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

Radiobiology

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:**	Radiobiology				
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:**	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 covers the principles and practices of radiation protection in medical imaging. Topics include the biological effects of ionizing radiation, radiation exposure limits, dose reduction strategies, radiation safety regulations, and practical applications in radiologic technology. The course aims to equip students with the knowledge and skills necessary to ensure safety in the use of radiation in medical 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	Understand the principles of radiation protection and safety.	**I**	**A2**	Explanation of 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.
a2	Recognize the biological effects of ionizing radiation on human tissues.	**I**	**A1**	Demonstrate an understanding of fundamental knowledge of Biomedical sciences (Biology, Biophysics, Anatomy, Physiology, Sectional anatomy and medical imaging technique).
B. Intellectual Skills:				
b1	Analyze radiation dose measurements and apply dose reduction techniques.	**I**	**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.
b2	Evaluate compliance with radiation safety standards and regulations.	**I**	**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	Implement radiation protection measures in clinical practice.	**I**	**C1**	Execute quality management system and standard procedures in radiological technology practice.
c2	Use radiation monitoring devices effectively.	**I**	**C2**	Apply technical skills in using medical imaging devices, tools, and materials in radiological technology practice.

D. Transferable Skills:				
d1	Implement radiation protection measures in clinical practice.	**I**	**D1**	Communicate effectively with clinicians, patients, and support staff.
d2	Use radiation monitoring devices effectively.	**I**	**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	Describe the basic principles of radiobiology and radiation physics	▪ Lectures, Tutorials, Laboratory Sessions	▪ Written Examinations, Assignments
a2	Explain the mechanisms of radiation interaction with biological systems	▪ Case Studies, Group Discussions	▪ Research Papers, Presentations

(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 cellular and molecular responses to radiation	▪ Laboratory Experiments, Problem-Solving Exercises	▪ Practical Exams, Quizzes
b2	Evaluate radiobiological effects in clinical settings	▪ Case Studies, Group Discussions	▪ Oral Presentations, Written Reports

(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	Apply radiation safety principles and regulations	▪ Laboratory Sessions, Field Visits	▪ Competency Assessments, Reports
c2	Demonstrate research skills in radiobiology	▪ Research Projects, Literature Review	▪ Research Proposals, Presentations

(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 in written and oral forms	▪ Group Discussions, Presentations	▪ Written Reports, Oral Examinations
d2	Work collaboratively in interdisciplinary teams	▪ Group Projects, Collaborative Assignments	▪ Team Reports

IV. Course Contents:

A. Theoretical Aspect:

No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours	Learning Outcomes (CILOs)
1	**Introduction to Radiobiology**	– History of Radiobiology – History and Development of Radiobiology	1	2	a1, a2
2	**Radiation Interactions with Matter**	– Types of Radiation – Mechanisms of Radiation Interaction with Matter	1	2	a1, a2
3	**Biological Effects of Ionizing Radiation**	– Early and Late Effects – Analysis of Radiosensitivity in Tumor Cells – Biological Effects of Ionizing Radiation	1	2	a1, a2, b1
4	**Cellular Responses to Radiation**	– DNA Damage and Repair – Quantification of DNA Damage	1	2	a1, a2, b1, b2
5	**Molecular Responses to Radiation**	– Signal Transduction Pathways	1	2	a1, a2, b1, b2

No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours	Learning Outcomes (CILOs)
		– Evaluation of Radioprotective Agents			
6	**Radiosensitivity Testing of Tumor Cell Lines**	– Cell Survival Curves – Assessment of Cell Survival Curves	1	2	a3, c1
7	**Dosimetric Calibration of Radiation Sources**	– Calibration Methods – Dosimetry Calculations	1	2	b1, c1
8	**Mid-Term Exam**	– In all previous Topics	1	2	a1, a2, b1, b2, c1
9	**Assessment of Radiobiological Effects in Imaging**	– Imaging Techniques – Assessment of Radiobiological Effects in Imaging – Evaluation of Imaging Techniques	1	2	a2, c1
10	**Evaluation of Radiation Safety Procedures**	– Safety Protocols – Radiation Safety Procedures and Regulations – Dosimetric Calibration of Radiation Sources	1	2	b1, c1, c2
11	**Application of Radiobiological Concepts in Radiation Therapy**	– Treatment Planning – Simulation of Treatment Planning – Cellular and Molecular Responses to Radiation	1	2	a3, c1
12	**Role of Radiobiology in Nuclear Medicine**	– Tracer Kinetics – Radiobiological Aspects of Radioisotope Therapy	1	2	a2, c1
13	**Radiobiological Aspects of Space Radiation**	– Space Travel Effects – Space Radiation Effects on Biological Systems – Radiosensitivity Testing of Tumor Cell Lines	1	2	a1, a2, b1, d1
14	**Ethical Considerations in Radiobiological Research**	– Human Subject Protection – Discussion on Ethical Dilemmas in Radiobiological Research	1	2	c1, c2

