

University of Utah BE/ECE7310 Spring 2018

Instructors:

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Course Objectives:

By the end of this course, students should have a working understanding of the important aspects of MRI. This includes knowledge of the hardware pieces that form an MRI scanner, relaxation processes, Bloch equations, image formation, different pulse sequences, flow and diffusion phenomena, and several current applications of MRI. This preparation should be sufficient for following much of the current research in the field and serve as a basis for working with MRI acquisitions and MRI data.

Grading:

Homework and Labs	20%
Test #1	20%
Test #2	20%
Project	15%
Final Exam	25%

Text used in previous years:

Liang, Z.-P. and P. C. Lauterbur (2000). Principles of Magnetic Resonance Imaging - A Signal Processing Perspective. New York, IEEE Press.

TENTATIVE CLASS SCHEDULE FOR SPRING 2018. SUBJECT TO CHANGE

Advanced Magnetic Resonance Imaging			
	Tue/Thur	Tues/Thurs at INC 2:00-3:20pm	L&L+Lian
Tue	9-Jan-17	Introduction - class overview + math review Charge, spin, angular momentum, magnetic moments, Quantum	L&L #1-2
Thurs	11-Jan-17	Mechanics Fields, Magnetization motion in a magnetic field, Resonance, Rotating	L&L #3
Tue	16-Jan-17	Frame	L&L #3
Thurs	18-Jan-17	RF excitation, relaxation, Bloch Equations	L&L #3
Tue	23-Jan-17	Solutions to Bloch Equations (including computer simulations)	L&L #3
Thurs	25-Jan-17	Signal Detection Lab #1 - RF coils intro	L&L #3
Tue	30-Jan-17	Free Induction decay - concepts of RF echoes spin echo - stimulated echo	L&L #4
Thurs	1-Feb-17	Applied Magnetic gradient fields, gradient echoes, REVIEW	L&L #4
Tue	6-Feb-17	Exam #1 NMR physics and fundamentals	
Thurs	8-Feb-17	Math basics - Fourier, Radon, + discrete math	L&L #2

Tue	13-Feb-17	Signal Localization, MRI imaging equations Lab #2 - Matlab - getting fluent with Fourier transforms	L&L #5
Thurs	15-Feb-17	Slice selection, RF pulses, spatial signal encoding	L&L #5
Tue	20-Feb-17	Introduction to k-space Lab #3 MRI safety training	L&L #5
Thurs	22-Feb-17	MRI techniques, 1D, 2D, 3D	L&L #5
Tue	27-Feb-17	Signal sampling - voxel sensitivity function	
Thurs	1-Mar-17	MRI image reconstruction 1	L&L #6
Tue	6-Mar-17	MRI image reconstruction 2 - parallel imaging and compressed sensing Lab #4 TBD - Image recon or RF coil design or pulse sequence design	L&L #10
Thurs	8-Mar-17	Pulse sequences and imaging techniques	L&L #7
Tue	13-Mar-17	Pulse sequences and imaging techniques	L&L #7
Thurs	15-Mar-17	Image resolution, noise (SNR, CNR), and artifacts, REVIEW	L&L #8
Tue	20-Mar-17	Exam #2 MRI- image formation	
Thurs	22-Mar-17	Spring Break	
Tue	27-Mar-17	Spring Break	
		Advanced MRI topics and assignments	
Thurs	29-Mar-17	Spectroscopic imaging	
Tue	3-Apr-17	Flow effects, angiography	
Thurs	5-Apr-17	Fast imaging	L&L #9
Tue	10-Apr-17	Diffusion	
Thurs	12-Apr-17	Cardiac imaging	
Tue	17-Apr-17	Student presentations	
Thurs	19-Apr-17	Student presentations	
Tues	24-Apr-17	Last day of class, REVIEW Final exam, date TBA	
