Nuclear and Radiation Engineering Laboratory

EGN 4505L Section 1488
Class Periods: T, 3-4, and TR, 3-4
Location: NSC214 (lecture) and Rhines 115
Academic Term: Spring 2020

Instructor:
Yong Yang
yongyang@ufl.edu
352-846-4791
Office Hours: Monday, period 3-4 (9:35-11:25am), Wednesday, period 3 (9:35-10:25am), Rhines Hall, 202A

Teaching Assistants:
Please contact through the Canvas website

- N/A, however, UFTR staff may lead some of the laboratory exercise.

Course Description
A laboratory experience integrating practical applications of radiation sources and generators, radiation interactions and transport through matter, radiation detection, and other non-destructive technologies. Students select appropriate forms of radiation and detection methods to design solutions for specific nuclear and radiation engineering problems.

Course Pre-Requisites / Co-Requisites

ENU 4605 Interaction of Radiation with Matter
ENU 4612 Nuclear Radiation Detection and Instrumentation

Course Objectives
Provide both academic and hands-on experience of applications of radiation in industry. Laboratory exercises will be conducted within the framework of non-destructive testing and evaluations (NDE) using a variety of radiation sources including radioisotopes, machine generated x-rays, reactor generated neutrons, and several forms of non-ionizing radiation. Basic lab exercises will introduce the students to fundamental techniques in NDE and reactor operations. Advanced lab exercises will require the students to select appropriate forms of radiation and detection methods to design solutions to specific NDE problems.

Materials and Supply Fees
There is a laboratory fee of $59.12

Professional Component (ABET):

1. Graduates will have successful careers in Nuclear Engineering and related disciplines.
2. Graduates will pursue continuing education or advanced degrees.

Relation to Program Outcomes (ABET):

Outcome	Coverage*
1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	L
2. an ability to apply engineering design to produce solutions that meet specified needs with	L

consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	
3. an ability to communicate effectively with a range of audiences	H
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	
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	M
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	H
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.	M

*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not covered or assessed in the course.

Required Textbooks and Software

None. I will post materials from time to time for you to download off the course page.

Recommended Materials

Recommended Reading

1. Glenn F. Knoll, *Radiation Measurement and Detection*, 3rd Ed., Wiley and Sons, 1999.
2. Albert Macovski, *Medical Imaging Systems*, Prentice-Hall, 1983.
3. Jerrold T. Bushberf, J. Anthony Seibert, Edwin M. Leidholdt, Jr., and John M. Boone, *The Essential Physics of Medical Imaging*, Williams & Wilkins, 1994.
4. John G. Proakis and Dimitris G. Manolakis, *Digital Signal Processing: Principles, Algorithms, and Applications*, 3rd Ed., Prentice-Hall, 1996.

Recommended Texts and Support to Assist with Report Writing

1. Sheldon Jeter and Jeffery Donnell, "*Writing Style and Standards in Undergraduate Reports,*" College Publishing, 2004.
2. The Mayfield Handbook of Technical and Scientific Writing (available at http://www.mhhe.com/mayfieldpub/tsw/toc.htm). *Excellent resource and free!*
3. Writing standards for a variety of Nuclear and Radiological Engineering related journal publications, including Nuclear Instruments and Methods, IEEE Transactions on Nuclear Science, Nuclear Technology, and Journal of Health Physics. These are available on the web, but I can provide you with copies by request).
4. The University of Florida Reading and Writing Center is also available to help students become better readers and writers. More information (including operating hours) can be found at http://www.at.ufl.edu/rwcenter.

Course Schedule

Date		**Lecture Topic**	**Lab/Homework Topic for that Week**
January	7	Introduction Eddy Current Testing	
			Lab 1: Eddy Current Testing (group 1)
	14	Radiation Worker Training (Part 19) (prepare for 2nd Person Training Quiz)	Lab 1: Eddy Current Testing (group 2)
	21	Ultrasonic Testing	Lab 2: Ultrasonic and Acoustic Emission (group 1)
			Lab 2: Ultrasonic and Acoustic Emission (group 2)
	28	HPGe Detector Calibration	Lab 3: Detector Calibration and Activity Concentration Calculations (group 1)
			Lab 3: Detector Calibration and Activity Concentration Calculations (group 2)
February	4	Inverse Multiplication and Approach to Criticality	
			Lab 4: Approach to Criticality
	11	Neutron Activation Analysis I: Induced Radioactivity	
			Lab 5: Neutron Activation Analysis I – Induced Radioactivity
	18	Radiographic Imaging Digital Imaging Fundamentals and Transformations	
			No Lab This Week, but Digital Imaging Fundamentals Homework
	25	Control Blade Worth I	Lab 6: Blade Worth Measurements I – Rod Drop Method
			Lab 6: Blade Worth Measurements I – Rod Drop Method
March	3	**No Class – Spring Break**	
			No Lab – Spring Break
	10	Control Blade Worth II	
			Lab 7: Blade Worth Measurements II – Positive Period Method
	17	Temperature Coefficient Hot Channel Factors	

			Lab 8: Temperature Coefficient & Hot Channel Factors
	24	Infrared and Thermal Imaging	
			Lab 9: Thermal Imaging
	31	Neutron and X-Ray Radiography	
April	7	Neutron Activation Analysis II	
			Lab 10: Neutron Activation Analysis II – Isotope ID and Activity Calculations
	14	**No Class – Prepare for Design Class**	
			No Lab This Week
	21	Class Wrap and Review	
May	1	**Final Exam (10:00 - 12:00 PM)**	

Attendance Policy, Class Expectations, and Make-Up Policy

Students are expected to attend each class period. Periods which may be missed should be brought to the attention of the Instructor as far in advance of the class period as possible. In the event of an unexcused absence, it is the student's responsibility to obtain and review the material that was covered during that class period. Students MUST participate in each laboratory exercise and produce an individual laboratory report on six laboratory exercises. This statement is required: Excused absences must be consistent with university policies in the undergraduate catalog (https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx) and require appropriate documentation.

Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade
Course Attendance		10%
Homework and Quizzes**	100 each	20%
Lab Reports	100 each	50%
Final Exam	100	20%
Total		100%

**There will be 4 or 5 homework sets and quizzes (combined) during the course. Quizzes will be based advanced lab preparation. Homework sets will be due one week after completion of the laboratory experiment. Training quizzes will also be considered as part of grades.

Grading Policy

Percent	Grade	Grade Points
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:
https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

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.

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

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 suppor*t*, 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://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf.

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