Course Description for Ultrasound equipment techniques

1. Course Name:
Ultrasound equipment techniques
2. Course Code:
MTRA3101
3. Semester / Year:
Annual System
4. Description Preparation Date:
27/9/2025
5. Available Attendance Forms:
Daily attendance
6. Number of Credit Hours (Total) / Number of Units (Total)
90hrs./ units4
7. Course administrator's name (mention all, if more than one name)
Name: dr. imad Sadeq taiyh Email: imad.sadeq@alayen.edu.iq
8. Course Objectives

Course Objectives	• Familiar with the concepts of ultrasound. • Understand the ultrasound equipment techniques. • Understand the transducers features. • Explain components of transducer. • Explain functions of components of transducer. • Discuss the beam-stepping arrays.
9. Teaching and Learning Strategies	
Strategy	• Asking questions and guiding students to discover the answers themselves. • Using animations and videos to explain scientific concepts. • Using discussions and interactive activities to increase engagement and understanding. • Assessing students' progress through continuous evaluations like short questions. • Allowing students to train in a real-world environment to acquire practical skills.

10. Course Structure

Week	Hours	Required Learning	Unit or subject name	Learning	Evaluation method

		Outcomes		method	
1	6	Studying the common features of all transducers, their key elements, and their practical applications.	Common features of all transducers and transducer elements.	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
2	6	Explaining the functions and the materials used for backing layer and matching layer.	• Backing layer. • Matching layer.	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
3	6	Studying the lens in transducers, its composition, and its function and discussing the developments in transducer technology.	• Lens. • Developments in transducer technology.	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
4	6	Explaining the linear- and curvilinear-array transducers and studying the active group of elements.	Linear- and curvilinear-array transducers (beam -stepping arrays).	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
5	6	Understanding the beam shape control in the scan plane and studying scan plane focusing in transmission	Beam shape control in the scan plane.	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).

		and scan plane dynamic focusing and aperture in reception.			
6	6	Explaining the grating lobes and discussing the effect of slice thickness.	• Grating lobes. • Slice thickness.	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
7	6	Studying the phased-array transducers and explaining the concept of beam-steering arrays.	Phased-array transducers (beam-steering arrays).	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
8	6	Discussing the image quality variation across the field of view and illustrating the dependence of beam width and sensitivity on angle.	Image quality variation across the field of view.	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
9	6	Explaining the hybrid beam-steeping/beam-steering transducers.	Hybrid beam-steeping/beam-steering transducers.	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
10	6	Studying the 3D/4D Transducers and knowing the difference between them.	3D/4D transducers.	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
11	6	Explaining the	Time-saving	Delivering	Conducting

		methods and techniques of time-saving for array transducers.	techniques for array transducers.	lectures using information technology (computer).	practical and theoretical exams (midterm + final semester exam).
12	6	Discussing the B-mode instrumentation signal amplitude processing and explaining the amplification.	B-mode instrumentation signal amplitude processing.	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
13	6	Illustrating the transmit power control and studying the time-gain compensation.	Transmit power control.	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
14	6	Studying the dynamic range of echoes, analogue-to-digital conversion, and explaining the harmonic imaging.	• Dynamic range of echoes. • Analogue-to-digital conversion. • Harmonic imaging.	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
15	6	Studying the concepts of colour flow and tissue imaging .	Colour flow and tissue imaging.	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
11. Course Evaluation					
The students will be assessed through a midterm exam (40 marks) + a final exam (60 marks), with a total of 100 marks.					
12. Learning and Teaching Resources					

Required textbooks (curricular books, if any)	1. Diagnostic Radiology Physics, D.R. Dance et al. IAEA 2014. 2. The Essential Physics of Medical Imaging, Jerrold T. Bushberg et al. Lippincott Williams & Wilkins (2012).
Main references (sources)	1. M. Radhi Al-Qurayshi and H. Qasim. Al-Mosawi "***Radiation Physics and its applications in diagnostic radiological techniques***", Middle Technical University (MTU), Iraq, (2015). 2. Hoskins PR, Martin K, Thrush A, editors. ***Diagnostic ultrasound: physics and equipment***. CRC Press; 2019 Apr 29.
Recommended books and references (scientific journals, reports…)	1. Journal of Medical Physics. 2. Journal of Physica Medica.
Electronic References, Websites	https://www.pub.iaea.org/MTCD/Publications/PDF/Pub1564webNew-74666420.pdf

Course Description for Radiographic techniques for head and spinal cord

1. Course Name:
Radiographic techniques for head and spinal cord
2. Course Code:
MTRA3102
3. Semester / Year:
Annual System
4. Description Preparation Date:
22**9**\2025
5. Available Attendance Forms:
Daily attendance
6. Number of Credit Hours (Total) / Number of Units (Total)
90hrs./ units4
7. Course administrator's name (mention all, if more than one name)
Name: Assist. Prof. Ali Riyad Saleim Email: Alisalm246@gmail.com
8. Course Objectives

Course Objectives	1. **Knowing how to take x-rays of each part of the body.** 2. **Knowing the appropriate positions to show different body parts** **3. Knowing how to use and control X-ray machines to obtain accurate clarity and thus accurate diagnosis.**
9. Teaching and Learning Strategies	
Strategy	-The course content is defined according to the prescribed curriculum, with a comprehensive handout for each lecture that includes the key topics and necessary illustrations to support understanding. -The material is presented using well-designed PowerPoint presentations, ensuring an interactive teaching style that engages students through questions and group discussions. -After each lecture, students are provided with a recorded video that includes a full explanation of the material, allowing them to review the content at any time. To ensure comprehension, understanding is assessed through short daily quizzes or weekly assignments that require students to apply the concepts covered. **Additional Notes:** • Interaction can be enhanced using modern educational tools such as interactive online

	quizzes. • Encouraging active participation by awarding extra points for contributions during the lecture. • Allocating a short time in each lecture to address students' questions to ensure clarity on all points.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1st	6	Understanding the history of CT scanners	**Lines & planes of projection of the skull Skull ,AP, lateral , towns view and base of skull**	Lecture + Practical	Quizzes and Oral Exams
2nd	6	Basic principles of CT scanners	**Skull AP , Lateral ,Townes and basal view**	Lecture + Practical	Quizzes and Oral Exams
3rd	6	Understanding helical movement	**Sella turcica & Optic foramina and jugular foramina**	Lecture + Practical	Quizzes and Oral Exams
4th	6	Understanding interpolation algorithms	**Petrous &temporal bones**	Lecture + Practical	Quizzes and Oral Exams
5th	6	Multislice CT scanners	**Mastoid positions**	Lecture + Practical	Quizzes and Oral Exams
6th	6	CT system design	**Face & sinuses , and nose PA and lateral projection , shown structure**	Lecture + Practical	Quizzes and Oral Exams
7th	6	Collimation	**Mandible PA and oblique projection, shown structure, main finding**	Lecture + Practical	Quizzes and Oral Exams
8th	6	Control Console	**TMJ view, maxillary bone**	Lecture + Practical	Quizzes and Oral Exams
9th	6	Reconstruction methods	**Paranasal sinuses, waters view & lateral view, shown structure main finding**	Lecture + Practical	Quizzes and Oral Exams
10th	6	Iterative reconstruction	**Vertebral level & Cervical spine ,AP , lateral , AP for C1-C3 ,**	Lecture + Practical	Quizzes and Oral Exams
11th	6	CT image quality	**Cervical spine for C3- C7, shown**	Lecture + Practical	Quizzes and Oral Exams

			structure		
12th	6	Image noise	**Cervico-thoracic region position**	Lecture + Practical	Quizzes and Oral Exams
13th	6	Image artifacts	**Thoracic spine , AP , Lateral, lateral decubitus , shown structure**	Lecture + Practical	Quizzes and Oral Exams
14th	6	Positron Emission Tomography	**Lumber spine , AP , Lateral ,oblique projection, shown structure**	Lecture + Practical	Quizzes and Oral Exams
15th	6	Advanced technical CT applications	**Lumbo-sacral junction& Sacrum and Coccyx projections**	Lecture + Practical	Quizzes and Oral Exams

11. Course Evaluation

Distributing the score out of 100 according to the tasks assigned to the student such as daily preparation, daily oral, monthly, or written exams, reports .... etc

