

**Applied Radiation Protection**  
ENU 4641C

***Class Periods and Locations:*** M,W,F, Period 5, 11:45 a.m. – 12:35 p.m.  
Location is NEB, Room 0102

***Academic Term:*** Spring 2021

***Instructor:***

Dr. Donald Wall

[Donald.wall@ufl.edu](mailto:Donald.wall@ufl.edu)

Phone: 273-2662

Office Hours: Monday 2:00 p.m. – 4:00 p.m.

Wednesday, 2:00 p.m. – 4:00 p.m.

Additional times are available by appointment.

Room 311, Materials Engineering Building (MAE)

***Teaching Assistants:***

none

***Course Description***

Two one-hour lectures of introduction to practical radiation protection techniques and practices, including laboratory experiences. Examination of pertinent regulations, current practice, ethics and instrumentation and measurement practices. Design of facilities and controls to optimize benefits of radiation applications and minimize exposure risks.

***Course Pre-Requisites***

ENU 4605 with a minimum grade of C and ENU 4630

***Course Objectives***

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

- evaluate appropriate means of radiation protection
- evaluate biological effects of radiation
- Use legal criteria to establish radiation protection procedures

The course objectives will be addressed by means of:

- textbook study
- lecture material that will compliment and clarify the textbook material
- provide examples of applications, including some in-class problem solving exercises
- homework problems, with emphasis on problems that have applications in the field

***Materials and Supply Fees***

none

**Professional Component (ABET):**

3 credits of engineering topics.

**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.	High
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.	medium
3. an ability to communicate effectively with a range of audiences.	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	Medium
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	n/a
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.	n/a
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies	High

\*Coverage is given as high, medium, low or not applicable.

**Required Textbooks**

- Introduction to Health Physics
- Thomas E. Johnson
- 2017
- ISBN 9780071835268
  
- The Health Physics Solution Manual
- Thomas E. Johnson
- 2018
- ISBN 9781929169054

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**Dr. Donald Wall, Spring 2021**

## ***Recommended Materials***

Electronic versions of documents or sources of electronic versions will be provided on an as-needed basis.

## ***Course Schedule***

The class meeting times are:

Monday, Wednesday, Friday, Period 5, 11:45 a.m. – 12:35 p.m.

Location: NEB, Room 0102

Final exam:

April 30, 2021

7:30 a.m. – 9:30 a.m.

Location: TBA. The location will be assigned as required by the UF policy and will presumably be in NEB, Room 0102, unless circumstances or official policy leads to an alteration of the location or time. The location and time will be confirmed and announced ahead of time.

The textbook content will serve as an outline for the topics in this course. There will be six assignments, six quizzes, a term paper and two exams during the semester and one final exam.

The general approach to grades and performance assessment will be to use a larger number of diagnostics (mostly quizzes) and assignments where each component has a relatively low impact on the overall grade which will mean that proportionally less weight will be placed on exams. The intent is to prevent the situation where there is a disproportional weight attached to a single exam or to the final exam. This approach will reduce the consequences of having a “bad day” on any particular assignment, quiz or exam. Everyone has bad days from time to time, and it is my idea that a single bad day should not outweigh consistent performance.

The day-to-day outline of lecture coverage is a draft form and may be subject to change. The assignment deadlines will not be moved forward, but may be moved back. Exam dates will not change unless required by UF schedule.

**Important:** The material in Chapters 1 – 5 in the textbook has been covered in prior courses and will not be reviewed in this course. Accordingly, you are independently responsible for *all* of the material in Chapters 1 – 5. Review Chapters 1 – 5 if necessary and work the end of the chapter problems as needed.

We will cover in detail Chapters 6 – 11 and some sections from the *Code of Federal Regulations*.

Dates	Subject	Reading	Assignments Due	Quiz Date
Week of Jan. 11	Syllabus and course policies. Introduction	Ch. 6		
Week of Jan. 18	Monday, January 18 – university holiday – no classes		A1, Jan. 22	
Week of Jan. 25		Ch. 7		Q1 Jan. 25
Week of Feb. 1			A2, Feb. 5	
Week of Feb. 8	Exam 1, Ch. 6 & 7, Feb. 12	Ch. 8 CFR		Q2 Feb. 8
Week of Feb. 15			A3, Feb. 19	
Week of Feb. 22		Ch. 9		Q3 Feb. 22
Week of Mar. 1		Ch. 10		Q4 Mar. 3
Week of Mar. 8	Exam 2, Ch. 8 & 9, Mar. 12		A4, Mar. 8	
Week of Mar. 15	Hot cell Group 1, Mar. 19		A5, Mar 19, HC Gp. 1	Q5 Mar. 17
Week of Mar. 22	No class on Mar. 24 – Recharge day Hot cell Group 2, March 26	Ch. 11	A5, Mar 26, HC Gp. 2	
Week of Mar. 29	No class on Apr. 2 Hot cell Group 3, March 31		A5, Mar 31. HC Gp. 3	
Week of Apr. 5	Hot cell Group 4, Apr. 9		A5, Apr. 9 HC Gp. 4	Q6 Apr. 7
Week of Apr. 12	Hot cell Group 5, Apr. 16		A5, Apr. 16, HC Gp. 5	
			A6, Apr. 12, Everyone	
			Term paper due, Apr. 12	
Week of Apr. 19	Class as scheduled, Apr. 19 Reading Days Apr. 22 & 23			
April 30	Final Exam			

A# refers to Assignment number

Q# refers to quiz number

Other reading material will be made available as .pdf documents or will be directed to relevant websites.

