

# BIOL\_EN 4420/7420 & PHYSICS 4420/7420

## Introduction to Biomedical Imaging (Online)

### University of Missouri

---

#### Course Description and Rationale

The course is primarily designed for upper-level undergraduate students and graduate students who are interested in physics and principles of biomedical imaging. Topics to be covered include the background physics, basic knowledge of medical imaging, radiographic imaging, X-ray CT, nuclear medicine, scintigraphy, PET, SPECT, ultrasound, and MRI. The course also introduces some recent developments of biomedical imaging, such as multimodality imaging and molecular imaging.

Prerequisites: Physics 2760 (University Physics II) or instructor's consent.

#### Course Goals

After completing the entire course, you should be able to:

1. Apply physics principles in biomedical imaging.
2. Demonstrate an understanding of how instrumentation of biomedical imaging works.

#### Textbook

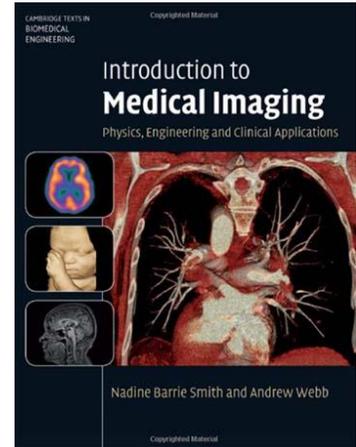
*Introduction to Medical Imaging: Physics, Engineering and Clinical Applications*, Nadine B. Smith and Andrew Webb, Cambridge University Press, 1st Ed., 2010.

There are several good reference books that you may want to refer to:

1. *Medical Imaging Signals and Systems*, Jerry L. Prince, Jonathan Links, Prentice Hall, 2nd Edition, 2015. This book provides in-depth mathematics and physics of medical imaging modalities.
2. *The Essential Physics of Medical Imaging*, by Jerrold T. Bushberg, J. Anthony Seibert, Edwin M. Leidholdt Jr., John M. Boone, LWW, 3rd Edition, 2011. This is a comprehensive textbook that covers very detail knowledge of medical imaging for medical physics major.

#### Online Course Access

You may access the course via <http://courses.missouri.edu>. Under course login, select Blackboard and enter your PawPrint or User ID. MU students, if you have difficulty logging in to the course or you do not see the course listed, please contact the *Mizzou IT Help Desk* at 573/882-5000. Students from participating institutions, please contact your campus faculty member. Everyone *MUST* enable Compatibility View with Internet Explorer 8.



Cover page of the textbook

#### Instructor Information

Dr. Ping Yu, Professor  
Department of Physics and Astronomy  
University of Missouri  
220 Physics Building  
Phone: 573-8827664  
E-mail: [yuping@missouri.edu](mailto:yuping@missouri.edu)

#### Teaching Assistant

Ms. Lee Li  
Department of Physics and Astronomy  
University of Missouri  
202 Physics Building  
Phone: 573-8823053  
E-mail: [lelchf@mail.missouri.edu](mailto:lelchf@mail.missouri.edu)

## Expectations

- **What to Expect from a Technology-Enhanced Course** - This course is designed for online teaching. It is essential that you access the course site at least 3 times a week. You are expected to do all of the readings, watch all Tegrity lectures weekly, and complete all homework assignments.
- **What the Instructors Expect from You** - We expect that you will have a foundational understanding of physics and principle of biomedical imaging, and use them to solve medical imaging problems. All class correspondence should be submitted to the relevant Discussion Board forum; only personal or confidential matters should be directed to the instructor in e-mail.
- **What You May Expect from the Instructor** - Monitor and facilitate online questions and answers, respond to private questions within 24 to 48 hours, provide timely feedback on assignments, and help build a learning community.