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	**1.** Whitley, A. S., Jefferson, G., Holmes, K., Sloane, C., Anderson, C., & Hoadley, G. (2015). Clark's Positioning in Radiography 13E. crc Press. **2.** Lampignano, J., & Kendrick, L. E. (2021). Bontrager's Handbook of Radiographic Positioning and Techniques: 10e, South Asia Edition-E-Book. Elsevier Health Sciences.
Main references (sources)	Rollins, J. H., Long, B. W., & Curtis, T. (2022). Merrill's Atlas of Radiographic Positioning and Procedures-3-Volume Set-E-Book. Elsevier Health Sciences.
Recommended books and references (scientific journals, reports…)	**1.** Research Gate
Electronic References, Websites	1. **Radiopaedia**: A free educational website that contains articles and clinical images in the field of medical imaging. Link: www.radiopaedia.org 2. **American College of Radiology (ACR)**: Contains guidelines and references related to medical imaging and clinical practices. Link: www.acr.org 3. **RSNA (Radiological Society of North America)**: Provides educational resources, research, and recent articles on medical imaging. Link: www.rsna.org 4. **National Institutes of Health (NIH) - Imaging**: A scientific platform

	containing research and reports on the applications of medical imaging. Link: www.nih.gov 5. **Physics Open Resources by IAEA**: Educational resources on medical physics and imaging technologies provided by the International Atomic Energy Agency. Link: www.iaea.org 6. **PubMed**: A scientific database that contains research papers and articles in the field of medical imaging. Link: pubmed.ncbi.nlm.nih.gov 7. **Computed Tomography (CT) Basics**: A platform that focuses on explaining the principles of computed tomography in a simplified manner. Link: www.ctisus.com 8. **European Society of Radiology (ESR)**: Offers articles and training courses related to advancements in medical imaging. Link: www.myesr.org

Course description for Radiological anatomy of brain and spinal column

1. Course Name:
Radiological anatomy of brain and spinal column
2. Course Code:
MTRA3104
3. Semester / Year:
Annual System
4. Description Preparation Date:
2026–2025
5. Available Attendance Forms:
Daily attendance
6. Number of Credit Hours (Total) / Number of Units (Total)
90hrs./ units4
7. Course administrator's name (mention all, if more than one name)
Name: Dr. raad ajeel Email: raadajeel@yahoo.com
8. Course Objectives

Course Objectives	• Understanding normal and pathological anatomy as visualized through X-rays, computed tomography (CT), magnetic resonance imaging (MRI), and ultrasound. • Enhancing diagnostic skills by training students to accurately interpret radiological images for clinical diagnosis and treatment planning. • Integrating imaging with clinical practice by combining anatomical knowledge with imaging findings to address clinical scenarios. • Mastering advanced imaging techniques by exploring the use of 3D imaging, cross-sectional anatomy, and advanced visualization methods in anatomical interpretation.
9. Teaching and Learning Strategies	
Strategy	1. **Interactive Lectures with Imaging Integration** • Utilizing radiographic imaging (X-rays, CT scans, and MRI) during lectures to explain anatomical structures and their clinical significance. • Incorporating case-based discussions to highlight the application of anatomy in diagnosis. 2. **Problem-Based Learning (PBL)** • Presenting clinical cases where students analyze radiographic images to identify anatomical structures and diseases. • Encouraging group discussions to enhance critical thinking and collaborative problem-solving.

	3. **Hands-on Imaging Workshops** • Conducting practical sessions where students operate imaging equipment (such as ultrasound) to visualize anatomical structures.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	4	-Understanding the functional and anatomical relationship between the central nervous system and the spine. -The role of radiographic imaging and diagnostic techniques, such as myelography, in evaluating these structures.	Normal anatomy of brain:	Discussion ,interactivity .	Oral and written exam
2	4	Understanding the functional and anatomical relationship between the central nervous system and the spine. -The role of radiographic imaging and diagnostic techniques, such as myelography, in evaluating these structures.	Cerebrum, cerebral cortex and lobes of brain.	Oral and written exam	Oral and written exam
3	4	Understanding the functional and anatomical relationship between the central nervous system and the spine. -The role of radiographic imaging and diagnostic techniques, such as myelography, in evaluating these structures.	Radiological features of the cerebrum..	Oral and written exam	Oral and written exam
4	4	Understanding the functional and anatomical relationship between the central nervous system and the spine. -The role of radiographic imaging and diagnostic techniques, such as myelography, in evaluating these structures.	Normal anatomy of corpus callosum,	Oral and written exam	Oral and written exam
5	4	Understanding the	- Radiological	Oral and	Oral and

		functional and anatomical relationship between the central nervous system and the spine.	features of corpus callosum..	written exam	written exam
6	4	-The role of radiographic imaging and diagnostic techniques, such as myelography, in evaluating these structures.	Normal anatomy of basal ganglia,	Oral and written exam	Oral and written exam
7	4	Understanding the functional and anatomical relationship between the central nervous system and the spine.	- Radiological features of the basal ganglia radiological features of the heart.	Oral and written exam	Oral and written exam
8	4	-The role of radiographic imaging and diagnostic techniques, such as myelography, in evaluating these structures.	Normal anatomy of thalamus, hypothalamus, pituitary and pineal glands,	Oral and written exam	Oral and written exam
9	4	Understanding the functional and anatomical relationship between the central nervous system and the spine.	- Radiological features of the thalamus, hypothalamus, pituitary and pineal gland.	Oral and written exam	Oral and written exam
10	4	-The role of radiographic imaging and diagnostic techniques, such as myelography, in evaluating these structures.	Normal anatomy of brainstem,	Oral and written exam	Oral and written exam
11	4	Understanding the functional and anatomical relationship between the central nervous system and the spine.	- Radiological features of the brainstem..	Oral and written exam	Oral and written exam
12	4	-The role of radiographic imaging and diagnostic techniques, such as myelography, in evaluating these structures.	Normal anatomy of cerebellum,	Oral and written exam	Oral and written exam
13	4	Understanding the functional and anatomical relationship between the central nervous system and the spine.	- Radiological features of the cerebellumh.	Oral and written exam	Oral and written exam
14	4	-The role of radiographic imaging and diagnostic	Normal anatomy of ventricles, cisterns,	Oral and written	Oral and written

		techniques, such as myelography, in evaluating these structures.	CSF production and flow ventricles,	exam	exam
15	4	Understanding the functional and anatomical relationship between the central nervous system and the spine.	- Radiological features of the ventricular system.	Oral and written exam	Oral and written exam

11. Course Evaluation

Distributing the score out of 100 according to the tasks assigned to the student such as daily preparation, daily oral, monthly, or written exams, reports .... etc

12. Learning and Teaching Resources

Required textbooks (curricu books, if any)	• **Gray's Anatomy for Students** – Richard L. Drake, A. Wayne Vogl, Adam W. M. Mitchell. • **Clinically Oriented Anatomy** – Keith L. Moore, Anne M. R. Agur. • **Neuroanatomy: An Illustrated Colour Text** – A. R. Crossman, David Neary. • **Essential Radiology: Clinical Presentation, Pathophysiology, Imaging** – Richard B. Gunderman. • **Textbook of Radiology and Imaging** – David Sutton.
Main references (sources)	• **Atlas of Human Anatomy** – Frank H. Netter. • **Neuroanatomy through Clinical Cases** – Hal Blumenfeld. • **Radiographic Anatomy, Positioning, and Procedures** – Kenneth L. Bontrager. • **Brain Imaging: Case Review Series** – David M. Yousem, Norman J. Beauchamp. • **Fundamentals of Diagnostic Radiology** – William E. Brant, Clyde A. Helms.
Recommended books and references (scientific journals, reports…)	• **Imaging Anatomy of the Human Brain: A Comprehensive Atlas Including Adjacent Structures** – Neil M. Borden. • **Neuroradiology: The Requisites** – David M. Yousem, Robert I. Grossman. • **The Radiology Handbook: A Pocket Guide to Medical Imaging** – Jeffrey S. Klein, Brian C. Stambrook. • **Pocket Atlas of Radiographic Anatomy** – Torsten Moeller, Emil Reif
Electronic Referenc Websites	• **Adiopaedia** (www.radiopaedia.org) – موسوعة متخصصة في علم الأشعة تحتوي على صور وتقارير علمية. • **National Library of Medicine (NLM)** (www.nlm.nih.gov) – قاعدة بيانات تحتوي على مراجع بحثية وكتب إلكترونية متعلقة بالتشريح والأشعة. • **PubMed** (www.pubmed.ncbi.nlm.nih.gov) – محرك بحث للأبحاث العلمية • **Visible Body** (www.visiblebody.com)

Course Description for Special Radiographic Procedures of the head, breast and respiratory System

1. Course Name:
Special Radiographic Procedures of the head, breast and respiratory System
2. Course Code:
MTRA3103
3. Semester / Year:
Annual System
4. Description Preparation Date:
2026–2025
5. Available Attendance Forms:
Daily attendance
6. Number of Credit Hours (Total) / Number of Units (Total)
90hrs./ units4
7. Course administrator's name (mention all, if more than one name)
Name: Hayder Suhail Najm Email: hayder.suhail@alayen.edu.iq
8. Course Objectives

Course Objectives	1. Introduce students to the principles and methods of medical imaging for different body systems. 2. Enable students to analyze and interpret medical images for clinical diagnosis. 3. Train students on modern imaging techniques such as PET-CT and MRI. 4. Enhance practical assessment and clinical diagnostic skills using medical imaging. 5. Develop research skills in the field of imaging technology.

