and is not directly considered in the grade.

Pursuant to HWCOE policy, the following statement is required: Excused absences are consistent with university policies in the undergraduate catalog. https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx and require appropriate documentation.

12.2 Assignments

The following restrictions apply for submission format:

- All assignments must be submitted as a single PDF via Canvas.
- Use pencil or black/dark-blue ink and either white paper (lined or not) or engineering paper. You may typeset your homework using Microsoft Word, LaTeX, or other appropriate typesetting software.
- Use a one-column layout. Each problem should appear beneath the previous or on a new sheet of paper, not next to other problems.
- Submissions, or any part thereof, that are unreadable will earn zero credit.
- Submissions that are only readable with unusual effort, difficulty, or unpleasantness (e.g., text too small to read comfortably, writing too light to see, poor penmanship, etc.) and those that violate the first, second, and/or third bullet point in this list will be subject to a 10% deduction for the first instance, followed by a 30% deduction for the second, and zero credit for the third and further instances. These progressive penalties apply to these issues as a set. For example, a 10% penalty for multiple PDFs will be followed by a 30% penalty for a multi-column layout.

The following restrictions apply for submission deadlines and excused absences:

- Assignments are due by 2359 on the specified date.
- A grace period until 0800 the following day is set for each assignment. Students may submit assignments within this grace period without penalty.
- After 0800 the following day, the assignment closes on Canvas and no submissions are allowed, unless there is an approved excused absence.

- For excused absences, you must contact me via email as soon as conditions permit and provide a reason for your excused absence. I reserve the right to require documentation (except for religious holidays), consistent with university policy. Upon approval of an excused absence, I will modify the "open until" date in Canvas to allow you to make up the assignment.

12.3 Electronic Communication and Course Website

Canvas is used extensively for the course including, but not limited to:

- Distributing and storing the course syllabus, along with any syllabus updates
- Maintaining student grades
- Regular communication with students through announcements
- Providing access to course materials

Microsoft Teams is used for this course including, but not limited to:

- Communication between students and instructor through the "Chat" feature.

12.4 Changes to Syllabus

Changes to this syllabus will be provided via the Canvas platform. Such changes may include those required by policy changes, changes in the speed of course coverage, university closure, or errors in previous syllabus versions.

13 Standardized Syllabus Content

The following statements were required to be inserted into all syllabi by the HWCOE and/or UF. While you may ask me questions about the statements, I may have to refer you to the appropriate UF unit responsible for the statement.

13.1 Academic Policies & Resources

To support consistent and accessible communication of university-wide student resources, instructors must include this link to academic policies and campus resources: `https://go.ufl.edu/syllabuspolicies`. Instructor-specific guidelines for courses must accommodate these policies.

13.2 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, please contact your instructor or any of the following:

- Your academic advisor or Undergraduate/Graduate Program 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

14 Changelog

[1.0] - 2025-08-01

- Original version