Syllabus For College Of Engineering

ENU 4505L: Nuclear and Radiation Engineering Laboratory

1. Catalog Description

A laboratory experience integrating practical applications of radiation sources and generators, radiation interactions and transport through matter, and radiation detection. Students select appropriate forms of radiation and detection methods to design solutions for specific nuclear and radiation engineering problems. (3 credits)

2. Pre-requisites for ENU 4505L:

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

3. Course Objectives

Provide both academic and hands-on experience of applications of radiation in industry. Laboratory exercises will include non-destructive testing and evaluations (NDE) using a variety of radiation sources including radioisotopes, subcritical multiplication, 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 detection methods to design solutions to specific problems.

4. ABET Program Outcomes Supported by Course:

This course supports the following program outcomes:

b1. An ability to design and conduct experiments
b2. an ability to interpret data
c. An ability to develop an engineering design to meet specific technical requirements within realistic constraints such as economic, environmental, heath and safety, and reliability
d. An ability to function on multidisciplinary skills teams
j. A knowledge of contemporary issues as they relate to professional engineering practice
m. An ability to measure and interpret measurements of nuclear and radiological processes

5. Instructor

Ms. K. L. Goluoglu, Lecturer, 232 Nuclear Sciences Center
(865) 719-0521 klgoluoglu@mse.ufl.edu
Office Hours: Monday-Friday, Periods 6-7 (12:50-2:45), or by appointment.
Note: Office hours may change due to class and lab schedules.

6. Teaching Assistant

TBD

7. Meeting Times

Periods 3-4 (9:35 – 11:30 AM) on Tuesdays and Thursday
Lab Sections will be determined during the first day of class.

8. Class Schedule

Two (2) 2-hour class periods each week (Tuesday and Thursday). Tuesdays will generally be devoted towards lecture, and Thursdays will be the associated experiment. Depending on class size, additional laboratory sections can be scheduled on other days of the week. These lab sections will be discussed during the first day of class.

Note: There may be Thursday lectures during the semester.

9. Meeting Location

Tuesdays: Nuclear Science Building, Room 227 Laboratories: NSC 125, or UFTR

10. Material and Supply Fees

N/A

11. Textbooks Required

None [However, class notes will be provided throughout the course.]

12. Tentative Course Outline

Date	Topic/Lab
6-Jan	Introduction- expectations, syllabus, schedule
8-Jan	Lecture: Inverse Multiplication and Approach to Criticality
13-Jan	Lecture: Radiation Safety
15-Jan	NO CLASS
20-Jan	Activity- Setting up the Subcritical Assembly
22-Jan	Lab: Approach to Criticality
27-Jan	Lecture: Control Blade Worth
29-Jan	Lab: Blade Worth Measurements
3-Feb	Lecture: HPGe Detector Calibration
5-Feb	Lab: Detector Calibration and Activity Concentration Calculations
10-Feb	Lecture: Neutron Activation Analysis I: Induced Radioactivity
12-Feb	Lab: Neutron Activation Analysis I – Induced Radioactivity
17-Feb	Lecture: Neutron Activation Analysis II
19-Feb	Lab: Neutron Activation Analysis II – Isotope ID and Activity Calculations
24-Feb	Lecture: Temperature Coefficient Hot Channel Factors
26-Feb	Lab: Temperature Coefficient & Hot Channel Factors
10-Mar	Lecture: Advanced Scintillation Detector Properties
12-Mar	Lab: Scintillation Detector Property Measurements
17-Mar	Lecture: Radiography for Non-Destructive Testing and Inspection Protocols
19-Mar	Lab: Digital Radiography and Design of Flaw Inspection Protocols
24-Mar	Lecture: Ultrasonic Testing
26-Mar	Lab: Ultrasonic and Acoustic Emission
31-Mar	Lecture: Eddy Current Testing
2-Apr	Lab: Eddy Current Testing
7-Apr	Group Projects
9-Apr	Group Projects
14-Apr	Group Projects
16-Apr	Group Projects
21-Apr	Final Exam

Note: Course material and schedule may change due to equipment/facility availability; advanced warning if this is to be the case. Course schedule may also change due to conferences/travel.

For the Spring 2015 Semester, the UFTR will not be available. However, data were obtained from previous reactor experiments. For these labs, the course will review the experiment, how data were obtained, and analyze results/calculate operating parameters (aka, “dry lab”). These labs are to be written up just like any other lab report. The “dry labs” are indicated in red in the tentative schedule. If available, the UF subcritical assembly will be used.

13. Attendance and Expectations

Students are required to attend each lecture period and their assigned lab section. Periods that 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 seven laboratory exercises.

14. Grading

Attendance 10%, Lab Reports 60%, Group Project- 15%, Final Exam 15%

Group Projects

In addition to the six lab reports, each student must participate in a group project and contribute to a group report on that project. Students will be formed into groups on the first day of class. Students will be able to choose from a set of experiments, choosing one for their group to perform and document. The group reports will have a similar format to the regular lab reports, but will be of an extended length (maximum 4000 words). The reports will be graded according to the report rubric provided, with each student being given the same group grade.

