Ministry of Higher Education & Scientific Research

Scientific Supervision and Evaluation Authority

Department of Quality Assurance and Academic Accreditation

International Accreditation Division

Colleges Academic Program Description Form

Year 2023 – 2024

College name: Al Rafidain University College

Name: University

Number of departments:

Date of Filling: 3/4/2024

Signed:	Signed:
Department's Head:	Scientific Assistant:
Date:	Date:

File checked by:

Officer of Quality Assurance and University Performance

Ph. D. Anwar Jaff'ar Mohammed Jwad

Date / /

Signed

Description of Academic Program

Performance Revision for Higher Education Institutions (Academic Program Review)

Academic Program Description

The academic description program for the Radiology Technology Department was prepared on the basis that it is considered one of the important departments within the medical group due to its effective role in providing cadres working in the field of Radiology in the Ministry of Health and the private sector.

1. Name of Institution	Al Rafidain University College
2. Department	Radiology Techniques
3. Name of Academic Program	Radiology Techniques
4. Certificate	Bachelor degree in Radiology Techniques
5. Academic System	Semester for the 1st and 2nd Annual for the 3rd and 4th
6. Accreditation Program	
7. Other External Influences	Quality Assurance Program of Ministry of Higher Education and Scientific Research
8. Date of Academic Program Description	

9. Goals of Academic Program

Department of Radiology Techniques established in year 2017/2018 to be part of the scientific departments at Al-Rafidain University College. It includes morning studies and follows the Semester system for the first and second stages, Annual system for the third and fourth stages. The study period in the department is four years, after which the student graduates and obtains a Bachelor's degree in Radiology Techniques. The department includes number of Lecturers who hold a doctorate and a master's degree in addition to the technical staff. The department includes number of specialized laboratories that have been equipped with the best modern laboratory devices that contribute effectively to the development of the student's practical capabilities in addition to their harmony with the requirements of the theoretical aspect at the level of each subject.

10. Learning requirements, Outcomes, Teaching, Learning and Assessment methods

Learning Outcomes	Teaching & learning Methods	Assessment Methods
A. Knowledge & Understanding		
A.1- Ability to apply knowledge in physical and chemical sciences. A.2- Ability to complete the tasks of analyzing the use of X-ray and ultrasound devices in a scientific manner based on basic sciences.	Theoretical, practical, and applied lectures, daily homework, and discussions.	Exams, assignments, daily homework, discussions, laboratory reports, and graduation projects.

B. Subject specific skills		
B.1- Ability to prepare and implement laboratory experiments, in addition to interpreting and analyzing the results and preparing the final report. B.2- Ability to diagnose pathological injuries through laboratory work using the latest devices, to achieve the desired goal in a practical manner in the medical fields.	Theoretical, practical, and applied lectures, daily homework, and discussions.	Exams, assignments, daily homework, discussions, laboratory reports, and graduation projects.
C. Thinking Skills		
C.1- The ability to use modern techniques, skills, necessary tools to practice pathological diagnosis based on laboratory work mechanisms. C.2- Realizing Ethical responsibility to give the most accurate results.	Theoretical, practical, and applied lectures, daily homework, and discussions.	Exams, assignments, daily homework, discussions, laboratory reports, and graduation projects.
D. General and transferable skills (other skills related to employment and personal development).		
D.1- Ability to work within a team that includes all medical and health specialties. D.2- Ability to develop oneself and work in the field.	Theoretical, practical, and applied lectures, daily homework, and discussions.	Exams, assignments, daily homework, discussions, laboratory reports, and graduation projects.

Department of Radiology Techniques

First Stage

Semester System

Vocabulary

Department of Radiological Techniques

First Stage

First Semester

First Stage						
First Semester						
#	**Subject's name**	**Theory**	**Practical**	**units**	**Level**	**Teaching language**
1	Anatomy of Skeleton	2	2	3	Specialized	English
2	General physics	2	2	3	Assistant	English
3	General physiology	2	2	3	Assistant	English
4	Biology	2	2	3	Assistant	English
5	General Chemistry	2	2	3	Assistant	English
6	Computer principles 1	1	2	2	Assistant	English
7	Human rights and democracy	2	-	2	Assistant	Arabic
8	English language	2	-	2	Assistant	English
		15	12	15		
Total Theory = 15 / Total Practical 12 / Total units = 21						

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Al Rafidain University College

Department of Radiology Techniques

Subject's name	English	Anatomy of the Skeleton	First Stage / First Semester	Theory	Practical	Total	Units
	Arabic	تشريح الهيكل العظمي					
Teaching language		English		2	2	4	3

Objectives:

Defining the surface anatomy, anatomical positions & planes of the body and:

1. The general anatomy of the upper limbs skeleton.
2. The general anatomy of the chest skeleton.
3. The general anatomy of the vertebral column.
4. The general anatomy of the lower limbs skeleton.
5. The general anatomy of the upper & lower limbs muscles.
6. The general anatomy of the joints, type of joints & mechanism of movement.
7. The general anatomy of the skull, facial bones & paranasal sinuses.

