Republic of Yemen

Ministry of Education & Higher Research

Council of Academic Accreditation & Quality Assurance of

Higher Education (CAQA)

21 septamber University of Medical and Applied Science

Faculty of Applied Medical Science

Department of Medical Radiology and Imaging Technology

Program of Radiologic Technology and Medical Imaging

Course Specification of

Nuclear Medicine Technique

Course Code. (____)

2024

I. General Information:

1.	**Course Title:**	Nuclear Medicine Technique				
2.	**Course Code:**					
3.	**Credit Hours:**	**Credit Hours**	**Theory Contact Hours**		**Practical Contact Hours**	
			Lecture	**Tutorial/ Seminar**	**Lab**	**Clinical**
		2	2	--	--	--
4.	**Level/ Semester at which this Course is offered:**	4th Level / 1st Semester				
5.	**Pre –Requisite (if any):**	Radiation Physics, Medical Imaging Techniques, Nuclear Medicine physics				
6.	**Co –Requisite (if any):**	None				
7.	**Program (s) in which the Course is Offered:**	Bachelor of Radiologic Technology and Medical Imaging				
8.	**Language of Teaching the Course:**	English				
9.	**Location of Teaching the Course:**	Faculty of Applied Medical Science				
10.	**Prepared by:**					
11.	**Date and Number of Approval by Council:**					

II. Course Description:

The **Nuclear Medicine Technique** course is designed to provide students with the foundational knowledge and practical skills needed to understand and apply nuclear medicine technologies in clinical settings. This includes techniques for imaging, administering radiopharmaceuticals, and using advanced imaging systems such as gamma cameras and PET scanners. The course covers the principles of radioactive decay, the behavior of radiopharmaceuticals in the body, imaging principles, and applications of nuclear medicine in various clinical scenarios. Emphasis is placed on safety protocols, patient preparation, image acquisition, and interpretation of results.

III. Course Intended Learning Outcomes (CILOs) : Upon successful completion of the course, students will be able to:			Referenced PILOs	
A. Knowledge and Understanding:		**I, P or M/A**		
a1	Understand the principles of nuclear medicine and the interaction of radiation with the human body.	**P**	**A1**	Demonstrate and understanding of fundamental knowledge of Biomedical sciences (Biology, Biophysics, Anatomy, Physiology, Sectional anatomy and medical imaging technique).
a2	Describe the radiopharmaceuticals used in nuclear medicine and their clinical applications.	**p**	**A2**	Explanation the principles and procedures of medical imaging acquisitions, medical imaging technique and Radiological Technology Sciences as well as patient positioning in computed radiography and MRI technique.
B. Intellectual Skills:				
b1	Analyze the behavior of radiopharmaceuticals in different organ systems.	**P**	**B3**	Analyze and evaluate evidence-based information needed in medical imaging practice.
b2	Evaluate the quality of images obtained through nuclear medicine techniques.	**p**	**B2**	Devising solutions for positioning and instructing people throughout a procedure, as well as using the radiation safety protocols.
C. Professional and Practical kills:				
c1	Prepare and administer radiopharmaceuticals for diagnostic imaging.	**P**	**C2**	Apply technical skills using medical imaging devices, tools, and materials in radiological technology practice.
c2	Operate nuclear medicine imaging systems safely and effectively.	**p**	**C4**	Utilize appropriate manual and automated techniques in radiological imaging investigations
D. Transferable Skills:				

d1	Communicate effectively with patients and healthcare professionals in nuclear medicine settings.	**M**	**D1**	Communicate effectively with clinicians, patients, and support staff.
d2	Apply problem-solving and critical thinking skills in clinical scenarios involving nuclear medicine techniques.	**M**	**D3**	Recognize the need to obtain further education in the pursuit of life-long learning.

I= Introduced, P=Practiced or M/A= Mastered/Advanced

(A) Alignment of Course Intended Learning Outcomes (Knowledge and Understanding) to Teaching Strategies and Assessment Methods:

	Course Intended Learning Outcomes	Teaching Strategies	Assessment Strategies
a1	Understand the principles of nuclear medicine and the interaction of radiation with the human body.	▪ Lectures on the principles of nuclear medicine, radiation types, and radiopharmaceuticals.	▪ Written exams, quizzes.
a2	Describe the radiopharmaceuticals used in nuclear medicine and their clinical applications.	▪ Demonstrations of radiopharmaceuticals and their applications in different organs.	▪ Practical exams, assignments.

