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

Course Name	CODE	SEMESTER	T+L Hour	CREDIT	ECST
Medical Imaging	BENG532	FALL-SPRING	3+0	3	10

Prerequisite Courses	None

Course Type	Elective
Course Language	English
Course Coordinator	Assoc. Prof. Dr. İsa YILDIRIM
Lecturers	Assoc. Prof. Dr. İsa YILDIRIM
Course Assistants	
Course Objectives	This course will provide a detailed review of imaging principles and instrumentation of all the conventional clinical imaging systems, including X-ray radiography, computerized tomography (CT), gamma camera, SPECT, PET, ultrasound (US), Doppler US, Magnetic Resonance (MR) and functional MR (f-MR).
Learning Outcomes	A student who has taken this course 1. has learned basic characteristics of imaging systems in diagnostic radiology, 2. recognizes commonly used imaging systems and their operating principles, 3. recognizes which system will provide the most helpful diagnostic images for a specific patient
Course Content	•General characteristics of imaging systems; •X-ray and CT: general principles, interaction of X-rays with tissues, contrast agents, imaging techniques, image reconstruction, radiation dose; •Nuclear Medicine: general principles, radionuclide, radioactive decay, gamma camera, imaging techniques, SPECT, PET; •Ultrasound imaging: general principles, interaction of acoustic waves with tissue, acoustic impedance, instrumentation, scanning modes, artifacts, blood velocity measurements, contrast agents; •MR imaging: general principles, nuclear magnetism, magnetic resonance, instrumentation, imaging sequences, contrast agents, imaging techniques, functional MRI.

WEEKLY SUBJECTS AND RELATED PRELIMINARY PAGES

Week	Subjects	Preliminary
1	Introduction to biomedical imaging	
2	General characteristics of imaging systems	
3	X-rays, X-ray film, instrumentation	
4	Computed tomography, instrumentation	
5	Fourier slice theorem, Radon transform	
6	Iterative methods in image reconstruction	
7	Limited view angle imaging and digital breast tomosyntheis	
8	Midterm, Nuclear medicine, radioactivity	
9	Gamma camera, SPECT, PET, instrumentation	
10	Image reconstruction, clinical applications	
11	Ultrasound, wave propagation and acoustic impedance, instrumentation	
12	US imaging characteristics, scanning methods and modes, Doppler US	

13	MR imaging, magnetic resonance, Larmor frequency, relaxation	
14	Slice selection, phase/frequency encoding, imaging sequences, functional MRI	
15	Project presentations	
16	Final Exam	

RESOURCES	
Course Notes	Lecture notes
Other Resources	TEXTBOOK: Introduction to Biomedical Imaging, Andrew R. Webb, IEEE Product No.: PC5893, IEEE Press and John Wiley & Sons, Inc., 2003, ISBN: 0-471-23766-3. RECOMMENDED BOOKS: 1. Medical Imaging Electronics, Krzysztof Iniewski, Wiley 2009, ISBN: 9780470391648. 2. Biomedical Imaging, K. M. Mudry, R. Plonsey and J. D. Bronzino (Eds.) CRC Press 2003, ISBN 0-8493-1810-6.

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		100

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