Theoretical & practical Syllabus	
Week	Details
1	• Introduction, definition: - surface anatomy & anatomical position, - vertical & horizontal lines & planes of abdominal organs, - cell & tissues, - Types.
2	• Skeleton of the upper limb: - shoulder girdle: (clavicle and scapula bones)
3	- The humerus, - radius ulna bones
4	The hand
5	The muscles of upper limbs
6	• Joints: - type of joints - mechanism of movement
7	• Skeleton of the chest: - Ribs, sternum and segments of the spinal cord
8	• Vertebrate - (cervical, thoracic, lumbar, sacrum and coccyx) - intervertebral disc
9	• Skeleton of the lower limb: - bony pelvis (pelvic girdle)
10	The femur, tibia and fibula bones
11	The foot
12	The muscles of lower limbs
13	• Skull: - bone of the skull
14	- Facial bones,

	- mandible - TMJ
15	- Nasal cavity & - Paranasal sinus

References:

1. VanPutte, C. L., Regan, J. L., Russo, A. F., Seeley, R. R., Stephens, T., & Tate, P. (2017). Seeley's anatomy & physiology. McGraw-Hill. (Eleventh edition).
2. Abrahams, P. H., Spratt, J. D., Loukas, M., & VanSchoor, A. (2018). Abrahams' and McMinn's Clinical Atlas of Human Anatomy.
3. Netter, F. H. (2018). Atlas of Human Anatomy.
4. Drake, R., Vogl, A. W., & Mitchell, A. W. (2014). Gray's anatomy for students. (Third edition).
5. Marieb. Wihelm. Mallat. Human anatomy. Eighth edition.
6. S. Hombach-Klonish, T. Klonish, J. Peeler. Sobota clinical atlas of human anatomy. First edition.

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Al Rafidain University College

Department of Radiology Techniques

Subject's name	English	General Physics	First Stage / First Semester	Theory	Practical	Total	Units
	Arabic	الفيزياء العامة					
Teaching language		English		2	2	4	3

Objectives:

1. Learn the standard units of measurements.
2. Define the Electricity & Magnetism.
3. Know the Gravitation and Kinetic Energy.
4. Define the Work-energy relation.
5. Know the Conservative and neoconservative forces.
6. Define Momentum, Impulse and Collisions.
7. Define Periodic Motion.
8. State and explain the Dynamics of Rotational Motion.
9. Define the heat and pressure.

Theoretical & practical Syllabus		
Week	Theoretical	Practical
1	• Standard units of measurements - Length - Mass - Time	• Preface - Instructions to students - Important notes about the lab
2	• Electricity - Electrostatics - Electrostatic Laws - Electric Potential - Electrodynamics - Electric Circuits - Electric Power • Magnetism - Electromagnetism - Electromagnetic Induction - Electromechanical Devices (transformer)	- Concept of measurement - Accuracy and uncertainty of the measurement - Plotting graphs and graph analysis
3	• Mechanics - Velocity - Acceleration	• Measurement & Instruments - Physical Measurements - Electrical Measurements - Glossary of laboratory instruments

4	- Newton's Laws of Motion - Gravitational field - Weight - Friction - force and acceleration	Ohm's Law
5	• Momentum - Impulse - Impulse and Collisions - Impulse-momentum relation - Law of conservation of momentum	Determination the effect of force acting on a mass. The surface tension The appointment of the surface tension of a liquid
6	- Work - Energy - Types of energy - Energy Conservation	Conservation of Energy
7	- Work-energy relation - Power - Conservative and neoconservative forces - Gravitational potential energy	Study of the body fall through the viscous medium.
8	• Periodic Motion - Simple harmonic motion: springmass system, simple pendulum, physical pendulum	Hooke's Law & Simple Harmonic Oscillators
9	• Dynamics of Rotational Motion - Moment of inertia - Angular position, angular velocity, angular acceleration - Torque	**1.** The Simple Pendulum **2.** Determination the rotational inertia of a body
10	- Torque-angular acceleration relation - Static equilibrium - Rotational kinematics - Work done by a torque	The moment of inertia of Gyroscope
11	- Rotational kinetic energy - Angular momentum - Static equilibrium experiments - Rotational motion problems	**1.** Moment of Inertia of a Wheel **2.** Measuring the effect of torque acting on a rotating mass.
12	- Damped and Driven oscillation - Periodic Motion experiment	Damped and Forced Oscillators
13	- Gravitational potential energy - Escape velocity	Measure the Young coefficient of the wire
14	• Heat, temperature - Latent heat - Specific Heat - Methods of heat transferring	Specific Heat Set the specific heat of metal

15	• Gases, • Pressure & volume, laws of pressure.	Boyle´s Law

References:

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. RF Farr and PJ Allisy-Roberts ***"Physics for Medical Imaging",*** Saunders, 4th edition (2001).

3. Stewart Carlyle Bushong, "Radiologic ***Science for Technologists Physics, Biology, and Protection"*** Elsevier, Inc. , 7th edition, 2017.

