

Department of Radiology

Technologies

(third level)



Radiographic anatomy 2 course

This course studies how to teach the student the structures that appear in radiographs of various body organs.

1. Educational institution	Al-Ayen Iraqi University, College of Health and Medical Technologies
2. Scientific department/center	Department of Radiology Technologies
3. Course name/code	Radiographic anatomy 2
4. Available forms of attendance	%100
5. Annual/ courses	Annual
6. Number of study hours (total)	2 theoretical hours + 2 practical hours = 4 hours x 30 weeks = 120 hours
7. Date this description was prepared	2024
8. Course objectives Preparing radiography technologist has knowledge potential in learning about the anatomy of the human body through the x-ray image.	

10. Course outcomes and teaching, learning and evaluation methods
A- Cognitive objectives 1. Preparation of a radiology technician who has sufficient knowledge of general medical anatomy. 2- Prepare a radiology technician who has full knowledge of radiographic anatomy. 3- Teaching the student medical terminology related to radiographic anatomy. 4- Teaching the student the relationship between the picture and detailing the organ to be photographed.
B - The skills objectives of the course. 1- Teaching the student to control image quality and build details of the anatomical area. 2- Building a protocol for building dimensions and planning angles to plan the x-ray process.

3- Study all concepts related to anatomical conditions that require in-depth understanding and related to blood vessels. 4. Know all the differences between radiological devices, which vary according to the field of interest in anatomical vision.
Teaching and learning methods
• Lectures • Video clips
Evaluation methods
1. Written exams every week. 2. Daily oral evaluation. 3. Semester exams.
D - General and qualifying transferable skills (other skills related to employability and personal development). 1- Teaching the student to participate with the rest of the radiology units in the relationship of image quality to anatomy. 2- Teaching the student how to decide which device is appropriate based on the anatomy of the affected organ or the type of disease. 3- Preparing trainers with advanced skills in radiographic anatomy.

11. Course structure					
Evaluation method	Teaching method	Name of the unit/topic	outcomes Education	hours	the week
Apply and test	Intreactive	Anatomy Cranial parts	Understands the material	4	.1
Apply and test	Intreactive	Anatomy Temporal bone	Understands the material	4	.2
Apply and test	Intreactive	Main parts of the brain	Understands the material	4	.3
Apply and test	Intreactive	Anatomy of the orbit	Understands the material	4	.4
Apply and test	Intreactive	Anatomy of nasal cavity	Understands the material	4	.5
Apply and test	Intreactive	Anatomy of cervical spine	Understands the material	4	.6
Apply and test	Intreactive	Thoracic spine	Understands the material	4	.7
Apply and test	Intreactive	Lumbar spine	Understands the material	4	.8
Apply and test	Intreactive	Mediustinal structures	Understands the material	4	.9
Apply and test	Intreactive	Heart	Understands the material	4	.10
Apply and test	Intreactive	Blood supply for chest	Understands the material	4	.11
Apply and test	Intreactive	Abdominal anatomy i	Understands the material	4	.12
Apply and test	Intreactive	Abdominal anatomy	Understands the material	4	.13
Apply and test	Intreactive	Urinary system i	Understands the material	4	.14
Apply and test	Intreactive	Urinary system ii	Understands the material	4	.15
Apply and test	Intreactive	Pancreas and spleen	Understands the material	4	.16
Apply and test	Intreactive	Large and small bowels i	Understands the material	4	.17
Apply and test	Intreactive	Large and small bowels ii	Understands the material	4	.18
Apply and test	Intreactive	Blood supply for abdomen	Understands the material	4	.19
Apply and test	Intreactive	Pelvic anatomy, bone	Understands the material	4	.20
Apply and test	Intreactive	Pelvic anatomy, tests	Understands the material	4	.21
Apply and test	Intreactive	Prostate	Understands the material	4	.22

Apply and test	Intreactive	Anatomy for female i	Understands the material	4	.23
Apply and test	Intreactive	Anatomy for female ii	Understands the material	4	.24
Apply and test	Intreactive	Blood supply for pelvic	Understands the material	4	.25
Apply and test	Intreactive	i Anatomy of breast	Understands the material	4	.26
Apply and test	Intreactive	Anatomy of breast ii	Understands the material	4	.27
Apply and test	Intreactive	biliary system	the Understands material	4	.28
Apply and test	Intreactive	Review	Understands the material	4	.29
Apply and test	Intreactive	Review	Understands the material	4	.30

12. Infrastructure	
1- Required prescribed books	Training bag
2- Main references (sources)	Fundamentals of Sectional Anatomy
A-Recommended books and references (scientific journals, reports,...)	Studies published on the PUBmed website
B - Electronic references, Internet sites...	Radiopedia.org

13. Course development plan
The curriculum development plan is based on the following: 1. Giving the prescribed scientific material and observing and analyzing the students' results 2. Study feedback from students' comments about vocabulary 3. Study the practical laboratory notes for the course 4. Comparing current vocabulary with the vocabulary of corresponding colleges in the field

Radiography techniques 2 course

This course studies how to teach the student about radiography of the skull and spine for normal and abnormal (pathological) cases.

1. Educational institution	Al-Ayen Iraqi University, College of Health and Medical Technologies
2. Scientific department/center	Department of Radiology Technologies
3. Course name/code	Radiography techniques 2
4. Available forms of attendance	%100
5. Annual/ courses	Annual
6. Number of study hours (total)	2 theoretical hours + 4 practical hours = 6 hours x 30 weeks = 180 hours
7. Date this description was prepared	2024
8. Course objectives	Teach the student x-ray imaging of the skull and spine for normal and abnormal (pathological) cases.

