Course Information

COURSE INFORMATION

Course Title	Code	Semester	L+U Hour	Credits	ECTS
Radiation Measurement and Imaging	FZK492	8. Semester	3 + 0	3.0	7.0

Prerequisites	None

Language of Instruction	Turkish
Course Level	Bacheclor's Degree (First Cycle)
Course Type	Elective
Mode of delivery	Face to face
Course Coordinator	Assoc. Prof. Dr. Emine Dilara AYDIN
Instructors	
Assistants	
Course Objectives	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 Content	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).
Course Learning Outcomes	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

Quick Access

Physics
- Qualification Awarded
- Level of Qualification
- Qualification Requirements and Regulations
- Specific Admission Requirements
- Recognition of Prior Learning
- Profile of the Program
- Program Key Learning Outcomes
- Occupational Profile of Graduates
- Access to Further Studies
- Course Structure & Credits
- Exam Regulations & Assessment & Grading
- Graduation Requirements
- Mode of Study
- Programme Director(or Equivalent)
- Evaluation Questionnaire
- TYYÇ

Course Information
- Course Information
- Weekly Course Content
- Resources
- Course Category
- CONTRIBUTION OF COURSE LEARNING OUTCOMES TO PROGRAMME OUTCOMES
- ECTS credits and course workload

WEEKLY COURSE CONTENT

Week	Topics	Teaching and Learning Methods and Techniques	Study Materials
1. Week	Radiation sources and basic concepts	Oral lecture, questions-answers, homework	
2. Week	Interaction of charged-particles, gamma rays and neutrons with matter	Oral lecture, questions-answers, homework	
3. Week	Counting statistics and error prediction	Oral lecture, questions-answers, homework	
4. Week	Radiation detectors	Oral lecture, questions-answers, homework	
5. Week	Radiation detectors	Oral lecture, questions-answers, homework	
6. Week	Radiation detectors	Oral lecture, questions-answers, homework	
7. Week	Neutron detection methods	Oral lecture, questions-answers, homework	
8. Week	Mid-term Exam		
9. Week	Fundamental physics in image formation	Oral lecture, questions-answers, homework	
10. Week	Fundamental physics in image formation	Oral lecture, questions-answers, homework	
11. Week	Dijital image processing	Oral lecture, questions-answers, homework	
12. Week	Instrumentation for nuclear imaging		
13. Week	Instrumentation for nuclear imaging	Oral lecture, questions-answers, homework	
14. Week	X-ray CAT	Oral lecture, questions-answers, homework	
15. Week	X-ray SPECT and PET	Oral lecture, questions-answers, homework	
16. Week	Final Exam		

RESOURCES

Recommended Sources
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

ASSESSMENT

Measurement and Evaluation Methods and Techniques
Mid-term Exam, Attendance, Problem Solving, Quiz, Final Exam

COURSE CATEGORY

Course Category	Percentage
Support Courses	% 100

CONTRIBUTION OF COURSE LEARNING OUTCOMES TO PROGRAMME OUTCOMES

Programme Outcomes	Contribution Level	DK1	DK2	DK3	DK4	DK5	DK6	DK7	DK8
PY1	5	0	4	4	5	5	5	4	4
PY2	4	4	5	4	4	4	3	4	4
PY3	1	3	2	2	2	1	1	1	1
PY4	3	3	3	3	3	4	3	3	4
PY5	1	2	2	1	1	1	2	1	1
PY6	3	3	2	3	3	3	2	2	3
PY7	1	2	1	2	1	1	1	2	2
PY8	1	1	2	1	1	1	2	1	1
PY9	1	1	1	2	1	1	1	2	1
PY10	3	3	3	3	3	3	2	2	2
PY11	1	1	1	1	1	1	1	2	1
PY12	1	1	1	1	2	1	1	1	1
PY13	1	1	1	1	1	1	1	2	1
PY14	1	1	1	1	1	1	2	1	1
PY15	3	3	3	3	3	4	3	3	3

*DK = Course's Contrubution.

	0	1	2	3	4	5
Level of contribution	None	Very Low	Low	Fair	High	Very High

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ECTS CREDITS AND COURSE WORKLOAD

Event	Quantity	Duration (Hour)	Total Workload (Hour)
Class Hours (14 weeks)	14	3	42
Final Exam Preparation	1	18	18
Mid Term Exam Preparation	1	15	15

Further Study	14	5	70
Quiz 1	4	2	8
Assignment 1	4	2	8
Mid Term Exam 1	1	2	2
Final Exam	1	2	2
Preliminary Study	14	1	14
		Total Workload	179
		Total Workload / 25.5 (s)	7.02
		ECTS Credit of the Course	7