Jordan University of Science and Technology

Faculty of Engineering

Biomedical Engineering Department

BME565 Magnetic Resonance Imaging - JNQF Level: 7

First Semester 2023-2024

Course Catalog
3 Credit Hours. Introduces physics of magnetic resonance. Covers magnetic field modalities, relaxation times, gradient and RF coils, pulse sequences, hardware, imaging techniques, artifacts, and applications.

Text Book	
Title	MRI Basic Principles and Applications
Author(s)	Brian M. Dale PhD MBA,, Mark A. Brown PhD,, Richard C. Semelka MD,
Edition	5th Edition
Short Name	Textbook
Other Information	ISBN 978-1-119-01305-1

Course References

Short name	Book name	Author(s)	Edition	Other Information
Ref #1	Magnetic Resonance Imaging; physical principle and sequence design.	Robert W. Brown Ph.D.,, Yu-Chung N. Cheng Ph.D.,, E. Mark Haacke	1st Edition	

Instructor	
Name	**Dr. Areen Al-Bashir**
Office Location	C5 L-1
Office Hours	Sun : 13:00 - 13:30 Mon : 10:00 - 11:30 Mon : 13:00 - 13:30 Tue : 09:30 - 11:30 Wed : 10:00 - 11:30
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Class Schedule & Room
Section 1: Lecture Time: Mon, Wed : 08:30 - 10:00 Room: C5025

Prerequisites		
Line Number	**Course Name**	**Prerequisite Type**
284600	BME460 Medical Imaging Systems	Prerequisite / Study

Tentative List of Topics Covered		
Weeks	**Topic**	**References**
Week 1	Production of net magnetization	
Week 2	Concepts of magnetic resonance	
Week 3	Relaxation	
Week 4	principles of magnetic resonance imaging	
Week 5	Pulse sequences	
Week 6	Measurement parameters and image contrast	
Week 7	Signal suppression techniques	
Weeks 8, 9	Artifacts & Motion artifact reduction techniques	
Week 10	Magnetic resonance angiography	
Weeks 11, 12	Advanced imaging applications	
Week 13	Magnetic resonance spectroscopy	
Week 14	MRI System	
Weeks 15, 16	Safety and Clinical Applications	

Mapping of Course Outcomes to Program Outcomes and NQF Outcomes	Course Outcome Weight (Out of 100%)	Assessment method
Understand the effect of putting protons inside a magnetic field.Comprehend the interactions of the magnetic field produced by a radiofrequency probe and the nuclear spins, the induced precession and the process to give rise to the MRI signal. Know the concept of chemical shift, and why protons in fat and water resonate at slightly different signals, and how this phenomena of spin-lattice and spin-spin relaxation produces an effect on the measured MRI signal [1SO1] [1L7K1, 1L7S1]	30%	

Know the techniques for measuring spin-lattice and spin-spin relaxation times, the principles behind frequency encoding, phase encoding, and slice selection in magnetic resonance imaging, and the full implementation of both spin-echo and gradient-echo imaging sequences [1SO1, 1SO2] [1L7K1, 1L7S1]	20%	
Understand the theory and practical construction of radiofrequency coils, magnetic field gradients, and superconducting magnets. [1SO1, 1SO2] [1L7K1, 1L7S1, 1L7S3]	20%	
Know the Advanced techniques and specific clinical applications of MRI [1SO7] [1L7S1, 1L7S2, 1L7S3, 1L7C2, 1L7C4]	30%	

Relationship to Program Student Outcomes (Out of 100%)						
SO1	SO2	SO3	SO4	SO5	SO6	SO7
50	20					30

Relationship to NQF Outcomes (Out of 100%)					
L7K1	L7S1	L7S2	L7S3	L7C2	L7C4
31.67	37.67	6	12.67	6	6

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