Form: Course Syllabus		
	Form Number	EXC-01-02-02A
	Issue Number and Date	2/3/24/2022/2963 05/12/2022
	Number and Date of Revision or Modification	
	Deans Council Approval Decision Number	2/3/24/2023
	The Date of the Deans Council Approval Decision	23/01/2023
	Number of Pages	06

1.	**Course Title**	Nuclear Medicine
2.	**Course Number**	0302770
3.	**Credit Hours (Theory, Practical)**	3 Credit Hours (Theory)
	Contact Hours (Theory, Practical)	3 Theory
4.	**Prerequisites/ Corequisites**	0342765
5.	**Program Title**	Master Degree in Medical Physics
6.	**Program Code**	2
7.	**School/ Center**	Science
8.	**Department**	Physics
9.	**Course Level**	Graduate - 700
10.	**Year of Study and Semester (s)**	1st Semester, 2024/2025
11.	**Other Department(s) Involved in Teaching the Course**	None
12.	**Main Learning Language**	English
13.	**Learning Types**	☐Face to face learning ☐Blended ☐Fully online
14.	**Online Platforms(s)**	☐Moodle ☐Microsoft Teams
15.	**Issuing Date**	9-1-2025
16.	**Revision Date**	

17. Course Coordinator:

Name: Pr.Issa Al-Shakhrah Contact hours: 3 hrs

Office number: 015 Phone number: 22058

Email: issashak@ju.edu.jo

18. Other Instructors:

Name:
Office number:
Phone number:
Email:
Contact hours:
Name:
Office number:
Phone number:
Email:
Contact hours:

19. Course Description:

As stated in the approved study plan. Radionuclides used in medicine and methods of production. Preparation of labeled materials and radiopharmaceuticals. 'In vivo' and sample measurement techniques. Principle of tracer kinetics. Radionuclide imaging, design and evaluation of cameras and scanners. Gamma-ray emission tomography and positron tomography. Dynamic studies. Clinical applications of radionuclide techniques.

20. Program Intended Learning Outcomes: (To be used in designing the matrix linking the intended learning outcomes of the course with the intended learning outcomes of the program)

1. **SO1**: to be able to identify core concepts of medical physics and the physics principles in medical radiation therapy and different applications in medical physics.
2. **SO2**: to be able to develop design, hypothesize, and conduct scientific research in medical physics.
3. **SO3**: to be able to apply mathematical and analytical skills to solve problems, interpret diagnostic data, and test hypotheses in medical physics.

4. **SO4**: to be able to recognize and uphold ethical, social, and legal responsibilities in medical physics practice.
5. **SO5**: to be able to use computational tools to analyze data and demonstrate competency with medical diagnostic instruments.
6. **SO6**: to be able to function effectively independently and on teams for establishing goals, plan tasks, meet deadlines, and analyze risk and uncertainty.

21. Course Intended Learning Outcomes: (Upon completion of the course, the student will be able to achieve the following intended learning outcomes)

1. Explain the principles of radioactive decay, specific activity, parent-daughter decay, and equilibrium states, including secular and transient equilibrium.
2. Evaluate methods for producing radionuclides using reactors, accelerators, and generators, emphasizing their medical applications.
3. Describe the principles, components, and historical development of the Anger camera and its role in radionuclide imaging.
4. Assess performance characteristics of gamma cameras, including spatial resolution, detection efficiency, and image uniformity correction.
5. Develop and apply quality control testing protocols for nuclear medicine imaging instruments.
6. Analyze digital image processing techniques, including data acquisition and enhancement, used in nuclear medicine.
7. Model tracer kinetics using concepts of compartments, distribution volume, blood flow, and clearance in nuclear imaging.
8. Design and interpret dynamic planar scintigraphy studies for cardiac, renal, and other clinical applications.
9. Implement and evaluate Single Photon Emission Computed Tomography (SPECT) systems for clinical diagnostics and performance analysis.
10. Apply principles of Positron Emission Tomography (PET) imaging, including detector design, data corrections, and quantitative analysis for research and clinical use.

