Course Description for Biological of Radiation hazards

1. Course Name:	
Biological of Radiation hazards	
2. Course Code:	
RT307–BRH	
3. Semester / Year:	
Annual System	
4. Description Preparation Date:	
2024–2025	
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	Deterministic Effects of Ionizing Radiation	Delivering lectures using information technology (computers).	Conducting practical and theoretical exams (midterm + final semester exam).

		high radiation dose, and explain the relationship between dose size and the degree of effect on the exposed tissues.			
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	Stochastic Effects of Ionizing Radiation	Delivering lectures using information technology (computers).	Conducting practical and theoretical exams (midterm + final semester exam).

		probability of these effects occurring.			
8	5	The student will be able to explain the effect of ionizing radiation on fertility, such as its impact on reproductive cells (e.g., sperm and eggs), and the changes that may occur in reproductive capacity due to exposure to high radiation doses.	Effects of Radiation on Fertility	Delivering lectures using information technology (computers).	Conducting practical and theoretical exams (midterm + final semester exam).
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	Malignant Tumors Resulting from Radiation	Delivering lectures using information technology (computers).	Conducting practical and theoretical exams (midterm + final semester exam).

		term.			
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 how these factors affect the response of cells and tissues to ionizing radiation.	Factors That Determine the Biological Effects of Radiation	Delivering lectures using information technology (computers).	Conducting practical and theoretical exams (midterm + final semester exam).
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).

+14 15	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 inherited and impact the genetic health of organisms.	Genetic Effects of Ionizing Radiation	Delivering lectures using information technology (computers).	Conducting practical and theoretical exams (midterm + final semester exam).

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 for Computer Applications 1

1. Course Name:
Computer Applications 1
2. Course Code:
RT308- CAP
3. Semester / Year:
Annual System
4. Description Preparation Date:
2025/1/1
5. Available Attendance Forms:
Daily attendance
6. Number of Credit Hours (Total) / Number of Units (Total):
45hrs./ units2
7. Course administrator's name (mention all, if more than one name)
Name: Wassam Talib Hatem **Email: wissam.talib@alayen.edu.iq**
8. Course Objectives

Course Objectives	• **Introducing the student to computer applications such as the Excel program and learning about its benefits, specifications, and methods of operating and closing it.** • **Learning how to open a saved file, enter data, perform mathematical operations, and how to adjust and format data.** • **Helping the student link the information acquired in the lecture and link it to the labor market to keep pace with scientific development.**
9. Teaching and Learning Strategies	
Strategy	• **Interactive Learning:** The student participates in acquiring, analyzing, and sharing information. • **Theoretical Lectures:** Direct interaction, discussions, and mini-research projects. • **Practical Lectures:** Hands-on application, assignments, experimenting with new examples, and linking theory to practice.

10. Course Structure					
Week	**Hours**	**Required Learning Outcomes**	**Unit or subject name**	**Learning method**	**Evaluation method**
1	3	Understanding the Origin and General Operation of Computers	Introduction to Computer Applications, Operating Systems, and Their Components	Theoretical lecture	Ask a question in the last 10 minutes of the lecture.
2	3	Getting to Know Excel and How to Open and Close It	Concept of Excel, Its Features, and Methods of Opening and Closing the Program	Theoretical lecture	Ask a question in the last 10 minutes of the lecture.
3	3	Explaining Methods for Opening and Saving Files	How to Open Work Sheets and Workbooks and Save Files	Theoretical lecture	Ask a question in the last 10 minutes of the lecture.
4	3	Learning How to Enter Data and Perform Mathematical Operations	Entering Data in Excel, Performing Calculations, and Formatting Data	Theoretical lecture	Exam in the last 10 minutes of the lecture
5	3	Clarifying Data Collection in Calculations and How to Sort Data	Collecting Data or Cell Groups and Sorting Data	Theoretical lecture	Ask a question in the last 10 minutes of the lecture.
6	3	Ability to Use Functions and Explain the Purpose of Each Function	Using Functions Such as MAX, MIN, SUM, and AVERAGE	Theoretical lecture	Exam in the last 10 minutes of the lecture
7	3	Performing Copy, Paste, and Move Operations on Data	Copying, Moving, and Pasting Entered Data	Theoretical lecture	Ask a question in the last 10 minutes of the lecture.
8	3	Explaining How to Edit Cells, Change Their Shape, Color, and Background	Controlling Cell Display, Changing Its Style, and Formatting Using Formatting Tools	Theoretical lecture	Exam in the last 10 minutes of the lecture
9	3	Understanding How to Work with Charts and Convert Data into Charts	Handling Charts and Converting Numerical and Text Data into Charts	Theoretical lecture	Ask a question in the last 10 minutes of the lecture.

