COURSE INFORMATON					
Course Title	*Code*	*Semester*	*L+P Hour*	*Credits*	*ECTS*
Biomedical Signals and Processing	BME515		(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	Assist. Prof. Gokhan Ertas
Assistants	
Goals	To provide knowledge on representation and processing of biomedical signals
Content	Fundamentals of biomedical signals. Signals in time and transform domains. Discretization of signals. Discrete time signals in the transform domain. Digital filters and filter design. Processing of signals using digital filters. Optimal filtering. Techniques as applied to biomedical signals such as ECG, EMG and EEG.

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) Filters and filter design in biomedical signal processing	2,4,5,6,7,11	1,2	A,C,D
3) Signal processing as applied 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	Fundamental of biomedical signals	Lecture Notes, Articles
2	Signals in time and transform domains.	Lecture Notes, Articles
3	Discretization of signals.	Lecture Notes, Articles
4	Discrete time signals in the transform domain.	Lecture Notes, Articles
5	Digital filters and filter design.	Lecture Notes, Articles
6	Processing of signals using digital filters.	Lecture Notes, Articles
7	MID-TERM	Lecture Notes, Articles
8	Processing of signals using digital filters.	Lecture Notes, Articles
9	Optimal filtering.	Lecture Notes, Articles
10	Optimal filtering.	Lecture Notes, Articles
11	Techniques as applied to biomedical signals such as ECG, EMG and EEG.	Lecture Notes, Articles
12	Techniques as applied to biomedical signals such as ECG, EMG and EEG.	Lecture Notes, Articles
13	Student presentations	Lecture Notes, Articles
14	Student presentations	Lecture Notes, Articles

RECOMMENDED SOURCES	
Textbook	Kayvan Najarian and Robert Splinter. Biomedical Signal and Image Processing. CRC Press, 2012. Katarzyn J. Blinowska and Jaroslaw Zygierewicz. Practical Biomedical Signal Analysis Using MATLAB. CRC Press, 2012.
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