Course ILOs	The learning levels to be achieved					
	Remembering	Understanding	Applying	Analysing	evaluating	Creating
1	✓	✓	✓			
2		✓			✓	
3	✓	✓	✓			
4				✓	✓	
5			✓			✓
6		✓		✓		
7			✓			✓
8			✓			✓
9			✓		✓	
10			✓	✓		

2٢. The matrix linking the intended learning outcomes of the course with the intended learning outcomes of the program:

Program ILOs / Course ILOs	ILO (1)	ILO (2)	ILO (3)	ILO (4)	ILO (5)	ILO (6)
1	✓		✓			
2	✓		✓			
3	✓		✓			
4			✓		✓	
5					✓	
6	✓				✓	
7		✓	✓			
8		✓	✓			✓

9			✓		✓	
10			✓		✓	

٢٣. Topic Outline and Schedule:

Week	Lecture	Topic	ILO/s Linked to the Topic	Learning Types (Face to Face/ Blended/ Fully Online)	Platform Used	Synchronous / Asynchronous Lecturing	Evaluation Methods	Learning Resources
1	1.1	Introduction and overview of radioactive decay and specific activity	1	Face-to-Face	Classroom	Synchronous	Class discussion, problem-solving	Physics in Nuclear Medicine (4th Ed.)
	1.2	Parent-daughter decay and Bateman equations	1	Face-to-Face	Classroom	Synchronous	Quiz, problem-solving	Physics in Nuclear Medicine (4th Ed.)
	1.3	Secular, transient, and no equilibrium concepts	1	Face-to-Face	Classroom	Synchronous	Class discussion	Physics in Nuclear Medicine (4th Ed.)
2	2.1	Reactor-produced radionuclides	2	Face-to-Face	Classroom	Synchronous	Assignment, in-class questions	Physics in Nuclear Medicine (4th Ed.)
	2.2	Accelerator-produced radionuclides	2	Face-to-Face	Classroom	Synchronous	Quiz, problem-solving	Physics in Nuclear Medicine (4th Ed.)
	2.3	Radionuclide generators	2	Face-to-Face	Classroom	Synchronous	Class discussion	Physics in Nuclear Medicine (4th Ed.)

3	3.1	General concepts of radionuclide imaging	3	Face-to-Face	Classroom	Synchronous	Quiz, group work	Physics in Nuclear Medicine (4th Ed.)
	3.2	Historical development and basic principles of the Anger camera	3	Face-to-Face	Classroom	Synchronous	Presentation	Physics in Nuclear Medicine (4th Ed.)
	3.3	Detector systems, electronics, and image recording systems	3	Face-to-Face	Classroom	Synchronous	Class discussion	Physics in Nuclear Medicine (4th Ed.)
4	4.1	Performance limitations of gamma cameras	4	Face-to-Face	Classroom	Synchronous	Quiz	Physics in Nuclear Medicine (4th Ed.)
	4.2	Image non-uniformity and correction techniques	4	Face-to-Face	Classroom	Synchronous	Problem-solving	Physics in Nuclear Medicine (4th Ed.)
	4.3	Detection efficiency and performance at high counting rates	4	Face-to-Face	Classroom	Synchronous	Class discussion	Physics in Nuclear Medicine (4th Ed.)
5	5.1	Quality control in nuclear medicine imaging	5	Face-to-Face	Classroom	Synchronous	Practical evaluation	Physics in Nuclear Medicine (4th Ed.)
	5.2	Types and frequencies of recommended quality control tests	5	Face-to-Face	Classroom	Synchronous	Assignment	Physics in Nuclear Medicine (4th Ed.)
	5.3	Case studies of quality control issues	5	Face-to-Face	Classroom	Synchronous	Group presentation	Physics in Nuclear Medicine (4th Ed.)
6	6.1	Digital imaging and data acquisition techniques	6	Face-to-Face	Classroom	Synchronous	Quiz	Physics in Nuclear Medicine (4th Ed.)