9. Teaching and Learning Strategies

Strategy	**Interactive Lectures** **Group Discussions and Case Studies** **Practical Training in Laboratories** **Use of Technology and Virtual Simulations** **Presentations and Research Projects**

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	6	Understand different brain imaging methods and their clinical applications	Method of imaging the brain	Interactive Lectures, Case Studies, Video Demonstrations	Theoretical Exam, Practical Evaluation
2	6	Understand the differences between CT and MRI and their applications	CT & MRI of the brain	Discussion Sessions, Clinical Simulations	Analytical Report, Practical Exam
3	6	Understand spinal cord imaging techniques	Cerebral &lumber myelography	Practical Training, Lectures	Clinical Evaluation, Theoretical Exam
4	6	Recognize radiographic imaging techniques for the spine	Methods of imaging the spine	Interactive Sessions, Video Lectures	Practical Evaluation, Short Exam
5	6	Identify differences between cervical and lumbar imaging	Cervical & lumbar myelography	Clinical Simulations, Discussions	Practical Evaluation, Short Exam
6	6	Understand the role of medical imaging in diagnosing salivary gland diseases	Methods of imaging of the salivary glands	Clinical Case Studies, Educational Videos	Written Exam, Medical Image Analysis
7	6	Compare the use of CT and MRI in thyroid disease diagnosis	Methods of imaging the thyroid &parathyroid glands with CT & MRI of the thyroid and parathriod glands	Interactive Learning, Discussion Sessions	Oral Exam, Clinical Evaluation
8	6	Evaluate different imaging techniques for internal organs	Sonogram, retrograde colostomy enema, ileogram, logogram, herniogram& Evacuating proctogram	Lectures, Practical Training	Written Exam, Practical Evaluation
9	6	Differentiate between X-ray, ultrasound, and MRI in breast imaging	Methods of imaging of the breast & mammary glands • Mammography • Ultrasound • Magnetic Resonance Imaging • Radionuclide Imaging	Case Study, Clinical Training, Video Lectures	Practical Evaluation, Research Report, Theoretical Exam
10	6	Learn about image-guided biopsy techniques	Image-Guided Breast Biopsy Preoperative Localization	Clinical Training, Lectures	Practical Evaluation, Theoretical Exam
11	6	Understand medical	Methods imaging of	Simulation	Theoretical

		imaging applications in lung diseases	respiratory system	Sessions, Case Studies	Exam, Clinical Evaluation
12	6	Identify the role of CT scans in lung disease diagnosis	C.T of respiratory system	Presentations , Practical Training	Practical Exam, Image Analysis
13	6	Apply image-guided biopsy techniques for lung disease diagnosis	Guided lung biopsy CT scan	Case Studies, Clinical Training	Practical Exam, Clinical Evaluation
14	6	Understand the importance of imaging in diagnosing pulmonary embolism	Methods of imagings pulmonary embolism.	Clinical Simulations, Educational Videos	Written Exam, Image Analysis
15	6	Compare the use of PET-CT in lung disease assessment	Pulmonary arteriography and pet-CT scan for respiratory system	Clinical Study, Theoretical Lectures	Practical Evaluation, Final Exam

11. Course Evaluation

Midterm Exam: **40 Marks** + Final Exam: **60 Marks** / **Total:** 100 Marks

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	**Radiologic Science for Technologists: Physics, Biology, and Protection** – Stewart C. Bushong.
Main references (sources)	1. **Merrill's Atlas of Radiographic Positioning and Procedures** – Eugene Frank, Bruce W. Long **2. Computed Tomography for Technologists: A Comprehensive Text** – Lois E. Romans
Recommended books and references (scientific journals, reports…)	1. **Diagnostic Imaging: Brain** – Anne G. Osborn 2. **Fundamentals of Body CT** – W. Richard Webb 3. **Atlas of Ultrasound-Guided Procedures in Interventional Pain Management** – Samer N. Narouze
Electronic References, Websites	1. Radiopaedia: [Radiopaedia](https://radiopaedia.org). 2. Pub Med:[PubMed](https://pubmed.ncbi.nlm.nih.go 3. Radiology Society of North America (RSNA): The [RSNA](https://www.rsna.org) 4. CTisus - https://www.ctisus.com 5. European Society of Radiology (ESR) - https://www.myesr.org 6. Radiological Society of North America (RSNA) - https://www.rsna.org 7. edX - Biomedical Imaging and Applications - https://www.edx.org 8. University of New Mexico - Radiologic Sciences Program - https://radiology.unm.edu

Course Description for General Pathology

1. Course Name:
General Pathology
2. Course Code:
MTRA3105
3. Semester / Year:
Annual System
4. Description Preparation Date:
27-9-2025
5. Available Attendance Forms:
Daily attendance
6. Number of Credit Hours (Total) / Number of Units (Total)
60hrs./ units3
7. Course administrator's name (mention all, if more than one name)
Name: Assist. lect. Milad Ali Talib Email: milad.a.talib@gmail.com
8. Course Objectives

Course Objectives	• Understand the concepts of Apoptosis and necrosis. • Understand subcellular response to injury. • Understand the concepts of genetic diseases, Homodynamic disorders, Red Blood Cells Disorder, bone disease .
9. Teaching and Learning Strategies	
Strategy	• Asking questions and guiding students to discover the answers themselves. • Using animations and videos to explain scientific concepts. • Using discussions and interactive activities to increase engagement and understanding. • Assessing students' progress through continuous evaluations like short questions. • Allowing students to train in a real-world environment to acquire practical skills.

10. Course Structure

Week	Hours	Required	Unit or subject name	Learning	Evaluation

		Learning Outcomes		method	method
1	4	Necrosis and Cell death	Cellular injury (reversible and irreversible) Atrophy. Hypoxia. Cell Death (apoptosis) Necrosis pattern	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
2	4	Inflammation	cardinal Signs of inflammation Acute Inflammation. Chronic Inflammation Neutrophil and Macrophages role and arrival at site of inflammation	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
3	4	Wound Healing	Wound Healing and regeneration Repair Normal and aberrant wound healing	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
4	4	Carcinogenesis	Introduction to basic principles of Carcinogenesis Oncogenes Tumor suppressor genes Tumor progression (invasion and spread)	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
5	4	Neoplasia	Clinical features of Neoplasia Histological features of Neoplasia Serum tumor marker Grading and staging of cancer	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
6	4	Genetic diseases	Genetic Disorders Single gene disorders Glycogen storage Diseases Structural protein defects Receptor protein defects Lysosomal Storage Disease Multifactorial Inheritance Disorders	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
7	4	Homodynamic disorders	Hyperemia and Congestion	Delivering lectures using	Conducting practical and

			Edema Hemorrhages Homeostasis and thrombosis Prothrombotic properties of Injured or activated endothelium Homodynamic disorders	information technology (computer).	theoretical exams (midterm + final semester exam).
8	4	Homodynamic disorders	Disorders of primary Homeostasis Disorders of Secondary Homeostasis	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
9	4	Homodynamic disorders	Thrombosis basic principles Disruption in normal Blood Flow Endothelial cell Damage	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
10	4	Embolism	basic principle of Embolism Pulmonary Embolism. Systemic Embolism Infarction Shock	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
11	4	Red Blood Cells Disorder	Anemia Microcytic Anemia Iron Deficiency Anemia Anemia of chronic Disease	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
12	4	Red Blood Cells Disorder	Sideroblastic Anemia Thalassemia Macrocytic and no macrocytic Anemia Anemia due to underproduction (Aplastic Anemia)	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
13	4	Bone Diseases	Bone cells and bone types Malformation and diseases caused by defects in nuclear proteins and transcription Factors Diseases caused by defects in hormons and signal transduction mechanisms	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).

			Diseases associated with defects in extracellular structural protein Slides		
14	4	Cholecystitis	Diseases associated with defects in metabolic pathways Diseases associated with decrease bone mass Disease caused by osteoclast dysfunction Diseases associated with abnormal mineral homeostasis	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
15	4	Fractures	Fracture phases. Osteonecrosis Osteomyelitis Pott's Disease Saber Shins	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).

11. Course Evaluation

The students will be assessed through a midterm exam (40 marks) + a final exam (60 marks), with a total of 100 marks.

