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

CT & MRI Technique

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:**	CT & MRI Technique				
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:**	4th Level / 2nd Semester				
5.	**Pre –Requisite (if any):**	CT & MRI 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 **CT & MRI Technique** course covers the principles, technology, and clinical applications of both computed tomography (CT) and magnetic resonance imaging (MRI). Students will learn about the technical aspects of these imaging modalities, including their underlying physics, instrumentation, and safety considerations. The course also emphasizes the role of CT and MRI in diagnostic imaging, with a focus on patient positioning, image acquisition, and image interpretation. Students will be introduced to the latest advancements in these technologies, including contrast media used in both techniques and their respective clinical applications.

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 CT and MRI imaging technologies.	**A**	**A1**	Demonstrate and understanding of fundamental knowledge of Biomedical sciences (Biology, Biophysics, Anatomy, Physiology, Sectional anatomy and medical imaging technique).
a2	Learn about the physics and instrumentation involved in CT and MRI systems.	**A**	**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 CT and MRI images for diagnostic purposes.	**A**	**B3**	Analyze and evaluate evidence-based information needed in medical imaging practice.
b2	Compare the advantages and limitations of CT and MRI imaging.	**A**	**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	Perform CT and MRI scans, including patient positioning and protocol selection.	**A**	**C2**	Apply technical skills using medical imaging devices, tools, and materials in radiological technology practice.
c2	Operate and troubleshoot CT and MRI machines in a clinical setting.	**A**	**C4**	Utilize appropriate manual and automated techniques in radiological imaging investigations
D. Transferable Skills:				

d1	Communicate effectively with patients and healthcare teams regarding imaging procedures.	**A**	**D1**	Communicate effectively with clinicians, patients, and support staff.
d2	Demonstrate critical thinking in identifying and solving technical issues in CT and MRI.	**A**	**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 CT and MRI imaging technologies.	▪ Lectures, demonstrations, and case studies on CT and MRI principles.	▪ Quizzes, final exam.
a2	Learn about the physics and instrumentation involved in CT and MRI systems.	▪ Demonstrations of CT and MRI machines, including practical lab exercises.	▪ Practical assignments, lab evaluations.
(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 CT and MRI images for diagnostic purposes.	▪ Image interpretation exercises, clinical case discussions, and image critique.	▪ Case study reports, oral presentations.
b2	Compare the advantages and limitations of CT and MRI imaging.	▪ Comparative analysis of CT and MRI imaging in clinical practice.	▪ Written reports, 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	Perform CT and MRI scans, including patient positioning and protocol selection.	▪ Hands-on practice with CT and MRI machines, positioning exercises.	▪ Practical exams, peer evaluations.
c2	Operate and troubleshoot CT and MRI machines in a clinical setting.	▪ Troubleshooting, lab exercises focusing on machine operation and patient safety.	▪ Practical assessments, lab performance.

(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 teams regarding imaging procedures.	▪ Group discussions on patient care and communication in imaging settings.	▪ Participation in discussions
d2	Demonstrate critical thinking in identifying and solving technical issues in CT and MRI.	▪ Real-world case scenarios for troubleshooting technical issues in CT and MRI.	▪ Practical exams, case study analysis.

IV. Course Contents:

A. Theoretical Aspect:

No.	Title	Sup-title	Number of Weeks	Contact Hours	Learning Outcomes (CILOs)
1	**Introduction to CT and MRI Technology**	– History, basic principles, comparison of CT and MRI, safety protocols	1	2	a1, a2
2	**Physics of CT Imaging**	– X-ray production, CT detectors, image reconstruction, radiation safety	1	2	a1, b1
3	**Physics of MRI Imaging**	– Magnetic fields, RF pulses, gradients, signal processing	1	2	a1, b1
4	**CT Equipment and Instrumentation**	– CT scanner components, types of CT scanners, maintenance, and calibration	1	2	a2, c2