10. Course outcomes and teaching, learning and evaluation methods
A- Cognitive objectives 1. Know and understand the principles of radiography. 2. Use special imaging positions to obtain clear radiographs. 3. Know and understand how x-ray machines work. 4. Know and understand the anatomy of the parts being photographed. 5. Examination of the skull and spine using X-ray techniques.
B - The skills objectives of the course. 1- Teaching the student how to use and perform radiological examination of various body systems. 2- Preparing efficient cadres to meet the needs of educational institutions in general and the health sector in general private. 3- Availability of qualified personnel to work in the field of teaching and

imaging examinations in hospitals Governmental and private centres. 4- Exchanging scientific expertise and competencies with similar laboratories in other universities and colleges.
Teaching and learning methods
• Lectures • Video clips
Evaluation methods
1. Written exams every week. 2. Daily oral evaluation. 3. Semester exams.
D - General and qualifying transferable skills (other skills related to employability and personal development). 1- Identify how to protect against radiation and its harms 2- Learn how to deal with the patient during radiography 3- Directing and advising patients to prepare them before performing the radiography 4- Identify the use of modern devices and update student information as these devices develop

11. Course structure					
Evaluation method	Teaching method	Name of the unit/topic	Required learning outcomes	hours	the week
Apply and test	Interactive	Lines & planes of projection of the skull 1	Understands the material	6	.1
Apply and test	Interactive	Lines & planes of projection of the skull 2	Understands the material	6	.2
Apply and test	Interactive	Skull AP, Lateral, Towns	Understands the material	6	.3
Apply and test	Interactive	Skull, towns and basal view	Understands the material	6	.4
Apply and test	Interactive	Sinuses, face, and nose PA and lateral	Understands the material	6	.5
Apply and test	Interactive	Sinuses, shown structure	Understands the material	6	.6
Apply and test	Interactive	Paranasal sinuses, waters view & lateral view	Understands the material	6	.7
Apply and test	Interactive	Paranasal sinuses, shown structure main finding	Understands the material	6	.8
Apply and test	Interactive	Mandible PA and oblique	Understands	6	.9

		projection, shown structure, main finding	the material		
Apply and test	Intreactive	Chin ventro - dorsal, TMJ view, maxillary bone	Understands material the	6	.10
Apply and test	Intreactive	Main skull pathology, image interpretation of special cases	Understands the material	6	.11
Apply and test	Intreactive	Cases for skull and facial bones	Understands the material	6	.12
Apply and test	Intreactive	Cervical spine, AP, lateral	Understands the material	6	.13
Apply and test	Intreactive	Cervical spine, AP for C1-C3, AP view for C3-C7, shown structure	Understands the material	6	.14
Apply and test	Intreactive	Cervico-thoracic region lateral waterskiing position, oblique view	Understands the material	6	.15
Apply and test	Intreactive	Main cervical spine finding, image interpretation of cervical fractures	Understands the material	6	.16
Apply and test	Intreactive	Cases review for cervical spine	Understands material the	6	.17
Apply and test	Intreactive	Thoracic spine, AP, lateral	Understands the material	6	.18
Apply and test	Intreactive	Thoracic spine, lateral decubitus, shown structure	Understands the material	6	.19
Apply and test	Intreactive	Image interpretation and main pathology of the thoracic spine	Understands the material	6	.20
Apply and test	Intreactive	Lumber spine, AP, lateral	Understands the material	6	.21
Apply and test	Intreactive	Lumber spine, oblique projection, shown structure	Understands the material	6	.22
Apply and test	Intreactive	Main finding, fractures, pathology, image interpretation of the lumber spine	Understands the material	6	.23
Apply and test	Intreactive	Sacrum and coccyx, AP, lateral, shown structure, main finding	Understands the material	6	.24
Apply and test	Intreactive	Cases review for the spinal column	Understands the material	6	.25
Apply and test	Intreactive	Abdomen, AP, PA erect, lateral view, Urinary tract KUB, shown structure	Understands the material	6	.26
Apply and test	Intreactive	Urinary tract KUB, shown structure	Understands the material	6	.27
Apply and test	Intreactive	pediatric imaging,	Understands the material	6	.28
Apply and test	Intreactive	Mammography, main position, finding, image interpretation	Understands the material	6	.29
Apply and test	Intreactive	Cases review,	Understands the material	6	.30

12. Infrastructure	
1- Required prescribed books	Bontrager's Handbook of Radiographic Positioning and Techniques: 10e, South Asia Edition-E-Book. Elsevier Health Sciences. Merrill's Atlas of Radiographic Positioning and Procedures-3-Volume Set-E-Book. Elsevier Health Sciences
2- Main references (sources)	Clark's Positioning In Radiography. A. S. Whitley
A-Recommended books and references (scientific journals, reports,...)	Textbook of Radiographic Positioning and Related Anatomy, 11th Edition Image Interpretation: Bones, Joints, and Fractures, 1st Edition
B - Electronic references, Internet sites...	Radiopedia.org

13. Course development plan
The curriculum development plan is based on the following: 1. Giving the prescribed scientific material and observing and analyzing the students' results 2. Study feedback from students' comments about vocabulary 3. Study the practical laboratory notes for the course 4. Comparing current vocabulary with the vocabulary of corresponding colleges in the field

Pathology course

This course aims to know and understand pathology and its relationship to other organ functions.