Final Exam

A 2-hour final exam will take place on **Tuesday, April 21** during class. This exam will be closed book - closed note and will test the knowledge you should have acquired during the experiments and lectures alike. It will be a combination of multiple choice, diagram drawings, basic calculations, and short answer questions.

Lab Reports

Each student will be required to write six (6) lab reports during the course. The due date for the reports is **5 PM on the day exactly one week after the experiment**. No due date extensions shall be granted. **There is a maximum limit of 2000 words per report. This word limit does not include the abstract or appendices.** The content and format of the lab reports is described below. This format and content is similar to the format for a peer-reviewed professional publication, and the grading rubric is discussed below.

As mentioned, the student is required to write six reports during the semester (not including the group project). However, the course will perform ~ten experiments. It is left to the student to choose which labs to write reports for. Each student MUST write six lab reports. Please see the notes below style and content to help you prepare your reports.

1) The **audience** is a nuclear engineer, unfamiliar with the experiment. This implies:

a) Explain **what** was done for each part of the lab. This does not mean a step-by-step description of the procedure, but rather a description of the general measurement. If a setup diagram makes the experiment clearer, then include one in the **body** of the report.
b) Explain **why a** particular measurement was taken. Provide a conceptual (and possibly theoretical) description of the experiment. The reader will require this knowledge so that he/she may understand the measured results.
c) Drawing from the conceptual description of each measurement, **predict** the expected result.
d) Present the result, with **quantitative** measures of its accuracy (e.g. percent)
e) **Analyze** the result. Address both the **magnitude** of the deviation and its **direction** (i.e. Is the measured number greater than or less than the proper result?).

*The report should concentrate on the **analysis** of the results, not the results themselves. The particular number that is measured is less important than the ability to communicate a complete description of the experiment.*

2) Figures (Drawings and Plots)

a) The goal is to make the reports as understandable as possible. Therefore, use drawings liberally.
b) Do not turn in a report with pencil drawings on it. If the best way to make a drawing is by hand (most of the time, it is not), then photocopy the report after the drawing is added and turn that in (so that the drawing and text will be the same in color and consistency).
c) When making plots, use a software package such as MS Excel, SigmaPlot, or the like. Include axes labels (with units) and label each of the figures in the report.

3) Formal writing (textbook style).

a) Do not use a conversational tone (i.e. write in complete sentences, do a spell check)
b) Do not write in the first person.

4) The Appendix is supplemental to the report. Do not expect it to be read. If you want the reader to see something, then put it in the body of the report.

Successful Completion of Gordon Rule Writing Requirements

Your writing will be evaluated on a number of criteria: Content, Organization, Argument and Support, Style, and Mechanics. In order to be a successful writer (and therefore receive a Satisfactory evaluation for your writing/communication requirements), please look over the following guidelines on satisfactory completion of Gordon Rule Writing requirements for this course. The student must earn an S (satisfactory) evaluation on the writing requirements of the course.

Gordon Rule Writing Requirements		
	SATISFACTORY (Y)	**UNSATISFACTORY (N)**
CONTENT	Papers exhibit at least some evidence of ideas that respond to the experiment/laboratory topic with complexity, critically evaluation the results, and provide at least an adequate discussion with basic understanding of experiment.	Papers either include a central discussion that is unclear or off-topic or provide only minimal or inadequate discussion of the experimental results. Papers may also lack sufficient or appropriate discussion of the results, with little or no tie-in with the underlying theory.
ORGANIZATION AND COHERENCE	Documents and paragraphs exhibit at least some identifiable structure for topics, including a clear thesis statement but may require readers to work to follow progression of ideas. Figures, tables and graphs are used in a logical manner to properly explain results, with these items being placed within a logical manner/progression of the experimental result. An outside nuclear engineer should be able to understand your report, and be able to repeat at least some of the experiment.	Documents and paragraphs lack clearly identifiable organization, may lack any coherent sense of logic in associating and organizing ideas, and may also lack transitions and coherence to guide the reader. Poor use of figures, graphs, and tables do not provide any cohesion with the discussion in the report.
ARGUMENT AND SUPPORT	The reports use persuasive and confident presentation of ideas, strongly supported with experimental evidence (including comparisons with what your theoretical expectations). At the weak end of the Satisfactory range, documents may provide only generalized discussion of the experimental results or may provide adequate discussion but rely on weak support for arguments.	Documents make only weak generalizations, providing little or no support, as in summaries or narratives that fail to provide critical analysis. No crucial comparisons with the underlying theory of the experimental results.

