



The Hashemite University
Faculty of Allied Health Sciences
Department of Medical Imaging
Course Syllabus

| Course information | |
|---------------------------|---------------------------------|
| Course Title | Magnetic Resonance Imaging (01) |
| Course Code | 110508334 |
| Prerequisites | 110102161 |
| Credit Hours | 3 |

| Course Description | |
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| <p>This course covers different basic topics such as basic physics of NMR, relaxation phenomena, relaxation time measurement, basic NMR imaging theory and methods, biophysical background of tissue NMR, image contrast manipulation, image artifacts, contrast agents in MRI, basic imaging pulse sequences, spatial encoding, k-space, hardware for MRI, quality control and MR safety.</p> | |

| Course Objectives | |
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| By the end of this course, the student is expected to: | |
| Be able to understand the physical principles of nuclear magnetic resonance and major hardware components of the MRI scanner and MR safety. | |
| Be able to describe the process of relaxation phenomena and the biophysical background of tissue NMR. | |
| Be able to understand the process of image contrast manipulation. | |
| Be able to understand the different types of MR image artifacts and their manipulation | |
| Be able to describe the process of signal encoding and image formation | |

| Recommended Textbook | |
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| Title | MRI in practice |
| Author | Catherine Westbrook, Carolyn Roth, John Talbot |
| Publisher | Blackwell |
| Year | 2005 |
| Edition | Third |

| Other References | |
|-------------------------|--|
| Title | MRI from picture to proton |
| Author | Donald McRobbie, Elizabeth Moore, Martin Graves, Martin Prince |
| Publisher | Cambridge |
| Year | 2008 |
| Edition | Second |

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|------------------|---|
| Title | MRI the Basics |
| Author | Ray Hashemi, William Bradlly, Christopher Lisanti |
| Publisher | Lippincott Williams and Wilkins |
| Year | 2010 |
| Edition | Third |

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| Website | http://www.cis.rit.edu/htbooks/mri/ |
| Website | http://www.imaios.com/en/e-Courses/e-MRI/ |
| Website | http://www.mr-tip.com/serv1.php |
| Website | http://www.mritutor.org/ |
| Website | http://www.revisemri.com/ |
| Website | http://medicalphysicist.co.uk/mriportfolio.htm |
| Website | http://www.ismrm.org/mr_sites.htm |

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| Website | http://www.users.on.net/~vision/ |
| Website | http://www.mrisafety.com/ |
| Website | http://www.refindia.net/rlinks/reviewedlinks/functional_MRI.htm |
| Website | http://psychology.uwo.ca/fmri4newbies/ |
| Website | http://www.eecs.umich.edu/~dnoll/primer2.pdf |

Course Contents

Part One: Nuclear Magnetic Resonance (NMR)

- ❖ Introduction
- ❖ Interaction of magnetic moment (μ) with the external magnetic field (B_0) and RF (B_1) field
- ❖ Magnetic Susceptibility
- ❖ Relaxation Phenomena
- ❖ Image contrast mechanisms
- ❖ Gradient echo versus Spin echo
- ❖ Measurement of relaxation times
- ❖ Biophysical basis of relaxation phenomena

Part Two: MR Hardware and Safety

- ❖ MR hardware (Magnet)
- ❖ MR hardware (Magnetic field gradients)
- ❖ MR hardware (Radio frequency fields)
- ❖ MRI Safety

Part Three: Spatial Encoding and k-Space

- ❖ Spatial encoding (slice selection)
- ❖ Spatial encoding (frequency encoding)
- ❖ Spatial encoding (phase encoding)
- ❖ K-space and signal sampling
- ❖ Field of view and spatial resolution
- ❖ Imaging parameters and tradeoffs
- ❖ Quality Assurance

Assessment

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| First Exam | 25% |
| Second Exam | 25% |
| In course assessment | 10% |
| Final Exam | 40% |