

**CEDAR CREST COLLEGE**  
**Bio 342 – Radiation Biology**  
**Spring 2010**

**RADIATION BIOLOGY**

The properties of radiation, its detection and measurement and its pathological and therapeutic effect upon the living system will be presented.

**MEETING TIME**

**Lecture:** MWF 10:00 – 10:50 AM  
SC 106

**Lab:** Tues. 8:00 – 11:00 AM  
SC 100  
Lehigh Valley Hospital  
St. Luke's Hospital

**INSTRUCTOR:** Brian S. Misanko, Ph.D.  
Office: SC 114  
Voice-mail: 610-606- 4666 ext 3516  
E-mail [bsmisank@cedarcrest.edu](mailto:bsmisank@cedarcrest.edu)

**TEXT: Nuclear Medicine and Pet/CT: Technology and Techniques, 6th Ed** by Christian et.al.

**COURSE OBJECTIVES:**

1. To understand basic principles of nuclear physics.
2. To become aware of radiation detectors and instrumentation utilized to measure radioactivity.
3. To become proficient in the use of practical mathematics used in radiation biology.
4. To comprehend the biological effects of radiation.
5. To learn radiation safety, protection and regulations.

## **COURSE OUTCOMES:**

1. Students will demonstrate critical analysis and quantitative reasoning in solving practical mathematics in radiation biology.
2. Students will demonstrate the ability to communicate clearly and effectively, both orally and through the written word by class and laboratory participation and completing exams.
3. Students will demonstrate basic knowledge in nuclear physics, instrumentation, radiation safety and radiation biology through class and laboratory participation and exams.

## **EVALUATION:**

There will be three (3) 50-minute exams and a final exam. Each exam will include material previously discussed prior to the exam. All questions will be multiple choice, short answer, or essay. All tests will include mathematics problems that pertain to understanding the physics of radiation biology. Exams may cover material presented in class, readings from the textbook or handout material, which may or may not have been discussed in class.

Lecture exams	600 pts
Lab reports/Clin.Obs.	180 pts
Final Exam	220 pts

## **NO MAKE –UP EXAMINATIONS WILL BE GIVEN DURING THE SEMESTER**

In the case that one if the lecture exams are missed for any reason, including illness or emergency, the final examination grade (percentage) will be substituted for the missed exam grade. Additional exams that are missed will be assigned a grade of 0.

## **CLASSROOM PROTOCOL AND HONOR CODE**

Appropriate classroom behavior is implicit in the Cedar Crest College Honor Code. Such behavior is defined and guided by complete protection for the rights of all students and faculty to a courteous, respectful classroom environment. That environment is free from distractions such as late arrivals, early departures, inappropriate conversations and any other behaviors that might disrupt instruction and/or compromise student's access to their Cedar Crest College education.

As your instructor, I fully support the Honor Code described in the Cedar Crest College Customs Book. I expect adherence to this code and I provide here some elaboration with respect to this course:

## **Examination Procedure**

Students shall submit only work which is their own. They shall maintain responsible academic conduct during a class, test or examination: they shall neither seek nor receive aid from another student, nor use materials that are not authorized by the instructor.

## **Preparation of Papers**

In preparing papers, students must follow the instructions of the professor. **Copying material or failing to cite references properly is plagiarism.**

## **Personal Electronic Equipment**

All personal electronic equipment must be turned off and stored away during classroom instruction.

No personal electronic equipment will be allowed in the student's possession while taking an examination.

Electronic equipment includes but not limited to: cell phones, I-pods, blackberries and palm pilots.

## SCHEDULE

### I. NUCLEAR PHYSICS

Text : pp. 39-58, Handout

Jan.	20	Introduction – Energy Levels
	22	Radiation
	25	Beta Decay
	27	Gamma Decay
	29	Decay Schemes
Feb.	1	Decay (Text: pp.10-14)
	3	Decay/Half-life
	5	Half-life
	8	Interactions with matter (Text: pp.14-16)
	10	Interactions
	<b>12</b>	<b>Review</b>
	<b>15</b>	<b>TEST I</b>

### II. INSTRUMENTATION

Text: pp. 59-67

Feb.	17	Gas-Filled Detectors
	19	Scintillation Detectors
	22	Photomultiplier Tube
	24	Gamma-Ray Spectroscopy
	26	Gamma Camera (Text: 68-72)
Mar.	1	Tomography (Text: 80-85)
	3	SPECT (Text: 267-282)
	5	PET (Text: 314-329)
	<b>8 -12</b>	<b>Spring Break</b>
	15	CT (Text: 344-356)

### III. PRODUCTION OF NUCLIDES

Text: pp. 165-191, Handout

Mar.	17	Fission
	19	Nuclear Reactors
	<b>22</b>	<b>TEST II</b>
	24	Production
	26	Generators
	29	Radiopharmaceuticals