Ministry of Higher Education & Scientific Research

Al Rafidain University College

Department of Radiology Techniques

Subject's name	English	General Physiology	First Stage / First Semester	Theory	Practical	Total	Units
	Arabic	الفسلجة العامة					
Teaching language		English		2	2	4	3

Objectives:

1. Understand the main physiologic concepts of cells and their component.
2. Understand the factors of homeostasis regulation in human body
3. Understand the physiologic mechanisms of blood flow, gases exchange and gastric secretions

Theoretical & practical Syllabus		
Week	Theoretical	Practical
1	Introduction to Human Physiology - Cell components and organelles	Microscope parts & uses
2	Blood: -Blood Functions blood components: blood plasma, plasma proteins function	Finger puncture –blood smear
3	Formed elements: leukocytes (types and function), Platelets, and Erythrocytes, Erythropoietin Role in Erythrocytes Production.	Preparation of blood smear: slide method
4	Blood Clotting: clotting factors and Mechanism of Blood Clot Formation	Staining of blood film
5	Fluid Compartments in the Body: ICF,ECF, interstitial fluid and transcellular fluids, compositions of body fluids	Sahli method for hemoglobin estimation
6	Fluid shift: Diffusion, Osmosis, hydrostatic pressure, filtration & Active Transport Across Cell Membranes	Packed cell volume(PCV)
7	Homeostasis: Blood glucose homeostasis, excretion homeostasis and Body Temperature Regulation	Scientific film about blood & circulating system
8	Heart and blood vessels: - Heart function - Blood vessels function - Cardiac valves and their functions - Heart sounds.	Blood grouping & Rh factor

9	Circulations: systemic circulation, pulmonary circulation, Cardiac cycle, cardiac output, and electrical properties	Determination of Bleeding time
10	Blood Pressure: - Mean arterial blood pressure and its regulation - Role of kidney in regulation blood pressure	Determination of Clotting time
11	Measurement of lung function: - Lung volumes and capacities - Exchange & transport of gases in the blood	Hemocytometry
12	Gastrointestinal tract: - GI tract general functions - Oral cavity function, Salivary glands function, stomach function, small intestine and large intestine function	Red blood cell count
13	Gastrointestinal tract Secretions: General characteristic of GI Secretions and their functions	Differential count of white blood cell(WBC) and Total White blood cell count
14	Physiology of Pregnancy: Parturition, stages of labor hormonal stimulation of parturition and lactation	Scientific film about bleeding & transfusion
15	Fetal development: - The newborn - First year after birth - Aging and death	Erythrocyte sedimentation rate (ESR)

References:

1. Seeleys ***anatomy and physiology*** (eleven edition) Cinnamon L. VanPutte , Jennifer L. Regan , and Andrew F. Russo (2017)
2. ***Essentials of Human Anatomy & Physiology***, Global Edition Suzanne Keller Elaine Marieb (2017)
3. ***Human Anatomy and Physiology***, Global Edition [Sep 14, 2015] Erin, C. Amerman
4. Study Guide to Human Anatomy and Physiology 1 (2012) Michael Harrell M.S.

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Al Rafidain University College

Department of Radiology Techniques

Subject's name	English	Biology	First Stage / First Semester	Theory	Practical	Total	Units
	Arabic	بايولوجي					
Teaching language		English		2	2	4	3

Objectives:

1. Understand the level of organization among living organisms.
2. Be able to recognize and describe cell morphology and components.
3. Understand the Nucleic acid structure and role.

Theoretical & practical Syllabus		
Week	Theoretical	Practical
1	Introduction to Biology -History and General concepts of Biology -Cell theory -Comparing Prokaryotic and Eukaryotic Cells	Identification of parts and functions of the light Microscope
2	Introduction to the Chemistry of Life -Cells chemistry and Chemical bonds -Water -pH, Salts and ions	Using the light Microscope to observe Prokaryotic Cells
3	Biologically Important Molecules: -Carbohydrates -Lipids -Proteins -Nucleic Acids	Using the light Microscope to observe (or Slides) Eukaryotic Cells
4	Introduction to Cell Structure and Function - Plasma Membrane , Passive transport, active transport, factors effect on permeability - Cytoplasm	Identification of different stages of mitosis using microscopic slides
5	Introduction to Cell Structure and Function - Cytoskeleton -Microfilaments, Intermediate Filaments, Microtubules, Flagella and Cilia	Identification of different stages of meiosis using microscopic slides
6	Eukaryotic cell organelles: - Mitochondria (morphology, structure), -lysosomes (types, function).	Using slides to study and distinguish morphological features and types of human cells

7	Eukaryotic cell organelles: - Golgi complex (morphology, function)	Use of slides to understand the structure of cellular components: mitochondria, Golgi apparatus, Endoplasmic reticulum
8	Eukaryotic cell organelles: -Endoplasmic reticulum (smooth & rough) and their function. -Vesicles and Vacuoles -Ribosome (protein synthesis).	Use of slides to understand the structure of nucleus, nucleoplasm, nucleolus and nuclear envelope
9	Eukaryotic cell organelles: - The nucleus, nuclear envelope.	Use of potato strips to observe osmosis
10	Eukaryotic cell organelles: Chromosome structure - changes (duplication, translocation, inversion)	Studying osmosis: using of vinegar for dissolving egg shell
11	DNA Replication and protein synthesis -The structure of the DNA	Use of slides to understand the types of chromosomes based on the position of centromere
12	DNA Replication and protein synthesis -Transcription	Experiment for DNA extraction from Banana
13	DNA Replication and protein synthesis -Translation	Use of slides to understand DNA transcription steps and factors involve in each step
14	Introduction to Reproduction at the Cellular Levels -The Cell Cycle -Mitosis	Use of slides to understand DNA translation steps and factors involve in each step
15	Introduction to Reproduction at the Cellular Levels -Meiosis -Prokaryotic Cell Division	Use of slides to understand cell cycle steps and positions of checkpoints

