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

Radiation Physics 2

Course Code. (____)

2024

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:

1.	Course Title:	Radiation Physics 2				
2.	Course Code:					
3.	Credit Hours:	Credit Hours	Theory Contact Hours		Practical Contact Hours	
			Lecture	Tutorial/ Seminar	Lab	Clinical
		3	2	--	2	--
4.	Level/ Semester at which this Course is offered:	2nd Level / 1st Semester				
5.	Pre –Requisite (if any):	Radiation Physics 1				
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:

This course builds upon the foundational concepts introduced in Radiation Physics 1, delving deeper into the principles and applications of radiation physics in medical imaging and radiologic technology. Topics include advanced radiation interactions, radiobiology, radiation protection, and quality assurance. Emphasis is placed on understanding the underlying physics behind various imaging modalities and ensuring safe and effective radiation practices in clinical settings.

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	Explain the basic physiological mechanisms of major body systems	**M**	**A1**	Demonstrate an understanding of fundamental knowledge of Biomedical sciences (Biology, Biophysics, Anatomy, Physiology, Sectional anatomy and medical imaging technique).
a2	Describe the interrelationships between different physiological systems	**M**		
	B. Intellectual Skills:			
b1	Evaluate physiological data critically	**M**	**B3**	Analyze and evaluate evidence-based information needed in medical imaging practice.
b2	Formulate clinical interpretations based on advanced physiological principles	**M**	**B1**	Assess the radiation exposure times and intensity of exposure to guarantee the imaging technique is accurate to reduce the risk factors and adapt to patient needs.
	C. Professional and Practical kills:			
c1	Conduct advanced physiological measurements and experiments	**P**	**C2**	Apply technical skills in using medical imaging devices, tools, and materials in radiological technology practice.
c2	Integrate physiological knowledge with radiologic and diagnostic techniques	**P**	**C4**	Utilize appropriate manual and automated techniques in radiological imaging investigations.
	D. Transferable Skills:			
d1	Present physiological concepts and data effectively	**M**	**D1**	Communicate effectively with clinicians, patients, and support staff.
d2	Collaborate efficiently in a multidisciplinary healthcare team	**M**	**D4**	Function effectively as an individual, as a member, or leader of a team engaged in appropriate

				activities to the radiologic technology disciplines to accomplish a common goal.

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	Explain advanced concepts in radiation physics.	▪ Lectures, Interactive Discussions	▪ Written Exams, Problem-Solving Tasks
a2	Analyze radiation interactions in various imaging modalities.	▪ Case Studies, Laboratory Sessions	▪ Assignments, Practical Exams

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

	Course Intended Learning Outcomes	Teaching Strategies	Assessment Strategies
b1	Apply radiation physics principles to solve complex problems.	▪ Problem-Based Learning, Tutorials	▪ Written Exams, Problem-Solving Tasks
b2	Evaluate radiation safety measures and protocols.	▪ Simulation Exercises, Group Projects	▪ Case Study Analysis, Oral Exams

(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	Implement quality assurance procedures in radiologic technology.	▪ Hands-On Training,	▪ Skill Assessments, Lab Reports
c2	Assess radiation dose and its impact on imaging quality.	▪ Software Demonstrations, Practical Exercises	▪ Dosimetry Calculations, Case Studies

(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 on radiation safety practices.	▪ Presentations, Group Discussions	▪ Oral Presentations
d2	Demonstrate critical thinking in radiation-related scenarios.	▪ Problem-Solving Tasks, Role-Playing Exercises	▪ Critical Analysis Essays

IV. Course Contents:

A. Theoretical Aspect:

No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours	Learning Outcomes (CILOs)
1	**Advanced Radiation Interactions**	– Compton Scattering, Pair Production	1	2	a1, a2
2	**Radiobiology**	– Cellular Effects, DNA Damage	1	2	b1, b2
3	**Radiation Dosimetry**	– Dosimetric Concepts, Tissue Weighting Factors	1	2	c1, c2
4	**Quality Assurance in Radiology**	– Image Quality Assessment, Equipment Calibration	1	2	a2, c1
5	**Radiation Protection**	– ALARA Principle, Shielding Techniques	1	2	a2, c2
6	**Advanced Imaging Modalities**	– PET-CT, MRI, Nuclear Medicine	1	2	b1, b2
7	**Radiation Therapy**	– Treatment Planning, Dose Calculation	1	2	c1, c2
8	**Mid-Term Exam**	– In all previous Topics	1	2	a1, a2, b1
9	**Radiation Regulations**	– Regulatory Agencies, Compliance Requirements	1	2	a2, d1
10	**Emerging Technologies**	– Artificial Intelligence in Medical Imaging	1	2	b2, c2
11	**Radiological Emergency Management**	– Response Protocols, Contamination Control	1	2	a1, a2, d2
12	**Advanced Imaging Physics**	– Image Reconstruction Techniques	1	2	b1, c1

