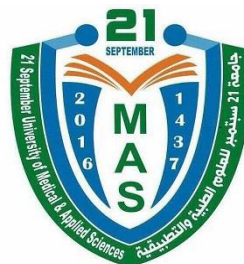


Republic of Yemen
Ministry of Education & Higher Research
Council of Academic Accreditation & Quality Assurance of
Higher Education (CAQA)



**21 september 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
Computer Application in Radiology

Course Code. (____)

2024



T4: This Template is Developed and Approved by CAQA-Yemen, 2023

Prepared by:

Reviewed by:

Dr. -----

Head of the Department:

Dr. Awadh Al-Kubati

Quality Unit:

Dr. Mohammed
Al-shamahi

Dean:

Dr. Abdulsalam
Dalaq

I. General Information:

1.	Course Title:	Computer Application in Radiology				
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:	3 rd Level / 1 st Semester				
5.	Pre –Requisite (if any):	Radiologic equipment’s I&II				
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 introduces the application of computer systems in the field of radiology. Topics include Picture Archiving and Communication Systems (PACS), Radiology Information Systems (RIS), imaging processing software, and the integration of AI in diagnostic imaging. The course provides both theoretical and practical knowledge, emphasizing the role of technology in enhancing imaging quality, workflow efficiency, and patient care.

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 fundamental principles of computer applications in radiology.	P	A1	Demonstrate and understanding of fundamental knowledge of Biomedical sciences (Biology, Biophysics, Anatomy, Physiology, Sectional anatomy and medical imaging technique).
a2	Recognize the importance of data management and security in radiology systems.	P	A3	Exhibit professional characteristics required by the radiologic technology profession.
B. Intellectual Skills:				
b1	Analyze the effectiveness of imaging software and digital tools.	P	B3	Analyze and evaluate evidence-based information needed in medical imaging practice.
b2	Evaluate the impact of advanced computing technologies, such as AI, on radiology practices.	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	Operate PACS and RIS systems efficiently.	P	C2	Apply technical skills using medical imaging devices, tools, and materials in radiological technology practice.
c2	Utilize imaging software for processing and analyzing diagnostic images.	P	C3	Prepare, process, interpret and present medical images using appropriate qualitative techniques.
D. Transferable Skills:				
d1	Apply problem-solving skills in system troubleshooting.	P	D3	Recognize the need to obtain further education in the pursuit of life-long learning.

Prepared by:

Reviewed by:

Dr. -----

Head of the Department:

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Al-shamahi

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Dalaq

d2	Communicate technical findings effectively with healthcare teams.	P	D1	Communicate effectively with clinicians, patients, and support staff.
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 the fundamental principles of computer applications in radiology.	▪ Lectures, readings	▪ Written exams, quizzes
a2	Recognize the importance of data management and security in radiology systems.	▪ Case studies, lectures	▪ Assignments, written 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	Analyze the effectiveness of imaging software and digital tools.	▪ lectures, Problem-based learning	▪ Practical exams, assignments
b2	Evaluate the impact of advanced computing technologies, such as AI, on radiology practices.	▪ Group discussions, case studies	▪ Presentations, case study 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	Operate PACS and RIS systems efficiently.	▪ lectures, simulations	▪ written exams, reports
c2	Utilize imaging software for processing and analyzing diagnostic images.	▪ Workshops, exercises	▪ written exams, assignments
(D) Alignment of Course Intended Learning Outcomes (Transferable Skills) to Teaching Strategies and Assessment Methods:			
Course Intended Learning Outcomes		Teaching Strategies	Assessment Strategies

d1	Apply problem-solving skills in system troubleshooting.	Problem-solving tasks, role-playing	Presentations evaluations
d2	Communicate technical findings effectively with healthcare teams.	Group discussions, projects	Case study reports, group projects

IV. Course Contents:

A. Theoretical Aspect:

No.	Title	Sup-title	Number of Weeks	Contact Hours	Learning Outcomes (CILOs)
1	Introduction to Digital Radiography and PACS	- Computed radiography - DICOM (digital imaging and communications in medicine) - Digital imaging - Digital radiography - Direct capture DR - Indirect capture DR - PACS	1	2	a1, a2
2	Basic Computer Principles	- Computer System - Binary System - Computer System Components - Software - Categories of Software	1	2	a1, c1
3	Computer System principles (deeper View)	- Types of computers - The Central Processing Unit - Control Unit- CU - Bus Line - Memory - Further Looking Inside the System Unit - Computer Video - Resolution - Ports	1	2	a2, c1
4	NETWORKING AND COMMUNICATION BASICS	- Basic Concepts in Communication - Essentials for Communications - Understanding Networking	1	2	b1, c2

