HARVARD MEDICAL SCHOOL
JOINT PROGRAM IN NUCLEAR MEDICINE

COURSE OUTLINE
2022

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

Passing course grade: minimum 75 (see performance evaluation section below).

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

Lecture Location and Time 8:00 - 9:00 am In-person (preferred) in the Touchdown Conference Room on L1 at BWH (see map on page 6). Zoom will only be used for the residents unable to join in-person or if the instructor preferers to teach remotely (via Zoom).

Lab time Zoom link will be provided by Danielle Ogarro prior to each session.
7:30-10:30 am

Course Schedule

Time: 8:00 – 9:00 AM

Day	Date	Topic	Instructor
Fri	8/5/2022	Atomic and Nuclear Structures, Charged particle, and Photon interactions (Chap. 2 and 6)	M.F. Kijewski
Mon	8/8/2022	Modes of Radioactive Decay and Radioactivity (Chap. 3 and 4)	M.F. Kijewski
Fri	8/12/2022	**Problem Set 1 -** Atomic Structure, Charged Particles, and Photon Interactions	K. Grogg
Mon	8/15/2022	Radiation Detectors (Chap. 7)	M.F. Kijewski
Fri	8/19/2022	Detection and Measurement, Counting Systems (Chap. 12)	K. Grogg
Mon	8/22/2022	Survey meters, dose, exposure	K. Grogg
Fri	8/26/2022	Basics of MRI	J. Moroz
Mon	8/29/2022	Nuclear Counting Statistics (Chap. 9)	M Palmer
Fri	9/2/2022	**Problem Set 2 -** Radiation Detectors, Dose, Exposure, Counting Stats	M. Wilks
Mon	9/5/2022	**Labor Day– No Lecture**	
Mon	9/12/2022	Gamma Camera, Collimators (Chap. 13)	B. Auer
Fri	9/16/2022	Gamma Camera QC (Chap. 14)	A. Könik
Mon	9/19/2022	**Problem Set 3 -** Gamma Camera	A. Könik and B. Auer
Tues	9/20/2022	**Lab 1 -** Hot Lab Measurements	M. Palmer
Fri	9/23/2022	Gamma Camera artifacts	A. Könik
Mon	9/26/2022	Tomography (Chap 16)	G. El Fakhri
Fri	9/30/2022	**Lab 2 -** Gamma Camera (Planar/Scintigraphy)	M. Kijewski, B. Auer, A. Könik
Mon	10/3/2022	**Mid-Term**	B. Auer and A. Könik
Fri	10/7/2022	Mid-Term - Review	B. Auer

Mon	10/10/2022	**Columbus Day – No Lecture**	
Fri	10/14/2022	SPECT I @ 7:30A	B. Auer
Mon	10/17/2022	SPECT II	B. Auer
Fri	10/21/2022	Image Quality in NM (Chap 15)	A. Könik
Mon	10/24/2022	**Problem Set 4** – Tomo/SPECT	B. Auer
Fri	10/28/2022	**Lab 3 –** Conventional SPECT	M. Kijewski, B. Auer, and A. Könik
Mon	10/31/2022	PET I (Chap 18)	G. El Fakhri
Fri	11/4/2022	**Lab 4 –** 360 deg CZT SPECT	M. Kijewski, B. Auer, and A. Könik
Mon	11/7/2022	PET II (Chap 18)	G. El Fakhri
Fri	11/11/2022	Basics of CT (Chap 19)	F. Detmer
Mon	11/14/2022	Quantitation and Lesion Detection in SPECT and PET	M. Palmer
Thurs	11/17/2022	Artifacts in SPECT and PET	A. Könik
Mon	11/21/2022	**Problem Set 5 – PET and PET/CT**	B. Auer and A. Könik
Fri	11/25/2022	**Day After Thanksgiving – No Lecture**	
Mon	11/28/2022	Dynamic imaging and Tracer Kinetic Modeling (Chap 21)	T. Ng
Fri	12/2/2022	**Lab 5 – PET I**	B. Auer and A. Könik
Mon	12/5/2022	Internal Dosimetry (Chap 22)	G. El Fakhri
Thurs	12/8/2022	**Lab 6 – PET II**	B. Auer and A. Könik
Mon	12/12/2022	Invited Speaker – Research Highlights @ 7:45A	Pr. Chi Liu (Yale)
Fri	12/16/2022	**Review for Final**	B. Auer and A. Könik
Mon	12/19/2022	**FINAL EXAM**	B. Auer and A. Könik

PHYSICS & INSTRUMENTATION -- FALL 2021
COURSE POLICIES AND PERFORMANCE EVALUATION

General Course Policies

The overall goal of this course is to give you the physical and technical background information that will assist you with a better understanding how nuclear medicine imaging 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 are any questions regarding these policies, please contact one of the course directors (Georges El Fakhri, Arda Könik, or Benjamin Auer).