1. Educational institution	Al-Ayen Iraqi University, College of Health and Medical Technologies
2. Scientific department/center	Department of Radiology Technologies
3. Course name/code	Pathology
4. Available forms of attendance	%100
5. Annual/ courses	Annual
6. Number of study hours (total)	2 theoretical hours + 2 practical hours = 4 hours x 30 weeks = 120 hours
7. Date this description was prepared	2024
8. Course objectives 1. Knowledge and understanding of pathology and its relationship to other organ functions. 2. Scientific skills that enable the student to study the pathological lesions of each organ in the human body and the importance of knowing the clinical signs. 3. Thinking and analysis skills that enable the student to know the interconnection of organs according to their anatomical locations and the type of infections that occur due to microbes. 4. Students achieved knowledge of histological events and clinical signs and linked them to the general changes of the disease state	

10. Course outcomes and teaching, learning and evaluation methods
A- Cognitive objectives 1. Enabling students to obtain knowledge and understanding of the intellectual and skills framework of pathology 2. Enabling the student to obtain knowledge and understanding of diseases, their causes, and methods of diagnosing the disease 3. Developing students' ability to distinguish between diseases and their clinical signs through differential diagnosis
B - The skills objectives of the course. 1. Enabling the student to know how to diagnose the disease and the pathology of the disease 2. Enabling the student to recognize the differential diagnosis of the disease and

compare it with other diseases 3. Enabling students to know about diseases and their impact on public health
Teaching and learning methods
• Lectures • Video clips
Evaluation methods
1. Written exams every week. 2. Daily oral evaluation. 3. Semester exams.
D - General and qualifying transferable skills (other skills related to employability and personal development). 1 - Developing the student's ability to learn the most important racial and pathological differences that arise from the disease. 2- It helps the student to know the importance of pathology and its relationship to other sciences

11.Course structure					
Evaluation method	Teaching method	Name of the unit/topic	Required learning outcomes	hours	the week
Apply and test	Intreactive	Necrosis - cell death	Understands Subject	theoretical 2 practical 2 +	1.
Apply and test	Intreactive	Inflammation	Understands Subject	theoretical 2 practical 2 +	2.
Apply and test	Intreactive	Repair process	Understands Subject	theoretical 2 practical 2 +	3.
Apply and test	Intreactive	Infection	Understands Subject	theoretical 2 practical 2 +	4.
Apply and test	Intreactive	Body response to infection	Understands Subject	theoretical 2 practical 2 +	5.
Apply and test	Intreactive	Carcinogenesis	Understands Subject	theoretical 2 practical 2 +	6.
Apply and test	Intreactive	Radiation effect - early	Understands Subject	theoretical 2 practical 2 +	7.
Apply and test	Intreactive	Radiation effect - late	Understands Subject	theoretical 2 practical 2 +	8.
Apply and test	Intreactive	Homodynamic disorders	Understands Subject	theoretical 2 practical 2 +	9.
Apply and test	Intreactive	Blood disorders- WBC, RBC	Understands Subject	theoretical 2 practical 2 +	10.
Apply and test	Intreactive	Blood disorders - coagulation	Understands Subject	theoretical 2 practical 2 +	11.
Apply and test	Intreactive	Diseases of bones & joints	Understands Subject	theoretical 2 practical 2 +	12.
Apply and test	Intreactive	Bone fracture	Understands Subject	theoretical 2 practical 2 +	13.
Apply and test	Intreactive	Pathological diseases of the kidneys	Understands Subject	theoretical 2 practical 2 +	14.
Apply and test	Intreactive	Pathological diseases of the ureters & Urinary bladder	Understands Subject	theoretical 2 practical 2 +	15.
Apply and test	Intreactive	Pathological diseases of the esophagus & stomach	Understands Subject	theoretical 2 practical 2 +	16.
Apply and test	Intreactive	Pathological diseases of small & large bowels	Understands Subject	theoretical 2 practical 2 +	17.
Apply and test	Intreactive	Pathological diseases of the liver	Understands Subject	theoretical 2 practical 2 +	18.
Apply and test	Intreactive	Pathological diseases of the lung & pleura	Understands Subject	theoretical 2 practical 2 +	19.
Apply and test	Intreactive	Pathological diseases of the upper respiratory tract	Understands Subject	theoretical 2 practical 2 +	20.
Apply and test	Intreactive	Pathological diseases of the upper respiratory tract	Understands Subject	theoretical 2 practical 2 +	21.

Apply and test	Intreactive	Pathological diseases of the brain	Understands Subject	theoretical 2 practical 2 +	22.
Apply and test	Intreactive	Pathological diseases of the spinal cord	Understands Subject	theoretical 2 practical 2 +	23.
Apply and test	Intreactive	Pathological diseases of the gall bladder & biliary tract	Understands Subject	theoretical 2 practical 2 +	24.
Apply and test	Intreactive	Pathological diseases of the cardiovascular system	Understands Subject	theoretical 2 practical 2 +	25.
Apply and test	Intreactive	Pathological diseases of the endocrine system	Understands Subject	theoretical 2 practical 2 +	26.
Apply and test	Intreactive	Pathological diseases of the pituitary gland & adrenals	Understands Subject	theoretical 2 practical 2 +	27.
Apply and test	Intreactive	Pathological diseases of the lymphatic system	Understands Subject	theoretical 2 practical 2 +	28.
Apply and test	Intreactive	Pathological diseases of the female reproductive system	Understands Subject	theoretical 2 practical 2 +	29.
Apply and test	Intreactive	Pathological diseases of the breast	Understands Subject	theoretical 2 practical 2 +	30.

