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

Course Name	CODE	SEMESTER	T+L Hour	CREDIT	ECST
MEDICAL IMAGING	ECE541	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 • has learned basic characteristics of imaging systems in diagnostic radiology, • recognizes commonly used imaging systems and their operating principles, • 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	

SOURCES

Course Notes	Lecture notes and slides
Other Sources	**Course 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. **Additional Materials:** 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.

COURSE MATERIALS SHARING	
Documents	Lecture notes and slides
Homeworks	3 Homework assignments
Exams	1 Midterm and Final Exams

EVALUATION SYSTEM		
SEMESTER STUDY	**NUMBER**	**CONTRIBUTION**
Midterm	1	30
Term Project	1	15
Homework	3	15
SUB-TOTAL		
Contribution of Semester Study		60
Contribution of Final Exam		40
TOTAL		100

Course Category	
Sciences and Mathematics	%25
Engineering	%75
Social Sciences	%0

RELATIONSHIPS BETWEEN LEARNING OUTCOMES AND PROGRAM QUALIFICATIONS

No	Program Qualifications	Contribution Level				
		1	2	3	4	5
1	The skills of using mathematics, science and engineering information in advanced research					X
2	The skills of analyzing, designing and/or implementing an original system that will be able to solve an engineering problem,					X
3	The skills of using the required software, hardware and modern measurement equipments in their field of research,				X	
4	The skills of planning independent research and implementing in detail,				X	
5	The skills of following literature, listening to and making technical presentation, writing a paper in academic level,					X
6	The skills of innovative and interrogative thinking and finding original solutions					X

*From 1 to 5, it increasingly goes.

ECTS / WORK-LOAD TABLE			
Activities	Activities	Duration (Hour)	Total (Work-Load)
Course Length (Including exam week: 16x total course hour)	16	3	48
Out-of-class Study Time (Pre-study, practice)	16	2	32
Internet search, library work, literature search	16	1	16
Homework	3	30	90
Midterms	1	60	60
Final	1	60	60
Total Work-Load			306
Total Work-Load / 30			306/30
Course ECTS Credit			10