

Standardized Syllabus for ENU-6051

ENU-6051 Radiation Interaction Basics and Applications I

1. Catalog Description (including credit hours)
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),
2. Pre-requisites - None
Co-requisites – None
3. 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.
4. Contribution of course to meeting the professional component (N/A)
5. Relationship of course to program outcomes (N/A)
6. Instructor: William G. Vernetson, Ph.D.
 - a. Room 237 Nuclear Science Center
 - b. Telephone: 352-378-1127 (home for messages)
 - c. vernet@ufl.edu
 - d. Class Web site: none
 - e. Office Hours: Tuesdays: 8:30 a.m. – 9:45 a.m.
Thursdays: 10:15 a.m. – 11:30 a.m.
Other times by appointment
7. Teaching Assistant
 - a. Office location – N/A
 - b. Telephone – N/A
 - c. E-mail address – N/A
 - d. Office hours – N/A
8. Meeting Times: Tuesday, Period 6-7, 12:50 – 2:45 p.m.
Thursday, Periods 6, 12:50 p.m. – 1:40 p.m.
9. Class/laboratory schedule, i.e., number of sessions each week and duration of each session – no laboratories
10. Meeting Location: Room 225, NSC

11. Material and Supply Fees: N/A
12. Textbooks Required (no specific software requirement)
 - a. Radiation Interaction, Basics and Applications
 - b. Compiled Selections from Recommended Reading
 - c. August, 2015
 - d. University Readers
13. Recommended Reading
 - a. *Radiation, and Radiation Protection*, James E. Turner, 3rd Edition, 2007, ISBN 9783-527-40606-7
 - b. *Fundamentals of Nuclear Science and Engineering*, J. Kenneth Shultis and Richard E. Faw, 1986, 1st Edition, ISBN 0-8247-0834-2
 - c. *Physics for Radiation Protection*, James E. Martin, 2000, ISBN 0-471-35373-6
 - d. *Introduction to Radiological Physics and radiation Dosimetry*, Frank H. Attix, 1992, ISBN 0-471-01146-0
14. Course Outline
 - a. **Characterization of Radiation; Introduction to Modern and Nuclear Physics (3 Weeks)**
 - **Introduction**
 - **Forces and Energy in Atoms**
 - **Theory of Electromagnetic Radiation**
 - **Nuclear Models**
 - **The Nucleus and Nuclear Radiation Kerma and Radiation Dose**
 - b. **Radioactive Decay (1 Week)**
 - **Radioactive Series Decay**
 - **Radioactive Dating**
 - c. **Photon Interactions (3 Weeks)**
 - **Exponential Attenuation**
 - **Photon Interactions with Matter**
 - **Gamma- and X-Ray Interaction with Matter**
 - **Radiation Shielding and Buildup Factors**
 - d. **Charged Particle Interactions (4 Weeks)**
 - **Heavy Charged Particle Interactions**
 - **Electron Interactions**
 - **Charged Particle Track Phenomena**
 - **Charged Particle Interactions with Matter**
 - e. **X-Ray Generation (1 Week)**
 - f. **Neutron Interactions (3 Weeks)**
 - **Neutron Nuclear Reactions**
 - **Neutron Chain (Fission) Reactions**

g. Accelerator and Medical Applications (1 Week)

- **Accelerators**
- **Medical Applications**

15. Attendance is expected but will not be specifically marked off. Missing classes will 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. are to be turned off during class as if during takeoff from Atlanta; 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 sent from 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 which is not to include working puzzles, texting, tweeting, twittering, or whatever.

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.

16. Grading – methods of evaluation

Homework/quizzes - 10%

Midterm exam 1 -30%

Midterm Exam 2 - 30%

Final exam - 30%

17. Grading Scale

- a. A 90-100
- b. B+ 85-90-
- c. B 80-85-
- d. C+ 75-79+
- e. C 70-75-
- f. D+ 65-69+
- g. D 60-65-
- h. F <60

Grades are not curved significantly, though improvement over the course of the semester and classroom effort may be used to clarify close grade boundaries upwards a point or two. Minus grades may be used for such cases.

“Graduate students need an overall GPA of 3.00 truncated and a 3.00 truncated GPA in their major (and in the minor, if a minor is declared) at graduation.” For more information on grades and grading policies, please visit:

<http://gradcatalog.ufl.edu/content.php?catoid=4&navoid=907#grades>

18. Requirements for class attendance and make-up exams, assignments, and other work are consistent with university policies that can be found at:
<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>

19. 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 (<http://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.

Note that failure to comply with this commitment will result in disciplinary action compliant with the UF Student Honor Code Procedures.

See <http://www.dso.ufl.edu/sccr/procedures/honorcode.php>

20. Accommodation for Students with Disabilities – Students Requesting classroom accommodation must first register with the Dean of Students Office. That office will provide the student with documentation that he/she must provide to the course instructor when requesting accommodation.

21. UF Counseling Services –Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include:

- UF Counseling & Wellness Center, 3190 Radio Rd, 392-1575, <http://www.counseling.ufl.edu/cwc/Default.aspx>, counseling services and mental health services.
- Career Resource Center, Reitz Union, 392-1601, career and job search services.

University Police Department 392-1111

22. Software Use – All faculty, staff and student 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.

23. Students are expected to provide feedback on the quality of instruction in this course based on 10 criteria. These evaluations are conducted online at <https://evaluations.ufl.edu>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are <https://evaluations.ufl.edu/results>. “