No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours	Learning Outcomes (CILOs)
15	**Future Trends and Innovations in Radiobiology**	– Emerging Technologies – Applications of Radiobiological Concepts in Radiation Therapy – Future Trends and Innovations in Radiobiology	1	2	a1, a2, b2, d1, 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	**None**			
2				
3				
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,**
- **Tutorials,**
- **Case Studies,**
- **Group Discussions,**
- **Research Projects,**
- **Literature Review,**
- **Problem-Solving Exercises,**
- **Group Projects,**
- **Collaborative Assignments**

VII. Assessment Methods:

- **Written Examinations,**
- **Assignments,**
- **Presentations,**
- **Quizzes,**
- **Oral Examinations,**
- **Written Reports,**
- **Team Reports.**

VII. Assignments:

No.	Assignments	Week Due	Mark	Aligned CILOs (symbols)
1	**Research Project**	6	**3%**	a2, d1, d2
2	**Laboratory Report**	9	**2%**	b1, c1
3	**Case Study Analysis**	12	**3%**	a1, a2, b1, b2, c1
4	**Presentation on Ethical Issues in Radiobiology**	14	**2%**	c1, c2
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**	8	20	25%	a1, a2, b1, b2, c1, c2
3	**Assignments**	Ongoing	10	10%	a1, a2, b2, c2, d2
4	**Final Written Exam**	16	70	70%	a1, a2, b1, b2, c1, c2, d1, d2
Total			**100**	**100 %**	

IX. Learning Resources:

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

1- Hall, E. J., & Giaccia, A. J. (2018). Radiobiology for the Radiologist. Lippincott Williams & Wilkins.
2- Joiner, M. C., & van der Kogel, A. J. (2019). Basic Clinical Radiobiology. CRC Press.

2- Essential References:

1- Khan, F. M. (2014). The Physics of Radiation Therapy. Lippincott Williams & Wilkins.
2- Hendee, W. R., & Ibbott, G. S. (2012). Radiation Therapy Physics. John Wiley & Sons.

3- Electronic Materials and Web Sites etc.:

Electronic Materials and Websites

- American Association of Physicists in Medicine (AAPM) - www.aapm.org
- Radiation Research Society - www.radres.org

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.

6	**Forgery and Impersonation:** Forgery/Impersonation is an act of fraud that results in the cancelation of the student's exam, assignment or project. If it takes place in a final exam, the penalties stipulated for in the Uniform Students' Bylaw (2007) shall apply**.**
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

Radiobiology

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:**	Radiobiology				
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:**	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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II. Course Description:

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III. Course Intended Learning Outcomes (CILOs) :
Upon successful completion of the course, students will be able to:

	A. Knowledge and Understanding:
a1	Understand the principles of radiation protection and safety.
a2	Recognize the biological effects of ionizing radiation on human tissues.
	B. Intellectual Skills:
b1	Analyze radiation dose measurements and apply dose reduction techniques.
b2	Evaluate compliance with radiation safety standards and regulations.
	C. Professional and Practical kills:
c1	Implement radiation protection measures in clinical practice.
c2	Use radiation monitoring devices effectively.
	D. Transferable Skills:
d1	Implement radiation protection measures in clinical practice.
d2	Use radiation monitoring devices effectively.

IV. Course Contents:

A. Theoretical Aspect:

No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours
1	**Introduction to Radiobiology**	– History of Radiobiology – History and Development of Radiobiology	1	2
2	**Radiation Interactions with Matter**	– Types of Radiation – Mechanisms of Radiation Interaction with Matter	1	2
3	**Biological Effects of Ionizing Radiation**	– Early and Late Effects – Analysis of Radiosensitivity in Tumor Cells – Biological Effects of Ionizing Radiation	1	2
4	**Cellular Responses to Radiation**	– DNA Damage and Repair – Quantification of DNA Damage	1	2

No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours
5	**Molecular Responses to Radiation**	– Signal Transduction Pathways – Evaluation of Radioprotective Agents	1	2
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16	**Final Theoretical Exam**	– All theoretical topics	1	2

No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours
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	None		
2			
Number of Weeks /and Units Per Semester		14	28

C. Tutorial Aspect (if any):

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

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