

HARVARD MEDICAL SCHOOL JOINT PROGRAM IN NUCLEAR MEDICINE

COURSE OUTLINE 2020

Course Title: Physics & Instrumentation in Nuclear Medicine

**Course Instructor(s)
& Contact Information:**

Course Directors:

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Objective(s):

To provide a firm understanding of radiological physics as applied to nuclear medicine and a thorough understanding of how nuclear medicine instrumentation works.

Criteria for Successful Completion of This Course

Factors determining successful completion of the course are:

- completion of all homework assignments and lab reports,
- attendance at lectures and labs, participation in class discussions
- passing the mid-term and final exams (minimum score of 75).

Textbook:

Physics in Nuclear Medicine, Fourth Edition, Cherry, Sorenson & Phelps, Saunders, 2012.

Lecture Location(s):

ZOOM or Thorn Building Hollenberg Conference Room – 3rd Floor

<https://partners.zoom.us/j/3620415227?pwd=dm1CenJnOE1tQmdCS3B2ZW1LUVFKdz09>

Meeting ID: 362 041 5227

Passcode: JPNM2020

Course Schedule

Time: 8:00 – 9:00 AM

Day	Date	Topic	Instructor
Fri	8/7/2020	Atomic Structure and Nuclear Structure (Chap. 2)	G. El Fakhri
Mon	8/10/2020	Charged particle & Photon interactions (Chap. 6)	M. Wilks
Fri	8/14/2020	Modes of Radioactive Decay (Chap. 3)	M.F. Kijewski
Mon	8/17/2020	Decay of Radioactivity (Chap. 4)	M.F. Kijewski
Fri	8/21/2020	Problem Set 1 - Atomic Structure, Charged Particles, Photon Interactions	M.F. Kijewski
Mon	8/24/2020	Radiation Detectors (Chap. 7)	A. Konik
Fri	8/28/2020	Detection and Measurement, Counting Systems (Chap. 12)	M.F. Kijewski
Mon	8/31/2020	Survey meters, dose, exposure	M. Wilks
Fri	9/4/2020	Problem Set 2 - Radiation Detectors, Dose, Exposure, Counting Stats	G. El Fakhri
Mon	9/7/2020	Labor Day– No Lecture	
Fri	9/11/2020	Pulse-height spectroscopy (Chap. 10)	M.F. Kijewski
Mon	9/14/2020	Nuclear Counting Statistics (Chap.9)	M. Palmer
Fri	9/18/2020	Gamma Camera, Collimators (Chap. 13)	K Grogg
Mon	9/21/2020	Lab 1 - All Day - Hot Lab Measurements	Palmer & Kijewski
Fri	9/25/2020	Gamma Camera QC (Chap. 14)	A. Konik
Mon	9/28/2020	Problem Set 3 - Gamma Cameras	A. Konik
Fri	10/2/2020	Gamma Camera artifacts	A. Konik
Mon	10/5/2020	Tomography 1 (Chap 16)	G. El Fakhri
Fri	10/9/2020	Mid-Term	M.F. Kijewski
Mon	10/12/2020	Columbus Day – No Lecture	
Fri	10/16/2020	Tomography 2 (Chap 16)	M. Wilks
Mon	10/19/2020	SPECT (Chap 17) and SPECT QC	K. Grogg
Fri	10/23/2020	Image Quality in NM (Chap 15)	A. Konik
Mon	10/26/2020	Problem Set 4 – Tomo/SPECT	M. Wilks
Fri	10/30/2020	Lab 2 - All Day - Gamma Camera/SPECT	Palmer & Kijewski

Mon	11/2/2020	Basics of CT (Chap 19)	M.F. Kijewski
Fri	11/6/2020	PET 1 (Chap 18)	G. El Fakhri
Mon	11/9/2020	PET 2 (Chap 18)	G. El Fakhri
Fri	11/13/2020	Artifacts in PET	G. El Fakhri
Mon	11/16/2020	Problem Set 5 – PET and PET/CT	G. El Fakhri
Fri	11/20/2020	Quantitation and Lesion Detection in SPECT and PET	M. Palmer
Mon	11/23/2020	Dynamic imaging and Tracer Kinetic Modeling (Chap 21)	M. Wilks
Fri	11/27/2020	Day After Thanksgiving – No Lecture	
Mon	11/30/2020	Internal Dosimetry (Chap 22)	G. El Fakhri
Fri	12/4/2020	Lab 3 - All Day - PET	Kijewski
Mon	12/7/2020	Review for Final	M.F. Kijewski
Fri	12/11/2020	FINAL EXAM	M.F. Kijewski