Gordon Rule Writing Requirements		
	SATISFACTORY (Y)	**UNSATISFACTORY (N)**
STYLE	Documents use a writing style with word choice appropriate to the context, genre, and discipline. Sentences should display complexity and logical sentence structure. At a minimum, documents will display a less precise use of vocabulary and an uneven use of sentence structure or a writing style that occasionally veers away from word choice or tone appropriate to the experiment/topic. Figures, tables and graphs follow an appropriate style/format, and that style is used consistently throughout the document. For additional information on style and format, I will provide you with sample reports. In addition, you can consult the writing formats for a variety of publications, including Nuclear Instruments and Methods in Physics Research, IEEE Transactions on Nuclear Science, or Journal of Health Physics.	Documents rely on word usage that is inappropriate for the context, genre, or discipline. Sentences may be overly long or short with awkward construction. Documents may also use words incorrectly. Figures, tables and graphs are poorly constructed with little adhesion to a consistent format.
MECHANICS	Reports will feature correct or error-free presentation of ideas. At the weak end of the Satisfactory range, reports may contain some spelling, punctuation, or grammatical errors that remain unobtrusive so they do not muddy the paper's argument or points.	Papers contain so many mechanical or grammatical errors that they impede the reader's understanding or severely undermine the writer's credibility.

Grading Rubric for ENU 4505L Reports

The grading rubric for the reports is provided below. This paper format is based on the format for professional journal publications; these guidelines will be provided to the class. All reports are graded out of 100 points. Both technical and grammatical correctness will be considered to determine the grade.

Section	Content	Points
Abstract	A brief description of the objective of the experiment, the results achieved, and the major conclusions. 50-100 words.	**5**
Introduction	Introduce the subject; summarize the fundamentals necessary to understand the paper. The introduction is NOT an extended version of the abstract- do not use the same sentences in both sections.	**5**
Theory	Include a summary (1-2 paragraphs) on the basic theory of the experiment.	**5**
Experimental Procedure and Setup	A past tense description of the steps followed, in your own words. Describe the experiment so that another researcher could reproduce it. If reference is made to handouts, and place these handouts in an appendix. If applicable, include a block diagram for the experiment. If applicable, include a table listing all equipment and any necessary settings for each piece of equipment.	**5**
Results and Analysis	Are all results required by the procedure presented and discussed? Is all data present? Note: large data sets should be included in the Appendix Are the results explained IN YOUR OWN WORDS? Figures, tables and graphs are used in a logical manner to properly explain results, with these items being placed within a logical manner/progression of the experimental result. Is error analysis included for applicable data? The report uses persuasive and confident presentation of ideas, strongly supported with experimental evidence (including comparisons with what your theoretical expectations). Since you already performed the experiment, write in past tense.	**40**
Conclusions and Summary	A summary of the **major** results of the lab. Did you accomplish the goals and how did your results compare to	**5**

Section	Content	Points
	the expected behavior? Did the data support the theory? This should be verified with the major results and % error values from the experiment. The reader should get all the important results and major findings of your work from the conclusion (the details should be in the Results and Analysis section). A conclusion section should be able to stand on its own. Do not repeat sentences from the Abstract, Introduction, and the Results sections. It should summarize the most important results, their novelty, advantages, and limitations. Here you may also mention planned future work and/or recommendations to others.	
Style	Documents use a writing style with word choice appropriate for nuclear engineers. Figures, tables and graphs follow an appropriate style/format, and that style is used consistently throughout the document. Fonts are consistent throughout the document Page numbers are included in the document, and are at the same location on each page. Documents and paragraphs exhibit at least some identifiable structure for topics, including a clear thesis statement	**15**
Grammar and Spelling	Clear evidence that the paper was proofread by the student prior to submission for grading. No spelling mistakes! Proper use of verb tense. Normally, when discussing the experiment, use past tense. Adequate grammar style (no run-on sentences, proper paragraph format, proper sentence structure, etc.)	**15**
Other	Proper referencing of information that is not considered common knowledge (use a standard referencing format). When in doubt, provide a reference. DO NOT LIST references unless they are cited in the document. Are appendices included, and properly referenced within the main document?	**5**
Total Score		**100**

15. Grading Scale

The grading scale is as follows:

93-100 A, 90-92 A-
87-89 B+, 83-86 B, 80-82 B-
77-79 C+, 73-76 C, 70-72 C-
67-69 D+, 63-66 D, 60-62 D-
0-59 E

Note: this scale may be adjusted by a couple of points depending on specific topics covered and difficulty.

16. Make-up Exam Policy

Make-up lab sessions or exams are only allowed through prior requests or DOCUMENTED medical reasons. In cases where students will be out of town, a reasonable attempt to perform the lab before the scheduled date will be performed.

17. Honesty Policy

All students admitted to the University of Florida have signed a statement of academic honesty committing themselves to be honest in all academic work and understanding that failure to comply with this commitment will result in disciplinary action. This statement is a reminder to uphold your obligation as a UF student and to be honest in all work submitted and exams taken in this course and all others.

18. 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.

19. UF Counseling Services

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

- - University Counseling Center, 301 Peabody Hall, 392-1575, Personal and Career Counseling.
- - SHCC mental Health, Student Health Care Center, 392-1171, Personal and Counseling.
- - Center for Sexual Assault/Abuse Recovery and Education (CARE), Student Health Care Center, 392-1161, sexual assault counseling.
- - Career Resource Center, Reitz Union, 392-1601, career development assistance and counseling.

20. 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.