12. Infrastructure

1- Required prescribed books	Training bag
2- Main references (sources)	Robbins Abbas Kumar Pathology Basic Edition 9 th
A-Recommended books and references (scientific journals, reports,...)	Textbook of Pathology Basic
B - Electronic references, Internet sites...	The website of Al-Ayen Iraqi University

13. Course development plan

The curriculum development plan is based on the following:

1. Giving the prescribed scientific material and observing and analyzing the students' results
2. Study feedback from students' comments about vocabulary
3. Study the practical laboratory notes for the course
4. Comparing current vocabulary with the vocabulary of corresponding colleges in the field

Special radiological procedures 2 course

This course teaches how to use contrast media and conduct X-ray examination of various body systems

1. Educational institution	Al-Ayen Iraqi University, College of Health and Medical Technologies
2. Scientific department/center	Department of Radiology Technologies
3. Course name/code	special radiological procedures 2
4. Available forms of attendance	%100
5. Annual/ courses	Annual
6. Number of study hours (total)	2 theoretical hours + 4 practical hours = 6 hours x 30 weeks = 180 hours
7. Date this description was prepared	2024
8. Course objectives 1- University students are prepared to fully understand (Special Radiological procedures 2), which qualifies them to understand how to use contrast media and conduct X-ray examinations of various body systems. And improving the capabilities and skills of radiology technicians to work in the field of interventional radiology 2- Preparing students who are able to perform radiological and non-radiological examinations at the practical and applied level through the use of available means such as animated films and projection films to explain the most important examinations for catheter interventions of the heart and arteries and MRI and ultrasound examination of the remaining parts of the body.	

10. Course outcomes and teaching, learning and evaluation methods

A- Cognitive objectives 1. Teach the student how to use contrast media 2. Identify the anatomy after using contrast material 3. Knowing the appearance of the disease after using contrast material 4. Ability to define and use abbreviations for common special radiological procedures. 5. Learn about reading radioactive chips after contrast.
B - The skills objectives of the course. 1- Teaching how to deal with the dye and the relationship between the timing of administration and the presentation of anatomical parts 2- Comparison between the anatomical parts of the body in different radiology devices before and after the use of contrast media (conventional X-rays / CT scanners / resonance imaging) 3- Maintaining the quality of the radiological examination
Teaching and learning methods
• Lectures • Video clips
Evaluation methods
1. Written exams every week. 2. Daily oral evaluation. 3. Semester exams.
D - General and qualifying transferable skills (other skills related to employability and personal development). 1. - Graduate as a radiology technician familiar with common special radiological procedures 2 to enable him to perform radiographic calculations 2- Enabling the student to develop himself continuously after graduation to keep pace with developments in the field of specialization. Teaching and learning methods. Continuous guidance on (special radiological examinations 2) during lectures.

11. Course structure					
Evaluation method	Teaching method	Name of the unit/topic	Required learning outcomes	hours	the week
Apply and test	Intreactive	Methods of imaging of the heart and .angiocardigraphy	Understands the material	6	1.
Apply and test	Intreactive	Coronary arteriography & cardiac CT .including coronary angiography	Understands the material	6	2.
Apply and test	Intreactive	Methods of imaging the arterial system & introduction to catheter .techniques	Understands the material	6	3.
Apply and test	Intreactive	Femoral, brachial & axillary punctures .for catheterization	Understands the material	6	4.
Apply and test	Intreactive	General complications of catheter .techniques	Understands the material	6	5.
Apply and test	Intreactive	Ascending aortoraphy and lower limb .arteriography	Understands the material	6	6.
Apply and test	Intreactive	.Balloon angiography	Understands the material	6	7.
Apply and test	Intreactive	.Vascular embolization	Understands the material	6	8.
Apply and test	Intreactive	.CT & MRI angiography	Understands the material	6	9.
Apply and test	Intreactive	Methods of imaging the venous .system & peripheral venography	Understands the material	6	10.
Apply and test	Intreactive	.Central venography	Understands the material	6	11.
Apply and test	Intreactive	.Portal venography	Understands the material	6	12.
Apply and test	Intreactive	Position emission tomography .imaging	Understands the material	6	13.
Apply and test	Intreactive	.f-FDG PET scanning 18	Understands the material	6	14.
Apply and test	Intreactive	Lymph node imaging.	Understands the material	6	15.
Apply and test	Intreactive	Imaging modalities of bones & joints.	Understands material the	6	16.
Apply and test	Intreactive	.Muscloskeletal MRI – general points	Understands the material	6	17.
Apply and test	Intreactive	.Arthrography-general points	Understands the material	6	18.
Apply and test	Intreactive	.Arthrography of the knee & hip	Understands the material	6	19.
Apply and test	Intreactive	Arthrography of the shoulder & Am .bow	Understands the material	6	20.
Apply and test	Intreactive	.Radionuclide bone scan	Understands the material	6	21.

Apply and test	Intreactive	.Method of imaging the brain	Understands the material	6	22.
Apply and test	Intreactive	.CT & MRI of the brain	Understands the material	6	23.
Apply and test	Intreactive	.Cerebral & lumber myelography	Understands the material	6	24.
Apply and test	Intreactive	Methods of imaging the spine.	Understands the material	6	25.
Apply and test	Intreactive	.Cervical & lumber myelography	Understands the material	6	26.
Apply and test	Intreactive	Methods of imaging of the salivary glands	Understands the material	6	27.
Apply and test	Intreactive	Methods of imaging the thyroid & parathyroid glands with CT & MRI of the thyroid and parathyroid glands	Understands the material	6	28.
Apply and test	Intreactive	Methods of imaging of the breast & mammary glands	Understands the material	6	29.
Apply and test	Intreactive	Final exam	Understands the material	6	30.

12. Infrastructure

1- Required prescribed books	Training bag
2- Main references (sources)	CHAPMAN & NAKIELNY'S GUIDE TO RADIOLOGICAL PROCEDURES
A-Recommended books and references (scientific journals, reports,...)	CHAPMAN & NAKIELNY'S GUIDE TO RADIOLOGICAL PROCEDURES (eight edition)
B - Electronic references, Internet sites...	PubMed, ISI, master mri, question & answer mri, Google schooler.... etc.