No.	Title	Sup-title	Number of Weeks	Contact Hours	Learning Outcomes (CILOs)
		– Key Network Terminology – Common Topologies – Data Transmission			
5	Understanding Transmission Medium	– Basic transmission medium concept – Medium examples by type – Networks connections – Major Categories of Networks – Communication protocol standards – Computer in radiology	1	2	b1, c2
6	Mid-term Exam	– All Previous topics	1	2	a1, a2, b1, b2, c1, c2
7	Cassette-Based Equipment: The Computed Radiography Cassette, Imaging Plate, and Reader	– Computed Radiography Equipment – Cassette – Imaging Plate – Acquiring and Forming the Image – The Reader – The Laser – Using the Laser to Read the Imaging Plate – Digitizing the Signal – Spatial Resolution – Speed – Erasing the Image – Preprocessing, Processing, and Forwarding the Image	2	4	a1, b1, c1
8	Cassette-Based Image Acquisition	– Computed Radiography Image Acquisition – Part Selection – Technical Factors – Kilovoltage Peak Selection – Milliampere-Second Selection – Equipment Selection – Imaging Plate Selection – Grid Selection – Collimation – Exposure Indicators	2	4	a1, a2, b1, b2

No.	Title	Sup-title	Number of Weeks	Contact Hours	Learning Outcomes (CILOs)
		- Automatic Data Recognition - Common CR Image acquisition Errors			
9	Cassetteless Equipment and Image Acquisition	- Digital Radiography - Flat-Panel Detectors - Direct Conversion - Direct Conversion DR Scintillator - Direct Conversion DR TFT - Indirect Conversion - Amorphous Silicon Detector - Cesium Iodide Detectors - Charge-Coupled Devices - Complementary Metal Oxide Silicon - Factors That Effect on Detectors - Detective Quantum Efficiency - Detector Size - Spatial Resolution - Pixel Size and Matrix Size - Potential Cassetteless Image Acquisition Errors	2	4	a2, b1, b2, c2 d1, d2
10	Digital Radiographic Image Processing and Manipulation	- Digital Radiographic Image Processing and Manipulation - CR Reader Functions - CR Image Sampling - Histogram Analysis - The Nyquist Theorem - DR and The Nyquist Theorem - Aliasing - Automatic Rescaling - Latitude - Quality Control Workstation Functions - Image Processing Parameters - Contrast Manipulation - Spatial Frequency Resolution - Spatial Frequency Filtering - Basic Functions of the Processing System - Image Management	3	6	a1, a2, b1, c1, c2, d2

No.	Title	Sup-title	Number of Weeks	Contact Hours	Learning Outcomes (CILOs)
		– Patient Demographics Input – Manual Send – Archive Query			
16	Final Exam	– All topics	1	2	a1, a2, b1, b2, c1, c2, d1, d2
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				
2				
3				
Number of Weeks /and Units Per Semester				

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:

Prepared by:

Reviewed by:

Dr. -----

Head of the Department:

Dr. Awadh Al-Kubati

Quality Unit:

Dr. Mohammed
Al-shamahi

Dean:

Dr. Abdulsalam
Dalaq

- Lectures
- Interactive Discussions:
- Case-Based Learning
- Problem-Solving Exercises

VII. Assessment Methods:

- Written Exams
- Assignments
- Oral Presentations
- Presentation

VII. Assignments:

No.	Assignments	Week Due	Mark	Aligned CILOs (symbols)
1	Research Paper on PACS and RIS Systems	4	3	a1, c1
2	Practical Report on Digital Imaging Techniques	6	3	b1, c2
3	Group Project on AI in Radiology	8	3	b2, c1
4	Case Study on Data Security in Radiology	10	3	a2, d1
5	Group Presentation on Future Trends in Imaging	12	3	a2, b1, d2
Total			15	

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 Exam	6	15	15%	a1, a2
2	Assignments	10	15	15%	a1, b1, b2, c2, c1
3	Final Exam	16	70	70%	a1, a2

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- Christi E. Carter, Beth L. Vealé, 2022, DIGITAL RADIOGRAPHY AND PACS, Edition 4, Mosby, Inc., an affiliate of Elsevier Inc. Library of Congress.
- 2- Andreas Maier, Stefan Steidl, Vincent Christlein, Joachim Hornegger, 2018, Medical Imaging Systems an Introductory Guide, Springer Nature Link.

2- Essential References:

- 1- Oleg S. Pianykh Limited preview, 2008, Digital Imaging and Communications in Medicine (DICOM): A Practical Introduction and Survival Guide, Springer-Verlag Berlin Heidelberg
- 2- Carrison K.S. Tong and Eric T.T. Wong, 2009, Governance of picture archiving and communications systems : data security and quality management of filmless radiology, Library of Congress Cataloging-in-Publication Data, IGI Global.
- 3- Oleg S. Pianykh, 2012, Latest edition, Digital Imaging and Communications in Medicine (DICOM), Springer Nature Link.
- 4- Troy Farncombe, Kris Iniewski, 2014, Medical Imaging Technology and Applications, CRC Press

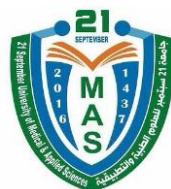
3- Electronic Materials and Web Sites etc.:

Electronic Materials and Websites

- Radiology & Imaging Tech Resources Online (e.g., Radiopaedia)
- American College of Radiology (ACR) Guidelines on Radiology Systems
- 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.
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.