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	
Main references (sources)	1. Kumar Vinay, Abul K. Abbas, Jon C. Aster (2017). Robbins basic pathology. Tenth Edition. 2. Edward F. Goljan (2013). Rapid Review Pathology Fourth Edition. 3. Edward Klatt and Vinay Kumar (2009). Robbins and Cotran Review of Pathology. Fourth Edition.
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	

Course Description for Physics of Ultrasound

1. Course:	
Physics of Ultrasound	
2. Course Code:	
MTRA3106	
3. Semester/Year:	
Annual System	
4. Date of preparation of this description:	
26-**9**-2025	
5. Available attendance formats:	
Daily attendance	
6. Number of credit hours (total) / number of units (total):	
60hrs./ units2	
(Course administrator's name (if more than one name .7	
Name: dr. imad Sadeq taiyh **Email:** imad.sadeq@alayen.edu.iq	
8. Course Objectives	
• label and describe the basic physical properties of an ultrasonic pulse that affect • Its own shooting characteristics. • Describe the basic function of the transducer and how it forms an ultrasonic pulse. • Describe the general relationship between wavelength and image quality. • Describe the factors that determine the intensity of the reflected pulse. • Statement of the physical and medical definition of ultrasound. • Explain how a piezoelectric actuator works. • Determination of ultrasonic characteristics. • Brief description of piezoelectric materials • Explain the piezoelectric effect and the reverse electropotheric effect.	**Course Objectives**
9. Teaching and Learning Strategies	
1. Interactive lectures: - **Detailed description and explanation**: Use lectures to provide basic concepts and detailed explanation of each of the mentioned objectives. - **Questions and** discussions: Encourage students to ask questions and participate in discussions to increase their understanding.	Strategy

2. Demos and experiments:

- **Visual stimulation**: the use of interactive demonstrations to demonstrate how an ultrasound pulse is formed and the effect of wavelength on image quality.
- **Practical** experiments: Organizing laboratory experiments so that students can observe and measure the physical properties of ultrasound in practice.

3. Project-based education:

- **Research Project**: Assign students to conduct research on a specific topic, such as the effect of piezoelectric materials or ultrasound applications in medicine.
- **Presentations**: Encourage students to prepare and make presentations about their research and share it with their peers.

4. Use technology:

- **Computer simulation**: the use of software and computer simulations to illustrate concepts such as the intensity of the reflected pulse and the effect of wavelength.
- **Virtual Classrooms**: Organize online learning sessions to increase communication and provide educational resources.

5. Group Studies:

- **Group** discussions: Organize group discussion sessions to increase understanding of concepts and exchange ideas among students.
- **Problem solving:** Encourage students to solve real ultrasound problems collectively.

6. Performance Appraisal:

- **Quizzes**: Conduct quizzes to assess students' understanding of basic concepts.
- **Final Projects**: Evaluate students based on their final projects and presentations.
- **Laboratory reports**: Request laboratory reports to assess students' understanding of practical experiences.

7. Feedback:

- **Individual feedback**: Provide individual feedback to students based on their performance and guide them to improve weaknesses.
- **Group feedback**: Organize group feedback sessions to discuss group performance and provide tips for improvement.

10. Course Structure

Evaluation method	Learning method	Unit or subject name	Required Learning Outcomes	Hours	Week
Short Exams and Discussion	theoretical	Chapter 8	Introduction and Overview,Definition of Ultrasound	2	1
Short Exams and Discussion	theoretical	Chapter 8	Wave types, phase velocity, group velocity	2	2
Short Exams and Discussion	theoretical	Chapter 8	Diagnostic ultrasound detection ultrasound	2	3
Short Exams and Discussion	theoretical	Chapter 8	Ultrasonography Systems	2	4
Short Exams and Discussion	theoretical	Chapter 8	Amplification , Image Processing , Display	2	5
Short Exams and Discussion	theoretical	Chapter 8	Ultrasound generation methods	2	6

Short Exams and Discussion	theoretical	Chapter 8	Ultrasound properties	2	7
Short Exams and Discussion	theoretical	Chapter 8	Intensity and power temporal and spatial properties	2	8
Short Exams and Discussion	theoretical	Chapter 8	The interaction of ultrasound with tissues	2	9
Short Exams and Discussion	theoretical	Chapter 8	Acoustic impedance, spatial resolution	2	10
Short Exams and Discussion	theoretical	Chapter 8	Acoustic beam and converter formation	2	11
Short Exams and Discussion	theoretical	Chapter 8	Converter concentration and profit	2	12
Short Exams and Discussion	theoretical	Chapter 8	Ultrasonic patterns	2	13
Short Exams and Discussion	theoretical	Chapter 8	Doppler effect	2	14
Short Exams and Discussion	theoretical	Chapter 8	Continuous wave Doppler (benefits and (harms	2	15

11. Course Evaluation

The grade is distributed out of 100 according to the tasks assigned to the student such as daily preparation, daily, oral, monthly, written exams, reports ...etc
Daily exams : 10%
Semester exams: 70%
Reporting: 10%
Discussions in practice: 10%

12. Learning and Teaching Resources

M. Radhi Al-Qurayshi and H. Qasim. AL-Mosawi "Radiation Physics and its applications in diagnostic radiological techniques", Middle Technical University (MTU), Iraq, (2015).	Required textbooks (curricular books, if any)
Peter Hoskins, Kevin Martin, Abigail Thrush, Diagnostic Ultrasound: Physics and Equipment", Second Edition, Cambridge university press, New York, 2010.	Main references (sources)
Diagnostic Imaging and Laboratory Technology Essential Health Technologies Health Technology and Pharmaceuticals WORLD HEALTH ORGANIZATION Geneva	Recommended books and references (scientific journals, reports…)
	Electronic References, Websites

Course Description for Biological of Radiation hazards

1. Course Name:
Biological of Radiation hazards
2. Course Code:
MTRA3107
3. Semester / Year:
Annual System
4. Description Preparation Date:
2026–2025
5. Available Attendance Forms:
Daily attendance
6. Number of Credit Hours (Total) / Number of Units (Total)
75hrs./ units4
7. Course administrator's name (mention all, if more than one name)
Name: Reda Mohammed Ahmed Email: redaelsaman8@gmail.com
8. Course Objectives

Course Objectives	• Study of the Biological Effects of Ionizing Radiation • Study of the Physical and Biological Factors Affecting the Response of Organs and Tissues • Study of Radiation Risks and Comparison with Other Types of Risks • Explanation of the Deterministic and Stochastic Effects of Ionizing Radiation • Study of Malignant Tumors Resulting from Radiation Exposure • Explanation of the Effects of Radiation on the Fetus and the Central Nervous System
9. Teaching and Learning Strategies	
Strategy	• Encourage students to ask questions about the biological effects of ionizing radiation and research the answers themselves. • Design a scientific project that involves studying the effects of radiation on living tissues. • Use simulations or mathematical models to simulate the biological effects of radiation on tissues. • Show videos that explain the deterministic and stochastic effects of radiation, as well as the effects on the fetus and the central nervous system. • Promote teamwork among students to share knowledge and collaborate in understanding the biological effects of radiation.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	5	The student will be able to identify the factors influenced by the law, such as the rate of cell division, the degree of tissue differentiation, and its sensitivity to radiation.	Bergonie and Tribondeau Law	Delivering lectures using information technology (computers).	Conducting practical and theoretical exams (midterm + final semester exam).
2	5	The student will be able to define the main biological factors that affect cell sensitivity to radiation, such as the rate of cell division, cellular differentiation, and genetic mutations.	Biological Factors Affecting Cell Sensitivity to Radiation	Delivering lectures using information technology (computers).	Conducting practical and theoretical exams (midterm + final semester exam).
3	5	The student will be able to explain how to reduce risks by determining the appropriate radiation dose based on the type of tissue and its sensitivity.	The Relationship Between Radiation Dose and Organ Response	Delivering lectures using information technology (computers).	Conducting practical and theoretical exams (midterm + final semester exam).
4	5	The student will be able to explain the deterministic effects of ionizing radiation, such as tissue damage or cell death, that occur predictably after the body is exposed to a high radiation dose, and explain the relationship between dose size and the degree of effect on the exposed tissues.	Deterministic Effects of Ionizing Radiation	Delivering lectures using information technology (computers).	Conducting practical and theoretical exams (midterm + final semester exam).

5	5	The student will be able to explain the biological effects of ionizing radiation on cells and tissues, such as DNA damage, genetic mutations, and injuries that may lead to changes in tissue function or the development of diseases like cancer.	Biological Effects of Radiation	Delivering lectures using information technology (computers).	Conducting practical and theoretical exams (midterm + final semester exam).
6	5	The student will be able to explain the effects of ionizing radiation on genetic material, such as the occurrence of genetic mutations that can be passed on to future generations, and explain how these mutations affect the genetic health of organisms.	Genetic Effects of Radiation	Delivering lectures using information technology (computers).	Conducting practical and theoretical exams (midterm + final semester exam).
7	5	The student will be able to explain the stochastic effects of ionizing radiation, such as genetic mutations and cancer, that occur unpredictably even at low doses of radiation, with an explanation of the relationship between radiation dose and the increased probability of these effects occurring.	Stochastic Effects of Ionizing Radiation	Delivering lectures using information technology (computers).	Conducting practical and theoretical exams (midterm + final semester exam).
8	5	The student will be able to explain the effect of ionizing radiation on fertility, such as its impact on reproductive cells	Effects of Radiation on Fertility	Delivering lectures using information technology (computers).	Conducting practical and theoretical exams (midterm + final semester exam).

