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:

TENTATIVE CLASS SCHEDULE FOR SPRING 2018. SUBJECT TO CHANGE

<table>
<thead>
<tr>
<th>Tue/Thur</th>
<th>Advanced Magnetic Resonance Imaging</th>
<th>Tues/Thurs at INC 2:00-3:20pm</th>
<th>L&amp;L+Lian</th>
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</thead>
<tbody>
<tr>
<td>Tue 9-Jan-17</td>
<td>Introduction - class overview + math review</td>
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<td>L&amp;L #1-2</td>
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<tr>
<td>Thurs 11-Jan-17</td>
<td>Charge, spin, angular momentum, magnetic moments, Quantum</td>
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<td>L&amp;L #3</td>
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<tr>
<td>Tue 16-Jan-17</td>
<td>Mechanics</td>
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<td>L&amp;L #3</td>
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<tr>
<td>Thurs 18-Jan-17</td>
<td>Fields, Magnetization motion in a magnetic field, Resonance, Rotating</td>
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<td>L&amp;L #3</td>
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<tr>
<td>Tue 23-Jan-17</td>
<td>Solutions to Bloch Equations (including computer simulations)</td>
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<td>L&amp;L #3</td>
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<tr>
<td>Thurs 25-Jan-17</td>
<td>Signal Detection</td>
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<td>L&amp;L #3</td>
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<tr>
<td>Tue 30-Jan-17</td>
<td>Lab #1 - RF coils intro</td>
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<td>L&amp;L #4</td>
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<tr>
<td>Thurs 1-Feb-17</td>
<td>Free Induction decay - concepts of RF echoes spin echo - stimulated echo</td>
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<td>L&amp;L #4</td>
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<tr>
<td>Tue 6-Feb-17</td>
<td>Applied Magnetic gradient fields, gradient echoes, REVIEW</td>
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<td>L&amp;L #4</td>
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<tr>
<td>Thurs 8-Feb-17</td>
<td>Math basics - Fourier, Radon, + discrete math</td>
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<td>L&amp;L #2</td>
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</tbody>
</table>
Tue 13-Feb-17  Signal Localization, MRI imaging equations
    Lab #2 - Matlab - getting fluent with Fourier transforms
Thurs 15-Feb-17  Slice selection, RF pulses, spatial signal encoding
Tue 20-Feb-17  Introduction to k-space
    Lab #3 MRI safety training
Thurs 22-Feb-17  MRI techniques, 1D, 2D, 3D
Tue 27-Feb-17  Signal sampling - voxel sensitivity function
Thurs 1-Mar-17  MRI image reconstruction 1
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
Thurs 8-Mar-17  Pulse sequences and imaging techniques
Tue 13-Mar-17  Pulse sequences and imaging techniques
Thurs 15-Mar-17  Image resolution, noise (SNR, CNR), and artifacts, REVIEW
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
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