(B) Alignment of Course Intended Learning Outcomes (Intellectual Skills) to Teaching Strategies and Assessment Methods:

	Course Intended Learning Outcomes	Teaching Strategies	Assessment Strategies
b1	Analyze the behavior of radiopharmaceuticals in different organ systems.	▪ Case studies, analysis of radiopharmaceutical behavior in the body.	▪ Case study reports, practical evaluations.
b2	Evaluate the quality of images obtained through nuclear medicine techniques.	▪ Image quality analysis and troubleshooting during lab sessions.	▪ Image analysis assignments, practical evaluations.

(C) Alignment of Course Intended Learning Outcomes (Professional and Practical Skills) to Teaching Strategies and Assessment Methods:

Course Intended Learning Outcomes	Teaching Strategies	Assessment Strategies

c1	Prepare and administer radiopharmaceuticals for diagnostic imaging.	▪ Lab sessions for preparing and administering radiopharmaceuticals.	▪ Practical exams, lab reports.
c2	Operate nuclear medicine imaging systems safely and effectively.	▪ Hands-on sessions with gamma cameras and PET scanners.	▪ Practical exams, supervisor feedback.

(D) Alignment of Course Intended Learning Outcomes (Transferable Skills) to Teaching Strategies and Assessment Methods:

Course Intended Learning Outcomes		Teaching Strategies	Assessment Strategies
d1	Communicate effectively with patients and healthcare professionals in nuclear medicine settings.	▪ Role-playing scenarios for patient communication, discussing procedures.	▪ role-play assessments.
d2	Apply problem-solving and critical thinking skills in clinical scenarios involving nuclear medicine techniques.	▪ Problem-solving exercises using clinical cases involving nuclear medicine.	▪ Group discussions, written assignments.

IV. Course Contents:

A. Theoretical Aspect:

No.	Title	Sup-title	Number of Weeks	Contact Hours	Learning Outcomes (CILOs)
1	**Introduction to Nuclear Medicine**	– Definition, principles, history, clinical applications	1	2	a1, a2
2	**Radiation and Radiation Safety in Nuclear Medicine**	– Types of radiation, safety protocols, radiation dose reduction	1	2	a1, c1
3	**Radiopharmaceuticals: Principles and Production**	– Types of radiopharmaceuticals, production methods, labeling	1	2	a2, b1
4	**Radiopharmaceuticals in Diagnostic Imaging**	– Mechanisms of action, biodistribution, organ-specific applications	1	2	a2, b1
5	**Gamma Cameras: Operation and Imaging Techniques**	– Camera components, image acquisition, resolution, calibration	1	2	c2, b2

No.	Title	Sup-title	Number of Weeks	Contact Hours	Learning Outcomes (CILOs)
6	**Positron Emission Tomography (PET): Principles and Applications**	– PET scanning technology, tracer principles, clinical applications	1	2	a2, b2
7	**Mid-term Exam**	– All Previous topics	1	2	a1, a2, b1, b2, c1, c2
8	**PET/CT: Integration and Hybrid Imaging**	– Principles of PET/CT scanners, clinical applications	1	2	a2, b2
9	**SPECT Imaging: Principles and Applications**	– Single-photon emission, imaging techniques, clinical applications	1	2	a2, b2
10	**Patient Preparation and Safety in Nuclear Medicine**	– Preparing patients, patient communication, safety protocols	1	2	c1, d1
11	**Image Acquisition and Quality Control in Nuclear Medicine**	– Optimization of image quality, quality control techniques	1	2	b2, c2
12	**Nuclear Medicine in Oncology**	– Clinical applications in cancer diagnosis and treatment monitoring	1	2	b1, a2
13	**Nuclear Medicine in Cardiology**	– Clinical applications in cardiac imaging, myocardial perfusion	1	2	b1, a2
14	**Nuclear Medicine in Neurology**	– Clinical applications in brain imaging, neuroreceptor imaging	1	2	b1, a2
15	**Emerging Trends and Future of Nuclear Medicine**	– Advancements in radiopharmaceuticals, molecular imaging, AI in imaging	1	2	a1, b2
16	**Final Exam**	– All topics	1	2	a1, a2, b1, b2, c1, c2
Number of Weeks /and Units Per Semester			**16**	**32**	