References:

1. Elizabeth o Grady, Jason Cashmore, Marsha, Carol Wismer(2018). ***Principles of Biology-An introduction to Biological Concepts*** . second Edition.
2. Peter Raven (2016) ***Biology***. Elven Edition.
3. VJ. Bekish, Yu.T. Nikulin (2006) ***Practical Book on Medical Biology.***

Ministry of Higher Education & Scientific Research

Al Rafidain University College

Department of Radiology Techniques

Subject's name	English	General Chemistry	First Stage / First Semester	Theory	Practical	Total	Units
	Arabic	الكيمياء العامة					
Teaching language		English		2	2	4	3

Objectives:

1. To introduce the student to the science of chemistry
2. how to deal with chemical materials
3. to detect and separate materials and prepare standard materials
4. skills for developing Algorithmic (math) problem solving
5. Concept analysis and construction
6. Writing objective reports and statements
7. Use of laboratory equipment/safety

Theoretical & practical Syllabus		
Week	Theoretical	Practical
1	• The atom • Molecular structure • Electronically distribution • Chemical bonding • Liquid mixture	Laboratory instructions, laboratory instruments & glass ware. Preparation of standard solutions.
2	• Buffer solutions – types	Percentage solutions, molar solutions and dilution methods
3	Quantitative & qualitative analysis methods.	Normal solutions
4	Molar and normal concentrations and methods	- Buffer – aced, base
5	- Problems and discussion.	Perception titration.
6	- Acids, base – examples. Oxidation & reduction	Oxidation titration.

7	Principles of organic chemistry • Hydrocarbons • Alkenes • Perpration properties reactions.	Separation and purification of organic compounds Aldehyde and ketoses identification.
8	Alcohols – ketones – aldehydes – carboxylic acids classification & properties	Reactions Alcohols – identification, reactions
9	Aromatic hydrocarbons Carbohydrates – classification & reactions	Reactions of carbohydrates & identification of types
10	Amines aryl amines	Identification of types.
11	Introduction to biochemistry and machinery of life	Lipids – identifications and reactions.
12	Biochemistry and nutrition	
13	Suger, starches and fibers	
14	Isomers, classifications	Unknown tes
15	Electrolytes, electrochemistry	Determination of some elements Ca+, Cl-

References:

1. ***Solutions for General Chemistry: Principles and Modern Applications*** 11th Ralph H. Petrucci, F. Geoffrey Herring, Jeffry D. Madura, Carey Bissonnette

2. ***Solutions for CHEMISTRY: The Molecular Nature of Matter and Change*** 7th Martin S. Silberberg, Patricia G. Amateis

Ministry of Higher Education & Scientific Research

Al Rafidain University College

Department of Radiology Techniques

Subject's name	English	Computer fundamentals 1	First Stage / First Semester	Theory	Practical	Total	Units
	Arabic	مبادئ الحاسوب 1					
Teaching language		English		1	2	3	2

General objectives:

Provide students with skills to deal with basic office applications and create office files and documents.

Use of operating system as well as the basics of working within the digital environment.

Specific objective:

Providing the student with knowledge in managing and using various computer applications.

Theoretical & practical Syllabus		
Week	Theoretical	Practical
1	Computer Fundamentals Computer concept, Computer Life Cycle Phases, Computer Generations Development	Practical examples of browsing, opening and closing windows and dialog boxes, and the correct way to deal with the keyboard, pointer and other devices.
2	Advantages of computer and its areas of use Classification of the computer in terms of purpose, size and data type	- Practical examples of customization, dealing with icons, and changing screen resolution.
3	Computer Components Computer Hardware Parts Software Entities	- Train the student to create a new user, enlarge windows, display the keyboard, and identify the physical components of the calculator.
4	Your Personal Computer Security Concept and Software Licensing	- Training the student to deal with computer software licenses and their types and to deal with the original source of the programs.