## Video Lectures

Video recordings of all lectures are provided for you during the semester. You can view these recordings using Tegrity (implemented in Blackboard). You may watch recordings online, or download them for off-line viewing on your computer, smartphone, or media player. These recordings are jointly copyrighted by the Curators of the University of Missouri and your instructor. Posting them to another website, including YouTube, Facebook, BlipTV, or any other site without express and written permission may result in disciplinary action and possible civil prosecution.

## Homework

Homework will be assigned and posted in Blackboard. The homework is due on the Friday following the week the assignment is given. Homework assignments must be submitted through the Blackboard Assignment Manager (accessible via the Assignments button on the Course Navigation Menu) using the naming convention HWx\_LastnameFirstinitial. X designates which homework assignment, for example, HW1\_smitha for Homework 1 and HW2\_smitha for Homework 2. All course assignments should be submitted in Word (.doc or .docx) or PDF format. Each page of your homework should include your student ID number. You can also handwrite your homework and scan it as a PDF file. All students, undergraduates and graduate, are required to complete the homework assignments and exams.

## Weekly Schedule and Assignments

**Your weekly routine:** Every week, you should expect to login to the course site no fewer than 2-3 times. Each week of the course will have a corresponding instructional unit, which includes your assigned reading, video lectures and homework assignments. You are strongly encouraged to view the unit video lectures before completing your reading assignments.

Week	Dates	Unit Title	Chapter Covered
1	Jun. 5-9	Part I: Introduction, background knowledge, and general medical image properties	Chapter 1
2	Jun. 12-16	Part II: Physics of X-ray radiography and X-ray planar radiography	Chapter 2
3	Jun. 19-23	Part II: X-ray computed tomography	Chapter 2
4	Jun. 26-June 29	Part III: Nuclear medicine and planar scintigraphy	Chapter 3
4	June 30	<b>Midterm exam</b>	
5	July 3-July 7	Part III: Nuclear medicine and imaging: PET and SPECT	Chapter 3
6	July 10-14	Part IV: Ultrasound imaging	Chapter 4
7	July 17-21	Part V: Magnetic resonance imaging	Chapter 5
8	July 24-28	Part V: Magnetic resonance imaging con't and review for the final exam	Chapter 5
8	July 31	<b>Final exam</b>	

## Grading Scale

Contribution to the grade:

Homework:	30%
Midterm Exam:	30%
Final Exam:	40%

You may expect the following course grade:

0-32.9%	F
33-39.9 %	D
40%-64.9%	C
65-79.9%	B
80%-100%	A

## Late Work Policy

Assignments more than 3 days late will get 50% off unless **prior** arrangements have been made. If you have circumstances that affect your ability to complete assignments, please contact the instructor or teaching assistant **at least 3 days in advance** of the due date.

## Exams

There will be one midterm exam and one final exam during the summer semester. All exams are given at the Mizzou Online office or approved off-campus proctors. The exams will be similar to homework problems that have descriptions, theory questions, calculations and problems for which you have to provide full solutions.

## Help Available

MU students, if you are having any technical difficulties please email [helpdesk@missouri.edu](mailto:helpdesk@missouri.edu) or contact the DoIT Help Desk at 573/882-5000. Students in partnering institutions, please contact your campus faculty member with any issues.

## Online Class Netiquette

Your instructor and fellow students wish to foster a safe on-line learning environment. All opinions and experiences, no matter how different or controversial they may be perceived, must be respected in the tolerant spirit of academic discourse. You are encouraged to comment, question, or critique an idea but you are not to attack an individual.

Our differences, some of which are outlined in the University's nondiscrimination statement below, will add richness to this learning experience. Please consider that sarcasm and humor can be misconstrued in online interactions and generate unintended disruptions. Working as a community of learners, we can build a polite and respectful course ambience.

## Academic Integrity Policy

Academic honesty is fundamental to the activities and principles of a university. All members of the academic community must be confident that each person's work has been responsibly and honorably acquired, developed, and presented. Any effort to gain an advantage not given to all students is dishonest whether or not the effort is successful. The academic community regards academic dishonesty as an extremely serious matter, with serious consequences that range from probation to expulsion. When in doubt about plagiarism, paraphrasing, quoting, or collaboration, consult the course instructor.

