

MSc program, Biomedical Engineering Department

Course Unit Title	Magnetic Resonance Imaging	
Course Unit Code	BME511	
Type of Course Unit	Elective	
Level of Course Unit	Master of Science	
National Credits	3	
Number of ECTS Credits Allocated	10	
Theoretical (hour/week)	4	
Practice (hour/week)	-	
Laboratory (hour/week)	-	
Year of Study	-	
Semester when the course unit is delivered	-	
Course Coordinator	Assist. Prof. Dr. Dilber Uzun Özşahin	
Name of Lecturer (s)	Assist. Prof. Dr. Dilber Uzun Özşahin	
Name of Assistant (s)	-	
Mode of Delivery	Face to Face.	
Language of Instruction	English	
Prerequisites	-	
Recommended Optional Programme Components	-	
Course description:		
<p>This course is designed for biomedical engineering master students. The purpose of the course is to provide detailed information on technical aspects of magnetic resonance imaging. Biomedical diagnostic magnetic resonance imaging systems and the physical principles of nuclear magnetic resonance imaging are introduced in detail. Students are provided with overviews of the major physical techniques that engineers have used to explore in biomedical engineering level.</p>		
Objectives of the Course:		
<p>To provide the students with an understanding of critical evaluation of scientific literature and scientific and engineering research and development in this field, as well as the skills required to present and support their findings.</p>		
Learning Outcomes		
At the end of the course the student should be able to		Assessment
1	Develop a thorough understanding on basics of biomedical diagnostic magnetic resonance imaging devices	1
2	Develop a thorough understanding on physical principles of nuclear magnetic resonance imaging.	1, 2
3	Develop a thorough understanding on principles of MRI system electronics and instrumentations.	1, 2
4	Develop a thorough understanding on clinical applications of MRI	1, 3, 4

	modalities.		
Assessment Methods: 1. Written Exam, 2. Assignment, 3. Project/Report, 4. Presentation, 5. Lab. Work			
Course's Contribution to Program			
			CL
1	Apply the rules of scientific research and ethics		4
2	Discuss complex biomedical engineering issues as well as own research results comprehensively and in the context of current international research and present these in writing and orally		5
3	Solve problems by systems analytical thinking both in subject specific and interdisciplinary concepts		5
4	Combine specialized knowledge of various component disciplines		5
5	Carry out independent scientific work and organize (capacity of teamwork), Conduct and lead more complex projects		4
6	To assess the social and environment-related effects of their actions		3
CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)			
Course Contents			
Week	Chapter	Topics	Assessment
1		Introduction to MRI and math	
2		Image formation and gradient echo	
3		Spin echo and inversion recovery MRI pulse sequences	
4		Contrast manipulation, fast imaging, artefacts	
5		MRI hardware: magnet and gradient coils	
6		MRI hardware: radiofrequency pulses and transmit and receive coils	
7		Bloch equations, high field MRI advantages and limitations	
8		Midterm	Midterm Exam
9		Basics of structural (T1, T2, FLAIR) and functional (BOLD) neuroimaging for clinical investigation	

10		Basics of hemodynamic (dynamic susceptibility contrast, arterial spin labelling and vascular space occupancy) and diffusion tensor imaging	
11		Chemical imaging, MR spectroscopy, chemical exchange, and magnetization transfer imaging	
12		Susceptibility imaging, scanner console, and analysis approaches	
13		High-field (7 Tesla) applications and clinical imaging in cerebrovascular disease	
14		Recent Developments in Medical Imaging & Revision Week	
15		FINAL EXAM	Final Exam.
Recommended Sources:			
Lecture Notes.			
Assessment			
Project	15%		
Midterm Exam	30%	Written Exam	
Final Exam	50%	Written Exam	
Attendance	5%		
Total	100%		
Assessment Criteria			
Final grades are determined according to the Near East University Academic Regulations for Undergraduate Studies			
Course Policies			
<ol style="list-style-type: none"> 1. Attendance to the course is mandatory. 2. Late assignments will not be accepted unless an agreement is reached with the lecturer. 3. Students may use calculators during the exam. 4. Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Near East University General Student Discipline Regulations 			
ECTS allocated based on Student Workload			
Activities	Number	Duration (hour)	Total Workload(hour)

Course duration in class (including Exam weeks)	15	4	60
Labs and Tutorials	10	10	100
Assignment	-	-	-
Project/Presentation/Report	3	10	30
E-learning activities	-	-	-
Quizzes	-	-	-
Midterm Examination	1	6	6
Final Examination	1	12	12
Self Study	15	7	105
Total Workload			236
Total Workload/30(h)			9.47
ECTS Credit of the Course			10