Course Code	Course Name	Teorical	Practice	Laboratory	Credits	ECTS
FZK-4034	Radiation Measurement and Imaging	3.00	0.00	0.00	3.00	6.00

Course Detail

Course Language	: Turkish
Qualification Degree	: Bachelor
Course Type	: Optional
Preconditions	: Not
Objectives of the Course	: Aim of this course is to teach the basic principles of interaction of radiation with matter and radiation detectors that are designed on the basis of principles of operation, characteristics, radiation detection and measurement techniques, the use of radiation detectors of various nuclear systems, nuclear sciences and applications that are important for radiation imaging techniques and methods of the subject is to give the student.
Course Contents	: Radiation Sources, Units and Definitions, Interaction of Charged Particles, Gamma Rays and Neutrons with Matter. Counting Statistics and Error Prediction: Characterization of Data, Statistical Models, Application of Statistical Models, Error Propagation, Optimization of Counting Experiments, Limits of Detectability, Distribution of Time Intervals. General Properties of Radiation Detectors: Simplified Detector Model, Modes of Detector Operation, Pulse Height Spectra, Counting Curves and Plateaus, Energy Resolution, Detection Efficiency, Dead Time. Operation Principles and Properties of Ionization Chambers, Proportional Counters, Geiger-Mueller Counters, Scintillation Detectors, Slow Neutron Detection Methods, Fast Neutron Detection and Spectroscopy. Analaog and Digital Pulse Processing and Shaping.Theory and Use of Detectors For Imaging: Fundamental Physics and Mathematics Involved in Image Formation, Introduction to Digital Image Processing: Definitions,. Linear System Theory, Image Operations. Image Quality, Modulation Transfer Function, Noise Properties, Instrumentation for Nuclear Imaging, Scintillation Cameras, Radionuclide Tomographic Reconstruction, Data Acquisition and Reconstruction, Planer Radiographic Imaging, Multi-dimensional Tomography (X-ray CAT, PET,SPECT).
Recommended or Required Reading	: Knoll Glenn F., Radiation Detection and Measurement, John Wiley & Sons; ISBN: 0471073385; 3rd edition December 1999 Tsoulfanidis Nicholas, Measurement and Detection of Radiation, Taylor & Francis; ISBN: 1560323175; 2nd edition March 1995 Kleinknecht Konrad, Detectors for Particle Radiation, Cambridge University Press; ISBN: 0521640326; 2nd edition December 1998 Kember N. F. (Editor), Medical Radiation Detectors: Fundamental and Applied Aspects (Medical Science), Institute of Physics Pub; ASIN: 0750303190; June 1994 Sharp Peter F., Dendy Philip P., Keyes W. Ian, Sharp W. Ian, Radionuclide Imaging Techniques (Medical Physics Series), Academic Press; ISBN: 0126390207; November 1997 Hendee William R., Ritenour E. Russell, Medical Imaging Physics, John Wiley & Sons; ISBN: 0471382264; 4th edition June 15, 2002 Suetens Paul, Fundamentals of Medical Imaging, Cambridge University Press; ISBN: 0521803624; Bk&Cd-Rom edition March 2002 Kak Avinash C., Slaney Malcolm, Principles of Computerized Tomographic Imaging (Classics in Applied Mathematics, 33), Society for Industrial & Applied Mathematics; ISBN: 089871494X; July , 2001
Planned Learning Activities and Teaching Methods	: Lecture, Discussion, Report Preparation and/or Presentation
Recommended Optional Programme Components	: --
Instructors	: Prof. Dr. Emine Dilara Atalay
Instructor's Assistants	: --
Presentation Of Course	: Face to face

Course Outcomes

Upon the completion of this course a student :

1 To comprehend the properties of ionizing radiation.

2 To determine the detection techniques for ionizing radiation.

3 To select the correct systems for detection of radiation.

4 To know the basics of image formation and processing.

5 To understand the properties and working principles of diagnostic and treatment devices used in radiology and nuclear medicine and radiotherapy.

