

## ENU 6623 - RADIATION DOSIMETRY

- Objective:** To provide an introduction to radiation dosimetry with special applicability to health physics and medical physics.
- Description:** Radiation dosimetry quantities and units, internal dosimetry – radiation protection, internal dosimetry – diagnostic and therapeutic nuclear medicine, alpha and electron dosimetry, external dosimetry for photons and neutrons, medical radiation dosimetry of the patient.
- Textbook:** Richard E. Faw and J. Kenneth Shultis  
*Radiological Assessment: Sources and Exposures*  
American Nuclear Society (1999)  
ISBN 0-89448-455-9 (Order at [www.ans.org/store](http://www.ans.org/store))
- Handouts:** Various NCRP, ICRP, ICRU, and MIRD Documents and Reports
- Instructor:** Dr. Wesley E. Bolch, 205 NSC, 392-1401 ext. 308, [wbolch@ufl.edu](mailto:wbolch@ufl.edu)  
Office Hours: MWF 9:30 am - noon
- Homework:** Reading assignments will be given every week. Understanding of the material will be assessed by periodic in-class quizzes. Homework assignments will be given biweekly. Late assignments will be subject to a 20% per day reduction in grade.
- Exams:** All tests will be closed book. You will be expected to know the material well, and therefore you must put forth a reasonable effort to learn the material. If you need assistance, please ask for it.

### Grade Distribution:

Exam 1	15%	<b>Monday</b>	<b>February 27</b>	<b>6-9 pm</b>
Exam 2	15%	<b>Wednesday</b>	<b>April 5</b>	<b>6-9 pm</b>
Exam 3	15%	<b>Monday</b>	<b>May 1</b>	<b>6-9 pm</b>
Quizzes	5%			
Homework	30%			
Term Paper	15%			
Oral Presentation	5%			

## Course Schedule by Topic

### 1. Radiation Dosimetry Quantities and Units

- Review of radiation interactions and their coefficients
- Energy imparted, energy transferred, and net energy transferred
- Absorbed dose and kerma
- ICRP 30 internal dosimetry quantities
- ICRP 60 internal dosimetry quantities
- Operational dosimetry quantities for external exposures

### 2. Internal Radiation Dosimetry – Radiation Protection

- Reference individuals – ICRP 23 and ICRP 89
- Anatomic models of the human body – stylized and tomographic
- Retention equations – ICRP 30
- Excretion equations – ICRP 30
- Recycling biokinetic models – ICRP 30+
- Respiratory tract anatomy and physiology
- ICRP 30 Lung model
- ICRP HRTM (ICRP 66) – Particle deposition, clearance, and dosimetry
- Gastrointestinal tract anatomy and physiology
- ICRP 30 GI tract model and the ICRP HATM (to be published)
- Skeletal anatomy and physiology – ICRP 70
- ICRP 30 bone model and later refinements
- Age-dependent doses to members of the general public
- Computer codes and applications - LUDEP / IMBA

### 3. Internal Radiation Dosimetry – Diagnostic and Therapeutic Nuclear Medicine

- MIRD methodology for internal dose – MIRD Primer
- Compartmental modeling – MIRD Pamphlet 12
- Methods of radionuclide localization and quantification – MIRD Pamphlet 16
- Radionuclide therapy and radioimmunotherapy
- Bone marrow dosimetry methods – patient-specific dosimetry
- Computer codes and applications – SAAM II and MIRDOSE / OLINDA

### 4. Alpha Particle and Electron Dosimetry

- LET and range-energy relationships for alpha particles
- Methods of estimating beta spectra
- Dose point kernel methodology
- Computer codes and applications - User Written Codes

### 5. External Dosimetry – Photons and Neutrons

- Photon point dose from un-collided particles
- Photon point dose included buildup
- Neutron dose and shielding
- Organ and effective dose from external photon and neutron sources – ICRP 74
- Computer codes and applications - MCNP

### 6. Medical Radiation Dosimetry

- Diagnostic radiology
- Diagnostic and interventional fluoroscopy
- Computed tomography
- Dose to the embryo and fetus – external and internal exposures
- Computer codes and applications – CT and radiography dose calculators

