

School of Engineering and Natural Sciences / Computer Engineering (English)

2022 - 2023 Academic Year

MEDICAL IMAGING

Syllabus

Course Description					
Name	Code	Semester	T+A Hour	Credit	ECTS
MEDICAL IMAGING	COE4234060	Spring Semester	3+0	3	6
Prerequisites Courses	SİNYALLER VE SİSTEMLER; LİNEER CEBİR VE DİFERANSİYEL DENKLEMLER; DİFERANSİYEL DENKLEMLER				
Recommended Elective Courses					
Language of Instruction	English				
Course Level	First Cycle (Bachelor's Degree)				
Course Type	Elective				
Course Coordinator	Assist.Prof. Kevser Banu KÖSE				
Name of Lecturer(s)	Assoc.Prof. Muhammed Fatih TOY, Assist.Prof. Kevser Banu KÖSE				
Assistant(s)					
Aim					
Course Content	This course contains; Atomic structure, radioactivity, Rayleigh Scattering, Compton Scattering and Photoelectric Effect,X-Rays, X-ray Tube, X-Ray Devices, Fluoroscopy and Angiography,Computed Tomography Devices and Basic Working Principles,Sound Wave and Physics, Reflection, Refraction, Scattering and Attenuation,Piezoelectric Effect, Transducer, Ultrasonography, Ultrasound Modes and Acquisition,Proton, Spin, Magnetic Moment, Electromagnetism, Magnetic Field and Radio Frequency,Magnetic Resonance Imaging Devices, Image Formation in Magnetic Resonance Devices,Functional Magnetic Resonance device and BOLD technique,Diffusion Tensor Magnetic Resonance Device,Nuclear Medicine Imaging Devices,Positron Emission Tomography and Principles,Single Photon Emission Tomography (SPECT),Image analysis with MATLAB,Medical Image Reconstruction with MATLAB.				
Course Learning Outcomes			Teaching Methods	Assessment Methods	
1.Classify the techniques of medical imaging			1, 2, 3, 4		
1.1. Define X-ray imaging techniques			1, 3		
1.2. Define sound wave imaging techniques			1, 2, 3		
1.3. Express magnetic resonance imaging principles			1, 21, 22, 3		
1.4 Identify functional imaging techniques			1		
1.5. Explain nuclear medicine imaging systems			1, 2		
2. Express the working principles of medical imaging			1, 2, 21, 3, 4		
2.1. Define the terms of atom and molecule			1, 21		
2.2. Explain the principles of X-ray physics, and it's generation			1, 2, 3		
2.3. Explain the sound wave generation, and it's principles			1		
2.4. Identify reflection, refraction, scattering, weakening and Doppler			1, 2, 3		
2.5. Define the terms of proton, spin, positron and electromagnetism			1, 2, 21, 3	F	
2.6. Express magnetic field and magnetic moment			1		
2.7. Explain the essential principles of radio frequency physics			1		
2.8. Define the terms of photon, radyoactivity and the principles of decay			1		
2.9. Identify the Gamma rays and their usage for clinical imaging purposes			1, 2, 3		
3. Evaluate the working principles and equipments of medical imaging devices			1, 3		
3.1. Explain the equipment and working principles of X-ray device			1, 21, 3		
3.2. Explain the equipment and working principles of CT device			1		
3.3. Explain the equipment and working principles of ultrasonography device			1		
3.4. Explain the equipment and working principles of magnetic resonance (MR) device			1		
3.5. Explain the equipment and working principles of functioal MR and diffusion tensor MR device			1, 3		
3.6 Explain the equipment and working principles of positron emission tomography (PET) and Single-photon emission computed tomography (SPECT)			1, 3, 4		
4. Analyze the advanategs, disadvantages of the medical imaging devices			1, 3		
5. Summarize and perform the image generation on MATLAB.			1		
Teaching Methods	1: Lecture, 2: Question - Answer, 21: -, 22: -, 3: Discussion, 4: Exercise, Practice				
Assessment Methods	F: Performance task				
Lecture Schedule					
Sequenc e	Topics	Preliminary Preparation			
1	Atomic structure, radioactivity, Rayleigh Scattering, Compton Scattering and Photoelectric Effect				
2	X-Rays, X-ray Tube, X-Ray Devices, Fluoroscopy and Angiography				
3	Computed Tomography Devices and Basic Working Principles				
4	Sound Wave and Physics, Reflection, Refraction, Scattering and Attenuation				
5	Piezoelectric Effect, Transducer, Ultrasonography, Ultrasound Modes and Acquisition				
6	Proton, Spin, Magnetic Moment, Electromagnetism, Magnetic Field and Radio Frequency				
7	Magnetic Resonance Imaging Devices, Image Formation in Magnetic Resonance Devices				
8	Functional Magnetic Resonance device and BOLD technique				
9	Diffusion Tensor Magnetic Resonance Device				
10	Nuclear Medicine Imaging Devices				
11	Positron Emission Tomography and Principles				
12	Single Photon Emission Tomography (SPECT)				

Lecture Schedule		
Sequence	Topics	Preliminary Preparation
13	Image analysis with MATLAB	
14	Medical Image Reconstruction with MATLAB	
Evaluation Methods		Weight(%)
Midterm Exam		30
General Exam		70

Resources