13. Course development plan

The curriculum development plan is based on the following:

1. Giving the prescribed scientific material and observing and analyzing the students' results
2. Study feedback from students' comments about vocabulary
3. Study the practical laboratory notes for the course
4. Comparing current vocabulary with the vocabulary of corresponding colleges in the field

Radiation physics 2 course

Get an overview of MRI and ultrasound systems and the basic physics of both systems. Gain a basic understanding of how MRI and ultrasound images are created

1. Educational institution	Al-Ayen Iraqi University, College of Health and Medical Technologies
2. Scientific department/center	Department of Radiology Technologies
3. Course name/code	Radiation physics 2
4. Available forms of attendance	%100
5. Annual/ courses	Annual
6. Number of study hours (total)	2 theoretical hours + 2 practical hours = 4 hours x 30 weeks = 120 hours
7. Date this description was prepared	2024
8. Course objectives	
1. Develop knowledge of MRI, ultrasound, and image formation conditions 2. Obtain a detailed background in MRI and ultrasound physics and see available designs	

10. Course outcomes and teaching, learning and evaluation methods
A- Cognitive objectives 1- The student should know the physical and medical definition of ultrasound 2- The student should know the cases of ultrasound 3- To know the principles of magnetic resonance imaging 4- To know the role of MRI in detecting and characterizing diseases and to recognize the advantages of MRI
B - The skills objectives of the course. 1. The student will learn how to operate the Piezoelectric operator 2. That the student understands and explains how the Piezoelectric Effect and reverse Piezoelectric Effect 3. The student will gain an understanding of how different soft tissues have T1 relaxation times and how this affects the overall images created in the MRI

machine. 4. That the student understands and defines the meaning of TR (repetition time) and TE (echo delay time).
Teaching and learning methods
• Lectures • Video clips
Evaluation methods
1. Written exams every week. 2. Daily oral evaluation. 3. Semester exams.
D - General and qualifying transferable skills (other skills related to employability and personal development). 1. Describe the general relationship between image quality and wavelength for an ultrasound device 2. Explain the advantages and disadvantages of CW Doppler 3. Discuss the differences between T1-weighted images, proton density-weighted images, and T2-weighted images.

11. Course structure					
Evaluation method	Teaching method	Name of the unit/topic	Required learning outcomes	hours	the week
Apply and test	Intreactive	Magnetic Resonance Imaging	Understands the material	6	1.
Apply and test	Intreactive	Historical introduction, The Hardware Magnet Types	Understands the material	6	2.
Apply and test	Intreactive	RF Coils	Understands the material	6	3.
Apply and test	Intreactive	Other Hardware	Understands the material	6	4.
Apply and test	Intreactive	Excitation Relaxation	Understands the material	6	5.
Apply and test	Intreactive	Phase and Phase Coherence	Understands the material	6	6.
Apply and test	Intreactive	Acquisition Computing and Display	Understands the material	6	7.
Apply and test	Intreactive	Signal Coding	Understands the material	6	8.
Apply and test	Intreactive	Gradient Specifications	Understands the material	6	9.
Apply and test	Intreactive	MRI Image Quality, Artifacts, and Imaging Parameters	Understands the material	6	10.
Apply and test	Intreactive	Signal to Noise and Contrast Resolution	Understands the material	6	11.
Apply and test	Intreactive	Scan parameters (TR, TE, flip angle)	Understands the material	6	12.
Apply and test	Intreactive	Selection of the transmit and receive coil (RF coil) Field of View	Understands the material	6	13.
Apply and test	Intreactive	Number of Excitations, MRI Contrast Agents	Understands the material	6	14.
Apply and test	Intreactive	K-Space, Filling k-Space, K-Space Symmetry	Understands the material	6	15.
Apply and test	Intreactive	Physics of Ultrasound_Definition	Understands	6	16.

			the material		
Apply and test	Intreactive	Properties of Ultrasound	Understands the material	6	17.
Apply and test	Intreactive	Diagnostic Ultrasound, Piezoelectric Materials	Understands the material	6	18.
Apply and test	Intreactive	Ultrasound Transducers	Understands the material	6	19.
Apply and test	Intreactive	<u>Amplification</u>	Understands the material	6	20.
Apply and test	Intreactive	, DisplayImage Processor	Understands the material	6	21.
Apply and test	Intreactive	Things to consider	Understands the material	6	22.
Apply and test	Intreactive	Ultrasound Modalities	Understands the material	6	23.
Apply and test	Intreactive	Ultrasound Characteristics	Understands the material	6	24.
Apply and test	Intreactive	<u>Intensity and Power</u>	Understands the material	6	25.
Apply and test	Intreactive	Interactions of Ultrasound with Tissue	Understands the material	6	26.
Apply and test	Intreactive	ModesUltrasound	Understands the material	6	27.
Apply and test	Intreactive	Doppler Effect Basic principles The Doppler Equation	Understands the material	6	28.
Apply and test	Intreactive	Pulsed and Continuous Wave Doppler	Understands the material	6	29.
Apply and test	Intreactive	High PRF Color Flow Mapping Pulsed Wave Doppler	Understands the material	6	30.

12. Infrastructure	
1- Required prescribed books	Training bag
2- Main references (sources)	1-Radiation Physics and its applications in diagnostic radiological techniques 2-Medical Imaging Physics Fourth Edition 3-Basic Physics of Ultrasonographic Imaging
A-Recommended books and references (scientific journals, reports,...)	Textbook of Radition physics

13. Course development plan

The curriculum development plan is based on the following:

1. Giving the prescribed scientific material and observing and analyzing the students' results
2. Study feedback from students' comments about vocabulary
3. Study the practical laboratory notes for the course
4. Comparing current vocabulary with the vocabulary of corresponding colleges in the field

Radiation protection 2 Course

Radiation protection is the science of protecting humans from the effects of ionizing radiation, whether they are elementary particles such as protons and neutrons or high-energy electromagnetic radiation such as X-rays and gamma rays.