5	Computer Safety & Software License	Train the student to deal with computer security.
6	Ethics of the electronic world, forms of abuse, computer security, computer privacy	Training the student to deal with computer privacy
7	Computer programs and their types, intellectual property, electronic hacking, malware, the most important steps necessary to protect against hacking operations, the harms of computers to health	Training students to deal with electronic hacking and its types, types and recipes of viruses, how to make a backup image of the computer
8	Definition of Operating Systems Operating Systems Operating System, functions, objectives, classification Examples of some operating systems	Training students to deal with operating systems, format and partition the hard disk internally and externally.
9	Operating Systems Windows 7	-Training the student to install Windows 7.
10	Desktop Components Start Menu Taskbar	- Training the student on the Start menu, Run commands, taskbar, creating a file and saving it with the student's name on the desktop. Dealing with program windows and scroll bars. - Training the student on the uses of F1,F2,…,F12 on the keyboard
11	Folders, files and Icons	Create a folder with a specific name and train on changing the name, hiding, retrieving, deleting and its path.
12	Perform operations on windows desktop backgrounds	Student's Relationship to Perform Operations on Windows Desktop Backgrounds
13	Control Panel Windows Control Panel "Control Panel" (Category) Groups	Training the student to use the control panel
14	From the Defragment control panel, organize files inside the computer, install and delete programs.	Training the student to delete a specific program and install it again.

15	Common computer settings and conditions, printer management, setting the time and date, primary disk maintenance	Training students on common computer settings, installing the printer and how to deal with it, setting the time and date, maintaining primary disks, Partitions C, D, E, F

Sources;

Computer Fundamentals & Office Applications (Part 1)

Phd. Zyad Mohammed Aboud, Phd. Ghasan Hameed Abdul Majeed, Phd. Ameer Hussain,

Phd. Bilal Kamal Ahmed

Ministry of Higher Education & Scientific Research

Al Rafidain University College

Department of Radiology Techniques

Subject's name	English	Human rights and democracy	First Stage / First Semester	Theory	Practical	Total	Units
	Arabic	حقوق الانسان و الديمقراطية					
Teaching language		Arabic		2	0	2	2

Objectives: The student learns about the historical development of human rights in the first semester, democracy, its types, and types of freedoms.

Theoretical & practical Syllabus		
Week	**Theoretical**	
1	• Human rights identification	
2		
3	• From its Importance side • From People side	
4	• First generation; civil & political rights • Second generation: economic, social and culture rights. • Third generation: environmental, cultural and development rights	
5	• Mesopotamian civilization • Egyptian civilization	
6		
7		
8	Human Rights in Renaissance Societies • The Great Charter, or the Great Testament (Magna Carta 1215) • The Petition of Rights 1628 • The Habeas Corpus 1679 • The Declaration of Rights • The Contribution of Thinkers (Hobbes, John Locke, Rousseau, Voltaire, Montesquieu) and others. • The Declaration of Independence in the United States • The French Revolution and the Declaration of Human Rights	
9	Human Rights in Modern Times • The October Socialist Revolution in Russia in 1917 (Bolshevik Revolution) • The Covenant of the League of Nations and Human Rights	

	• The Universal Declaration of Human Rights in 1948
10	Human Rights in Modern Times • The Charter of the United Nations, 1954 • The two international covenants on human rights • Regional human rights covenants
11	NGOs and Human Rights • International Committee of the Red Cross • Amnesty International • Human Rights Watch • National Human Rights Organizations
12	Guarantees of respect and protection of human rights at the national and international levels • Constitution and laws • Freedom of the press and public opinion • Civil society organizations • Regional organizations (League of Arab States, European Union, Organization of American States) • United Nations and its specialized agencies
13	Water and Environmental Awareness in Iraq • General Concept of Awareness • Means of Achieving Awareness • Dimensions of Water Awareness • Uses of Water Awareness
14	Water and Environmental Awareness in Iraq • Challenges Facing Water Awareness Proposed Measures to Solve the Crisis of Fresh Water Shortage
15	The concept of equality • Historical development of the concept of equality • Modern development of the idea of equality • Gender equality • Equality between individuals according to their beliefs

Department of Radiological Techniques

First Stage

Second Semester

First Stage						
Second Semester						
#	**Subject's name**	**Theory**	**Practical**	**units**	**Level**	**Teaching language**
1	Anatomy of body systems	2	2	3	Specialized	English
2	Physics of atom	2	2	3	Assistant	English
3	Systemic physiology	2	2	3	Assistant	English
4	Radiobiology	2	4	4	Assistant	English
5	Principles of Nursing	2	4	4	Assistant	English
6	Computer principles2	1	2	2	Assistant	English
7	Medical Terminology	2	-	2	Assistant	English
8	Arabic Language	2	-	2	Assistant	Arabic
		15	16	15		
Total Theory = 15 / Total Practical 16 / Total units = 23						

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Department of Radiology Techniques

Subject's name	English	Anatomy of body systems	First Stage / Second Semester	Theory	Practical	Total	Units
	Arabic	تشريح اجهزة جسم الانسان					
Teaching language		English		2	2	4	3

Objectives:

At the end of the course, the student will be able to know:

1. The general anatomy of the central nervous system.
2. The general anatomy of the respiratory system.
3. The general anatomy of the cardiovascular system.
4. The general anatomy of the digestive system.
5. The general anatomy of the liver, biliary system, pancreas, and spleen.
6. The general anatomy of the urinary system.
7. The general anatomy of the breast.
8. The general anatomy of the male reproductive system.
9. The general anatomy of the female reproductive system.