## Course Schedule by Date

<i>Date</i>	<i>Course Topic</i>	<i>Book Chapter</i>	<i>Lecturer</i>	
<b>January</b>	9	Course Goals and Objectives		
	11	Radiation Dosimetry Quantities and Units	1 and 2	
	13	Radiation Dosimetry Quantities and Units	1 and 2	
	16	<b>No Class – Holiday</b>		
	18	Radiation Dosimetry Quantities and Units	1 and 2	
	20	Radiation Dosimetry Quantities and Units	1 and 2	
	23	Internal Radiation Dosimetry – Radiation Protection	8	
	25	Internal Radiation Dosimetry – Radiation Protection	8	
	27	Internal Radiation Dosimetry – Radiation Protection	8	
	30	Internal Radiation Dosimetry – Radiation Protection	8	
	<b>February</b>	1	Internal Radiation Dosimetry – Radiation Protection	8
		3	Internal Radiation Dosimetry – Radiation Protection	8
		6	Internal Radiation Dosimetry – Radiation Protection	8
		8	Internal Radiation Dosimetry – Radiation Protection	8
10		Internal Radiation Dosimetry – Radiation Protection	8	
13		Internal Radiation Dosimetry – Radiation Protection	8	
15		Internal Radiation Dosimetry – Radiation Protection	8	
17		Internal Radiation Dosimetry – Radiation Protection	8	
20		Internal Radiation Dosimetry – Nuclear Medicine	Handouts	
22		Internal Radiation Dosimetry – Nuclear Medicine	Handouts	
24		Internal Radiation Dosimetry – Nuclear Medicine	Handouts	
<b>Exam 1 March</b>		27	Internal Radiation Dosimetry – Nuclear Medicine	Handouts
		1	Internal Radiation Dosimetry – Nuclear Medicine	Handouts
	3	Internal Radiation Dosimetry – Nuclear Medicine	Handouts	
	6	Alpha Particle and Electron Dosimetry	7	
	8	Alpha Particle and Electron Dosimetry	7	
	10	Alpha Particle and Electron Dosimetry	7	
	13	<b>No Class - Spring Break</b>		
	15	<b>No Class - Spring Break</b>		
	17	<b>No Class - Spring Break</b>		
	20	Alpha Particle and Electron Dosimetry	7	
	22	Alpha Particle and Electron Dosimetry	7	
	24	Alpha Particle and Electron Dosimetry	7	
	27	External Dosimetry – MCNP	6	
29	External Dosimetry – MCNP	6		
31	External Dosimetry – MCNP	6		

**April**  
**Exam 2**

3	External Dosimetry – MCNP	6	Lee
5	External Dosimetry – Photons and Neutrons	6	Bolch
7	External Dosimetry – Photons and Neutrons	6	Bolch

### Course Schedule by Date (continued)

<b>Date</b>		<b>Course Topic</b>	<b>Book Chapter</b>	<b>Lecturer</b>
<b>April</b>	10	External Dosimetry – Photons and Neutrons	Handouts	Bolch
	12	External Dosimetry – Photons and Neutrons	Handouts	Bolch
	14	External Dosimetry – Photons and Neutrons	Handouts	Bolch
	17	External Dosimetry – MCNP	Handouts	Bolch
	19	Medical Radiation Dosimetry	Handouts	Bourke
	21	Medical Radiation Dosimetry	Handouts	Bourke
<b>Papers Due</b>	24	Medical Radiation Dosimetry	Handouts	Bourke
	26	Medical Radiation Dosimetry	Handouts	Bourke
<b>Resubmit</b>	28	<b>Oral Presentations – Friday, April 28, 2006</b>		
<b>May</b>	1			
<b>Exam 3</b>				

### TERM PAPER

Students must select a topic for a term paper and oral presentation. Please select your first, second, and third choices and meet with Dr. Bolch as soon as possible to reserve a topic. You may have an alternative topic that is of more interest to you. If so, please select an appropriate title and discuss it with me. **All papers should have a dosimetry (internal or external) component to them.**

The term paper should be written in a technical style suitable for publication in the journal *Health Physics* or *Medical Physics*. Use the instructions to authors as a guide. In addition, review a copy of the journal to determine format, structure, etc. A portion of your grade for the paper will be determined by your ability to prepare the paper correctly and to write properly. The paper must be in the range of 10-15 pages of double-spaced text excluding the title page and any figures or tables. All papers should contain at least 5 journal articles, 2 tables, and 2 figures. Late papers will be subject to a 20% per day reduction in grade.

Your term paper will be reviewed just as is done with a journal article submission. You will then be required to write the "journal editor" a response along with a corrected manuscript. A portion of your paper grade (~15%) will be made according to your responsiveness to the reviewer's comments.

The oral presentation should be based on your paper. Focus on interesting aspects of the paper as it will not usually be possible to cover your entire topic in the oral presentation. Structure your talk to include an introduction, the body of the talk, and a summary. Talks will be limited to 12 minutes and will be followed with 3 minutes for questions. Your grade will be influenced by you ability to stay within the time constraints, the quality of your presentation, and your ability to answer questions.

<b>Term Papers Submitted</b>	<b>Friday, April 21 at 4:30 pm</b>
<b>Term Papers Returned</b>	<b>Monday, April 24 via email</b>
<b>Term Paper Resubmitted</b>	<b>Friday, April 28 via email</b>
<b>Oral Presentations</b>	<b>Friday, April 28 from 8 am - noon</b>