

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:

Physics in Nuclear Medicine, Cherry S.R., Sorenson J.A. and Phelps M.E. (CSP), 3rd Edition, 2003, Saunders Inc., Philadelphia, PA.

For further reading:

Nuclear and Radiochemistry, Friedlander, Kennedy, Macias and Miller (F), 3rd ed., 1981, John Wiley.

Positron Emission Tomography and Autoradiography: Principles and Applications, Phelps, Mazziotta and Schelbert eds.(PMS), 1986, Raven press.

The Atomic Nucleus, Evans, R., 1955, Mccraw-Hill.

Grading:	Problem Sets	– 15%
	Exams	– 30% (15% each)
	Final Exam	– 25%
	Lab Grade	– 20%
	Project	– 10%

Session Date	Reading	Topic
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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		Prof. Nickles Lecture
9	Oct. 2		Exam #1
10	Oct. 7	CSP 7/8	Radiation Detectors/Electronics
11	Oct. 9	CSP 9	Nuclear Counting Statistics
12	Oct. 14	CSP 10/11	Pulse-Height Spectrometry / Radiation Measurement
13	Oct. 16	CSP 11/12	Counting Systems
14	Oct. 21	CSP 13/14	Gamma Camera

NUCLEAR IMAGING DEVICES

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

BIOLOGY AND CHEMISTRY OF NUCLEAR MEDICINE

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

CLINICAL USE OF RADIOISOTOPES

24	Nov. 25		Neuroimaging – Dr. Lance Hall
25	Nov. 27		Therapeutic Uses of Radioisotopes – Dr. Thomadsen**
	Dec. 2		No Class – Go to RSNA
26	Dec. 4		Radionuclide Cardiac Imaging – Dr. C. Stone**
27	Dec. 9		Review for Final
28	Dec. 11		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