B. Practical Aspect (Lab/Clinical) (if any):

No.	Tasks/ Experiments	Number of Weeks	Contact Hours	Learning Outcomes (CILOs)
1	Preparation of radiopharmaceuticals for diagnostic imaging	1	2	c1, a2
2	Operation of gamma camera: Image acquisition and processing	1	2	c2, b2
3	SPECT imaging: Acquisition and analysis of cardiac images	1	2	c2, b2
4	PET scanning: Image acquisition and interpretation	1	2	c2, b2
5	PET/CT imaging: Image acquisition and analysis	1	2	c2, b2
6	Patient preparation for nuclear imaging procedures	1	2	c1, d1
7	Troubleshooting common image quality issues in nuclear medicine	1	2	c2, b2
8	Case study: Nuclear medicine applications in oncology	1	2	b1, a2
9	Case study: Nuclear medicine applications in neurology	1	2	b1, a2
10	Case study: Nuclear medicine applications in cardiology	1	2	b1, a2
15	**Final Practical Exam**	1	2	a2, b1, b2, c1, c2, d1, d2
Number of Weeks /and Units Per Semester		**11**	**22**	

C. Tutorial Aspect (if any):

No.	Tutorial	Number of Weeks	Contact Hours	Learning Outcomes (CILOs)
1	**None**			
2				
3				

No.	Tutorial	Number of Weeks	Contact Hours	Learning Outcomes (CILOs)
Number of Weeks /and Units Per Semester				

VII. Teaching Strategies:

- Lectures and Visual Aids
- Practical Laboratory Sessions
- Case Studies
- Patient Role-play and Communication Exercises

VII. Assessment Methods:

- Written Exams
- Case Study Reports
- Lab Reports

VII. Assignments:

No.	Assignments	Week Due	Mark	Aligned CILOs (symbols)
1				
2				
3				
Total			10	

VIII. Schedule of Assessment Tasks for Students During the Semester:

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes
1	Mid-term Exam	Week 7	20	20%	a1, a2, b1
2	Case Study Report	Week 10	10	10%	d1, b1
3	Final Exam	Week 14	70	70%	a1, b1, b2

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes
Total			100	100 %	

IX. Learning Resources:

1- Required Textbook(s) (maximum two):

1- " Dibya Prakash, 2016, Nuclear Medicine: A Guide for Healthcare Professionals and Patients. Springer.
2- Ramesh Chandra, Arman Rahmim, 2017, Nuclear Medicine Physics: The Basics, Wolters Kluwer Health.

2- Essential References:

1- Jeffry A. Siegel, 2001, Guide for diagnostic nuclear medicine, Society of Nuclear Medicine.
2- Majid Assadi, Hojjat Ahmadzadehfar, Hans-Jürgen Biersack, 2018, Principles of Nuclear Medicine: Self-Assessment and Board Review 1st ed. Springer.

3- Electronic Materials and Web Sites etc.:

Electronic Materials and Websites

- www.snmmi.org
- www.nuclear-medicine.com

X. Course Policies: (Based on the Uniform Students' By law (2007)

1	**Class Attendance:** Class Attendance is mandatory. A student is considered absent and shall be banned from taking the final exam if his/her absence exceeds 25% of total classes.
2	**Tardiness:** A student will be considered late if he/she is not in class after 10 minutes of the start time of class.
4	**Assignments & Projects:** Assignments and projects must be submitted on time. Students who delay their assignments or projects shall lose the mark allocated for the same.
5	**Cheating:** Cheating is an act of fraud that results in the cancelation of the student's exam or assignment. If it takes place in a final exam, the penalties stipulated for in the Uniform Students' Bylaw (2007) shall apply.
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7	**Other policies:** The University official regulations in force will be strictly observed and students shall comply with all rules and regulations of the examination set by the Department, Faculty and University Administration.
3	**Exam Attendance/Punctuality:** No student shall be allowed to the exam hall after 30 minutes of the start time, and shall not leave the hall before half of the exam time has passed.

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الجمهورية اليمنية
وزارة التربية والتعليم والبحث العلمي
جامعة 21 سبتمبر للعلوم الطبية والتطبيقية
كلية التكنولوجيا الطبية

Faculty of Applied Medical Science

Department of Medical Radiology and Imaging Technology

Program of Radiologic Technology and Medical Imaging

Course Plan (Syllabus) of

Nuclear Medicine Technique

Course Code. .....

