COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
Advanced Magnetic Resonance Imaging Techniques	BME511		(3+0+0)	3	10

Prerequisites	-

Language of Instruction	English
Course Level	Master's Degree
Course Type	Technical Elective
Course Coordinator	Prof. Ali Ümit Keskin
Instructors	Academic Staff
Assistants	
Goals	To provide knowledge on the principles of the new developments and advances in MR imaging data acquisition and reconstruction strategies that are available in the clinical setting for the diagnosis and follow-up of diseases.
Content	Diffusion weighted imaging, perfusion weighted imaging, spectroscopic imaging, MR susceptibility weighted imaging, functional MRI, arterial spin labeling, cardiac MR imaging, interventional MRI.

Course Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) Knowledge of basics of biomedical signals and signal representation	2,4,5,6,7,11	1,2	A,C,D
2) Knowledge of statistical and adaptive signal processing	2,4,5,6,7,11	1,2	A,C,D
3) Applications of statistical and adaptive signal processing techniques to biomedical engineering	2,4,5,6,7,11	1,2,4	A,C,D

Teaching Methods:	1: Lecture, 2: Question-Answer, 3: Lab, 4: Case-study
Assessment Methods:	A: Testing, B: Experiment, C: Homework, D: Project

COURSE CONTENT		
Week	**Topics**	**Study Materials**
1	Fundamentals of Magnetic Resonance Imaging.	Lecture Notes, Articles
2	Fundamentals of Magnetic Resonance Imaging.	Lecture Notes, Articles
3	Fundamentals of Magnetic Resonance Imaging.	Lecture Notes, Articles
4	Diffusion weighted imaging.	Lecture Notes, Articles
5	Perfusion imaging.	Lecture Notes, Articles
6	Spectroscopic imaging.	Lecture Notes, Articles
7	MID-TERM	Lecture Notes, Articles
8	Magnetic susceptibility weighted imaging.	Lecture Notes, Articles
9	Functional MRI.	Lecture Notes, Articles
10	Arterial spin labeling.	Lecture Notes, Articles
11	Cardiac MRI.	Lecture Notes, Articles
12	Interventional MRI.	Lecture Notes, Articles
13	Student presentations.	Lecture Notes, Articles
14	Student presentations.	Lecture Notes, Articles

RECOMMENDED SOURCES	
Textbook	'Principles of Magnetic Resonance Imaging' by Dwight G. Nishimura. Stanford University.
Additional Resources	-

MATERIAL SHARING	
Documents	-
Assignments	-
Exams	-

ASSESSMENT		
IN-TERM STUDIES	**NUMBER**	**PERCENTAGE**
Mid-terms	1	50
Homework	10	20

Presentation	1	30
Total		**100**
CONTRIBUTION OF FINAL EXAMINATION TO OVERALL GRADE		40
CONTRIBUTION OF IN-TERM STUDIES TO OVERALL GRADE		60
Total		**100**

COURSE CATEGORY	Expertise/Field Courses

	COURSE'S CONTRIBUTION TO PROGRAM						
No	Program Learning Outcomes	Contribution					
		0	1	2	3	4	5
1	Ability to reach wide and deep knowledge through scientific research in the field of Biomedical Engineering, evaluate, interpret and apply.						**X**
2	Ability to use scientific methods to cover and apply limited or missing knowledge, and to integrate the knowledge of different disciplines to identify, define, formulate solutions to complex engineering problems.					**X**	
3	Ability to construct Biomedical Engineering problems, develop methods to solve the problems and use innovative methods in the solution.					**X**	
4	Ability to develop new and/or original ideas, tools and algorithms; develop innovative solutions in the design of system, component or process.						**X**
5	Ability to have extensive knowledge about current techniques and methods applied in Biomedical Engineering and their constraints.					**X**	
6	Ability to design and implement analytical modeling and experimental research, solve and interpret complex situations encountered in the process.						**X**
7	Ability to use a foreign language (English) at least at the level of European Language Portfolio B2 in verbal and written communication.						**X**
8	Ability to lead in multidisciplinary teams, develop solutions to complex situations and take responsibility.					**X**	
9	Ability to pass process and the results in Biomedical Engineering field, in national and international area in or outside of the field, systematically and clearly in written or oral form.					**X**	
10	Awareness of the social, legal, ethical and moral values and environmental dimensions. The ability to conduct research and implementation work within the framework of these values.					**X**	
11	Awareness of the new and emerging applications in Biomedical Engineering field, and the ability to examine them and learn if necessary.					**X**	
12	Ability to read, understand, present, critise research work and conduct original theoretical or applied research.				**X**		

ECTS ALLOCATED BASED ON STUDENT WORKLOAD BY THE COURSE DESCRIPTION			
Activities	Quantity	Duration (Hour)	Total Workload (Hour)
Course Duration (Excluding the exam weeks: 12x Total course hours)	12	3	36
Hours for off-the-classroom study (Pre-study, practice)	14	5	70
Midterm examination	2	3	6
Homework	5	6	30
Presentation	1	20	20
Final examination	1	3	3
Total Work Load			240
Total Work Load / 25 (h)			9.6
ECTS Credit of the Course			10