		(e.g., sperm and eggs), and the changes that may occur in reproductive capacity due to exposure to high radiation doses.			
9	5	The student will be able to estimate the biological risks resulting from exposure to ionizing radiation based on dose and duration of exposure, with an analysis of how these risks affect individuals and communities in different contexts, such as medical treatment or industrial environments.	Risk Assessment	Delivering lectures using information technology (computers).	Conducting practical and theoretical exams (midterm + final semester exam).
10	5	The student will be able to explain the relationship between exposure to ionizing radiation and the development of malignant tumors, such as cancer, and how radiation doses affect cells, leading to genetic mutations and an increased risk of developing tumors over the long term.	Malignant Tumors Resulting from Radiation	Delivering lectures using information technology (computers).	Conducting practical and theoretical exams (midterm + final semester exam).
11	5	The student will be able to identify the factors that influence the biological effects of radiation, such as tissue type, radiation dose, and duration of exposure, and	Factors That Determine the Biological Effects of Radiation	Delivering lectures using information technology (computers).	Conducting practical and theoretical exams (midterm + final semester exam).

		how these factors affect the response of cells and tissues to ionizing radiation.			
12	5	The student will be able to explain the effects of ionizing radiation on the fetus, such as the effects of radiation exposure during different stages of pregnancy (e.g., effects on tissue and organ growth or an increased risk of birth defects), and how radiation doses affect fetal development.	Effects of Radiation on the Fetus	Delivering lectures using information technology (computers).	Conducting practical and theoretical exams (midterm + final semester exam).
13	5	The student will be able to explain the effects of ionizing radiation on the central nervous system, such as effects on nerve cells and brain tissue, and how radiation exposure can lead to the deterioration of neurological functions or cause problems in mental and developmental growth.	Effects of Radiation on the Central Nervous System	Delivering lectures using information technology (computers).	Conducting practical and theoretical exams (midterm + final semester exam).
15+14	10	The student will be able to explain the genetic effects of ionizing radiation, such as the occurrence of genetic mutations that could affect future generations, and explain how these genetic mutations are	Genetic Effects of Ionizing Radiation	Delivering lectures using information technology (computers).	Conducting practical and theoretical exams (midterm + final semester exam).

		inherited and impact the genetic health of organisms.			

11. Course Evaluation

The student will be assessed through a midterm exam (40 marks) + a final exam (60 marks), with a total of 100 marks.

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	**Radiobiology for the Radiologist – Eric J. Hall, Amato J. Giaccia** **Introduction to Health Physics – Herman Cember, Thomas E. Johnson**
Main references (sources)	Radiation and Risk: A Study in Scientific Rhetoric – J. M. M. Horne Radiation Safety in Nuclear Medicine – Gopal B. Saha Radiation Dosimetry: Physical and Biological Aspects – Steve M. Seltze
Recommended books and references (scientific journals, reports…)	Radiation Research Journal Health Physics Journal
Electronic References, Websites	Environmental Protection Agency (EPA) - Radiation Protection (www.epa.gov/radiation) National Institute for Occupational Safety and Health (NIOSH)(www.cdc.gov/niosh/topics/radiation)

Course description of physics of magnetic resonance

1. **Course Name:**
physics of magnetic resonance
2. Course Code:
MTRA3206
3. **Semester / Year:**
Annual System
4. **Description Preparation Date:**
2026-2025
5. **Available Attendance Forms**
Daily attendance
6. **Number of Credit Hours (Total) / Number of Units (Total):**
60hrs./ units4
7. Course administrator's name (mention all, if more than one name)
Name: dr. imad Sadeq taiyh **Email:** imad.sadeq@alayen.edu.iq

8. Course Objectives

Course Objectives	**1. Familiar with the concepts of MRI** **2. Understand the basic magnetic resonance scanner** **3. Explain the principles of MRI** **4. Understand the MR imaging features** **5. Explain how different tissues have different T1 relaxation times and how this affects the overall image that is created.** **6. Define the meaning of TR (repetition time) and TE (echo delay time).** **7. Discuss the differences between T1-weighted images, proton density-weighted images, and T2-weighted images.**

9. Teaching and Learning Strategies

Strategy	**Teaching Strategies:** **1. Interactive Lectures:** - **Conceptual Framework:** Use lectures to introduce MRI concepts, basic functions of magnetic resonance scanners, and fundamental principles. - **Visualization Techniques:** Use diagrams and animations to illustrate how MRI works and its imaging features. **2. Hands-On Lab Sessions:** - **Practical Experience:** Conduct laboratory sessions where students can interact with MRI machines and observe their operation. - **Image Analysis:** Provide real MRI images for students to analyze and understand the

differences between T1, T2, and proton density-weighted images.

3. Group Discussions and Case Studies:

- **Clinical Cases:** Discuss various clinical cases to highlight the importance of different T1 relaxation times and how they affect image quality.
- **Problem-Solving:** Encourage group discussions to solve problems related to MRI physics and imaging features.

4. Project-Based Learning:

- Research Projects: Assign projects where students research the latest advancements in MRI technology and present their findings.
- Presentations: Have students present their research on TR and TE, and their impact on MRI images.

5. Use of Technology:

- **Simulation Software:** Utilize MRI simulation software to help students visualize the effects of different parameters on image quality.
- **Online Resources:** Provide access to online tutorials, videos, and articles about MRI principles and techniques.

6. Continuous Assessment:

- **Quizzes and Tests:** Conduct regular quizzes and tests to evaluate students' understanding of MRI concepts and principles.
- **Lab Reports:** Require detailed lab reports to assess students' practical knowledge and analytical skills.

Learning Strategies:

1. Active Participation:

- **Engagement in Discussions:** Encourage students to actively participate in class discussions and share their insights.
- **Interactive Q&A Sessions:** Hold Q&A sessions where students can ask questions and clarify their doubts.

2. Independent Study:

- **Self-Study Materials:** Provide reading materials and resources for students to study independently.
- **Homework Assignments:** Assign homework that reinforces the concepts taught in class.

3. Peer Learning:

- **Study Groups:** Form study groups where students can collaborate and learn from each other.
- **Peer Teaching:** Encourage students to explain concepts to their peers, enhancing their own understanding.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
First	2	Nuclear Magnetic Resonance ,Magnetic properties of the atomic nucleus	Chapter 9	Theoretical & practical	Short exams and discuss
Second	2	magnetic vectors - Tissue Concentration of Elements	Chapter 9	Theoretical & practical	Short exams and discuss
Third	2	Radio Frequency Energy: - RF pulses for excitation	Chapter 9	Theoretical & practical	Short exams and discuss
Forth	2	Nuclear Magnetic Interactions , Excitation - Relaxation	Chapter 9	Theoretical & practical	Short exams and discuss
Fifth	2	Resonance - Larmor Frequency	Chapter 9	Theoretical & practical	Short exams and discuss
Sixth	2	Tissue Magnetization - Magnetic Direction	Chapter 9	Theoretical & practical	Short exams and discuss
Seventh	2	Relaxation and tissue contrast - T1 relaxation	Chapter 9	Theoretical & practical	Short exams and discuss
Eighth	2	T2 (Spin-spin relaxation) ϖ Factors affects on T2	Chapter 9	Theoretical & practical	Short exams and discuss
Ninth	2	T2* relaxation - T1 and T2 values	Chapter 9	Theoretical & practical	Short exams and discuss
Tenth	2	Magnetic Susceptibility - Contrast Agents	Chapter 9	theoretical	Short exams and discuss
Eleventh	2	T1 Measurement, T2 Measurement	Chapter 9	theoretical	Short exams and discuss
Twelfth	2	The MRI image , Tissue Characteristics and Image Types	Chapter 9	theoretical	Short exams and discuss
Thirteenth	2	Fluid Movement and Image Types	Chapter 9	theoretical	Short exams and discuss
Fourteenth	2	NMR Spectroscopy	Chapter 9	theoretical	Short exams and discuss

Fifteenth	2	Essential concepts of imaging cycle - TR - TE - The Echo Event and Signals	Chapter 9	theoretical	Short exams and discuss

11. Course Evaluation

Distributing the score out of 100 according to the tasks assigned to the student such as daily preparation, daily oral, monthly, or written exams, reports .... etc

Daily exams: 10%
Semester exams: 70%
Preparing reports: 10%
Discussions in practical: 10%

