ABDULLAH GUL UNIVERSITY
GRADUATE SCHOOL OF ENGINEERING & SCIENCE
BIOENGINEERING DEPARTMENT
COURSE DESCRIPTION AND SYLLABUS

Course Name	CODE	SEMESTER	T+L Hour	CREDIT	ECST
Biosignal and Image Analysis	BENG 531	FALL-SPRING	3+0	3	10

Prerequisite Courses	None

Course Type	Selective
Course Language	English
Course Coordinator	Assoc. Prof. Dr. İsa YILDIRIM
Lecturers	Assoc. Prof. Dr. İsa YILDIRIM
Course Assistants	
Course Objectives	1. To develop an understanding of the fundamentals of signal processing 2. To develop an understanding of image processing and imaging 3. Applying the gained theoretical knowledge to biomedical signals and images
Learning Outcomes	A student who has taken this course 1. will gain theoretical knowledge on the fundamentals of deterministic signal processing, 2. random processes, 3. statistical signal processing, 4. classification, 5. as well as developing the skills necessary to apply the theoretical knowledge on biomedical signals and images
Course Content	Fundamentals of signal processing (linear time invariant systems, Fourier transforms for continuous and discrete signals, sampling, filter design; Imaging system: Point spread function, resolution (pixel, voxel, spatial, temporal); Image quality and uncertainties in image formation (digitization, quantum efficiency, calibration, CNR, SNR); Image registration, filtering and noise removal; Basic clustering methods; Time –frequency analysis; Compressed sensing; Applications for biomedical signal and images

WEEKLY SUBJECTS AND RELATED PRELIMINARY PAGES

Week	Subjects	Preliminary
1	Fundementals of systems and signals	
2	Discrete Fourier transform	
3	Sampling	
4	Filter design	
5	Imaging system: Point spread function, resolution (pixel, voxel, spatial, temporal)	
6	Image quality and uncertainties in image formation (digitization, quantum efficiency, calibration, CNR, SNR)	
7	Linear estimation and Wiener filter	
8	Midterm exam, Image registration	
9	Image registration, filtering and noise removal	
10	Basic clustering methods	
11	Time –frequency analysis (STFT and Wavelet transform)	
12	Inverse problems and regularization for biomedical signal and image analysis	

13	Compressed sensing	
14	Applications for biomedical signal and images	
15	Applications for biomedical signal and images	
16	Final Exam	

RESOURCES	
Course Notes	Lecture Notes
Other Resources	TEXTBOOK: There is NO text book for this class REFERENCE BOOKS: 1. Medical Imaging Signals and Systems, by Jerry Prince & Jonathan Links, Publisher: Prentice Hall, 2006 2. Biomedical Signal and Image Processing, Najarian and Splinter, 2006

MATERIAL SHARING	
Documents	Lecture notes and slides
Homework	3 Homework assignments
Exams	1 Midterm and Final Exams

RATING SYSTEM		
SEMESTER WORKS	**NUMBER**	**CONTRIBUTION**
Midterm	1	30
Term Project	1	15
Homework	3	15
TOTAL		
Success Rate of Semester		60
Success Rate of Final		40
TOTAL		

Course Category	
Basic Sciences and Mathematics	%25
Engineering Sciences	%75
Social Sciences	

THE RELATIONSHIP BETWEEN THE LEARNING OUTCOMES AND PROGRAM COMPETENCE

No	Program Outcomes	Contribution Level				
		1	2	3	4	5
1	Understanding of Life Sciences, Mathematics and Engineering at the post-graduate level, and being able to implement of this knowledge into bioengineering problems					X
2	Having the ability of developing a new scientific method or a technological product or process, and, designing experiments, implementing, collecting data and evaluating regarding these issues				X	
3	Choosing technical equipment used in the applications related to bioengineering, having sufficient knowledge in adopting and using new technological equipment					X
4	Having the ability of reaching the information, using resources, contributing to the literature by transferring the process and results of scientific studies as written or verbally in the national and international environments					X
5	Having the ability of working as an individual or a team, in the teams composed of discipline or different disciplines, gaining awareness of leadership and taking responsibility				X	
6	Having advanced level of foreign language knowledge to manage efficient verbal, written and visual communication in the major field				X	
7	Having the understanding of ethics in science and the responsibility in profession with the awareness of lifelong learning, being beneficial to society and sensitiveness to global issues					X
8	Being aware of the social impacts of the solutions and applications of the challenges regarding Bioengineering				X	

*From 1 to 5, it increasingly goes.

ECTS / WORK-LOAD TABLE			
Activities	Activities	Duration (Hour)	Total (Work-Load)
Course Duration (Including exam week: 16x total course hour)	16	3	48
Out of Class Exercise Time (Pre-study, reinforcement)	14	2	28
Reading			
Searching on Internet, library study	15	2	30
Material Designing, practice			
Preparation of report	1	50	50
Preparation of presentation	1	24	24
Presentation			
Homework	3	15	45
Midterms	1	25	25
Final	1	50	50
Total Work-Load			300
Total Work-Load / 30			300/30
Course ECTS Credit			10