No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours	Learning Outcomes (CILOs)
13	**Molecular Imaging**	– Principles of PET, SPECT Imaging	1	2	b1, c1
14	**Image Quality Optimization**	– Artifacts Reduction, Contrast Enhancement	1	2	a2, c1
15	**Future Trends in Medical Physics**	– Innovations, Research Directions	1	2	b2, d2
16	**Final Theoretical Exam**	– All theoretical 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	Radiation Therapy Planning: Treatment Simulation, Dose Calculation	1	2	c1, c2
2	Quality Control Procedures: Equipment Testing, Image Analysis	1	2	a2, c1
3	Radiographic Artifacts Analysis: Image Interpretation, Artifact Identification	1	2	a2, c1
4	Nuclear Medicine Imaging: Radiopharmaceutical Administration, Data Analysis	1	2	b1, b2
5	Advanced Imaging Techniques: MRI Sequences, CT Protocols	1	2	b1, c1
6	Radiation Protection Practices: Protective Gear Usage, Exposure Monitoring	1	2	a2, c2
7	Patient Dose Optimization: Image Quality Assessment, Dose Reduction	1	2	a2, c1

No.	Tasks/ Experiments	Number of Weeks	Contact Hours	Learning Outcomes (CILOs)
8	Radiological Emergency Drills: Emergency Response Training, Scenario Analysis	1	2	a1, a2, d2
9	Image Reconstruction Techniques: CT Reconstruction Methods, PET Image Analysis	1	2	b1, c1
10	Dosimetry Calculations: Treatment Planning, Radiation Dose Estimation	1	2	c1, c2
15	Final Practical Exam	1	2	a1, a2, b1, b2, c1, c2, d2
Number of Weeks /and Units Per Semester		**14**	**28**	

C. Tutorial Aspect (if any):

No.	Tutorial	Number of Weeks	Contact Hours	Learning Outcomes (CILOs)
1	**None**			
2				
3				
Number of Weeks /and Units Per Semester				

VII. Teaching Strategies:

- **Lectures**
- **Case Studies**
- **Laboratory Sessions**
- **Simulation Exercises**
- **Group Projects**
- **Problem-Based Learning**
- **Tutorials**
- **Software Demonstrations**
- **Presentations**

VII. Assessment Methods:

- **Written Exams**
- **Practical Exams**
- **Assignments**
- **Case Study Analysis**
- **Oral Exams**
- **Lab Reports**
- **Presentation Evaluations**

VII. Assignments:

No.	Assignments	Week Due	Mark	Aligned CILOs (symbols)
1	**Radiation Safety Report**	Week 3	**3**	a2, d1
2	**Image Quality Assessment Project**	Week 5	**4**	a2, c1
3	**Emergency Response Plan**	Week 7	**3**	a1, a2, d2
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	**Midterm Written Exam**	Week 6	20	20%	a1, a2, b1, b2, c1, c2, d1, d2
2	**Final Practical Exam**	Week 15	20	20%	a2, b1, b2, c1, c2
3	**Assignments**	During semester	10	10%	a1, a2, b2, c2, d2
4	**Final Written Exam**	Week 16	35	35%	a1, a2, b1, b2, c1, c2
Total			**100**	**100 %**	

IX. Learning Resources:

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

1. Ken Holmes, Marcus Elkington, Phil Harris, 2021, Clark's Essential Physics in Imaging for Radiographers, CRC Press, London.

2. Ervin B. Podgorsak, 2016, Radiation Physics for Medical Physicists, Springer.

2- Essential References:

1. Frank Herbert Attix, 2008, Introduction to Radiological Physics and Radiation Dosimetry, Wiley & Sons, Incorporated, John.
2. William R. Hendee, E. Russell Ritenour, 2003, Medical Imaging Physics, Wiley.
3. Ehsan Samei, Donald J Peck,, 2019, Hendee's Physics of Medical Imaging, John Wiley & Sons, Inc.
4. Mary Alice Statkiewicz Sherer, Paula J. Visconti, E. Russell Ritenour, Kelli Welch Haynes, 2017, Radiation Protection in Medical Radiography, Elsevier Health Sciences.

3- Electronic Materials and Web Sites etc.:

Electronic Materials and Websites

- American Association of Physicists in Medicine (AAPM)
- Radiological Society of North America (RSNA)

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.
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Faculty of Applied Medical Science

Department of Medical Radiology and Imaging Technology

Program of Radiologic Technology and Medical Imaging

Course Plan (Syllabus) of

Radiation Physics 2

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:

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15.	**Level/ Semester at which this Course is offered:**	2nd Level / 1st Semester				
16.	**Pre –Requisite (if any):**	Radiation Physics 1				
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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21.	**Prepared by:**					
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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a1	Explain the basic physiological mechanisms of major body systems
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	B. Intellectual Skills:
b1	Evaluate physiological data critically
b2	Formulate clinical interpretations based on advanced physiological principles
	C. Professional and Practical kills:
c1	Conduct advanced physiological measurements and experiments
c2	Integrate physiological knowledge with radiologic and diagnostic techniques
	D. Transferable Skills:
d1	Present physiological concepts and data effectively
d2	Collaborate efficiently in a multidisciplinary healthcare team

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No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours
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4	**Quality Assurance in Radiology**	– Image Quality Assessment, Equipment Calibration	1	2
5	**Radiation Protection**	– ALARA Principle, Shielding Techniques	1	2
6	**Advanced Imaging Modalities**	– PET-CT, MRI, Nuclear Medicine	1	2

No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours
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15	Final Practical Exam	1	2
Number of Weeks /and Units Per Semester		**14**	**28**

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No.	Tutorial	Number of Weeks	Contact Hours
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Number of Weeks /and Units Per Semester			

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