12. Learning and Teaching Resources

Required textbooks (curricular books, if any	M. Radhi Al-Qurayshi and H. Qasim. AL-Mosawi "Radiation Physics and its applications in diagnostic radiological techniques", Middle Technical University (MTU), Iraq, (2015).
Main references (sources)	M. Radhi Al-Qurayshi and H. Qasim. AL-Mosawi "Radiation Physics and its applications in diagnostic radiological techniques", Middle Technical University (MTU), Iraq, (2015).
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	

Course Description for Radiographic techniques for thorax and abdomen

1. Course Name:
Radiographic techniques for thorax and abdomen
2. Course Code:
MTRA3202
3. Semester / Year:
Annual System
4. Description Preparation Date:
22\9\2025
5. Available Attendance Forms:
Daily attendance
1. Number of Credit Hours (Total) / Number of Units (Total)
90hrs./ units4
6. Course administrator's name (mention all, if more than one name)
Name: Assist. Prof. Ali Riyad Saleim Email: Alisalm246@gmail.com
7. Course Objectives

Course Objectives	1. Knowing how to take x-rays of each part of the body. 2. Knowing the appropriate positions to show different body parts. 3. Knowing how to use and control X-ray machines to obtain accurate clarity and thus accurate diagnosis.
8. Teaching and Learning Strategies	
Strategy	• The course content is defined according to the prescribed curriculum, with a comprehensive handout for each lecture that includes the key topics and necessary illustrations to support understanding. • The material is presented using well-designed PowerPoint presentations, ensuring an interactive teaching style that engages students through questions and group discussions. • After each lecture, students are provided with a recorded video that includes a full explanation of the material, allowing them to review the content at any time. To ensure comprehension, understanding is assessed through short daily quizzes or weekly assignments that require students to apply the concepts covered. **Additional Notes:** • Interaction can be enhanced using modern educational tools such as interactive online quizzes. • Encouraging active participation by awarding extra points for contributions during the lecture. • Allocating a short time in each lecture to address students' questions to ensure clarity on all points.

9. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1st	6	Understanding Position of patient and image receptor	**Thorax: pharynx and larynx**	Lecture + Practical	Quizzes and Oral Exams
2nd	6	Understanding Position of patient and image receptor	**Trachea (including thoracic inlet)**	Lecture + Practical	Quizzes and Oral Exams
3rd	6	Understanding Position of patient and image receptor + Direction and location of the X-ray beam	**Lungs , AP ,lateral , apical view , shown structure, interpretation system**	Lecture + Practical	Quizzes and Oral Exams
4th	6	Understanding Position of patient and image receptor	**lordotic position**	Lecture + Practical	Quizzes and Oral Exams
5th	6	Understanding Position of patient and image receptor	**Heart and aorta, main branches**	Lecture + Practical	Quizzes and Oral Exams
6th	6	Understanding Position of patient and image receptor	**Bones of the thorax (upper ribs)**	Lecture + Practical	Quizzes and Oral Exams
7th	6	Understanding Position of patient and image receptor	**Bones of the thorax (lower ribs)**	Lecture + Practical	Quizzes and Oral Exams
8th	6	Understanding Position of patient and image receptor	**Sternum**	Lecture + Practical	Quizzes and Oral Exams
9th	6	Understanding Position of patient and image receptor	**Abdomen Planes & regions and Image**	Lecture + Practical	Quizzes and Oral Exams
10th	6	Understanding Position of patient and image receptor + Direction and location of the X-ray beam	**Abdomen , AP supine, PA erect , lateral view positions**	Lecture + Practical	Quizzes and Oral Exams
11th	6	Understanding Position of patient and image receptor	**Urinary tract – kidneys– ureters– bladder positions**	Lecture + Practical	Quizzes and Oral Exams
12th	6	Understanding Position of patient and image receptor	**Urinary bladder**	Lecture + Practical	Quizzes and Oral Exams
13th	6	Understanding Position of patient and image receptor	**Mammography Positioning terminology**	Lecture + Practical	Quizzes and Oral Exams
14th	6	Understanding Position of patient and image receptor	**Radiological considerations of mammography**	Lecture + Practical	Quizzes and Oral Exams
15th	6	Understanding Position of patient and image receptor + Direction and	**Mammography main position, finding, image**	Lecture + Practical	Quizzes and Oral Exams

		location of the X-ray beam	**interpretation**		

10. Course Evaluation

Distributing the score out of 100 according to the tasks assigned to the student such as daily preparation, daily oral, monthly, or written exams, reports .... etc

11. Learning and Teaching Resources

Required textbooks (curricular books, if any)	**1.** Whitley, A. S., Jefferson, G., Holmes, K., Sloane, C., Anderson, C., & Hoadley, G. (2015). Clark's Positioning in Radiography 13E. crc Press. **2.** Lampignano, J., & Kendrick, L. E. (2021). Bontrager's Handbook of Radiographic Positioning and Techniques: 10e, South Asia Edition-E-Book. Elsevier Health Sciences.
Main references (sources)	Rollins, J. H., Long, B. W., & Curtis, T. (2022). Merrill's Atlas of Radiographic Positioning and Procedures-3-Volume Set-E-Book. Elsevier Health Sciences.
Recommended books and references (scientific journals, reports…)	**1.** Research Gate
Electronic References, Websites	1. **Radiopaedia**: A free educational website that contains articles and clinical images in the field of medical imaging. Link: www.radiopaedia.org 2. **American College of Radiology (ACR)**: Contains guidelines and references related to medical imaging and clinical practices. Link: www.acr.org 3. **RSNA (Radiological Society of North America)**: Provides educational resources, research, and recent articles on medical imaging. Link: www.rsna.org 4. **National Institutes of Health (NIH) - Imaging**: A scientific platform containing research and reports on the applications of medical imaging. Link: www.nih.gov 5. **Physics Open Resources by IAEA**: Educational resources on medical physics and imaging technologies provided by the International Atomic Energy Agency. Link: www.iaea.org 6. **PubMed**: A scientific database that contains research papers and articles in the field of medical imaging. Link: pubmed.ncbi.nlm.nih.gov 7. **Computed Tomography (CT) Basics**: A platform that focuses on explaining the principles of computed tomography in a simplified

	manner. Link: www.ctisus.com 8. **European Society of Radiology (ESR)**: Offers articles and training courses related to advancements in medical imaging. Link: www.myesr.org

Course Description for Special Radiographic Procedures of the Cardiovascular and Central Nervous Systems

1. Course Name:
Special Radiographic Procedures of the Cardiovascular and Central Nervous Systems
2. Course Code:
MTRA3203
3. Semester / Year:
Annual System
4. Description Preparation Date:
2026–2025
5. Available Attendance Forms:
Daily attendance
6. Number of Credit Hours (Total) / Number of Units (Total)
90hrs./ units4
7. Course administrator's name (mention all, if more than one name)
Name: Hayder Suhail Najm Email: hayder.suhail@alayen.edu.iq
8. Course Objectives

Course Objectives	• Understand the fundamental principles of medical imaging techniques such as CT, MRI, PET, and cardiac catheterization. • Analyze radiographic images to diagnose cardiovascular diseases such as atherosclerosis and thrombosis. • Master angiographic imaging procedures, including coronary artery imaging and diagnostic catheterization. • Recognize the applications of positron emission tomography (PET) in cardiac diseases. • Understand venous and arterial imaging techniques and the potential complications of interventional procedures. • Develop analytical and clinical interpretation skills for radiographic images in a medical setting.

9. Teaching and Learning Strategies	
Strategy	**Interactive Lectures** **Group Discussions and Case Studies** **Practical Training in Laboratories**

	Use of Technology and Virtual Simulations **Presentations and Research Projects**