Week	Details
1	The mid brain, cerebral hemisphere, ventricles of the brain.
2	The hind brain: Cerebellum, pons and medulla oblongata.
3	Meninges, and spinal meninges.
4	The cranial nerves.
5	Lumber and sacral plexuses.
6	Respiratory system: lung, bronchial tree, vascular supply.
7	Cardiovascular system: heart, heart chambers, major vessels.
8	Digestive system: pharynx, esophagus, and stomach.
9	Digestive system: small intestine, and blood supply to abdominal wall.
10	Digestive system: Large intestine.

11	Liver, biliary system, pancreas, and spleen.
12	Urinary system: Kidney, ureter, urinary bladder, urethra & blood supply.
13	The breast: general anatomy, lobular structures.
14	Male reproductive system.
15	Female reproductive system.

References:

1. VanPutte, C. L., Regan, J. L., Russo, A. F., Seeley, R. R., Stephens, T., & Tate, P. (2017). ***Seeley's anatomy & physiology***. McGraw-Hill. (Eleventh edition).
2. Abrahams, P. H., Spratt, J. D., Loukas, M., & VanSchoor, A. (2018). ***Abrahams' and McMinn's Clinical Atlas of Human Anatomy.***
3. Netter, F. H. (2018). ***Atlas of Human Anatomy.***
4. Drake, R., Vogl, A. W., & Mitchell, A. W. (2014). ***Gray's anatomy for students***. (Third edition).
5. Marieb. Wihelm. Mallat. ***Human anatomy***. Eighth edition.
6. S. Hombach-Klonish, T. Klonish, J. Peeler. ***Sobota clinical atlas of human anatomy***. First edition.

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Al Rafidain University College

Department of Radiology Techniques

Subject's name	English	Physics of Atom	First Stage / Second Semester	Theory	Practical	Total	Units
	Arabic	فيزياء الذرة					
Teaching language		English		2	2	4	3

Objectives:

1. Define the atomic and Nuclear Structure.
2. Learn the types of the ionization radiation.
3. Know the mechanism of radiation interaction with matter.
4. Define the interaction scatter radiation with matter.
5. Discuss the types of attenuation coefficient.
6. Define nanotechnology science, types of nanomaterials synthesis, and their applications.

Week	Theoretical	Practical
1	Atomic and Nuclear Structure – Fundamental particles. – Nuclear Binding energy – Nuclear Stability – Auger electrons	Activity of Gamma Source
2	– Radioactive Decay – Radioactive materials – Activity – Half life	Beta decay of nuclei
3	Types of Radiation – Alpha particles – Beta particles – Gamma radiation – Others, decay models	Influence of magnetic field on α, β and γ radiation
4	Classification of radiation – Electromagnetic radiation – Particulate radiation – Ionizing and non – ionizing radiations	Deflection of beta particles
5	Electromagnetic energy – Velocity and amplitude – Frequency and wavelength	Beta spectrum (simple version)
6	Wave model: Visible light Particle model: Quantum theory	The interaction between cosmic rays and matter

7	Matter and energy – Interactions of photons with matter; mechanisms of energy loss – Photoelectric effect – Thompson scattering – Coherent (Rayleigh) scattering	– Photoelectric absorption and Compton scattering – Compton scattering of gamma rays – Interaction of gamma rays withy matter
8	– Incoherent scattering – Pair and triplet production	Pair Production and Annihilation
9	– Compton scattering by free electrons – Scattering and energy transfer coefficients – stopping power	– Calculations of Stopping Power, and Range of Ions Radiation (Alpha Particles). – Interaction with Different Materials and Human Body Parts
10	• Photon Attenuation Coefficients – Linear attenuation coefficient Exponential attenuation	Spectrophotometer
11	– Mass attenuation coefficient – Energy-Absorption coefficient	Measure the mass attenuation coefficient
12	• Interactions of electrons with matter – Ionizational (collisional) interactions – Radiative Interactions – stopping power	The interaction of electrons with matter
13	• Introduction of Nanomaterials – Properties of nanoparticles – Types of nanoparticles	Nanoparticles lab safety Notes for liquid handling and Micropipetting
14	• Synthesis Routes – Bottom-Up Approaches – Top-Down Approaches – Others • Characterization of nanoparticles	Synthesis of Gold-Silver Nanoparticles and Investigation of Their Optical Properties
15	• Applications of nanomaterials in medicine & biology	Use of Nanoparticles as biosensor

References:

1. Perry Sprawls, ***"Physical principles of medical imaging"***, 2nd Edition 1996.
2. Allisy-Roberts PJ, Williams J. Farr's "***physics for medical imaging".*** Elsevier Health Sciences; 2007 Nov 14.
3. Chris Guy & Dominic ffytche ***"An Introduction to The Principles of Medical Imaging"*** Revised Edition, Imperial College Press, London, (2005).
4. Sang Hyun Cho, Sunil Krishnan, MD, ***"Cancer Nanotechnology Principles and Applications in Radiation Oncology"***, In: Imaging in medical diagnosis and Therapy, William R. Hendee Series Editor ; Taylor & Francis Group, LLC (2013)

Ministry of Higher Education & Scientific Research

Al Rafidain University College

Department of Radiology Techniques

Subject's name	English	Systemic Physiology	First Stage / Second Semester	Theory	Practical	Total	Units
	Arabic	علم الفسلجة الوظيفي					
Teaching language		English		2	2	4	3

Objectives:

1. Understand the fundamental mechanisms that operate in human body and how they interact.
2. Understand the functions of important physiological systems including the cardio, respiratory, renal, reproductive and digestive systems.

