



THE OHIO STATE UNIVERSITY
COLLEGE OF ENGINEERING

Magnetic Resonance Spectroscopy and Imaging I

BIOMEDE 6113

Credit Hours:

3.00

Course Levels:

Graduate (5000-8000 level)

Course Components:

Lecture

Course Description:

Presentation of the basic principles of MRI/MRS, including basic MR physics, pulse sequences, adiabatic excitation, coil design, MR hardware, image formation, localized spectroscopy.

Prerequisites and Co-requisites:

Prereq: Grad standing, or permission of instructor.

Course Goals / Objectives:

- Provide basic knowledge of the principles and practice of magnetic resonance imaging
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Course Topics:

- Overview of Medical Imaging Systems & General imaging concepts (resolution, signal-to-noise ratio, contrast) & Review of Linear Systems Theory and Fourier Transformations
 - Introduction to MRI Physics and MRI system components & Magnetization and the origin of the MRI signal, Larmor Frequency
 - Theory of Relaxation, Relaxivity, Specific Relaxation times: T1 and T2 & Rotating Frame, Radiofrequency excitation pulses
 - Spin Echos & Bloch Equations
 - K-space & Slice Selective RF Excitation
 - Phase Encoding & Frequency Encoding
 - Pulse Sequence Basics (spin echo and gradient echo, partial saturation), Inversion Recovery, & Spin and Gradient echo protocols, application examples; T1, T2, Proton Density Weighted imaging
 - Pulse Sequences (turbo spin echo, turboFLASH, magnetization preparations) & Fat signal behavior and suppression methods
 - Advanced k-space trajectories (echo planar, radial, spiral) & Multi Slice Imaging; 3D imaging, k-space acquisition ordering
 - SNR and CNR (dependencies and tradeoffs) & SNR and CNR Cardiac and Vascular Applications
 - General Clinical Applications & Introduction to Parallel Imaging
 - Parameter mapping (T1, T2, T2*) & Its Cardiac and Vascular Applications
 - Flow and Motion Effects & Artifacts
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Designation:

Elective