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	6	Understand cardiovascular imaging methods	Methods of imaging of the heart and angiocardiography	Interactive Lectures, Educational Videos	Theoretical Exam, Image Analysis
2	6	Recognize coronary artery imaging techniques using CT	Coronary arteriography & cardiac CT including coronary angiography	Case Studies, Image Analysis	Practical Exam, Research Report
3	6	Understand basic principles of arterial imaging and catheterization procedures	Methods of imagines the arterial system &introduction to catheter techniques	Lectures, Discussion Sessions	Written Exam, Practical Evaluation
4	6	Identify catheterization puncture sites and techniques	Femoral, brachial &axillary punctures for catheterization	Practical Training, Clinical Simulation	Practical Exam, Clinical Evaluation
5	6	Recognize potential complications of catheterization procedures	General complications of catheter techniques.	Case Studies, Group Discussions	Medical Case Analysis, Written Exam
6	6	Evaluate vascular images using CT imaging	Ascending aortography and lower limb arteriography	Lectures, Image Analysis	Theoretical Exam, Applied Report
7	6	Understand balloon-assisted angiography techniques	Balloon angiography	Clinical Training, Live Case Observations	Clinical Evaluation, Medical Image Analysis
8	6	Recognize vascular occlusion techniques and treatment methods	Vascular emolization	Case Studies, Interactive Lectures	Clinical Analysis, Oral Exam
9	6	Understand the role of CT and MRI in vascular imaging	CT &MRI angiography	Educational Sessions, Videos	Written Exam, Image Analysis
10	6	Understand venous imaging techniques	Methods of imaging the venous system &peripheral venography.	Lectures, Practical Training	Practical Exam, Written Exam
11	6	Recognize central	Central venography	Interactive	Theoretical

		venous imaging techniques		Sessions, Clinical Simulation	Exam, Practical Evaluation
12	6	Analyze portal vein imaging techniques and their medical applications	Portal venography	Lectures, Clinical Image Analysis	Practical Evaluation, Analytical Report
13	6	Recognize the role of PET imaging in diagnostic medicine	Position emission tomography imaging	Lectures, Interactive Videos	Written Exam, Group Discussion
14	6	Understand the use of 18F-FDG in PET scanning	18f-FDG PET scanning	Educational Sessions, Clinical Study	Practical Exam, Clinical Data Analysis
15	6	Study lymph node imaging techniques using various imaging modalities	Lymph Node Imaging	Lectures, Analytical Workshops	Oral Exam, Medical Image Analysis

11. Course Evaluation

Midterm Exam: **40 Marks** + Final Exam: **60 Marks** / **Total:** 100 Marks

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	• Cardiovascular *Imaging: The Clinical Atlas* – Dmitriy Kireyev, Supriya G. Monteagudo • Atlas *of Cardiac CT* – Matthew J. Budoff • *Diagnostic Imaging: Interventional Radiology* – Brandt C. Wible
Main references (sources)	Watson, N. & Jones, H. *Chapman & Nakielny's Guide to Radiological Procedures*, 7th edition, Elsevier Health Sciences, 2017. *Interventional Radiology: A Survival Guide* – David Kessel, Iain Robertson *CT and MR Angiography: Comprehensive Vascular Assessment* – Geoffrey D. Rubin, Neil M. Rofsky
Recommended books and references (scientific journals, reports…)	• *Cardiac Imaging: A Multimodality Approach – Charles S. White* • *PET and PET-CT in Oncology – Stefan Dresel* • *Handbook of Nuclear Medicine and Molecular Imaging – N. Schaefferkoette*.
Electronic References, Websites	1. **Radiopaedia**: www.radiopaedia.org 2. **American College of Radiology (ACR)**: www.acr.org 3. **PubMed**: www.ncbi.nlm.nih.gov/pubmed 4. **European Society of Cardiology (ESC)**: www.escardio.org

Course Description for Equipment techniques of magnetic resonance imaging

1. Course Name:	
Equipment techniques of magnetic resonance imaging	
2. Course Code:	
MTRA3201	
3. Semester / Year:	
Annual System	
4. Description Preparation Date:	
27/9/2025	
5. Available Attendance Forms:	
Daily attendance	
6. Number of Credit Hours (Total) / Number of Units (Total)	
90hrs./ units4	
7. Course administrator's name (mention all, if more than one name)	
Name: dr. imad Sadeq taiyh Email: imad.sadeq@alayen.edu.iq	
8. Course Objectives	
Course Objectives	• Name the major components of a magnetic resonance imaging (MRI) system and the subassemblies of each. • List the three types of MRI systems and describe features of each. • Explain the concepts of the spatial characterization. • Identify the principal of controls on the MRI operating console. • Describe the MR image quality and artefact. • List & explain the important imaging methods & pulse sequences.
9. Teaching and Learning Strategies	
Strategy	• Asking questions and guiding students to discover the answers themselves. • Using animations and videos to explain scientific concepts. • Using discussions and interactive activities to increase engagement and understanding. • Assessing students' progress through continuous evaluations like short questions. • Allowing students to train in a real-world environment to acquire

	practical skills.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	6	Studying the main components of the MRI system and explaining the MR phenomenon.	Magnetic resonance imaging system components.	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
2	6	Explaining the three main types of magnets used in MRI.	Magnets: magnet types.	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
3	6	Studying what are gradient coils and knowing its types and functions.	Gradient coils: types & function.	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
4	6	Explaining the transmitter & receiver coils and studying the RF coils types.	Radio-frequency system.	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
5	6	Understanding the meaning of shimming and explaining the shimming methods and its advantages and disadvantages.	Shimming & magnetic field shielding: coils types.	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
6	6	• Studying the main	• MRI computer	Delivering lectures	Conducting practical and

		components of the MRI computer system and the functions of each component. • Explaining the electronic system of the MRI system and its functions.	system: types & functions. • MRI system electronics.	using information technology (computer).	theoretical exams (midterm + final semester exam).
7	6	• Explaining the frequency encoding and phase encoding. Studying the slice selection, slice location, and slice thickness.	• Data acquisition: spatial encoding. • Slice encoding.	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
8	6	Studying the K-space, decoding the signal, and fourier transformation (FT).	Image reconstruction.	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
9	6	Understanding the MR image resolution and studying how the MR image quality is affected by matrix size, field of view (FOV), and slice thickness.	MR image quality.	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
10	6	Studying the noise in MRI and identifying the noise sources and explaining	Noise.	Delivering lectures using information technology	Conducting practical and theoretical exams (midterm + final

		the signal-to-noise ratio (SNR) considerations: types & factors.		(computer).	semester exam).
11	6	Studying the artefacts in MRI and list the types of artefacts in MRI.	Artefacts.	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
12	6	• Explaining the spin echo pulse sequence and its types. • Studying the inversion recovery sequences and identifying its types.	Imaging methods: pulse sequences.	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
13	6	Studying the coherent gradient echo, incoherent gradient echo, and steady-state free precession.	Gradient echo sequences.	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
14	6	Explaining what are the echo planar imaging and the hybrid fast imaging techniques, how they work, their applications, and their disadvantages.	• Echo planar imaging (EPI). • Hybrid fast imaging technique (GRASE).	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
15	6	Studying the diffusion-	Diffusion-weighted	Delivering lectures	Conducting practical and

		weighted imaging technique, how it works, its applications, and its disadvantages.	imaging.	using information technology (computer).	theoretical exams (midterm + final semester exam).

11. Course Evaluation

The students will be assessed through a midterm exam (40 marks) + a final exam (60 marks), with a total of 100 marks.

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	1. Medical Imaging Physics, Fourth Edition. 2. The Essential Physics of Medical Imaging, Jerrold T. Bushberg et al. Lippincott Williams & Wilkins (2012).
Main references (sources)	1. Stewart Carlyle Bushong, Geoffrey Clarke, ***"Magnetic resonance imaging : Physical and Biological Principles"***, Mosby, Inc., an affiliate of Elsevier Inc., 4th edition, 2015. 2. Perry Sprawls, ***"Magnetic Resonance Imaging, Principles, Methods, and Techniques"***, Medical Physics Publishing , Madison, Wisconsin, 2000. 3. Perry Sprawls, ***"Physical principles of medical imaging"***, Medical Physics Publishing, Madison, Wisconsin 2nd edition, 1995.
Recommended books and references (scientific journals, reports...)	1. Journal of Physica Medica. 2. Journal of Medical Physics.
Electronic References, Websites	https://www.physicamedica.com

Course Description for Radiological anatomy of thorax and abdomen

1. Course Name:	
Radiological anatomy of thorax and abdomen	
2. Course Code:	
MTRA3204	
3. Semester / Year:	
Annual System	
4. Description Preparation Date:	
2026–2025	
5. Available Attendance Forms:	
Daily attendance	
6. Number of Credit Hours (Total) / Number of Units (Total)	
60hrs./ units3	
7. Course administrator's name (mention all, if more than one name)	
Name: Dr. raad ajeel Email: raadajeel@yahoo.com	
8. Course Objectives	
Course Objectives	• Understanding normal and pathological anatomy as visualized through X-rays, computed tomography (CT), magnetic resonance imaging (MRI), and ultrasound. • Enhancing diagnostic skills by training students to accurately interp radiological images for clinical diagnosis and treatment planni • Integrating imaging with clinical practice by combining anatomical knowlec with imaging findings to address clinical scenari • Mastering advanced imaging techniques by exploring the use of 3D imagi cross-sectional anatomy, and advanced visualization methods in anatomi interpretation.
9. Teaching and Learning Strategies	
Strategy	1. **Interactive Lectures with Imaging Integration** • Utilizing radiographic imaging (X-rays, CT scans, and MRI) during lectures to explain anatomical structures and their clinical significance. • Incorporating case-based discussions to highlight the application of anatomy in diagnosis. 2. **Problem-Based Learning (PBL)** • Presenting clinical cases where students analyze radiographic images to identify anatomical structures and diseases. • Encouraging group discussions to enhance critical thinking and collaborative problem-solving.

