

**RADI 6050**  
**Magnetic Resonance Imaging**  
**Spring, 2017**

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**CLASS DAYS and TIME:** Tuesdays & Thursdays 1:30- 2:30

**CLASSROOM:** RII Seminar Room - McDermott, Room 2.534

**COURSE FACULTY:** Geoffrey Clarke

**OFFICE LOCATION and HOURS:** McDermott 2.425 2:30-3:00 Thursday

**EMAIL:** clarkeg@uthscsa.edu

**TELEPHONE:** 210-567-1361

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**READ THIS DOCUMENT CAREFULLY - YOU ARE RESPONSIBLE FOR ITS CONTENTS.**

### **COURSE DESCRIPTION AND OBJECTIVES**

Course covers the physics and technology of magnetic resonance imaging at an advanced level. This course is designed to give the student a deep understanding of MRI equipment, the processes involved in image formation and trade-offs required to obtain high quality MRI research studies. The emphasis of this course is to describe MRI physics and technology in a manner such that the student will be able to undertake MRI experiments for quantitative biomedical measurements. Students enrolling in this course should be comfortable with vector algebra, differential and integral equations and matrix mathematics. RADI 5049 (Introduction to MRI) or its equivalent should be taken before attempting this course.

**Pre-requisites** – RADI 6049

**Semester credit hours** – 2 CU

By the end of this course, each student should be able to:

- apply a fundamental knowledge of NMR physics to understanding the magnetic resonance imaging processes.
- discuss the concepts underlying various technologies used for magnetic resonance imaging.
- recount clinical and research applications of magnetic resonance imaging.

### **COURSE ORGANIZATION**

**The main teaching modalities used in this course include:**

- 1) Auditory activities: presenting research and listening to oral presentations**
- 2) Visual activities: reading assignments, watching videos, demonstrations, presentations (including graphs & tables)**
- 3) Tactile/Kinesthetic: solving problems, participating in in-class mini-projects**

**Materials** – Textbook. Articles and other materials will be provided by instructors.

**Computer Access** – Students are required to bring wifi-enabled laptop for presentation of topics.

**Demonstrations** – Ten to twelve hands-on sessions for students to learn to use and test NMR equipment.

### **ATTENDANCE**

**Attendance is mandatory.** Students are expected to advise the instructor in advance if they will not be able to attend a class session. Missing quizzes and exams required prior approval and rescheduling.

## TEXTBOOKS

**Required:** Handbook of MRI Pulse Sequences. MA Bernstein, KF King, XJ Zhou, Elsevier Academic Press, 2004. ISBN-13: 978-0120928613

## GRADING POLICIES AND EXAMINATION PROCEDURES

The final grade will be based on the following weighted average: 60% for lab reports, 40% for presentations

### Grading System

A = 85-100%    B = 70-84%    C = 60-70%    F = < 60%

## REQUESTS FOR ACCOMODATIONS FOR DISABILITIES

In accordance with policy 4.2.3, **Request for Accommodation Under the ADA and the ADA Amendments Act of 2008 (ADAAA)**, any student requesting accommodation must submit the appropriate request for accommodation under the American with Disabilities Act (ADA, form 100). to his/her appropriate Associate Dean of their School and a copy to the ADA Coordinator. Additional information may be obtained at <http://uthscsa.edu/eoo/request.asp>.

## ACADEMIC INTEGRITY AND PROFESSIONALISM

Any student who commits an act of academic dishonesty is subject to discipline as prescribed by the UT System Rules and Regulations of the Board of Regents. Academic dishonesty includes, but is not limited to, cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, taking an exam for another person, signing attendance sheets for another student, and any act designed to give unfair advantage to a student or the attempt to commit such an act. Additional information may be obtained at <http://catalog.uthscsa.edu/generalinformation/generalacademicpolicies/academicdishonestypolicy/>

## TITLE IX AT UTHSCSA

### **Title IX Defined:**

Title of the Education Amendments of 1972 is a federal law that prohibits sex discrimination in education. It reads “no person in the United States shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity receiving Federal financial assistance.”

### **University of Texas Health Science Center San Antonio’s Commitment:**

University of Texas Health Science Center San Antonio (UTHSCSA) is committed to maintaining a learning environment that is free from discriminatory conduct based on gender. As required by Title IX, UTHSCSA does not discriminate on the basis of sex in its education programs and activities, and it encourages any student, faculty, or staff member who thinks that he or she has been subjected to sex discrimination, sexual harassment (including sexual violence) or sexual misconduct to immediately report the incident to the Title IX Director.

In an emergency, victims of sexual abuse should call 911. For non-emergencies, they may contact UPD at 210-567-2800. Additional information may be obtained at <http://students.uthscsa.edu/titleix/>

## EMAIL POLICY

none

## USE OF RECORDING DEVICES

Permitted for personal use only

## ELECTRONIC DEVICES

Electronic devices are permitted as long as they do not become a distraction for the class.

**Class Schedule** is TENTATIVE and will depend upon the progress of the class.

	<b>Date</b>	<b>Subject</b>
1	Tuesday, Jan 10	Introduction & Overview
2	Thursday, Jan 12	Hardware Considerations for Quantitative MRI
3	Tuesday, Jan 17	MR Image Reconstruction Methods
4	Thursday, Jan 19	The Bloch Equations
5	Tuesday, Jan 24	Relaxation & Hard RF Pulses
6	Thursday, Jan 26	Slice Selective RF Pulses
7	Tuesday, Jan 31	LAB 1 (Pharmscan setup/tuning/matching)
8	Thursday, Feb 2	RF Coil Circuits & Tuning
9	Tuesday, Feb 7	Manipulating Contrast and SNR in MRI
10	Thursday, Feb 9	Using MRI to Measure Spatial Features
11	Tuesday, Feb 14	LAB 2 (Pharmscan RF design & coil building)
12	Thursday, Feb 16	Magnetization Preparation Schemes
13	Tuesday, Feb 21	Relaxation Time Measurements
14	Thursday, Feb 23	MRI for Neurological Disorders
15	Tuesday, Feb 28	LAB 3 (Pharmscan tuning/matching/set-up)
16	Thursday, March 2	Blood Flow Measurements with MRI
17	Tuesday, March 7	LAB 4 (EPI and Functional MRI)
18	Thursday, March 9	MR Image Data Processing
	MARCH 13-17	NO CLASS – SPRING BREAK
19	Tuesday, March 21	LAB 5 (Pharmscan Data Processing)
20	Thursday, March 23	Quantitative MRI in Aging & Metabolic Diseases
21	Tuesday, March 28	LAB 6 (Diffusion Imaging & DTI)
22	Thursday, March 30	Localizing 1H-Magnetic Resonance Spectroscopy - (MRS)
23	Tuesday, April 4	LAB 7 (MRI/MRS of lipids)
24	Thursday, April 6	Multinuclear & Multidimensional MRS
25	Tuesday, April 11	LAB 8 (MRS and Phase Contrast Flow Measurements)
26	Thursday, April 13	Tissue Perfusion Imaging with MRI
27	Tuesday, April 18	Vascular Diseases/Quantitative Cardiac MRI
28	Thursday, April 20	LAB 9 (Cardiac MR Imaging)
29	Tuesday, April 25	Quantitative MRI for Cancer Studies
30	Thursday, April 27	Chemical Exchange Saturation Transfer & Magnetization Transfer
31	Tuesday, May 2	LAB 10 (31P MRS/MRI)
32	Thursday, May 4	Quantitative MRI in Liver
33	Tuesday, May 9	Hyperpolarized MRI Methods & Prospects
34	Thursday, May 11	Class Review (Oral Exam)