I. Information about Faculty Member Responsible for the Course:								
Name of Faculty Member:		**Office Hours**						
Location& Telephone No.:	-----							
E-mail:	--@--.--	SAT	SUN	MON	TUE	WED	THU	

2024/2025

Prepared by:	Reviewed by:	Head of the Department:	Quality Unit:	Dean:
	Dr. -----	Dr. Awadh Al-Kubati	Dr. Mohammed Al-shamahi	Dr. Abdulsalam Dalaq

I. General Information:

12.	**Course Title:**	Nuclear Medicine Technique				
13.	**Course Code:**					
14.	**Credit Hours:**	**Credit Hours**	**Theory Contact Hours**		**Practical Contact Hours**	
			Lecture	**Tutorial/ Seminar**	**Lab**	**Clinical**
		2	2	--	--	--
15.	**Level/ Semester at which this Course is offered:**	4^{th} Level / 1^{st} Semester				
16.	**Pre –Requisite (if any):**	Radiation Physics, Medical Imaging Techniques, Nuclear Medicine physics				
17.	**Co –Requisite (if any):**	None				
18.	**Program (s) in which the Course is Offered:**	Bachelor of Radiologic Technology and Medical Imaging				
19.	**Language of Teaching the Course:**	English				
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22.	**Date and Number of Approval by Council:**					

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Upon successful completion of the course, students will be able to:

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	B. Intellectual Skills:
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	C. Professional and Practical kills:
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	D. Transferable Skills:
d1	Communicate effectively with patients and healthcare professionals in nuclear medicine settings.
d2	Apply problem-solving and critical thinking skills in clinical scenarios involving nuclear medicine techniques.

IV. Course Contents:

A. Theoretical Aspect:

No.	Title	Sup-title	Number of Weeks	Contact Hours
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3	**Radiopharmaceuticals: Principles and Production**	– Types of radiopharmaceuticals, production methods, labeling	1	2
4	**Radiopharmaceuticals in Diagnostic Imaging**	– Mechanisms of action, biodistribution, organ-specific applications	1	2

No.	Title	Sup-title	Number of Weeks	Contact Hours
5	**Gamma Cameras: Operation and Imaging Techniques**	– Camera components, image acquisition, resolution, calibration	1	2
6	**Positron Emission Tomography (PET): Principles and Applications**	– PET scanning technology, tracer principles, clinical applications	1	2
7	**Mid-term Exam**	– All Previous topics	1	2
8	**PET/CT: Integration and Hybrid Imaging**	– Principles of PET/CT scanners, clinical applications	1	2
9	**SPECT Imaging: Principles and Applications**	– Single-photon emission, imaging techniques, clinical applications	1	2
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14	**Nuclear Medicine in Neurology**	– Clinical applications in brain imaging, neuroreceptor imaging	1	2
15	**Emerging Trends and Future of Nuclear Medicine**	– Advancements in radiopharmaceuticals, molecular imaging, AI in imaging	1	2
16	**Final Exam**	– All topics	1	2
Number of Weeks /and Units Per Semester			**16**	**32**

B. Practical Aspect (Lab/Clinical) (if any):

No.	Tasks/ Experiments	Number of Weeks	Contact Hours
1	Preparation of radiopharmaceuticals for diagnostic imaging	1	2
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No.	Tasks/ Experiments	Number of Weeks	Contact Hours
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4	PET scanning: Image acquisition and interpretation	1	2
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6	Patient preparation for nuclear imaging procedures	1	2
7	Troubleshooting common image quality issues in nuclear medicine	1	2
8	Case study: Nuclear medicine applications in oncology	1	2
9	Case study: Nuclear medicine applications in neurology	1	2
10	Case study: Nuclear medicine applications in cardiology	1	2
15	**Final Practical Exam**	1	2
Number of Weeks /and Units Per Semester		**11**	**22**

C. Tutorial Aspect (if any):

No.	Tutorial	Number of Weeks	Contact Hours
1	**None**		
2			
3			
Number of Weeks /and Units Per Semester			

VII. Teaching Strategies:

- **Lectures and Visual Aids**
- **Practical Laboratory Sessions**
- **Case Studies**
- **Patient Role-play and Communication Exercises**
-

VII. Assessment Methods:

- **Written Exams**
- **Practical Exams**
- **Case Study Reports**
- **Lab Reports**

VII. Assignments:

No.	Assignments	Week Due	Mark
1			
2			
3			
Total			**10**

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