	3. **Hands-on Imaging Workshops** • Conducting practical sessions where students operate imaging equipment (such ultrasound) to visualize anatomical structures.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method
1	4	The student identifies the bony structures of the thoracic cage and sternum and interprets their radiological features.	Normal anatomy and radiological features of the thoracic cage and sternum	Oral and written exam	Oral and written exam
2	4	The student describes the normal anatomy of the trachea, lungs, bronchial tree, pulmonary vessels, and bronchial vessels and explains their radiological features.	Normal anatomy and radiological features of the trachea, lungs, bronchial tree, and pulmonary vessels	Oral and written exam	Oral and written exam
3	4	The student explains the normal anatomy of the heart and identifies its various radiological features.	Normal anatomy and radiological features of the heart	Oral and written exam	Oral and written exam
4	4	The student describes the normal anatomy of the breast and identifies its different radiological features.	Normal anatomy and radiological features of the breast	Oral and written exam	Oral and written exam
5	4	The student describes the normal anatomy of the esophagus, its anatomical relations, blood supply, and analyzes its radiological features.	Normal anatomy and radiological features of the esophagus	Oral and written exam	Oral and written exam
6	4	The student explains the normal anatomy of the stomach, its anatomical relations, blood supply, venous drainage, and interprets its radiological features.	Normal anatomy and radiological features of the stomach	Oral and written exam	Oral and written exam
7	4	The student interprets the normal anatomy of the small intestine, its anatomical relations, blood supply, venous and lymphatic drainage, and explains its radiological features.	Normal anatomy and radiological features of the small intestine	Oral and written exam	Oral and written exam
8	4	The student describes the normal anatomy of the large intestine, its anatomical relations, blood supply, venous and lymphatic drainage, and identifies its radiological features.	Normal anatomy and radiological features of the large intestine	Oral and written exam	Oral and written exam
9	4	The student identifies the normal anatomy of the liver and biliary system, its lobes, segments, and blood supply, and analyzes its radiological features.	Normal anatomy and radiological features of the liver and biliary system	Oral and written exam	Oral and written exam

10	4	The student describes the normal anatomy of the pancreas, its anatomical relations, blood supply, and identifies its different radiological features.	Normal anatomy and radiological features of the pancreas	Oral and written exam	Oral and written exam
11	4	The student explains the normal anatomy of the spleen, its anatomical relations, blood supply, and analyzes its radiological features.	Normal anatomy and radiological features of the spleen	Oral and written exam	Oral and written exam
12	4	The student describes the normal anatomy of the kidneys, their location, anatomical relations, internal structures, arterial supply, venous drainage, and identifies their radiological features.	Normal anatomy and radiological features of the kidneys	Oral and written exam	Oral and written exam
13	4	The student identifies the normal anatomy of the female pelvis (uterus, ovaries, fallopian tubes, vagina, bladder, urethra), its anatomical relations, blood supply, and analyzes its radiological features.	Normal anatomy and radiological features of the female pelvis	Oral and written exam	Oral and written exam
14	4	The student explains the normal anatomy of the male pelvis (prostate, testes, bladder, urethra), its anatomical relations, blood supply, and analyzes its radiological features.	Normal anatomy and radiological features of the male pelv	Oral and written exam	Oral and written exam
15	4	The student identifies the bony structures of the thoracic cage and sternum and interprets their radiological features.	Normal anatomy and radiological features of the thoracic cage and sternum	Oral and written exam	Oral and written exam

11. Course Evaluation

Distributing the score out of 100 according to the tasks assigned to the student such as daily preparation, daily oral, monthly, or written exams, reports .... etc

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	**"Gray's Anatomy for Students"** A comprehensive guide to human anatomy with detailed illustrations
Main references (sources)	• **"Clinically Oriented Anatomy" by Keith L. Moore** Focuses on the clinical applications of anatomy, essential for medical students. • **"Radiologic Anatomy for the FRCR" by Philip Borg** Covers anatomical structures as seen in medical imaging.
Recommended books and references (scientific journals, reports…)	• **"Atlas of Human Anatomy" by Frank H. Netter** One of the best visual guides to human anatomy. • **"Human Anatomy & Physiology" by Elaine N. Marieb** A useful reference for understanding physiological and anatomical

	concepts.
Electronic References, Websites	• **PubMed (www.ncbi.nlm.nih.gov/pubmed)** – A vast database of medical literature. • **Radiopaedia (www.radiopaedia.org)** – A valuable resource for radiological anatomy. • **OpenStax (openstax.org)** – Free medical textbooks including anatomy and physiology.

Course Description for Systemic Pathology

1. Course Name:
Systemic Pathology
2. Course Code:
MTRA3205
3. Semester / Year:
Annual System
4. Description Preparation Date:
27-9-2025
5. Available Attendance Forms:
Daily attendance
6. Number of Credit Hours (Total) / Number of Units (Total)
90hrs./ units4
7. Course administrator's name (mention all, if more than one name)
Name: Assist. lect. Milad Ali Talib Email: milad.a.talib@gmail.com
8. Course Objectives

Course Objectives	• Understand the etiology and risk factors, pathogenesis, morphology and clinical features of systemic diseases. • Understand the functional alterations and outcomes of systemic diseases.
9. Teaching and Learning Strategies	
Strategy	Asking questions and guiding students to discover the answers themselves. Using animations and videos to explain scientific concepts. Using discussions and interactive activities to increase engagement and understanding. Assessing students' progress through continuous evaluations like short questions. Allowing students to train in a real-world environment to acquire practical skills.

10. Course Structure

Week	Hours	Required Learning Outcomes	Unit or subject name	Learning method	Evaluation method

1	2	Bone and cartilage Tumors	Osteoma Osteoid Osteoma Osteoblastoma Osteochondroma Chondroma Chondroblastoma	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
2	2	Joint Diseases	• Degenerative Arthritis • Goat and Pseudogout Disease Infectious Arthritis	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
3	2	Liver Disease	• Hepatic Injury patterns • Cirrhosis • Liver Failure • Jaundice Types of Neonatal Jaundice	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
4	2	Liver Disease	• Cholestasis Viral Hepatitis and Non viral Hepatitis • Metabolic liver Disease Hepatic, Bile Duct and Gall • Bladder Disease • Stones • Pharygian Cap • Cholelithiasis	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
5	2	Kidney Disease	• Diseases of Tubules Diseases of Glomerulus • Disease of Blood Vessels • Obstruction	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final

					semester exam).
6	2	Heart Disease	Congenital Heart Disease • Ischemic Heart Disease • Hypertensive Heart Disease • Valvular Heart Disease Cardiomyopathy Heart Disease Pericardium Heart Disease	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
7	2	Gastrointestinal Diseases –	• Diseases of Esophagus – • Diseases of Stomach Diseases of small/ large Bowel – • Appendix	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
8	2	Pancreas Diseases	• Congenital • Inflammatory (Acute, Chronic, Cyst) • Neoplasms	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
9	2	Lung Diseases	• Congenital Atelectasis. Acute Pulmonary Injury • Obstructive Pulmonary Disease • Vascular Pulmonary Diseases	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
10	2	Lower urinary	• Lower urinary	Delivering	Conducting

		tract diseases	tract diseases. Ureters Anomalies. Bladder Anomalies Urethra Anomalies	lectures using information technology (computer).	practical and theoretical exams (midterm + final semester exam).
11	2	• Female Reproductive System Diseases	• Vulva Disease • Vagina Disease • Cervix Disease • Uterus Disease • Tubes Disease • Ovaries and placenta	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
12	2	Endocrine Diseases	pituitary Disorders Thyroid Disorders • Parathyroid Disorders	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
13	2	Diseases of Lymphatic System	• lymph nodes • lymphadenitis • Lymphomas • Follicular lymphoma	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
14	2	Brain and Central Nervous System Diseases	• Acute Neuronal Injury • Cerebral edema	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).
15	2	Breast diseases	• Gland atrophy • Acute Mastitis	Delivering lectures	Conducting practical and

			• Ductesia	using information technology (computer).	theoretical exams (midterm + final semester exam).

11. Course Evaluation

The students will be assessed through a midterm exam (40 marks) + a final exam (60 marks), with a total of 100 marks.

12. Learning and Teaching Resources

Required textbooks (curricular books any)	
Main references (sources)	1. Kumar Vinay, Abul K. Abbas, Jon C. Aster (2017). Robbins basic pathology. Tenth Edition. 2. Edward F. Goljan (2013). Rapid Review Pathology Fourth Edition. 3. Edward Klatt and Vinay Kumar (2009). Robbins and Cotran Review of Pathology. Fourth Edition.
Recommended books and references (scientific journals, reports…)	
Electronic References, Websites	