COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
Magnetic Resonance Spectroscopic Imaging	BME513		(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 magnetic resonance spectroscopic imaging.
Content	1H, 13C and 31P NMR spectroscopy, nuclear spin states, nuclear magnetic moment, resonance, chemical environment and chemical shift, shielding, spin-spin splitting, spin-spin coupling, coupling constants, A2 AB AX spin systems, typical 31P, 13C and 1H spectra of chemical compounds, T1 and T2 relaxation, MR spectroscopic imaging, clinical MRS pulse sequences (PRESS, STEAM, ISIS), MR spectroscopic data reconstruction, underlying biochemistry and cellular physiology, clinical MR spectroscopic applications (pediatric, brain, prostate, muscle, cardiac, soft tissue applications).

Course Learning Outcomes	**Program Learning Outcomes**	**Teaching Methods**	**Assessment Methods**
1) To have knowledge on fundamentals of magnetic resonance imaging	2,4,5,6,7,11	1,2	A,C,D
2) To have knowledge on magnetic resonance spectroscopic imaging tehniques	2,4,5,6,7,11	1,2	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	1H, 13C and 31P NMR spectroscopy.	Lecture Notes, Articles
2	Nuclear spin states, nuclear magnetic moment, resonance.	Lecture Notes, Articles
3	Chemical environment and chemical shift, shielding.	Lecture Notes, Articles
4	Spin-spin splitting, spin-spin coupling, coupling constants.	Lecture Notes, Articles
5	A2 AB AX spin systems, typical 31P, 13C and 1H spectra of chemical compounds.	Lecture Notes, Articles
6	T1 and T2 relaxation.	Lecture Notes, Articles
7	MID-TERM	Lecture Notes, Articles
8	MR spectroscopic imaging.	Lecture Notes, Articles
9	Clinical MRS pulse sequences (PRESS, STEAM, ISIS).	Lecture Notes, Articles
10	MR spectroscopic data reconstruction.	Lecture Notes, Articles
11	Underlying biochemistry and cellular physiology.	Lecture Notes, Articles
12	Clinical MR spectroscopic applications (pediatric, brain, prostate, muscle, cardiac, soft tissue applications).	Lecture Notes, Articles
13	Student presentations	Lecture Notes, Articles
14	Student presentations	Lecture Notes, Articles

RECOMMENDED SOURCES	
Textbook	-
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