Faculty of Applied Medical Science

Department of **Medical Radiology and Imaging Technology**

Program of Radiologic Technology and Medical Imaging

Course Plan (Syllabus) of **Computer Application in Radiology** **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

I. General Information:

12.	Course Title:	Computer Application in Radiology			
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:	3 rd Level / 1 st Semester			
16.	Pre –Requisite (if any):	Radiologic equipment's I&II			
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			
21.	Prepared by:				
22.	Date and Number of Approval by Council:				

II. Course Description:

This course introduces the application of computer systems in the field of radiology. Topics include Picture Archiving and Communication Systems (PACS), Radiology Information Systems (RIS), imaging processing software, and the integration of AI in diagnostic imaging. The course provides both theoretical and practical knowledge, emphasizing the role of technology in enhancing imaging quality, workflow efficiency, and patient care.

III. Course Intended Learning Outcomes (CILOs) :

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

A. Knowledge and Understanding:

a1 Explain the fundamental principles of computer applications in radiology.

A2 Recognize the importance of data management and security in radiology systems.

B. Intellectual Skills:

b1 Analyze the effectiveness of imaging software and digital tools.

B2 Evaluate the impact of advanced computing technologies, such as AI, on radiology practices.

C. Professional and Practical skills:

c1 Operate PACS and RIS systems efficiently.

C2 Utilize imaging software for processing and analyzing diagnostic images.

D. Transferable Skills:

d1 Apply problem-solving skills in system troubleshooting.

D2 Communicate technical findings effectively with healthcare teams.

IV. Course Contents:

A. Theoretical Aspect:

No.	Title	Sup-title	Number of Weeks	Contact Hours
1	Introduction to Digital Radiography and PACS	– Computed radiography – DICOM (digital imaging and communications in medicine) – Digital imaging – Digital radiography – Direct capture DR – Indirect capture DR – PACS	1	2
2	Basic Computer Principles	– Computer System – Binary System – Computer System Components	1	2

Prepared by:

Reviewed by:

Dr. -----

Head of the Department:

Dr. Awadh Al-Kubati

Quality Unit:

Dr. Mohammed
Al-shamahi

Dean:

Dr. Abdulsalam
Dalaq

No.	Title	Sup-title	Number of Weeks	Contact Hours
		– Software – Categories of Software		
3	Computer System principles (deeper View)	– Types of computers – The Central Processing Unit – Control Unit- CU – Bus Line – Memory – Further Looking Inside the System Unit – Computer Video – Resolution – Ports	1	2
4	NETWORKING AND COMMUNICATION BASICS	– Basic Concepts in Communication – Essentials for Communications – Understanding Networking – Key Network Terminology – Common Topologies – Data Transmission	1	2
5	Understanding Transmission Medium	– Basic transmission medium concept – Medium examples by type – Networks connections – Major Categories of Networks – Communication protocol standards – Computer in radiology	1	2
6	Mid-term Exam	– All Previous topics	1	2
7	Cassette-Based Equipment: The Computed Radiography Cassette, Imaging Plate, and Reader	– Computed Radiography Equipment – Cassette – Imaging Plate – Acquiring and Forming the Image – The Reader – The Laser – Using the Laser to Read the Imaging Plate – Digitizing the Signal – Spatial Resolution – Speed – Erasing the Image – Preprocessing, Processing, and Forwarding the Image	2	4

No.	Title	Sup-title	Number of Weeks	Contact Hours
8	Cassette-Based Image Acquisition	– Computed Radiography Image Acquisition – Part Selection – Technical Factors – Kilovoltage Peak Selection – Milliampere-Second Selection – Equipment Selection – Imaging Plate Selection – Grid Selection – Collimation – Exposure Indicators – Automatic Data Recognition – Common CR Image acquisition Errors	2	4
9	Cassetteless Equipment and Image Acquisition	– Digital Radiography – Flat-Panel Detectors – Direct Conversion – Direct Conversion DR Scintillator – Direct Conversion DR TFT – Indirect Conversion – Amorphous Silicon Detector – Cesium Iodide Detectors – Charge-Coupled Devices – Complementary Metal Oxide Silicon – Factors That Effect on Detectors – Detective Quantum Efficiency – Detector Size – Spatial Resolution – Pixel Size and Matrix Size – Potential Cassetteless Image Acquisition Errors	2	4
10	Digital Radiographic Image Processing and Manipulation	– Digital Radiographic Image Processing and Manipulation – CR Reader Functions – CR Image Sampling – Histogram Analysis – The Nyquist Theorem – DR and The Nyquist Theorem – Aliasing – Automatic Rescaling – Latitude	3	6

No.	Title	Sup-title	Number of Weeks	Contact Hours
		– Quality Control Workstation Functions – Image Processing Parameters – Contrast Manipulation – Spatial Frequency Resolution – Spatial Frequency Filtering – Basic Functions of the Processing System – Image Management – Patient Demographics Input – Manual Send – Archive Query		
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			
2			
3			
Number of Weeks /and Units Per Semester			

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
- Interactive Discussions:
- Case-Based Learning
- Problem-Solving Exercises

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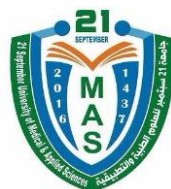
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