**Note:** People have reported to me that there are errors in the textbook and the solutions manual. I know that there are errors in the earlier editions of this textbook and I have not yet had time to work through all the problems in this edition. Consequently, I cannot say definitively whether or not the errors persist. Please bear that in mind when working through the problems and studying the solutions manual. There is nothing I can do about the errors that may exist other than find them and

point them out; in spite of the fact that there might be errors, the text nevertheless is well written and is one of the more “user friendly” resources.

## ***Quizzes, Assignments and Exams***

There will be six quizzes. Each quiz will be one or more problems taken directly from the end of each chapter. The quizzes will be closed book. Upon finishing the quiz you can then self-assess using the solutions manual.

There will be six assignments spaced throughout the course schedule. One of the assignments will be to successfully carry out a task in the hot cell facility at UFTR. The assignment is referred to as A5 in the schedule table. The A5 assignment is due on the date for each particular group as indicated in the schedule table.

## ***Term Paper***

This course has a writing requirement eligibility of 2000 words under the Gordon Rule.

Students will be required to write a term paper during the semester. Each individual must write their own paper. The paper must be on a topic in the field of radiation protection. The paper will be due on April 12. Substantial penalties will result from plagiarism and data falsification including course failure. Grades will be based upon the descriptions in the requirements table.

## **Requirements**

The following requirements must be met:

- No more than 20 pages and no fewer than 10 pages, excluding title page, figures and tables. Anything beyond 20 pages will not be considered.
- The paper must contain at least 2000 words to satisfy the Gordon rule.
- Single spaced, Times New Roman 12 point or Calibri 12 point or Arial 11 point or Cambria 11point font.
- 1 inch margins
- Each paper shall have a minimum of 5 references from peer-reviewed journal publications.
- Each paper must have at least six tables and figures (any combination). These can be generated by you, or from your references.

## **Details for Term Paper Writing**

1. Your audience members are nuclear engineers, knowledgeable but possibly unfamiliar with your topic.
2. Figure presentation
  - a. The goal is to make the paper as understandable as possible. Therefore, use figures liberally.
  - b. Do not turn in a report with drawings on it. Hand drawings for figures will not be accepted.

3. Use a software package such as MS Excel, SigmaPlot, or the like to make plots. Include axes labels (with units) and label each of the figures in your report.
4. Formal writing
  - 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.
5. An Appendix is supplemental to the report and will count toward the page limit.

### **Successful Completion of Gordon Rule Writing Requirements**

You receive 2,000 word credit for this course. The writing will be evaluated on the criteria that are listed in the grading criteria table, which include 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. Review the table below for a description on how the reports will be graded. Reports are worth 30 points toward the final grade. Note that both technical and grammatical correctness are used in determination of the grade.

## Term Paper Grading Criteria

The grading rubric is based upon the five categories that are listed in the table. The term paper is worth 30 points toward the final grade and each of the categories are equally weighted, i.e. six points for each category. The criteria in each category must be satisfied to receive full credit for the associated category.

Category	Criteria
Content	<ol style="list-style-type: none"><li>1. Exhibit analysis that provides critical evaluation the subject.</li><li>2. Discuss strengths and weaknesses.</li><li>3. Suggest where there can be improvements...what steps should be taken next.</li></ol>
Organization and Coherence	<ol style="list-style-type: none"><li>1. Paragraphs and the narrative exhibit appropriate structure, including a thesis statement when appropriate.</li><li>2. Figures, tables and graphs are used in a logical manner to explain results.</li><li>3. A knowledgeable person should be able to understand the paper.</li><li>4. The amount of review or background information is minimal.</li></ol>
Argument and Support	<ol style="list-style-type: none"><li>1. The text use provides explanation of the principle(s) that are the focus of the work.</li><li>2. Well-organized <i>specific</i> analysis of the results, data, figures and tables.</li><li>3. At the weak end of the Satisfactory range, the text provides a generalized discussion of the results, data, figures or tables.</li></ol>
Style	<ol style="list-style-type: none"><li>1. Documents use a writing style that is appropriate to the context and type of the paper.</li><li>2. Sentences should display logical order of presentation of concepts, principles, data, etc.</li><li>3. Figures, tables and graphs follow an appropriate format (e.g. consistent font, figure captions, axes labels) and the format is used consistently throughout the document. Refer to formats that are featured in textbooks or journal publications for examples.</li></ol>
Mechanics and adherence to structure requirements.	<ol style="list-style-type: none"><li>1. Reports will feature correct, error-free spelling, punctuation, or grammatical errors.</li><li>2. No more than 20 pages and no fewer than 10 pages, excluding title page, figures and tables.</li><li>3. Single spaced</li><li>4. Times New Roman or Calibri 12 point font or Arial or Cambria 11 point font.</li><li>5. 1 inch margins.</li><li>6. A minimum of 5 references from reliable or peer-reviewed sources or publications. Wikipedia (and many internet) sources do not count. Be cautious when referencing internet sources.</li><li>7. At least six tables and figures (any combination). These can be generated by you, or from your references.</li></ol>

***F2F Course Policy in Response to COVID-19***

We will have face-to-face instructional sessions to accomplish the student learning objectives of this course. In response to COVID-19, the following policies and requirements are in place to maintain your learning environment and to enhance the safety of our in-classroom interactions.

