Medical Physics 463 Syllabus, Fall 2013

Course Title: Radioisotopes in Medicine and Biology

Instructors: BT Christian, PA Ellison, RJ Nickles

Lecture Room: 1028 WIMR

Credits: 2-3

Frequency: Lecture: MW : 1:20-2:10PM Lab: Tuesday: 1-4PM

Course Description: This is a multidisciplinary course on the applications of radioisotopes in biomedical sciences with particular emphasis on the basic science underpinnings of nuclear medicine. The lectures in this course are organized into five sections: (1) the basic physics of nuclear science - atomic and nuclear structure, nuclear stability, radioactivity, interactions of radiation with matter, nuclear reactions and radionuclide production, (2) the principles of radiation detection and measurement - detection and electronics, counting systems and statistics, (3) the biological and chemical aspects of radioisotope use including tracer principles, radiopharmaceuticals, mechanisms of localization and radiopharmacy, (4) nuclear medicine instrumentation - principles and use of imaging devices and (5) the current clinical practice of general, neurologic and cardiologic nuclear medicine from the viewpoint of nuclear medicine physicians. The concluding lecture will describe current research that will influence future clinical practice. After taking this course, the student will have a better appreciation of the scope and limitations of the use of radioisotope techniques in medical imaging.

Main Text:


For further reading:


The Atomic Nucleus, Evans, R., 1955, Mcgraw-Hill.
Grading:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem Sets</td>
<td>15%</td>
</tr>
<tr>
<td>Exams</td>
<td>30% (15% each)</td>
</tr>
<tr>
<td>Final Exam</td>
<td>25%</td>
</tr>
<tr>
<td>Lab Grade</td>
<td>20%</td>
</tr>
<tr>
<td>Project</td>
<td>10%</td>
</tr>
</tbody>
</table>

Session Date | Reading | Topic

**PHYSICS OF NUCLEAR MEDICINE**

1. Sept. 4   CSP 1  Introductory Remarks and Background
2. Sept. 9   CSP 2  Basic Atomic and Nuclear Physics
3. Sept. 11  CSP 3  Nuclear Stability, Modes of Radioactive Decay
4. Sept. 16  CSP 4  Radioactive Decay, Chemical Effects of Decay
5. Sept. 18  CSP 5  Radionuclide Production
6. Sept. 23  CSP 5  Nuclear Reactions

**RADIATION DETECTION AND MEASUREMENT**

7. Sept. 25  CSP 6  Interaction of Radiation with Matter
8. Sept. 30  CSP 7/8  Prof. Nickles Lecture
9. Oct. 2    CSP 8  Exam #1
12. Oct. 16  CSP 11/12  Counting Systems
13. Oct. 21  CSP 13/14  Gamma Camera

**NUCLEAR IMAGING DEVICES**

14. Oct. 23 CSP 15  Image Quality
15. Oct. 28 CSP 16,17  Reconstruction / SPECT
16. Oct. 30 CSP 18  PET
17. Nov. 4   CSP 19  Exam #2

**BIOLOGY AND CHEMISTRY OF NUCLEAR MEDICINE**

18. Nov. 6   CSP 20  Radiotracer Kinetic Modeling
19. Nov. 11  CSP 21  Radiotracer Techniques
20. Nov. 13  CSP 22  Radiopharmaceuticals, Mechanisms of Localization
21. Nov. 18  CSP 23  Current Radiopharmacy Practice
22. Nov. 20  CSP 24  Radiopharmaceutical Research and Development

**CLINICAL USE OF RADIOISOTOPES**

23. Nov. 25 CSP 25  Neuroimaging – Dr. Lance Hall
24. Nov. 27 CSP 26  Therapeutic Uses of Radioisotopes – Dr. Thomadsen**
25. Dec. 2    CSP 27  No Class – Go to RSNA
26. Dec. 4 CSP 28  Radionuclide Cardiac Imaging – Dr. C. Stone**
27. Dec. 9 CSP 29  Review for Final
28. Dec. 11 CSP 30  Last Day of Class – Final Exam
MP 463: Radioisotopes in Medicine and Biology Lab

Instructors: RJ Nickles (rnickles@wisc.edu), BT Christian (bchristian@wisc.edu)

Laboratory Room: B1072 WIMR

Credits: 1

Hours: Tuesday: 1-4PM

Course Description: The purpose of this laboratory course is to give students hands-on experience with the tools used by nuclear medicine doctors, physicists, and researchers. The laboratory topics cover basic nuclear measurement and spectroscopy techniques, computational tools for modeling kinetics of radiotracer uptake, and the usage of simplified clinical SPECT and PET imaging detectors. Effort has been made to time the laboratory topics to coincide with the lecture material.

Schedule:

9/10 - Safety Meeting in 1190 WIMR

9/17 - Measuring

9/24 - No lab

10/1 - Spectroscopy

10/8 - No lab

10/15 - Kinetics modeling

10/22 - γ-camera

10/29 - No lab

11/5 - Stone-aged PET scanner

11/12 - Walking tour of hospital