6 To examine the importance of radiation in diagnosis and treatment.

7 To understand the importance of the biological effects of radiation.

8 To list the measures necessary for radiation safety.

Preconditions

Course Code	Course Name	Teorical	Practice	Laboratory	Credits	ECTS

Weekly Contents

	Teorical	Practice	Laboratory	Preparation Info	Teaching Methods
1.Week	*Radiation sources and basic concepts.				*Lecture, Discussion, Report Preparation and/or Presentation
2.Week	*Interaction of charged-particles, gamma rays and neutrons with matter				
3.Week	*Counting statistics and error prediction				
4.Week	*Radiation detectors				
5.Week	*Radiation Detectors				
6.Week	*Radiation Detectors				
7.Week	*Neutron detectors and measurement methods				
8.Week	*Fundamental physics in image formation				
9.Week	*Fundamental physics in image formation				
10.Week	*Dijital image processing				
11.Week	*Instrumentation for nuclear imaging				
12.Week	*Instrumentation for nuclear imaging				
13.Week	*X-ray CAT				
14.Week	*X-ray SPECT and PET				

Assesment Methods %

1 Final : 50.000

2 Ödev : 10.000

3 Presentation/Seminar : 40.000

ECTS Workload

Activities	Count	Time(Hour)	Sum of Workload
Ödev	4	3.00	12.00
Final	1	3.00	3.00
Individual study before lecture	3	5.00	15.00
Class Hours (14 weeks)	14	3.00	42.00
Presentation/Seminar	3	3.00	9.00
Final Exam Preparation	14	2.00	28.00
Further Study	14	3.00	42.00
Preliminary Study	14	3.00	42.00
			Total : 193.00
		Sum of Workload / 30 (Hour) :	6
			ECTS : 6.00

Program And OutcomeRelation

	P.O. 1	P.O. 2	P.O. 3	P.O. 4	P.O. 5	P.O. 6	P.O. 7	P.O. 8	P.O. 9	P.O. 10	P.O. 11	P.O. 12	P.O. 13	P.O. 14	P.O. 15	P.O. 16	P.O. 17	P.O. 18	P.O. 19	P.O. 20	P.O. 21	P.O. 22	P.O. 23	P.O. 24
L.O. 1	4	2	3	3	4	3	3	2	3	3	3	2	3	4	3	2	3	2	2	2	2	4	2	3
L.O. 2	4	3	3	3	3	2	4	3	2	4	3	2	2	3	4	1	2	3	3	3	3	2	3	3
L.O. 3	5	4	4	4	3	4	2	3	3	3	3	2	2	4	2	1	2	2	2	3	3	2	3	3
L.O. 4	5	2	5	3	4	3	4	4	4	4	3	2	3	3	4	2	3	3	3	3	2	3	3	2
L.O. 5	5	4	3	4	5	2	2	3	3	2	3	2	3	3	3	2	1	2	3	2	3	2	4	3
L.O. 6	3	2	4	3	3	4	5	2	2	3	3	2	2	2	2	3	4	4	2	2	2	2	3	3
L.O. 7	4	2	3	4	2	2	3	4	4	2	3	2	2	2	3	2	2	4	2	3	3	3	4	4
L.O. 8	4	2	3	4	5	3	3	2	3	3	4	3	2	3	3	2	2	3	3	2	3	2	3	3

Ders/Program Çıktıları İlişkisi

P.O. 1	P.O. 2	P.O. 3	P.O. 4	P.O. 5	P.O. 6	P.O. 7	P.O. 8	P.O. 9	P.O. 10	P.O. 11	P.O. 12	P.O. 13	P.O. 14	P.O. 15	P.O. 16	P.O. 17	P.O. 18	P.O. 19	P.O. 20	P.O. 21	P.O. 22	P.O. 23	P.O. 24	P.O. 2
3	4	3	4	4	3	3	4	2	4	3	3	2	4	2	4	3	3	3	3	4	2	4	2	3