- You are required to wear approved face coverings at all times during class and within buildings. Following and enforcing these policies and requirements are all of our responsibility. Failure to do so will lead to a report to the Office of Student Conduct and Conflict Resolution.
- This course has been assigned a physical classroom with enough capacity to maintain physical distancing (6 feet between individuals) requirements. Please utilize designated seats and maintain appropriate spacing between students. Please do not move desks or stations.
- Sanitizing supplies are available in the classroom if you wish to wipe down your desks prior to sitting down and at the end of the class.
- Follow your instructor's guidance on how to enter and exit the classroom. Practice physical distancing to the extent possible when entering and exiting the classroom.
- If you are experiencing COVID-19 symptoms (Click here for guidance from the CDC on symptoms of coronavirus), please use the UF Health screening system and follow the instructions on whether you are able to attend class. Click here for UF Health guidance on what to do if you have been exposed to or are experiencing Covid-19 symptoms.

Course materials will be provided to you with an excused absence, and you will be given a reasonable amount of time to make up work. Find more information in the university attendance policies.

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

Attendance is not used to determine grades. Changes of exam, quiz or assignment due dates as a result of absence will be in accordance with UF policy.

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.

**Makeup Exam Policy.** Students who need to miss an exam due to extenuating circumstances and who wish to take a makeup exam will be required to provide evidence that it is necessary to miss the exam. Missing an exam without prior notice will only be excused under documented and compelling circumstances. Makeup exams will not be permitted if the instructor is not notified of the circumstances within 48 hours after the exam has been given. Makeup exams will only be given under the direct supervision of the instructor. A makeup exam shall be scheduled within 72 hours of the original exam time, unless there are documented and compelling circumstances and in accordance with University policy.

Use of electronic devices for any reason other than immediate course-related purposes is prohibited. This includes cell-phone use, texting, checking email, internet use and similar activities. Laptops may be used to take notes or for specific course-related purposes as authorized by the instructor. Laptops may not be used for other purposes such as checking email or internet use. A person who commits an infraction will be required to leave the classroom for the remainder of the day.

**Late assignments.** Late assignments *will not be accepted* unless compelled by written UF policy. All assignments must be submitted through the Canvas system. Note that Canvas flags assignment submittal times, and flags assignments that are submitted after the due date and time. Some people wait until the last 15 minutes or so before the due time (this happens more frequently than one might think), which is usually at 11:59 p.m. on the due date. This is unwise in the case that something goes wrong, such as unexpected loss of internet. Late assignments *will not be accepted even if it is late by only a few minutes*.

**Submission of assignments.** All assignments are to be submitted via Canvas.

*The term paper is to be submitted as both a paper copy and an electronic upload to Canvas. The two documents, namely the paper copy and the electronic copy must be identical.*

**Legibility.** Assignments or portions of assignments, and exams that are illegible will receive zero credit. It is true that some people have poor handwriting. If that is the case, write slower, find a way to improve legibility and consult with the instructor for possible solutions. Please provide a sample of your writing to get an opinion if you are not sure whether or not it is legible. As a guideline, difficult to read (or messy) = illegible. *Assignments that are illegible will receive zero credit.*

Assignments that are handwritten must be submitted on lined paper, whether it is a hard copy or a scanned copy. Leave blank lines between sections, sets of calculations, etc., so the logic is straightforward to follow. Credit will be withheld if it is difficult to figure out or decipher the steps. Or messy. Think of it this way: sloppy work is not tolerated in the workplace. Some supervisors take a hard line on this.

## ***Evaluation of Grades***

<b>Assignment</b>	<b>Points per Category</b>
Assignment Sets (6 assignments, 15 pts. Each)	90
Quizzes (6 quizzes, 10 pts. each)	60
Exam 1	20
Exam 2	20
Term Paper	30
Final Exam	30
Total	250

## ***Grading Policy***

<b>Percent</b>	<b>Grade</b>
93 - 100	A
90 - 92.9	A-
86 - 89.9	B+
83 - 85.9	B
80 - 82.9	B-
76 - 79.9	C+
73 - 75.9	C
70 - 72.9	C-
60 - 69.9	D
< 60	E

Scores for quizzes, assignments, exams and the term paper that are posted on Canvas are for your reference, but are not official grades.

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 professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.aa.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluer.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-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](mailto:rbielling@eng.ufl.edu)
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, [taylor@eng.ufl.edu](mailto:taylor@eng.ufl.edu)
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, [nishida@eng.ufl.edu](mailto: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](mailto: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](mailto: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 support**, 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](https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf).

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