#### **IV. RADIATION, EXPOSURE AND PROTECTION**

Text: pp. 193-220, Handout

	31	Units
Apr.	<b>2-5</b>	<b>BREAK</b>
	6, 7	Dosimetry
	9	MPD
	12	Safety Regulations

#### **V. BIOLOGICAL EFFECTS**

Text: pp.220-224, Handout

Apr.	14	Basic Interactions –Cells
	16	Cell Survival Curves
	19	Biological Systems
	21	Acute Radiation Syndrome
	<b>23</b>	<b>TEST III</b>
	26	Somatic Effects
	28	Organ Changes
	30	Embryo and Fetus
May	3	Genetic Effects

#### **VI. RISKS VS BENEFITS**

	5	Risks /Benefits
		Summary and Review

**FINAL**

**RADIATION BIOLOGY  
LABORATORY  
CLINICAL OBSERVATION  
TUESDAY 8:00 -11:00AM**

Jan. 19		Orientation - Interviews
Jan. 26		Interviews
Feb. 2	A	Lehigh Valley Health Network (LVHN)
	B	St. Luke's Hospital (SLH)
Feb. 9		Plotting a Geiger-Muller Plateau Background Effects
Feb. 16	A	SLH
	B	LVHN
Feb. 23		Absorption of Beta and Gamma
Mar. 2	A	LVHN
	B	SLH
<b>Mar. 9</b>		<b>Spring Break</b>
Mar. 16		Inverse Square Law (Text pp. 4-5) Back scattering
Mar. 23	A	SLH
	B	LVHN
Mar. 30		Resolving Time, Efficiency (Text pp. 67-68)
Apr. 13	A	Complete Clinical Observations
	B	
Apr. 20		Molecular Nuclear Medicine
Apr. 27		Lehigh Valley Hospital Orientation
May 4		Journal Club

## Clinical Observation

### **OBJECTIVES:**

1. To gain a basic understanding of how radiation is utilized for the purpose of diagnostic medical imaging in Nuclear Medicine.
2. To learn what the role of the nuclear medicine technologist is.
3. To observe radiation safety, protection and regulations in practice.

### **CLINICAL COORDINATORS:**

Kathy Sanders, CNMT  
St Luke's Hospital  
801 Ostrum Street  
Bethlehem, PA 18105  
(610) 954-4884  
[sanderk@slhn.org](mailto:sanderk@slhn.org)

Kathy Hoffert, CNMT, RT (N)  
Lehigh Valley Health Network  
1200 S. Cedar Crest Boulevard  
Allentown, PA 18103  
(610) 402-7500  
[kathleen.hoffert@lvh.com](mailto:kathleen.hoffert@lvh.com)

### **DRESS CODE:**

You must wear a lab coat at all times in the clinical setting. If you do not bring one along with you to the hospital, you will not be allowed into the department. No jeans are allowed. Casual, professional attire only.

### **REQUIREMENTS:**

1. Be on time. If you are not able to attend due to illness you must call the hospital to which you were assigned to report off.
2. When attending LVH, report to the Nuclear Medicine classroom first.  
When attending SLH, report to Kathy Sanders' office.
3. You will be assigned a pocket dosimeter to measure any radiation exposure you may receive during your observation time. You will need to provide your date of birth and social security number for mandatory record keeping.
4. You will be assigned to shadow one of our current nuclear medicine technology students. This student will provide any guidance that you may need during your visit to the hospitals.
5. Ask questions!!!
6. Keep a journal of your clinical observations
7. For non-nuclear medicine majors, 12 hours of clinical observations are required. For nuclear medicine majors, 20 hours of clinical observation are required. 12 hours will be done during the lab times assigned and an additional 8 hours needs to be scheduled with the clinical coordinators.

## **CLINICAL OBSERVATION JOURNAL:**

This journal is worth 100 points and should include:

1. (7) mandatory procedures: (70 points)
  - a. whole body bone scan
  - b. limited/multi bone scan
  - c. SPECT bone scan
  - d. thyroid uptake and scan
  - e. perfusion lung scan
  - f. myocardial perfusion imaging with exercise
  - g. myocardial perfusion imaging with drug enhancement
2. Any additional procedures observed (10 points)
3. Describe what nuclear medicine technology is and the role of radiation in this diagnostic medical imaging modality. (5 points)
4. Describe what the role of the nuclear medicine technologist is. (5points)
5. Describe the ways in which you observed radiation safety practices in the clinical setting. (5 points)
6. What is ALARA. (5 points)

The documentation that we will be looking for when you observe a procedure include:

Name of the study  
Indications for the study  
Any pertinent patient history needed to be obtained  
Contra-indications for the study  
Patient preparations  
Dose administered  
Camera used  
Technique and procedures followed



## SCHEDULE OF HOSPITAL VISITS

Feb. 2	St Luke's Hospital Lehigh Valley Hospital	Group B Group A
Feb 16	St Luke's Hospital Lehigh Valley Hospital	Group A Group B
Mar. 2	St Luke's Hospital Lehigh Valley Hospital	Group B Group A
Mar 23	St Luke's Hospital Lehigh Valley Hospital	Group A Group B
Apr. 27	Complete Clinical Observations	

Group A  
Lucy Mikhael  
Amanda Koenig

Group B  
Michael Friend  
Caitlyn Beiswenger