1. Educational institution	Al-Ayen Iraqi University, College of Health and Medical Technologies
2. Scientific department/center	Department of Radiology Technologies
3. Course name/code	Radiography techniques 2
4. Available forms of attendance	%100
5. Annual/ courses	Annual
6. Number of study hours (total)	1 theoretical hours + 2 practical hours = 3 hours x 30 weeks = 90 hours
7. Date this description was prepared	2024
8. Course objectives 1. Providing sufficient information to students regarding radon. 2. Provide clinical examples that illustrate the principles of ALARA. 3. Distinguish between workers in the area who are occupationally at risk and those who are treated as members of the general public. 4. Discuss the factors that determine the dose to a pregnant person sitting next to a patient being injected with a radionuclide for a diagnostic or therapeutic procedure. 5. Describe the steps used in applying suitability criteria.	

10. Course outcomes and teaching, learning and evaluation methods
A- Cognitive objectives 1. Gaining knowledge of an important scientific topic and applying it in his field of work. 2. Obtaining new ideas that can be combined with his specialty 3. In response to recent developments in the field of radiation protection
B - The skills objectives of the course. 1. Developing the student from the practical aspect in the laboratory and the theoretical aspect in understanding the basics of radiation protection 2. Solve the problems facing the student in the field of work by developing his mind in thinking for a solution the problem 3. The student learns how to write scientific reports
Teaching and learning methods

• Lectures • Video clips
methods Evaluation
1. Written exams every week. 2. Daily oral evaluation. 3. Semester exams.
D - General and qualifying transferable skills (other skills related to employability and personal development). 1. Using a computer in the field of specialization. 2. The ability to search for information, analyze it statistically, and extract it through the use of the studied programs. 3. The ability to collect information, analyze it, and summarize the main ideas. 4. Writing technical reports on experiments used in the field of specialization.

11. Course structure					
Evaluation method	Teaching method	Name of the unit/topic	Required learning outcomes	hours	the week
Apply and test	Interactive	Review Structure of the Atom – Radiation Units – ALARA principles –	Understands the material	3	1
Apply and test	Interactive	Diagnostic X-Ray Room Measurement of Area Radiation Levels Leakage Radiation In-room Scattered Radiation Measurement Protective Barrier/Shielding Assessment Area Radiation Level Checklist	Understands the material	3	2,3
Apply and test	Interactive	Medical Sources: Occupational and Patient Doses Ionizing radiation interactions with tissue Radiobiological effects at the cellular and whole body level Genetic and somatic effects of ionizing radiation deterministic effects • stochastic effects • probability coefficients for tissues at risk • effective dose • Threshold and non-threshold effects.	Understands the material	3	4,5,6
Apply and test	Interactive	Radiation protection principles Justification • Optimization • Limitation •	Understands the material	3	7
Apply and test	Interactive	Radiation protection principles applied to medical diagnostic procedures Radiation protection of patients who are or might be pregnant Practical measures for the reduction of patient dose	Understands the material	3	8,9,10

		Some dose-saving equipment Some dose-saving techniques High-risk examinations			
Apply and test	Interactive	Risks from radiological examinations Explaining radiation risks to patients Personal protection and personal monitoring - how, why, when, where dose limits typical doses to staff and associated risks Protection of employees and members of the public protection of patients	Understands the material	3	11,12,13
Apply and test	Interactive	Physical factors affecting radio-sensitivity 1. Linear energy transfer 2. Relative biological effectiveness 3. Fractionation and protraction	Understands the material	3	14
Apply and test	Interactive	Biologic factors affecting Radio sensitivity 1. Oxygen effect 2. Age effect 3. Sex effect 4.Recovery 5.Chemical agents	Understands the material	3	15,16
Apply and test	Interactive	Early effects of radiation Acute radiation syndrome Hematologic syndrome • Gastrointestinal syndrome • Central nervous system • syndrome Local tissue damage Skin • Gonads • Extremities • Hematologic depression Cytogenetic damage	Understands the material	3	17,18
Apply and test	Interactive	Late effects of radiation	Understands the material	3	19,20

		- Leukemia • - Other malignant disease • - Effect of fetal irradiation - Prenatal death • - Neonatal death • - Congenital malformation • - Childhood malignancy • - Fetuses irradiated in utero			
Apply and test	Interactive	Radiation dose-response relationships Linear dose-response relationships Non-Linear dose-response relationships Constructing a dose-response relationships Linear, quadratic dose-response relationships Radiolysis of water Direct and indirect	Understands the material	3	21,22,23
Apply and test	Interactive	Maximum permissible dose Whole body non-occupational exposure Partial-body occupational exposure X-ray and pregnancy 1. The pregnant technologist 2. Management principles 3. The pregnant patient	Understands the material	3	24,25
Apply and test	Interactive	Designing for radiation protection Design of X-ray apparatus Design of protective barrier thickness	Understands the material	3	26
Apply and test	Interactive	Factors affecting barrier thickness Occupational Exposure	Understands the material	3	27
Apply and test	Interactive	Patient dose Patient dose in special examinations Reduction of occupational exposure Reduction of unnecessary patient dose Unnecessary examinations	Understands the material	3	28,29,30

12. Infrastructure

1- Required prescribed books	Training bag
2- Main references (sources)	1. RF Farr and PJ Allisy-Roberts “Physics for Medical Imaging”, Saunders, 4 th edition (2001). 2. S.C. Bushong “Radiologic Science For Technologists”, Mosby, Fifth edition (1988). H. Cember “Introduction to Health Physics”, Pergamon Press, Third edition (1987).
A-Recommended books and references (scientific journals, reports,...)	S.C. Bushong “Radiologic Science For Technologists”, Mosby, Fifth edition (1988).
B - Electronic references, Internet sites...	Website of the International Agency for Radiation Protection The website of Al-Ayen Iraqi University

13. Course development plan
The curriculum development plan is based on the following: 1. Giving the prescribed scientific material and observing and analyzing the students’ results 2. Study feedback from students’ comments about vocabulary 3. Study the practical laboratory notes for the course 4. Comparing current vocabulary with the vocabulary of corresponding colleges in the field

Computer applications 2 course

This course aims to provide the student with the skills of dealing with basic office applications and creating office files and documents. The use of the operating system as well as the basics of working within the digital environment.