**PHYSICS & INSTRUMENTATION -- FALL 2020
COURSE POLICIES AND PERFORMANCE EVALUATION**

General Course Policies

The overall goal of this course is give you the physical and technical background information that will assist you with a better understanding how nuclear medicine works. The specific topics that will be covered are listed in the course syllabus. The instructors involved in this course are committed to helping you reach this better understanding. Please do not hesitate to contact any of us if there is any concept that you do not fully understand or if you have any questions or concerns regarding the course. If there any questions regarding these policies, please contact one of the course directors (Georges El Fakhri at 617-726-9640 or Mi-Ae Park at 617-525-3039).

1. It is clear from the course syllabus that we are presenting a sizeable amount of material in a limited amount of time. **For this reason, your attendance at all components of the course including class discussion sessions, problem sessions, and lab experiments is mandatory, and, therefore, attendance will be recorded. In addition, classroom sessions will begin promptly at 8:00 AM, and thus punctuality is also mandatory.**

2. Discussion/lecture sessions: Students are expected to carefully read the assigned textbook sections and any additional handouts prior to class. Page numbers of the required reading in the text will be shown on the Course Schedule at www.jpnm.org. It may also be helpful to note any sections of the readings that are not fully understood and may require additional classroom discussion. Please ask questions in class! The more interactive these sessions are, the more effective the educational experience.

3. Homework: Homework is an educational tool that helps to solidify the understanding of the material covered in the assigned readings and the classroom discussions. The homework will

consist of a mixture of problems to be solved as well as several multiple-choice questions that test basic facts about the topics discussed. In many cases, the instructors will provide some generous hints about how to do some of the homework problems on the day they are handed out. You will typically have at least one week to complete the homework sets. The class discussion on the day the sets are due (typically Monday) will be dedicated to reviewing the problems and the methods used to solve them. Please try to do the homework problems first by yourself, but if you have trouble with some of the problems, then feel free to discuss them with another fellow. **If you have some major conceptual problem about one or more homework problems, PLEASE contact one of the course directors or any of the course instructors as soon as possible and we will be very happy to meet with you to try to clear things up!** Please don't feel embarrassed or intimidated. **We all strongly believe that there is no such thing as a stupid question and if there is an issue that you do not understand, most likely other students are confused as well!** During the homework session, please grade your work and give us your grade as it will count towards your homework grade.

4. Tutorial sessions: If there is any topic covered in course with which you do not feel comfortable, please contact one or more of the physics instructors (for example, the physicist at the institution you might currently be working). In addition, if there is a topic with which the entire class feels needs to be covered in more detail, we can arrange a special session. Please get in touch with us even if only to tell us that you think the physics material is easy, you understand all of it, and you don't have any questions! These casual, informal meetings will also provide valuable feedback to the instructors on how everyone is doing in the course so we can make adjustments, if necessary.

5. Labs: Four lab experiments will be completed this semester and will be conducted on weekdays when you will be excused from your clinical duties. We will generally do the experiments in the morning and you will have the afternoon to write up your lab reports, which should be submitted the same day. **As with the class and problem sessions, a lot of material will be covered in the lab in a limited amount of time, thus your attendance and punctuality are mandatory.** Since the whole day is freed for the lab, **reports are due at the end of the lab day.** Reports are to be individually prepared although discussion of the experiments and results are strongly encouraged.

Performance evaluation

Lecture Participation: 10% of grade, based on attendance and participation in in-class discussions. Attendance and punctuality for lectures are mandatory. Students should come to class having read any assigned readings or handouts, prepared to partake in discussion of topics to be covered.

Homework: 20% of grade, based on attendance and participation in homework review sessions, and instructors' impressions of your understanding of how to do the problems based on your grading of your own work.

Mid-term and final exams: 25% for the mid-term and 25% for the final; These exams mostly consist of short-answer-style questions, although there could also have some multiple-choice and true-false questions, as well as one or two problems that require simple math calculations. Class attendance is factored into the midterm and final tests.

Labs and lab write-ups: 20% of grade