

# HARVARD MEDICAL SCHOOL JOINT PROGRAM IN NUCLEAR MEDICINE

## COURSE OUTLINE 2009/2010

**Course Title:** Physics & Instrumentation in Nuclear Medicine

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

**Course Directors:**

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**Course Instructors:**

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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, Third Edition, Cherry, Sorenson & Phelps, Saunders, 2003.

**Lecture Location(s):** Brigham & Women's Hospital, , Thorn Research Building  
Hollenberg Conference Room – 3<sup>rd</sup> Floor

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## Course Schedule

**Time: 8:00 – 9:00 AM**

Day	Date	Topic	Instructor
Mon	8/31	Introduction; Atomic Structure and Nuclear Structure	G. El Fakhri
Wed	9/2	Charged particle & Photon interactions	G. El Fakhri
Fri	9/4	<b>Problem Set 1</b> - Atomic Structure, Charged Particles, Photon Interactions	G. El Fakhri
Mon	9/7	<b>Labor Day</b>	
Wed	9/9	Radiation Detectors	G. El Fakhri
Fri	9/11	Pulse-height spectroscopy	F.H. Fahey
Mon	9/14	Detection and Measurement, Counting Systems	F.H. Fahey
Wed	9/16	Survey meters, dose, exposure	F.H. Fahey
Fri	9/18	Nuclear Counting Statistics	F.H. Fahey
Mon	9/21	Modes of Radioactive Decay	F.H. Fahey
Wed	9/23	<b>Partners Clinical Fellows Retreat</b>	
Fri	9/25	Decay of Radioactivity	F.H. Fahey
Mon	9/28	<b>Problem Set 2</b> - Radiation Detectors, Dose, Exposure, Counting Stats	F.H. Fahey
Wed	9/30	<b>Lab-All Day</b> - HP measurements and gas detectors	F. Fahey
Fri	10/2	Gamma Camera 1	D. de Vries G. El Fakhri
Mon	10/5	Collimators	G. El Fakhri
Wed	10/7	Gamma Camera QC	F.H. Fahey
Fri	10/9	Gamma Camera Artifacts	F.H. Fahey
Mon	<b>10/12</b>	<b>Columbus Day – No Lecture</b>	
Wed	10/14	Tomography	G. El Fakhri
Fri	10/16	Tomography 2	G. El Fakhri
Mon	10/19	<b>Problem Set 3</b> -Gamma Cameras	G. El Fakhri
Wed	10/21	SPECT 1	F.H. Fahey
Fri	10/23	SPECT 2	F.H. Fahey
Mon	10/26	SPECT QC	F.H. Fahey
Wed	10/28	<b>Lab – All Day:</b> Planar gamma camera	F.H. Fahey
Fri	10/30	<b>Mid-Term Exam</b>	D.J.deVries D.J. de Vries

Mon	11/2	PET 1	G. El Fakhri
Wed	11/4	<b>Lab- All Day - SPECT</b>	F.H. Fahey D.J. deVries
Fri	11/6	<b>No lecture</b>	
Mon	11/9	PET 2	G. El Fakhri
Wed	11/11	<b>Veteran's Day</b>	
Fri	11/13	<b>Problem Set 4 - Tomography, SPECT</b>	G. El Fakhri
Mon	11/16	PET / CT	G. El Fakhri
Wed	11/18	Quantitation and Lesion Detection in SPECT and PET	G. El Fakhri
Fri	11/20	<b>Problem Set 5 – PET and PET/CT</b>	G. El Fakhri
Mon	11/23	Basics of CT for PET/CT	J. Yap
Wed	11/25	<b>Lab-All Day - PET</b>	F.H. Fahey M. R. Palmer
Fri	11/27	<b>Day After Thanksgiving – No Lecture</b>	
Mon	11/30	Artifacts PET and SPECT	G. El Fakhri
Wed	12/2	Prepare for Balloon Debate	G. El Fakhri
Fri	12/4	Review for Final	G. El Fakhri F.H. Fahey
Mon	12/7	<b>FINAL EXAM</b>	G. El Fakhri F.H. Fahey

### **Additional Notes:**

## **PHYSICS & INSTRUMENTATION -- FALL 2009 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 your 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 726-9640 or Fred Fahey at 355-2809).

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](http://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