1. Educational institution	Al-Ayen Iraqi University, College of Health and Medical Technologies
2. Scientific department/center	Department of Radiology Technologies
3. Course name/code	Computer applications 2
4. Available forms of attendance	%100
5. Annual/ courses	Annual
6. Number of study hours (total)	1 theoretical hours + 2 practical hours = 3 hours x 30 weeks = 90 hours
7. Date this description was prepared	2024
8. Course objectives 1- Identify the applications and basics of three programs: Excel, PowerPoint, and the statistical program SPSS. 2- Providing students with abundant information on how to apply computer concepts in the health and medical system 3- Urging students to actively participate in attending advanced scientific courses and conferences to practice their specialty 4- Introducing the student to: calculator software, Excel, the SPSS statistical program, and the PowerPoint program in practicing the profession, and learning about its concept, benefits, specifications, features, and methods of operation.	

10. Course outcomes and teaching, learning and evaluation methods
A- Cognitive objectives 1- Understands the principles and basics of computer programs. 2- Identify the types and stages of development of computer programs. 3- Get acquainted with statistical calculator programs, especially the statistical program SPSS. 4- Learn a set of program instructions related to computer programs targeted at health and medical teaching.

5- He can deal with Office programs, Excel and PowerPoint
B - The skills objectives of the course. 1 - Be able to deal with a computer. 2 - He can write and execute programs on the computer 3 - He carries out some procedures related to some electronic instructions
Teaching and learning methods
• Lectures • Video clips
Evaluation methods
1. Written exams every week. 2. Daily oral evaluation. 3. Semester exams.
D - General and qualifying transferable skills (other skills related to employability and personal development). 1- Using the electronic calculator in the field of specialization. 2- The ability to search for information, analyze it statistically, and extract it through the use of the studied programs. 3- The ability to collect information, analyze it, and summarize the main ideas. 4- Writing technical reports on the devices used in the field of specialization.

11. Course structure					
Evaluation method	Teaching method	Name of the unit/topic	Required learning outcomes	hours	the week
Apply and test	Interactive	Excel program	Understands the material	3	1.
Test and apply	Interactive	Cell handling	Understands the material	3	2.
and apply Test	Interactive	File handling	Understands the material	3	3.
and apply Test	Interactive	Using functions	Understands the material	3	4.
and apply Test	Interactive	Format cells	Understands the material	3	5.
and apply Test	Interactive	Formatting tables	Understands the material	3	6.
and apply Test	Interactive	Formatting tables	Understands the material	3	7.
and apply Test	Interactive	handling Cell	Understands the material	3	8.
and apply Test	Interactive	Statistical programme	Understands the material	3	9.
and apply Test	Interactive	Statistician the program	Understands the material	3	10.
and apply Test	Interactive	And Files dealing with data	Understands the material	3	11.
and apply Test	Interactive	Analysis application	Understands the material	3	12.

		Descriptive			
and apply Test	Interactive	Apply averages and comparisons	Understands the material	3	13.
and apply Test	Interactive	Application of statistical packages	Understands the material	3	14.
and apply Test	Interactive	Dealing with charts	Understands the material	3	15.
and apply Test	Interactive	Application of statistical packages	Understands the material	3	16.
and apply Test	Interactive	Application of statistical packages	Understands the material	3	17.
and apply Test	Interactive	program Power Point	Understands the material	3	18.
and apply Test	Interactive	Get to know the program	Understands the material	3	19.
and apply Test	Interactive	program the dealing with	Understands the material	3	20.
and apply Test	Interactive	Apply effects	Understands the material	3	21.
and apply Test	Interactive	Apply effects	Understands the material	3	22.
and apply Test	Interactive	Apply effects	Understands the material	3	23.
and apply Test	Interactive	program the dealing with	Understands the material	3	24.
and apply Test	Interactive	program the dealing with	Understands the material	3	25.
and apply Test	Interactive	And Files dealing with data	Understands the material	3	26.

and apply Test	Interactive	And Files dealing with data	Understands the material	3	27.
and apply Test	Interactive	Page formatting	Understands the material	3	28.
and apply Test	Interactive	Formatting tables	Understands the material	3	29.
apply and Test	Interactive	File format	Understands the material	3	30.

12. Infrastructure

1- Required prescribed books	Training bag
2- Main references (sources)	1-Computer and Internet basics. Mother. Dr.. Ziad Muhammad Abboud 2013 2-Discovering Statistics Using SPSS, 3rd Edition (Introducing Statistical Methods) Computer and Internet basics. Mother. Dr. Ziad Muhammad Abboud 2013 3-Discovering Statistics Using SPSS, 3rd Edition Introducing Statistical Methods
A-Recommended books and references (scientific journals, reports,...)	IC3 book for computers and spss program
B - Electronic references, Internet sites...	The official website of the spss program Office official website

13. Course development plan

The curriculum development plan is based on the following:

1. Giving the prescribed scientific material and observing and analyzing the students' results
2. Study feedback from students' comments about vocabulary
3. Study the practical laboratory notes for the course
4. Comparing current vocabulary with the vocabulary of corresponding colleges in the field

Radiological medical device techniques2 course

This course teaches how to use contrast media and conduct X-ray examination of various body systems.