No.	Title	Sup-title	Number of Weeks	Contact Hours	Learning Outcomes (CILOs)
5	**MRI Equipment and Instrumentation**	– MRI scanner components, types of MRI machines, safety considerations, quality assurance	1	2	a2, c2
6	**Image Reconstruction in CT**	– Reconstruction algorithms (FBP, iterative reconstruction), 3D imaging	1	2	b2, a1
7	**Image Reconstruction in MRI**	– Fourier transform, spin-echo and gradient-echo sequences, imaging parameters	1	2	b2, a1
8	**Mid-term Exam**	– All Previous topics	1	2	a1, a2, b1, b2, c1, c2
9	**CT Image Quality and Artifacts**	– Factors affecting quality, motion artifacts, metal artifacts, noise, and beam-hardening	1	2	b2, c1
10	**MRI Image Quality and Artifacts**	– Motion artifacts, magnetic susceptibility artifacts, chemical shift, and aliasing	1	2	b2, c1
11	**CT in Abdominal and Pelvic Imaging**	– Indications, patient positioning, scan protocols, image interpretation	1	2	a2, b1
12	**MRI in Abdominal and Pelvic Imaging**	– Indications, sequence selection, image quality assessment, clinical applications	1	2	a2, b1
13	**Advanced CT Imaging Techniques**	– CT angiography, cardiac CT, 3D imaging, and virtual colonoscopy	1	2	a1, b1
14	**Advanced MRI Imaging Techniques**	– Functional MRI (fMRI), diffusion tensor imaging (DTI), MR spectroscopy	1	2	a1, b2
15	**CT and MRI in Clinical Practice: Indications and Protocols**	– Clinical case studies, protocol development, and patient care in CT and MRI imaging	1	2	c1, d1
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	Hands-on Practice: Operating CT Machines	1	2	c1, a2
2	Hands-on Practice: Operating MRI Machines	1	2	c1, a2
3	Image Acquisition: Abdominal CT and MRI	1	2	a2, b1
4	Image Acquisition: Pelvic CT and MRI	2	4	a2, b1
5	CT Image Interpretation: Case Study on Abdominal Imaging	1	2	b1, c1
6	MRI Image Interpretation: Case Study on Brain Imaging	1	2	b1, c1
7	Troubleshooting CT Equipment	2	4	c2, d2
8	Troubleshooting MRI Equipment	1	2	c2, d2
9	Advanced CT Imaging Techniques: CT Angiography	2	4	a1, c1
10	Advanced MRI Imaging Techniques: fMRI and Diffusion Imaging	2	4	a1, c1
15	**Final Practical Exam**	1	2	a1, a2, b1, b2, c1, c2, d1, d2
Number of Weeks /and Units Per Semester		**15**	**30**	

C. Tutorial Aspect (if any):

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

No.	Tutorial	Number of Weeks	Contact Hours	Learning Outcomes (CILOs)
3				
Number of Weeks /and Units Per Semester				

VII. Teaching Strategies:

- Lectures
- Demonstrations
- Practical Sessions
- Case Studies

VII. Assessment Methods:

- Written Exams
- Quizzes
- Practical Exams
- Case Study Reports
- Assignments

VII. Assignments:

No.	Assignments	Week Due	Mark	Aligned CILOs (symbols)
1	Case Study on Abdominal Imaging (CT and MRI)	Week 4	5	a1, a2, b1, c1,c2, d1, d2
2	Oral Presentation on Advanced Imaging Techniques	Week 7	5	a2, b2, b1, c1,c2
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	10	10%	a1, a2, b1
2	**Practical Exam**	Week 15	30	30%	b1, b2, c1, c2, d1. d2
	Assignments	Due to	10	10%	a1, b1, b2, c1
3	**Final Exam**	Week 16	50	50%	a1, b1, b2
Total			**100**	**100 %**	

IX. Learning Resources:

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

1- John R. Haaga, Daniel Boll, 2016, Computed Tomography & Magnetic Resonance Imaging of The Whole Body, Elsevier Health Sciences.
2- Catherine Westbrook, 2008, Handbook of MRI Technique, Third Edition, Blackwell Publishing Ltd.
3- W Richard Webb, Wiliam E. Brant, Nancy M. Major, 2019, Fundamentals of Body CT, 5th Edition, Elsevier Health Sciences.

2- Essential References:

1- Sachin Khanduri, 2022, Textbook of Radiology for X-Ray, CT, MRI, BSc, BRIT and MSc Technicians, 2nd edition, Jaypee Brothers Medical Publishers.
2- Catherine Westbrook, John Talbot, 2018, MRI in Practice, 5th Edition, Wiley-Blackwell
3- John R. Haaga, Daniel Boll, 2016, CT and MRI of the Whole Body, 2-Volume Set, 6th Edition, Elsevier.

