

BME 7710 Section 001
MAGNETIC RESONANCE IMAGING
Fall 2014

Prerequisite: Standard engineering/science core courses. The understanding of the following topics would be advantageous: Fourier analysis, differential equations, complex variables, statistics, electronics laboratory, and electromagnetism.

Course Description: This is a conventional lecture series with blackboard material and power point presentations. The basics of magnetic resonance imaging will be presented.

Course Topics:

1. Introduction to magnetic moments, precession, Bloch Eq. Bloch equations, and both T1 and T2 relaxation times (3 sessions)
2. Signal concepts, spin and gradient echoes (3 sessions).
3. Fourier imaging in multi-dimensions (1 session)
4. Sampling, aliasing, filtering, and resolution, discrete Fourier transforms (3 sessions)
5. Signal, contrast, and noise (2 sessions)
6. Fast imaging, and image distortion (1 session)
7. Motion and MR angiography (2 sessions)
8. Hands on MRI (1 session)
9. Functional MRI of the brain (2 sessions)
10. Chemical shift, spectroscopy and spectroscopic imaging (2 sessions)

Textbook: R.W. Brown, Y.C.N. Cheng, E.M. Haacke, M.R. Thompson and R. Venkatesan, Magnetic Resonance Imaging: Physical Principles and Sequence Design, 2nd edition, Wiley, 2014. or
E.M. Haacke, R.W. Brown, M.R. Thompson and R. Venkatesan, Magnetic Resonance Imaging: Physical Principles and Sequence Design, 1st edition, Wiley, 1999.

Meeting: **Tuesdays and Thursdays 3:30-5:30pm**
Two 120 minute lectures per week.
Scott Hall – Room **2268** on **TUESDAYS**
Scott Hall – Room **3125** on **THURSDAYS**
University Health Center (Receiving Hospital) Lobby – Room Crockett A
on December 11, 2014

Lecturers: Yu-Chung Norman Cheng, PhD, Mark Haacke, PhD, Charbel Habib, PhD., Jaladhar Neelavalli, PhD and Yongquan Ye, PhD.

Teaching Assistant: Paul Kokeny, MS Email: kokenymri@gmail.com
Ehsan Hamtaei, MS Email: ehamtaei@gmail.com

Office Hours: Teaching Assistant will be available on:
Tuesdays and Thursdays from 1:30pm till 3:00pm – MRI Institute (440 E Ferry Ave, Detroit)

Grading:	Exam 1	20%	Thursday Oct 2th, 2014
	Exam 2	20%	Tuesday Nov 4th, 2014
	Exam 3	20%	Thursday Dec 11th, 2014 (at Crockett A)
	Problem sets	20%	
	Oral Presentation	15%	
	Written Report	5%	
	Total	100%	

1. Problems will be due as posted on the Assignment Schedule.
2. Chapter readings will be assigned in advance. *Please read the material ahead of time.*
3. Be prepared to answer questions in class, it is a fairly interactive class.
4. Be prepared to present problem solutions in class as well on occasion.
5. At some point further into the course, there will be an opportunity to see a whole body MR spectrometer in operation.
6. Finally, a **report and oral presentation** will be due by the end of the course on a topic of interest, including but not limited to the following: sodium imaging, functional brain imaging, cardiac imaging, correcting image distortion, perfusion imaging, water/fat separation, magnetic resonance angiography, spectroscopic imaging (CSI) of NAA, Choline, etc..., diffusion weighted imaging, etc. If the above topics have been covered in class then the focus should be on the clinical applications of the method but still demonstrating a good grasp of the basic MR imaging concepts. You should decide on a topic relatively early in the course. The report will be worth 5 marks and the oral presentation will be worth 15 marks. Note that the report should be **2 pages long** with 11pt Arial font.

Expectations: You will be expected to attend all class sessions and participate in discussions lead by the instructor and your classmates.

Blackboard: Blackboard will be used throughout the course for communication among students and with the instructor. Feel free to post both private and common questions. In order to use the system, you must log on through Pipeline. *Please activate your Wayne email address, forwarding it to your standard email if you wish.* This will be the address with which the class communicates with you.

Policy on Cheating: It is the policy of the Biomedical Engineering Program that any instance of cheating will result in a grade of F for the course. Cheating is defined by the University as “intentionally using or attempting to use, or intentionally providing or attempting to provide, unauthorized materials, information, or assistance in any academic exercise.” This includes any group efforts on assignments or exams unless specifically approved by the professors for that assignment/exam. Evidence of fabrication or plagiarism, as defined by the University in its brochure *Academic Integrity*, will also result in downgrading for the course. Please refer to the “Expectations for Citation in Biomedical Engineering” handout (available on the web) and to the Departmental recommended book on scientific writing for guidance. STUDENTS WHO CHEAT ON ANY ASSIGNMENT OR DURING ANY EXAMINATION WILL BE ASSIGNED A FAILING GRADE FOR THE COURSE.