Week	Theoretical	Practical
1	Physiology of cardiovascular system: Components of CVS and their functions Systole, diastole, peripheral resistance	Examination of Arterial Pulse
2	Physiology of Respiratory system: Pulmonary ventilation, elastic recoil, pressure changes during inspiration and expiration, pulmonary volumes, alveolar ventilation, respiratory control centers, factors influence breathing	Film about Stethography: recording normal movement of respiration
3	Physiology of Digestive system: stomach, gastric juice, regulation of stomach secretion, inhibition of secretion by nervous system, small intestine secretion	Film about Stethography: modified movements of respiration
4	Physiology of Pancreas and small and large intestine: pancreatic juice contains and function , regulation of pancreatic secretion, duodenum function , intestinal juice contents, large intestine	Film about determining vital capacity and effect of posture on vital capacity
5	Physiology of liver and gallbladder: liver functions, gallbladder function	Thermometer & its uses
6	Physiology of renal system: Parts of urinary system, function of urinary system, urine formation process, glomerular filtration	Arterial blood pressure estimation

7	Selective process of urine formation: Tubular reabsorption, Regulation of urine concentration and volume, tubular secretion, urine movements	Examination of Heart sounds
8	Micturition: Micturition reflex regulation and urination	Electrocardiogram (ECG)
9	Female reproductive system: Puberty in females, menstrual cycle, menopause, female fertility and pregnancy	Pulmonary volume estimation
10	Male reproductive system: Function, testosterone, puberty in males, regulation of male reproduction system, hormonal and neural mechanisms	Artificial respiration
11	Physiology of nervous system: General organization , CNS, PNS, nerve fiber, brain parts, brainstem function, cerebrum function, nerve impulses, action potential, relax Arc, Motor system: Sensory system	General urine examination (GUE)
12	Tract of spinal cord: Descending, ascending, intersegmental	Experiments on movement coordination
13	Physiology of spinal cord sections: Hemi section and complete section	Film about muscles
14	Endocrine control mechanism: Adrenal gland hormones role and function	Film about joints
15	Endocrine control mechanism: Pituitary gland hormones role and function	Taste sensation examination

References:

1. ***Seeleys anatomy and physiology*** (eleven edition) Cinnamon L. VanPutte , Jennifer L. Regan , and Andrew F. Russo (2017)

2-***Essentials of Human Anatomy & Physiology***, Global Edition Suzanne Keller Elaine Marieb (2017)

3-***Human Anatomy and Physiology***, Global Edition [Sep 14, 2015] Erin, C. Amerman

4-***Study Guide to Human Anatomy and Physiology*** 1 (2012) Michael Harrell M.S.

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Al Rafidain University College

Department of Radiology Techniques

Subject's name	English	Radiobiology	First Stage / Second Semester	Theory	Practical	Total	Units
	Arabic	البايولوجي الاشعاعي					
Teaching language		English		2	4	6	4

Objectives:

1- Understand the radiobiological effect of radiation on cells, tissues.

2- Understand the different responses of normal and tumor cells to radiation effect.

3- Study the effect of ionization radiation in radiotherapy.

Week	Theoretical	Practical
1	Introduction to Radiobiology • Radiation chemistry: - Initial physical event - Radiolysis of water - Direct Effect of Radiation - Indirect Effect of Radiation	Examination of Eukaryotic Cells structure and types
2	- Oxygen Effect (OER) - Radiosensitizers - RadioProtectors (DMF) • Irradiation-induced damage and the DNA damage response - The DNA damage response - Sensors of damage	Examination the Effects of Radiation on Cells (Water and DNA)
3	• Cell death after irradiation: - programmed cell death - Apoptosis3 - Autophagy - Necrosis, Senescence - mitotic catastrophe	Representation of Cell Cycle Phases and Checkpoints
4	• Molecular Repair of DNA Damage - Base Excision Repair - Homologous Recombination - Nonhomologous and Joining • Target theory - Single target -Single hit, - Multiple target- single hit	Stages of Mitosis stages

5	• Cell survival curves - Recovery - Cell-Cycle Effects - Radiation Effect Modification	Examination of DNA Damage Repair
6	• Types of Cellular Damage due to Radiation - Lethal Damage - Potential Lethal Damage	Examination of Target Theory and Survival Curves
7	• Radiobiology of Tissue and Organs Response to Radiation - The Most Sensitive - Sensitive - Moderately Sensitive - Less Sensitive	Examination of Cellular Damage due to Radiation
8	• The severity of radiation effect: - Subacute Effects - Acute Effects - Chronic Effects	Examination of Different Responses of tissue and Organs to Radiation
9	• Tumor Response to Radiation - Therapeutic index (combined radiation and drug treatments) - Tumor control probability - Normal Tissue complication Probability	
10	• Introduction to Biosafety and Security - Key components of Biorisk Management - Components of safety in all laboratories - Universal safety precautions	
11	• Biosafety barriers in laboratories - Personal protective equipment(PPE) - Facility Design	
12	• Biological Agents - Routs of infection - Basis for control Measures - Hazard group classification system - A Biosafety cabinet (BSC)	
13	• Biorisk and biohazards - Control of substances hazardous to health - Assessing risk for work with human blood and tissues hazards - Control measures for work with human blood and tissue - Containment level	
14	• Types of biological wastes - Categories of biological wastes - Decontamination of biological wastes	