1. Educational institution	Al-Ayen Iraqi University, College of Health and Medical Technologies
2. Scientific department/center	Department of Radiology Technologies
3. Course name/code	Radiological medical device techniques 2
4. Available forms of attendance	%100
5. Annual/ courses	Annual
6. Number of study hours (total)	2 theoretical hours + 4 practical hours = 6 hours x 30 weeks = 180 hours
7. Date this description was prepared	2024
8. Course objectives 1. Introducing the student to the components of radiological medical devices and how they work. 2. Providing knowledge about the historical background of radiological medical devices. 3. Explore the components of basic devices used in radiography, such as magnets, RF coils, and gradient coils. 4. Understand the acquisition, computing, and display processes in radiography. 5. Introduce the student to the different types of files used in radiography devices, including volumetric RF files, surface files, and sequential array files. 6. Explore the concepts of pixel, voxel, matrix, and slice thickness in radiography. 7. Providing theoretical and practical knowledge about radiography techniques	

10. Course outcomes and teaching, learning and evaluation methods

A- Cognitive objectives 1. Understanding the principles and techniques of operating radiological medical devices. 2. Identify the components of radiological medical devices and the role of each component in the radiography process. 3. Acquire the necessary knowledge about the history and development of radiological medical device technologies. 4. Developing skills in dealing with various types of files and magnets used in radiography. 5. The ability to analyze and understand radiographs and the data extracted from them. 6. Applying theoretical concepts in practical work on radiography devices. 7. Develop teamwork and communication skills in a multi-disciplinary work environment
B - The skills objectives of the course. 1. Developing skills in identifying and distinguishing between the components of radiological medical devices. 2. Acquiring analytical and critical thinking skills in evaluating the performance of radiological medical devices. 3. Develop effective interaction and communication skills with the work team in a medical environment. 4. Develop research and exploration skills to learn about the latest technologies and innovations in the field of radiological medical devices. 5. Improving the skills of practical application of theoretical concepts related to radiological medical device techniques. 6. Developing the skills of analyzing and interpreting radiographs and the data extracted from them. 7. Enhancing innovation and development skills in the field of radiological medical device technologies
Teaching and learning methods
• Lectures • Video clips
Evaluation methods
1. Written exams every week. 2. Daily oral evaluation. 3. Semester exams.
D - General and qualifying transferable skills (other skills related to employability and personal development). 1. Communication skills: Enhancing the student's ability to communicate effectively with patients and colleagues in the health work environment. 2. Technical skills: Developing practical work skills on radiological medical

devices and using modern technologies in this field.

3. Research skills: Enhancing the student's ability to research and collect the necessary information to analyze cases and make sound decisions.

4. Analytical skills: Develop the ability to accurately analyze data and medical images and understand the results correctly.

5. Technical skills: Learn to use modern devices and techniques in the field of medical imaging and radiology diagnosis.

6. Administrative skills: Developing time management, organization, and leadership skills to achieve efficiency in a healthy work environment.

11. Course structure					
Evaluation method	Teaching method	Name of the unit/topic	Required learning outcomes	hours	the week
Apply and test	Interactive	History of Hardware	Understands the material	3	1.
Test and apply	Interactive	Permanent magnets	Understands the material	3	2.
and apply Test	Interactive	Superconducting magnets	Understands the material	3	3.
and apply Test	Interactive	Volume RF Coils	Understands the material	3	4.
and apply Test	Interactive	Surface coils	Understands the material	3	5.
and apply Test	Interactive	Phased Array Coils	Understands the material	3	6.
and apply Test	Interactive	Acquisition	Understands the material	3	7.
and apply Test	Interactive	Gradient Coils	Understands the material	3	8.
and apply Test	Interactive	Slice / phase Encoding	Understands the material	3	9.
and apply Test	Interactive	Frequency Encoding	Understands the material	3	10.
and apply Test	Interactive	Pixel, Voxel, Matrix	Understands the material	3	11.
and apply Test	Interactive	Receiver bandwidth	Understands the material	3	12.

and apply Test	Interactive	Size of the (image) matrix	Understands the material	3	13.
and apply Test	Interactive	Matrices types	Understands the material	3	14.
and apply Test	Interactive	Number of acquisitions	Understands the material	3	15.
and apply Test	Interactive	Field of View	Understands the material	3	16.
and apply Test	Interactive	History of CT scan	Understands the material	3	17.
and apply Test	Interactive	Generations of CT Scanner i	Understands the material	3	18.
and apply Test	Interactive	Generations of CT Scanner ii	Understands the material	3	19.
and apply Test	Interactive	Principles of helical CT	Understands the material	3	20.
and apply Test	Interactive	Data acquisition	Understands the material	3	21.
and apply Test	Interactive	Basic CT components i	Understands the material	3	22.
and apply Test	Interactive	Basic CT components ii	Understands the material	3	23.
and apply Test	Interactive	Data Acquisition System	Understands the material	3	24.
and apply Test	Interactive	X-ray tubes and collimators	Understands the material	3	25.
and apply Test	Interactive	Radiation detectors	Understands the material	3	26.
		Axial computed tomography	Understands the		27.

and apply Test	Interactive		material	3	
and apply Test	Interactive	Multislice CT i	Understands the material	3	28.
and apply Test	Interactive	Multislice CT ii	Understands the material	3	29.
and apply Test	Interactive	CT fluoroscopy	Understands the material	3	30.

12. Infrastructure

1- Required prescribed books	Training bag
2- Main references (sources)	1- MRI- Essentials for Innovative Technologies 2- CT scan Hardware, overview
A-Recommended books and references (scientific journals, reports,...)	1- Radiopaedia. Org. 2- Radioinfo. 3-Rad. Assistant
B - Electronic references, Internet sites...	The official website of the spss program Office official website

13. Course development plan

The curriculum development plan is based on the following:

1. Giving the prescribed scientific material and observing and analyzing the students' results
2. Study feedback from students' comments about vocabulary
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4. Comparing current vocabulary with the vocabulary of corresponding colleges in the field