MSc program, Biomedical Engineering Department

Course Unit Title	Physics in Nuclear Medicine
Course Unit Code	BME533
Type of Course Unit	Elective
Level of Course Unit	MSc. program
National Credits	3
Number of ECTS Credits Allocated	10
Theoretical (hour/week)	4
Practice (hour/week)	-
Laboratory (hour/week)	-
Year of Study	2
Semester when the course unit is delivered	1
Course Coordinator	Assist. Prof. Dr. Dilber Uzun Özşahin
Name of Lecturer (s)	Assist. Prof. Dr. Dilber Uzun Özşahin
Name of Assistant (s)	-
Mode of Delivery	Face to Face.
Language of Instruction	English
Prerequisites	
Recommended Optional Programme Components	

Course description:

Deep knowledge of conventional nuclear medicine imaging devices. Introduction of radiation detectors. Gamma camera basic principles. Field of application of gamma camera. Performance, cons and pros of gamma camera. Characterizing or evaluating image quality. Limitation of image quality, and approaches to solve it. Tomographic image reconstruction techniques. Conventional image reconstruction techniques such as Ordered Subset Expectation (OSEM) Maximization and Filtered Back Projection (FBP). Basic of Single Photon Emission Computed Tomography (SPECT) and Positron Emission Tomography (PET). State-of-the-art SPECT and PET systems.

Objectives of the Course:

1. Radiation Detectors.
2. The Gamma Camera: Basic Principles.
3. The Gamma Camera: Performance Characteristics.
4. Image Quality in Nuclear Medicine.
5. Tomographic Reconstruction in Nuclear Medicine.
6. Single Photon Emission Computed Tomography (SPECT)
7. Positron Emission Tomography (PET)

Learning Outcomes

At the end of the course the student should be able to		Assessment
1	Understanding radiation detectors used in nuclear medicine.	1
2	Understanding the concept of the gamma camera.	1, 2,3
3	Understanding the performance of the gamma camera.	1, 2,4
4	Understanding the concept of image quality in nuclear medicine	1, 2,4

	(problems, limitations and solutions)	
5	Understanding the problems of conventional radionuclide imaging techniques, Alternative approaches such as PET, SPECT	1,2,3
6	Understanding the concept of the SPECT	1,2,3
7	Understanding the concept of the PET	1,2,3

Assessment Methods: 1. Written Exam, 2. Assignment, 3. Project/Report, 4. Presentation, 5. Lab. Work

Course's Contribution to Program

		CL
1	Adequate knowledge in nuclear medicine imaging devices, and knowledge in these areas in complex problems.	5
2	Ability to identify, formulate, and solve complex nuclear medicine imaging tecniques problems; ability to select and apply proper modeling methods such as new scıntillator crystals or laser ınduced optical barriers techniques for this purpose.	2
3	Ability to design a complex nuclear medicine imaging device systems, process under realistic constraints and conditions, in such a way as to meet the desired result; ability to compare state of the art systems for this purpose.	1
4	Ability to devise, select, and use modern techniques and tools needed for analyzing and solving complex problems encountered in engineering practice; ability to employ information technologies effectively.	3
5	Ability to design and conduct experiments in simulation environvent, gather data, analyze and interpret results for investigating complex engineering problems or discipline specific research questions.	1
6	Ability to work efficiently in intra-disciplinary and multi-disciplinary teams; ability towork individually.	2
7	Ability to communicate effectively in Turkish, both orally and in writing; knowledge of a minimum of one foreign language; ability to write effective reports and comprehend written reports, prepare design and production reports, make effective presentations, and give and receive clear and intelligible instructions.	1
8	Recognition of the need for lifelong learning; ability to access information, to follow developments in science and technology, and to continue to educate him/herself.	1
9	Consciousness to behave according to ethical principles and professional and ethical responsibility; knowledge on standards used in nuclear medicine imaging practice.	2

10	Knowledge about basic nuclear medicine imaging devices such as PET, SPECT	2
11	Knowledge about development of new techniques to improve imagind devices performance	1

CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate, 4: High, 5: Very High)

Course Contents

Week	Chapter	Topics	Assessment
1	7	Introduction of radiation detectors	Assignment 1
2	7	Application of radiation detectors	Assignment 2
3	13	Gamma camera basic principles	Assignment 3
4	13	Application of gamma camera in nuclear medicine	Assignment 4
5	14	Performance of Gamma camera	Assignment 5
6	14	Cons and prof of Gamma camera	Assignment 6
7			Midterm Exam
8	15	Characterizing or evaluating image quality	
9	15	Limitation of image quality, and all of the approaches to solve it	Assignment 7
10	16	Basic of Tomographic image reconstruction techniques	
11	16	Conventional image reconstruction techniques such as iterative algorithm (OSEM), and analytical method (FBP)	Assignment 8
12	17	Basic of SPECT	Assignment 9
13	17	State of the art SPECT systems, improving the performance of SPECT detectors using laser induced optical barrier technique	Assignment 10
14	18	Basic of PET, and conventional PET systems and improving the performance of PET systems	Assignment 11
15			Final Exam.

Recommended Sources

Textbook:

- Physics in Nuclear Medicine (Fourth Edition) “ISBN: 978-1-4160-5198-5” Simon, Cheery, R.

Supplementary Course Material

- https://en.wikibooks.org/wiki/Basic_Physics_of_Nuclear_Medicine

Assessment

Attendance	25%	Less than 25% class attendance results in NA grade
Assignment	5%	
Midterm Exam	25%	Written Exam
Final Exam	45%	Written Exam
Total	100%	

Assessment Criteria

Final grades are determined according to the Near East University Academic Regulations for Undergraduate Studies

Course Policies

- Attendance to the course is mandatory.
- Late assignments will not be accepted unless an agreement is reached with the lecturer.
- Students may use calculators during the exam.
- Cheating and plagiarism will not be tolerated. Cheating will be penalized according to the Near East University General Student Discipline Regulations.

ECTS allocated based on Student Workload

Activities	Number	Duration (hour)	Total Workload(hour)
Course duration in class (including Exam weeks)	15	4	60
Labs and Tutorials	-	-	35
Assignment	11	2	25
Project/Presentation/Report	-	-	30
E-learning activities	5	2	-
Quizzes	-	-	-
Midterm Examination	1	2	40
Final Examination	1	2	60
Self Study	15	4	50
Total Workload			300
Total Workload/30(h)			300/30
ECTS Credit of the Course			10