3- Electronic Materials and Web Sites etc.:

Electronic Materials and Websites

- www.radiologyinfo.org
- www.acr.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.
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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.
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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

CT & MRI 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:

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15.	**Level/ Semester at which this Course is offered:**	4th Level / 2nd Semester				
16.	**Pre –Requisite (if any):**	CT & MRI 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				
20.	**Location of Teaching the Course:**	Faculty of Applied Medical Science				
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22.	**Date and Number of Approval by Council:**					

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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 CT and MRI imaging technologies.
A2	Learn about the physics and instrumentation involved in CT and MRI systems.
	B. Intellectual Skills:
b1	Analyze CT and MRI images for diagnostic purposes.
B2	Compare the advantages and limitations of CT and MRI imaging.
	C. Professional and Practical kills:
c1	Perform CT and MRI scans, including patient positioning and protocol selection.
C2	Operate and troubleshoot CT and MRI machines in a clinical setting.
	D. Transferable Skills:
d1	Communicate effectively with patients and healthcare teams regarding imaging procedures.
D2	Demonstrate critical thinking in identifying and solving technical issues in CT and MRI.

IV. Course Contents:

A. Theoretical Aspect:

No.	Title	Sup-title	Number of Weeks	Contact Hours
1	**Introduction to CT and MRI Technology**	– History, basic principles, comparison of CT and MRI, safety protocols	1	2
2	**Physics of CT Imaging**	– X-ray production, CT detectors, image reconstruction, radiation safety	1	2
3	**Physics of MRI Imaging**	– Magnetic fields, RF pulses, gradients, signal processing	1	2
4	**CT Equipment and Instrumentation**	– CT scanner components, types of CT scanners, maintenance, and calibration	1	2

No.	Title	Sup-title	Number of Weeks	Contact Hours
5	**MRI Equipment and Instrumentation**	– MRI scanner components, types of MRI machines, safety considerations, quality assurance	1	2
6	**Image Reconstruction in CT**	– Reconstruction algorithms (FBP, iterative reconstruction), 3D imaging	1	2
7	**Image Reconstruction in MRI**	– Fourier transform, spin-echo and gradient-echo sequences, imaging parameters	1	2
8	**Mid-term Exam**	– All Previous topics	1	2
9	**CT Image Quality and Artifacts**	– Factors affecting quality, motion artifacts, metal artifacts, noise, and beam-hardening	1	2
10	**MRI Image Quality and Artifacts**	– Motion artifacts, magnetic susceptibility artifacts, chemical shift, and aliasing	1	2
11	**CT in Abdominal and Pelvic Imaging**	– Indications, patient positioning, scan protocols, image interpretation	1	2
12	**MRI in Abdominal and Pelvic Imaging**	– Indications, sequence selection, image quality assessment, clinical applications	1	2
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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	Hands-on Practice: Operating CT Machines	1	2

No.	Tasks/ Experiments	Number of Weeks	Contact Hours
2	Hands-on Practice: Operating MRI Machines	1	2
3	Image Acquisition: Abdominal CT and MRI	1	2
4	Image Acquisition: Pelvic CT and MRI	2	4
5	CT Image Interpretation: Case Study on Abdominal Imaging	1	2
6	MRI Image Interpretation: Case Study on Brain Imaging	1	2
7	Troubleshooting CT Equipment	2	4
8	Troubleshooting MRI Equipment	1	2
9	Advanced CT Imaging Techniques: CT Angiography	2	4
10	Advanced MRI Imaging Techniques: fMRI and Diffusion Imaging	2	4
15	**Final Practical Exam**	1	2
Number of Weeks /and Units Per Semester		**15**	**30**

C. Tutorial Aspect (if any):

No.	Tutorial	Number of Weeks	Contact Hours
1	**None**		
2			
3			
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VII. Teaching Strategies:

- **Lectures**
- **Demonstrations**
- **Practical Sessions**
- **Case Studies**

VII. Assessment Methods:

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- **Quizzes**
- **Practical Exams**
- **Case Study Reports**
- **Assignments**

VII. Assignments:

No.	Assignments	Week Due	Mark
1	**Case Study on Abdominal Imaging (CT and MRI)**	Week 4	**5**
2	**Oral Presentation on Advanced Imaging Techniques**	Week 7	**5**
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Total			**10**

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