Academic Dishonesty includes but is not necessarily limited to the following:

- A. Cheating or knowingly assisting another student in committing an act of cheating or other academic dishonesty.
- B. Plagiarism which includes but is not necessarily limited to submitting examinations, themes, reports, drawings, laboratory notes, or other material as one's own work when such work has been prepared by another person or copied from another person.
- C. Unauthorized possession of examinations or reserve library materials, or laboratory materials or experiments, or any other similar actions.

- D. Unauthorized changing of grades or markings on an examination or in an instructor's grade book or such change of any grade report.

**Academic Integrity Pledge:** *"I strive to uphold the University values of respect, responsibility, discovery, and excellence. On my honor, I pledge that I have neither given nor received unauthorized assistance on this work."* Students are expected to adhere to this pledge on all graded work whether or not they are explicitly asked in advance to do so.

The University has specific academic dishonesty administrative [procedures](#). Although policy states that cases of academic dishonesty must be reported to the Office of the Provost for possible action, the instructor may assign a failing grade for the assignment or a failing grade for the course, or may adjust the grade as deemed appropriate. The instructor also may require the student to repeat the assignment or to perform additional assignments. In instances where academic integrity is in question, faculty, staff and students should refer to [Article VI of the Faculty Handbook](#). Article VI is also available in the [M-Book](#). Article VI provides further information regarding the process by which violations are handled and sets forth a standard of excellence in our community.

### **Restrictions on Disclosure and Distribution**

The redistribution of audio or video recordings of statements or comments from the course to individuals who are not students in the course is prohibited without the express permission of the faculty member and of any students who are recorded. Unauthorized distribution of such materials is a violation of academic standards and may violate copyright laws and/or privacy rights. Students found to have violated this policy are subject to discipline in accordance with the provisions of [Section 200.020 of the Collected Rules and Regulations](#) of the University of Missouri pertaining to student conduct matters.

### **University of Missouri Notice of Nondiscrimination**

The University of Missouri System is an Equal Opportunity/ Affirmative Action institution and is nondiscriminatory relative to race, religion, color, national origin, sex, sexual orientation, age, disability or status as a Vietnam-era veteran. Any person having inquiries concerning the University of Missouri's compliance with implementing Title VI of the Civil Rights Act of 1964, Title IX of the Education Amendments of 1972, Section 504 of the Rehabilitation Act of 1973, the Americans With Disabilities Act of 1990, or other civil rights laws should contact the Assistant Vice Chancellor, [Human Resource Services](#), University of Missouri, 1095 Virginia Avenue, Columbia, Mo. 65211, 573/882-4256, or the Assistant Secretary for Civil Rights, U.S. Department of Education.

### **Students with Disabilities (Residential & Online Courses)**

If you anticipate barriers related to the format or requirements of this course, if you have emergency medical information to share with me, or if you need to make arrangements in case the building must be evacuated, please let me know as soon as possible.

If disability related accommodations are necessary (for example, a note taker, extended time on exams, captioning), please register with the Office of Disability Services (<http://disabilityservices.missouri.edu>), S5 Memorial Union, 573- 882-4696, and then notify me of your eligibility for reasonable accommodations. For other MU resources for students with disabilities, click on "Disability Resources" on the MU homepage.

### **Intellectual Pluralism Statement**

The University community welcomes intellectual diversity and respects student rights. Students who have questions concerning the quality of instruction in this class may address concerns to either the Departmental Chair or Divisional leader or Director of the [Office of Students Rights and Responsibilities](#) (<http://osrr.missouri.edu/>). All students will have the opportunity to submit an anonymous evaluation of the instructor(s) at the end of the course.

### **Grievance Policy**

Information concerning student grade appeal procedures and non-academic grievances and appeals may be found in the Student Handbook.