

RADI 6049
Introduction to Magnetic Resonance Imaging Physics
Fall, 2020

CLASS DAYS and TIME: Tuesdays & Thursdays 9:00- 10:00 AM

CLASSROOM: All classes will be conducted interactively over Zoom

COURSE FACULTY: Geoffrey Clarke & Qiang Shen

OFFICE LOCATION and HOURS: please schedule with instructors

EMAIL: clarkeg@uthscsa.edu

TELEPHONE: 210-567-1361

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

COURSE DESCRIPTION AND OBJECTIVES

Introduction to magnetic resonance imaging from the perspective of advanced user. This course is designed to give the student a conceptual understanding of MRI equipment, process of image formation and research applications of MRI. Hands-on sessions are included to improve the student's understanding of materials covered in class.

Pre-requisites – none **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:** 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. Other material will be provided by instructors.

Computer Access – Students are required to bring wifi-enabled laptop to class in order to take on-line quizzes and exams.

Demonstrations – Three labs (lab 1: Basic QC; lab 2: basic sequences; lab 3: fast sequences) will be scheduled.

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: "MRI: From Picture to Proton", 3rd ed. by DW McRobbie and EA Moore. Cambridge University Press, 2017. ISBN-13 978-1-107-64323-9

GRADING POLICIES AND EXAMINATION PROCEDURES

Describe in detail how grades for assignments/projects/tests will be weighted and factored into final grades, also include other information relevant to grading if applicable – for example information about extra credit, examination protocol, make-up exams, etc.

Grading System

The final grade will be based on the following weighted average: 60% for homework assignments, 20% for quizzes, 20% for Final exam

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

REQUESTS FOR ACCOMMODATIONS 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/eeo/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 if they do not become a distraction for the class.

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

Session	Subject	Reference	Note
Tu 8/25	Course structure, History of MRI, MRI evolution	McRobbie Ch.1	
Th 8/27	MR laboratory, clinical MRI	McRobbie Ch.2	
Tu 9/01	MR image contrast	McRobbie, Ch.3	
Th 9/03	MRI Pulse Sequence Overview	McRobbie, Ch.4	
Tu 9/08	MRI: Resolution & Field-of-View	McRobbie, Ch.5	
Th 9/10	Basic image optimization	McRobbie, Ch.6	
Tu 9/15	MR image artifacts	McRobbie, Ch.7	HOMEWORK #1 DUE
Th 9/17	QUIZ 1 (Chps. 1-6)		
Tu 9/22	Spatial Encoding Theory – Part 1	McRobbie, Ch.8.1-8.4	
Th 9/24	Spatial Encoding Theory – Part 2	McRobbie, Ch.8.5- 8.8	
Tu 9/29	MRI Relaxation Part 1	McRobbie, Ch.9.1-9.4	
Th 10/01	MRI Relaxation Part 2	McRobbie, Ch.9.5-9.7	
Tu 10/06	MRI equipment – Magnets & Gradient Coils	McRobbie, Ch.10.1-10.3	
Th 10/08	MRI equipment – Radiofrequency Subsystem	McRobbie, Ch.10.4-10.8	
Tu 10/13	MRI Physics QC	McRobbie, Ch.11	HOMEWORK #2 DUE
Th 10/15	QUIZ 2 (Chps. 7-10)		
Tu 10/20	MRI Safety	McRobbie, Ch.20	
Th 10/22	DEMO LAB#1: Basic MRI Quality Control		
Tu 10/27	Spin-Echo Based Pulse Sequences	McRobbie, Ch.12.1-Ch.12.4	
Th 10/29	Fast Imaging	McRobbie, Ch.12.5-Ch.13.2	
Tu 11/03	Gradient Echo Pulse Sequences	McRobbie, Ch.13.3-Ch.13.4	
Th 11/05	Partially Parallel Imaging & Others	McRobbie, Ch.14.1-14.6	
Tu 11/10	Sparse Reconstruction Methods	McRobbie, Ch. 14.7-14.9	HOMEWRK #3 DUE
Th 11/12	DEMO LAB#2: MRI Pulse Sequences	QUIZ 3 (Ch. 11-13, Ch. 20)	
Tu 11/17	MR Angiography	McRobbie, Ch.15	CLASS PROJECTS ASSIGNED
Th 11/19	Cardiac MRI	McRobbie, Ch.16	
Tu 11/24	In-vivo MR spectroscopy	McRobbie, Ch.17	
Th 11/26	Diffusion MRI	McRobbie, Ch.18.1- 18.2	
Tu 12/01	Perfusion and BOLD Imaging	McRobbie, Ch.18.3–18.5	
Th 12/03	NO CLASS	THANKSGIVING	
Tu 12/08	Quantitative MRI	McRobbie, Ch. 19	HOMEWORK #4 DUE
Th 12/10	DEMO Lab #3 – Fast MRI & MRS	QUIZ 4 (Ch. 14-19)	
Tu 12/15	Student Presentations – Class Projects Due		