	6.2	Digital image enhancement and processing	6	Face-to-Face	Classroom	Synchronous	Practical evaluation	Physics in Nuclear Medicine (4th Ed.)
	6.3	Tools and environments for digital processing	6	Face-to-Face	Classroom	Synchronous	Class discussion	Physics in Nuclear Medicine (4th Ed.)
7	7.1	Tracer concepts and compartments	7	Face-to-Face	Classroom	Synchronous	Assignment	Physics in Nuclear Medicine (4th Ed.)
	7.2	Distribution volume and steady-state kinetics	7	Face-to-Face	Classroom	Synchronous	Class discussion	Physics in Nuclear Medicine (4th Ed.)
	7.3	Blood flow, clearance, and flux rate constants	7	Face-to-Face	Classroom	Synchronous	Quiz	Physics in Nuclear Medicine (4th Ed.)
8	8.1	Dynamic imaging principles	8	Face-to-Face	Classroom	Synchronous	Class discussion	Physics in Nuclear Medicine (4th Ed.)
	8.2	Cardiac and renal dynamic imaging	8	Face-to-Face	Classroom	Synchronous	Quiz	Physics in Nuclear Medicine (4th Ed.)
	8.3	Other dynamic studies in nuclear medicine	8	Face-to-Face	Classroom	Synchronous	Practical evaluation	Physics in Nuclear Medicine (4th Ed.)
9	9.1	SPECT systems and applications	9	Face-to-Face	Classroom	Synchronous	Group work	Physics in Nuclear Medicine (4th Ed.)
	9.2	Performance evaluation of SPECT systems	9	Face-to-Face	Classroom	Synchronous	Quiz	Physics in Nuclear Medicine (4th Ed.)
	9.3	Case studies of SPECT clinical applications	9	Face-to-Face	Classroom	Synchronous	Presentation	Physics in Nuclear Medicine (4th Ed.)

10	10.1	PET imaging principles	10	Face-to-Face	Classroom	Synchronous	Assignment	Physics in Nuclear Medicine (4th Ed.)
	10.2	Detector designs and quantitative analysis for PET	10	Face-to-Face	Classroom	Synchronous	Quiz	Physics in Nuclear Medicine (4th Ed.)
	10.3	PET clinical and research applications	10	Face-to-Face	Classroom	Synchronous	Group discussion	Physics in Nuclear Medicine (4th Ed.)

٢٤. Evaluation Methods:

Opportunities to demonstrate achievement of the ILOs are provided through the following assessment methods and requirements:

Evaluation Activity	Mark	Topic(s)	ILO/s Linked to the Evaluation activity	Period (Week)	Platform

٢٥. Course Requirements:

(e.g.: students should have a computer, internet connection, webcam, account on a specific software/platform…etc.):

N/A

٢٦. Course Policies:

A- Attendance policies: According to JU by-laws.

B- Absences from exams and submitting assignments on time: According to JU by-laws.

C- Health and safety procedures: N/A

D- Honesty policy regarding cheating, plagiarism, misbehavior: According to JU by-laws.

E- Grading policy: According to JU by-laws.

F- Available university services that support achievement in the course: N/A

2٧. References:

A- Required book(s), assigned reading and audio-visuals:

Physics in Nuclear Medicine . Simon R.Cherry, James A.Sorenson and Michael E.Phelps.

4th Edition 2012, Saunders (An Imprint of Elsivier).USA.

B- Recommended books, materials, and media:

2٨. Additional information:

Name of the Instructor or the Course Coordinator: Prof.Issa Al-Shakrah	Signature: Al-Shakhrah	Date: 14 /1/2025
Name of the Head of Quality Assurance Committee/ Department	Signature:	Date:
…….	……..……	……..……
Name of the Head of Department	Signature:	Date:
…….	……..……	……..……
Name of the Head of Quality Assurance Committee/ School or Center	Signature:	Date:
…….	……..……	……..……
Name of the Dean or the Director	Signature:	Date:
…….	……..……	……..……