

ECE/BioE 480
Magnetic Resonance Imaging

Fall, 2020

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Textbook: Principles of Magnetic Resonance Imaging (IEEE Press/Wiley)
Z.-P. Liang and P. C. Lauterbur

Credits: 3hrs (undergraduate)
3/4 unit or 1 unit (graduate)

Grading policy: 25% Homework
35% Midterm exam
40% Final

Course Outline

Introduction

Tomographic Imaging Principles

- Fourier Transform Imaging
- Radon Transform Imaging

Magnetic Resonance Concepts: Signal Generation

- Spin, magnetic moment, and nuclear magnetism
- RF excitations
- Spin-spin relaxation and spin-lattice relaxation
- Free induction decay and echo formation

Imaging Principles: Signal Localization

- Selective excitations
- k-space imaging methods
 - Phase encoding
 - Frequency encoding
- k-space trajectories

Midterm Exam

Image Reconstruction Techniques

- Image reconstruction from Fourier-space data
- Image reconstruction from Radon-space data

Image Contrast Mechanisms

- ρ -weighted, T1-weighted, T2-weighted, T2*-weighted, diffusion-weighted contrasts
- Typical imaging sequences

Image Resolution and Artifacts

- Resolution limitation
- Image artifacts due to nonideal conditions

Selected Topics

- Fast imaging
- Biomedical applications

Final exam