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


**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 of 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.
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
12 Review
15 TEST I

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)
8 -12 Spring Break
15 CT (Text: 344-356)

III. PRODUCTION OF NUCLIDES
Text: pp. 165-191, Handout

Mar.
17 Fission
19 Nuclear Reactors
22 TEST II
24 Production
26 Generators
29 Radiopharmaceuticals
IV. RADIATION, EXPOSURE AND PROTECTION
Text: pp. 193-220, Handout

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

Kathy Hoffert, CNMT, RT (N)  
Lehigh Valley Health Network  
1200 S. Cedar Crest Boulevard  
Allentown, PA 18103  
(610) 402-7500  
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. (5 points)

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
<table>
<thead>
<tr>
<th>Date</th>
<th>Hospital 1</th>
<th>Group 1</th>
<th>Hospital 2</th>
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<td>Group B</td>
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<tr>
<td>Apr. 27</td>
<td>Complete Clinical Observations</td>
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**Group A**
- Lucy Mikhael
- Amanda Koening

**Group B**
- Michael Friend
- Caitlyn Beiswenger