Physics 514
Physics of Medical Imaging
TuTh 11:00-12:15
Lewis Hall, Room 109

Instructor: Dr. Joel Mobley
Room 1034 NCPA (Jamie Whitten National Center for Physical Acoustics)
Phone: 915-6937
jmobley@olemiss.edu (best way to contact me)

Office Hours: Thursday 1 – 2 in **Lewis 203**
Wednesday 3 – 5 at **1034 NCPA**
I am glad to meet by appointment. The best days are MWF. Email to set up as in-person, over Zoom or by phone.

NCPA is the **Jamie Whitten National Center for Physical Acoustics** and is located near the intersection of Chucky Mullins Dr. and Hill Dr. (see map on last page).

ATTENDANCE

The course is scheduled for in-person instruction. Students will be expected to attend all lectures and should notify me if they are unable to. Non-attendance for any health or health-related reasons will be accommodated.

Learning Objectives:

After completing this course, the student should understand the following:

- how the principles of physics are used in medical diagnostic imaging methods
- how to apply physics principles to solve problems in magnetism, radio frequency electromagnetic fields, quantum theory and image analysis that underlie MRI technology
- how to apply physics principles to solve problems in wave propagation that are fundamental to ultrasonic imaging technology
- how to apply physics principles to solve problems in x-ray interactions with matter and the numerical methods that central in x-ray Computed Tomography

Detailed lists of learning objectives will be provided throughout the semester

Additional Learning Objectives for Graduate Students

Students should be able to perform various transforms using tools in MATLAB or other software packages. These include: Radon transforms and related tomographic transforms; Fourier transforms in one and two dimensions. Also, they should gain a quantitative/analytical understanding of the concepts of nuclear magnetic resonance, x-ray interactions with materials and ultrasonic scattering.

Content: In this course we will study the physics of medical diagnostic imaging. We will cover magnetic resonance imaging (MRI), ultrasound and x-ray computed tomography (x-ray CT).

Specific subjects include:

- Proton magnetic resonance
- Radio frequency magnetic fields
- Fourier analysis
- Image and signal processing
- Propagation of ultrasound in soft tissue
- Scattering, reflection and refraction
- X-ray interactions with matter
- Attenuation and scattering
- Computed Tomography
- Radon transforms

Article Discussion: Throughout the semester, we will have class discussion days where a scientific article is reviewed. Students must read the article in advance and come prepared to participate in the discussion. The articles will be available in electronic format prior to the class.

Lecture Notes and Supplementary Materials:

Supplementary materials used during the course will be posted on Blackboard or emailed. Some of the lecture notes will be provided. Availability of these lecture notes will be based on attendance for the relevant class.

Textbooks for Reference (not required):

Intermediate Physics for Medicine and Biology, 4th Ed., by Hobbie and Roth.
ISBN-13: 978-0-387-30942-2

Introduction to Physics in Modern Medicine 2nd Ed., by Kane
ISBN-13: 978-1584889434

Grading

25 % each	2 Midterm Exams
25 %	Final Exam
20 %	Homework
5 %	Class Participation

Grading Scale, Minimum Score

A: 92 **B+**: 82 **C+**: 70 **D**: 50
A-: 87 **B**: 79 **C**: 66
B-: 74 **C-**: 60 **F:**<50

University of Mississippi Access and Inclusion

The University of Mississippi is committed to the creation of inclusive learning environments for all students. If there are aspects of the instruction or design of this course that result in barriers to your full inclusion and participation or to accurate assessment of your achievement, please contact the course instructor as soon as possible. Barriers may include, but are not necessarily limited to, timed exams and in-class assignments, difficulty with the acquisition of lecture content, inaccessible web content or the use of non-captioned or non-transcribed video and audio files. Students must also contact Student Disability Services at 662-915-7128 so that office can 1) provide you with an Instructor Notification form, 2) facilitate the removal of barriers and 3) ensure you have equal access to the same opportunities for success that are available to all students.

Academic Integrity

Every student of the University of Mississippi, by virtue of choosing to be part of the university community agrees to abide by the University of Mississippi Creed and the UM Academic Integrity Policy which covers academic integrity. Cheating on any assignment is forbidden and, in this course, will result in a zero grade on the given assignment. If a second case of cheating occurs, this will result in an F for the entire course. Please consult the M-Book, Academic Integrity document for details on university policy and the academic creed.

UM Creed

The University of Mississippi is a community of learning dedicated to nurturing excellence in intellectual inquiry and personal character in an open and diverse environment. As a voluntary member of this community:

- I believe in respect for the dignity of each person
- I believe in fairness and civility
- I believe in personal and professional integrity
- I believe in academic honesty
- I believe in academic freedom
- I believe in good stewardship of our resources
- I pledge to uphold these values and encourage others to follow my example

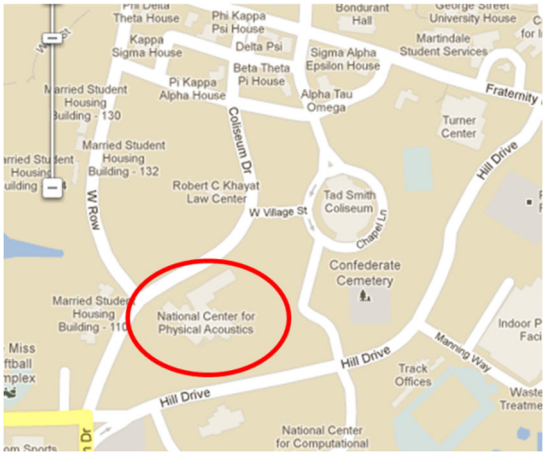
Class Materials Policy

All materials distributed electronically and in hard copy in this class are protected under intellectual copyright. Any attempt to upload these documents onto the Internet (or to distribute them by some other means) or to profit from the distribution (by Internet or other means) of these documents constitutes theft and will be in violation of intellectual property law and the UM Academic Conduct Code unless expressly permitted for by the instructor. Accessing such materials for your own use is also in violation of the UM Academic Conduct Code. Additionally, the distribution of your own class notes via the Internet or other means, or access of such materials, encourages absence from class and

is highly discouraged except for occasional loaning of notes to students concurrently enrolled in the class.

Audio and video recording

Audio and/or video recording of class lectures is not allowed unless explicit permission is given by the instructor. Permission will only be given if the student has a Student Disability Services request. In such cases, recordings may only be used by the student to whom permission is given and all recordings must be deleted at the end of the semester. Recordings may not be distributed online or elsewhere.



Location of NCPA