

# RADIATION INTERACTIONS BASICS AND APPLICATIONS I (3 CREDITS)

## ENU-6051 Section 002E

**Class Periods:** Tuesday, period 6/7, 12:50 p.m. – 2:45 p.m.  
Thursday, period 6, 12:50 p.m.

**Location:** Room 225, Nuclear Science Center

**Academic Term:** Fall 2016

**Instructor:** William G. Vernetson  
vernet@ufl.edu  
Office Phone Number: N/A

**Office Hours:** Tuesday: 8:15 – 9:45 a.m., Room 237 Nuclear Science Center  
Thursday: 10:00 a.m. – 11:30 a.m., Room 237 Nuclear Science Center  
Other times by appointment

**Teaching Assistants:** none

**Course Description:** Interaction of X-rays, gamma rays, neutrons, and charged particles with matter; radioactive decay, nuclear moments, and nuclear transitions. Applications to basic problems in nuclear engineering sciences (3 Credits),

**Course Pre-Requisites / Co-Requisites:** None specified

### **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.

**Materials and Supply Fees:** Not applicable

### **Required Textbooks and Software**

Various Authors, *Radiation Interaction, Basics and Applications*, University Readers, August, 2016

### **Recommended Materials**

*Radiation, and Radiation Protection*, James E. Turner, 3<sup>rd</sup> Edition, 2007, ISBN 9783-527-40606-7

*Fundamentals of Nuclear Science and Engineering*, J. Kenneth Shultis and Richard E. Faw, 1986, 1<sup>st</sup> Edition, ISBN 0-8247-0834-2

*Physics for Radiation Protection*, James E. Martin, 2000, ISBN 0-471-35373-6

*Introduction to Radiological Physics and radiation Dosimetry*, Frank H. Attix, 1992, ISBN 0-471-01146-0

### **Course Schedule**

**Course Title, Prefix, and Number**  
**Course Instructor and Academic Term**

- Week 1: Characterization of Radiation; Introduction to Modern and Nuclear Physics**
- Week 2: Characterization of Radiation; Introduction to Modern and Nuclear Physics (cont.)**
- Week 3: Characterization of Radiation; Introduction to Modern and Nuclear Physics (cont.)**
- Week 4: Radioactive Decay**
- Week 4: Photon Interactions**
- Week 5: Photon Interactions (cont.)**
- Week 6: Photon Interactions (cont.)**
- Week 7: X-ray Generation**
- Week 7: Heavy Charged Particle Interactions**
- Week 8: Electron Interactions**
- Week 9: Charged Particle Track Phenomena**
- Week 10: Charged Particle Interactions with Matter**
- Week 11: Neutron Interactions**
- Week 12: Neutron Interactions (cont.)**
- Week 13: Neutron Interactions (cont.)**
- Week 14: Accelerator and Medical Applications**

***Attendance Policy, Class Expectations, and Make-Up Policy***

Attendance is expected but will not be specifically marked off. Missing classes will likely cause a student’s grade to suffer because of missed material and/or quizzes. If a student anticipates missing a class, they should have someone pick up handouts or take notes, and let the instructor know beforehand. Otherwise, a student should see the instructor afterward to get any handout material. Or they may have a classmate pick up any handouts for them.

All cell phones, ipods, kindles, etc. should be turned off during class; the only exception is for a note-taking device in which case the instructor must be able to see it too. Failure to follow this requirement may cause the student to be requested to leave the classroom. If a student thinks he/she has an emergency situation that potentially requires communications during class, check with the instructor before class for permission. It is expected that all registered students will pay attention. Students are allowed to arrive late provided they do not disturb others and it does not occur frequently. Students are especially asked to be considerate of others in the class, especially if they must arrive late at some point. Other than asked not to enter because of frequent tardiness, no penalty is assessed for lateness.

Excused absences are consistent with university policies in the undergraduate catalog (<http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#attendance>) and require appropriate documentation.

***Evaluation of Grades***

<b>Assignment</b>	<b>Total Points</b>	<b>Percentage of Final Grade</b>
Homework Sets (~7) and quizzes	About 1000	15%
Midterm Exam 1	100	25%
Midterm Exam 2	100	30%
Final Exam	100	30%
		100%

***Grading Policy***

<b>Percent</b>	<b>Grade</b>	<b>Grade Points</b>
90.0 - 100.0	A	4.00

87.0 - 89.9	A-	3.67
84.0 - 86.9	B+	3.33
81.0 - 83.9	B	3.00
78.0 - 80.9	B-	2.67
75.0 - 79.9	C+	2.33
72.0 - 74.9	C	2.00
69.0 - 71.9	C-	1.67
66.0 - 68.9	D+	1.33
63.0 - 65.9	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 requesting accommodations should first register with the Disability Resource Center (352-392-8565, <https://www.dso.ufl.edu/drc>) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

***Course Evaluation***

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at <https://evaluations.ufl.edu/evals>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/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://www.dso.ufl.edu/sccr/process/student-conduct-honor-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.

***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: <http://registrar.ufl.edu/catalog0910/policies/regulationferpa.html>

***Campus Resources:***

***Health and Wellness***

<b>U Matter, We Care:</b>
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If you or a friend is in distress, please contact [umatter@ufl.edu](mailto:umatter@ufl.edu) or 352 392-1575 so that a team member can reach out to the student.

**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 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](mailto: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://www.dso.ufl.edu/documents/UF\\_Complaints\\_policy.pdf](https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf).

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