10	**3**	**Ensuring That Students Understand How to Modify Files**	**Making Modifications and Edits Provided by the Program**	**Theoretical lecture**	**Exam in the last 10 minutes of the lecture**
11	**3**	**How to Add or Delete a Row**	**Adding or Deleting Rows or Columns in a Worksheet**	**Theoretical lecture**	**Ask a question in the last 10 minutes of the lecture.**
12	**3**	**Learning How to Print Data**	**Printing Numerical Data or Charts**	**Theoretical lecture**	**Exam in the last 10 minutes of the lecture**
13	**3**	**Introduction to SPSS Software**	**Concept of SPSS Software**	**Theoretical lecture**	**Ask a question in the last 10 minutes of the lecture.**
14	**3**	**Explaining the Main Screen Components of SPSS**	**Main Screen Components and Data Entry in SPSS**	**Theoretical lecture**	**Ask a question in the last 10 minutes of the lecture.**
15	**3**	**Performing Data Saving and Retrieval Methods**	**Saving, Retrieving, and Understanding Different Data Types in SPSS**	**Theoretical lecture**	**Ask a question in the last 10 minutes of the lecture.**

11. Course Evaluation

12. Learning and Teaching Resources

Required textbooks (curricular books, if any)	
Main references (sources)	**1) Faith Abbey(2022): MY EXCEL GUIDE, Beginners, Intermediate, Advanced, Microsoft Excel.** **2) Kevin Pitch(2023) :Excel Guide for Success , Independently published .** **3) Aldrich, James . o (2016):Using_IBM _ SPSS_Statistics Second Edition .**
Recommended books and references (scientific journals, reports...)	**Global Publishers** **Microsoft Excel Functions and Formulas with Excel 2019/Office 365**
Electronic References, Websites	**https://tech-mab.com/excel-basics/** **https://www.mobt3ath.com/dets.php?page=150**

Course Description for Equipment techniques of magnetic resonance imaging

1. Course Name:	
Equipment techniques of magnetic resonance imaging	
2. Course Code:	
RT301−MRI	
3. Semester / Year:	
Annual System	
4. Description Preparation Date:	
27/1/2025	
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. Emad Omar Abdel-Muttalib Mohammed Email: emaddomarr78@gmail.com	
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 components of the MRI computer system and the functions of each component. • Explaining the electronic system of the MRI system and its functions.	• MRI computer system: types & functions. • MRI system electronics.	Delivering lectures using information technology (computer).	Conducting practical and 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.	Delivering lectures using	Conducting practical and theoretical

		noise sources and explaining the signal-to-noise ratio (SNR) considerations: types & factors.		information technology (computer).	exams (midterm + final 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-weighted imaging technique, how it works, its applications, and its disadvantages.	Diffusion-weighted 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. 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 General Pathology

1. Course Name:	
General Pathology	
2. Course Code:	
RT305–PAG	
3. Semester / Year:	
Annual System	
4. Description Preparation Date:	
27-1-2025	
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: Ashwaq Fawzi Eassein Email: fawzieassein@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 Learning Outcomes**	**Unit or subject name**	**Learning method**	**Evaluation 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	Delivering lectures using information technology (computer).	Conducting practical and theoretical exams (midterm + final semester exam).

			Disease Multifactorial Inheritance Disorders		
7	4	Homodynamic disorders	Hyperemia and Congestion Edema Hemorrhages Homeostasis and thrombosis Prothrombotic properties of Injured or activated endothelium Homodynamic disorders	Delivering lectures using information technology (computer).	Conducting practical and 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	Delivering lectures using information technology	Conducting practical and theoretical exams

			nuclear proteins and transcription Factors Diseases caused by defects in hormons and signal transduction mechanisms Diseases associated with defects in extracellular structural protein Slides	(computer).	(midterm + final semester exam).
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 Radiographic techniques for head and spinal cord

1. Course Name:
Radiographic techniques for head and spinal cord
2. Course Code:
RT302–HSC
3. Semester / Year:
Annual System
4. Description Preparation Date:
22\1\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 structure**	Lecture + Practical	Quizzes and Oral Exams
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:	
RT304–BSA	
3. Semester / Year:	
Annual System	
4. Description Preparation Date:	
2024–2025	
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	Normal anatomy of corpus callosum,	Oral and written exam	Oral and written exam

		central nervous system and the spine. -The role of radiographic imaging and diagnostic techniques, such as myelography, in evaluating these structures.			
5	4	Understanding the functional and anatomical relationship between the central nervous system and the spine.	- Radiological features of corpus callosum..	Oral and written exam	Oral and 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	Normal anatomy of cerebellum,	Oral and written exam	Oral and written exam

		myelography, in evaluating these structures.			
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 techniques, such as myelography, in evaluating these structures.	Normal anatomy of ventricles, cisterns, CSF production and flow ventricles,	Oral and written exam	Oral and written 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

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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:
RT303-SBR
3. Semester / Year:
Annual System
4. Description Preparation Date:
2024-2025
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 ileogram, enema, 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 imaging applications in lung diseases	Methods imaging of respiratory system	Simulation Sessions, Case Studies	Theoretical 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 of physics of magnetic resonance

1. **Course Name:**
physics of magnetic resonance
2. Course Code:
RT306-PMR
3. **Semester / Year:**
Annual System
4. **Description Preparation Date:**
2024-2025
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	