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, therefore, 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. 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: Six lab sessions will be completed this semester; these will be conducted on weekdays from 7:30 am to 10:30 am when you will be excused from your clinical duties. We will perform the experiments during this time, and we will give you 1 week to complete your own (individual) lab reports. **As with the class and problem sessions, a lot of material will be covered in the lab in a limited amount of time, and your attendance and punctuality are mandatory. The individual reports are due 1 week following the lab day**. Reports are to be individually prepared although discussion between residents and/or instructors of the experiments and results are strongly encouraged.

Performance evaluation

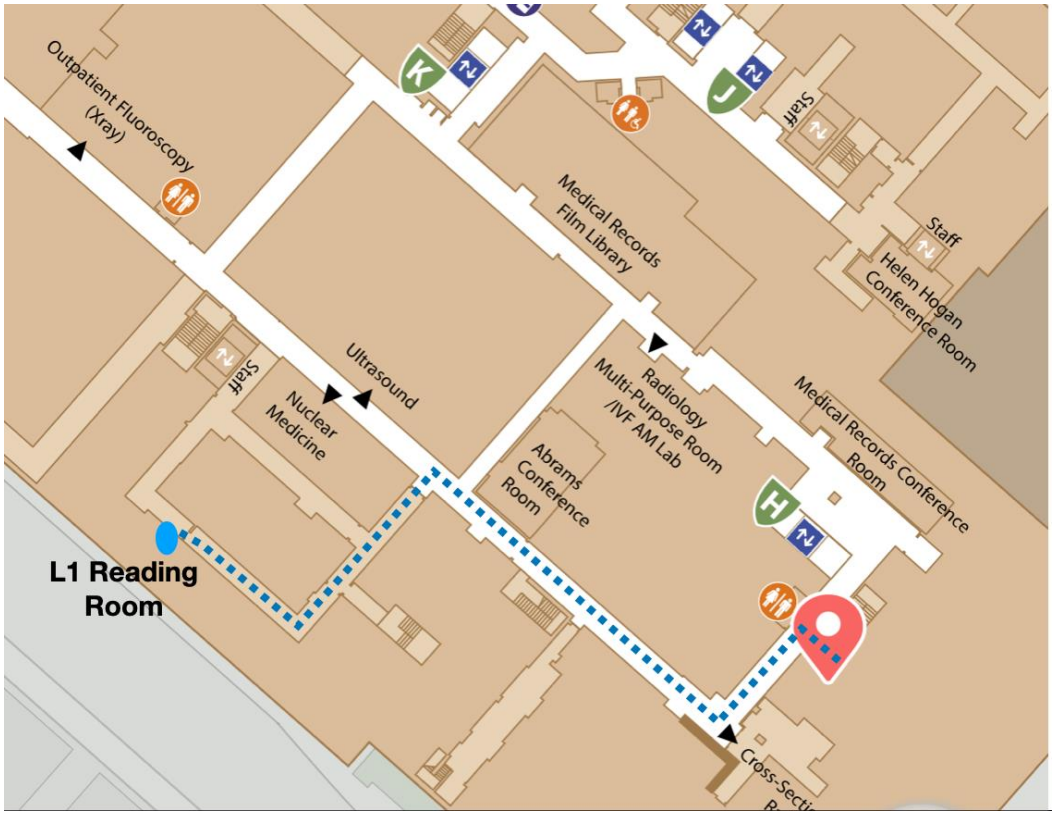
Lecture Participation: 10% of grade, based on attendance, participation in-class discussions, and responses to short quizzes at the end of the lectures. Attendance and punctuality for lectures are mandatory. Students should come to class having read any assigned readings or handouts, prepared to partake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

Homework: 15% 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: 20% for the mid-term and 30% for the final; These exams mostly consist of short-answer questions, although there could be some multiple-choice and true-false questions, as well as one or two problems that require simple math calculations.

Labs and lab write-ups: 25% of grade

Location of the Touchdown Conference Room (L1 BWH)


Outpatient Fluoroscopy (Xray)
K
J
Staff
Medical Records Film Library
Staff
Helen Hogan Conference Room
Ultrasound
Staff
Nuclear Medicine
Radiology Multi-Purpose Room /IVF AM Lab
Abrams Conference Room
Medical Records Conference Room
H
L1 Reading Room