15	• Transportation of biological wastes - International Transport Regulations - The Basic Triple Packaging System	

References:

1. Beyzaeoglu, M, ;Ozyigit, G. and Ebruli, C. (2010). Basic Radiation Oncology. Springer, Berlin, Heidelberg.

2. Elizabeth o Grady, Jason Cashmore, Marsha, Carol Wismer (2018) Principles of Biology- An introduction ***to Biological Concepts***, second edition.

3. international Atomic Energy Agency. ***Radiation Biology*** : A Hand book for Teacgers and students (2010). Series no.42.

Ministry of Higher Education & Scientific Research

Al Rafidain University College

Department of Radiology Techniques

Subject's name	English	Principles of Nursing	First Stage / Second Semester	Theory	Practical	Total	Units
	Arabic	اسس التمريض					
Teaching language		English		2	4	6	4

Objectives:

1- To introduce the students to the most important ways of dealing with patients.
2- To inform them how maintain the health of the patient and providing care for them.
3- To prepare the patients for different radiographic examinations, first aid methods and civil defense.

Week	Theoretical	Practical
1	Nursing, its importance and development among societies, the qualifications of nurse	
2	Temperature measurement routs , heart pulse characteristics and measurement sits	Clinical thermometer types , temperature and pulse measurement routs technique
3	Respiratory rate and respiratory types, blood pressure and blood pressure types	Respiratory rate and blood pressure measurement routs technique
4	Body mechanism , Patient positions types (erect,supine, dorsal recumbent, fowler's, lateral, pron, sim's, lithotomy, knee-chest, semi-fowler's , trendelenberge and reverse trendelenberge positions)	Patient positions types technique
5	Drug administration routs (mouth, inhalation , rectum & vagina , injection) drugs storage , weights and measures	Drug administration routs technique
6	Basic principles of medical and surgical sterilization and disinfection	Hand washing technique , cap, mask , surgical gloves and gown wearing technique
7	Urinary catheterization and enema types	Urinary catheter and enema techniques
8	Gastric lavage and artificial feeding	Gastric lavage and artificial feeding techniques
9	Role of nurse in patient preparation for general radiography and special GIT and urinary system radiography	General radiography , special GIT and urinary system radiography techniques
10	Fundamental and application of first aid, artificial respiration types and CRP	artificial respiration and CRP techniques

11	• Wounds and hemorrhage types, arterial pressure points • Dressing and bandages types and uses , surgical sutures types	First aid methods for wounds and hemorrhage in various sites in the body , determination of arterial pressure points
12	Poisoning , asphyxia and foreign bodies types • Fractures and burns types, electrical shock • War injuries types and principles of the civil defense	Techniques of simple dressing , suturing, removing sutures and clips, bandages uses techniques. First aid methods for poisoning , asphyxia and foreign bodies. Fractures , burns and electrical shock first aids
13	• Introduction to Biosecurity - Risks Characterization in biosecurity - Vulnerability assessment13 - Component o14f Laboratory Biose15curity • Biosafety level - Risk Assessment Strategy - Hazard groups, biosafety levels, practices and equipment - Standard practices required in biology laboratories.	
14	• Biorisk management system - Assess the capability of the laboratory staff to control hazards - Relation of risk groups to biosafety levels , practices of and equipment - Mitigation Control Measures - Sustainability of the bio-risk management system - Strengthening biorisk management	
15	• Accident response - spill cleanup procedure - Investigation of an accident inside the laboratory. • Biosafety training	

References:

1. Mosby's Pocket Guide to Nursing Skills & Procedures (2015). Eighth Edition. Anne Griffin Perry & Patricia A. Potter. Mosby's Elsevier Inc.
2. Drug Guide for Nursing Students (2015). Eleventh Edition . Linda Skidmore-Roth. Mosby's Elsevier Inc.
3. Study Guide for Fundamentals of Nursing the Art and Science of Nursing Care (2011). Seventh Edition . Carol R. Taylor, Carol Lillis, Priscilla LeMone, Pamela Lynn & Marilee LeBon. Wolters Kluwer Lippincott Williams & Wilkins.
4. Fundamentals of Nursing Standards & Practice (2010). Fourth Edition. Sue C. DeLaune & Patricia K. Ladner. Delmar Cengage Learning Inc.

Ministry of Higher Education & Scientific Research

Al Rafidain University College

Department of Radiology Techniques

Subject's name	English	Computer Fundamentals (2)	First Stage / Second Semester	Theory	Practical	Total	Units
	Arabic	مبادئ الحاسوب					
Teaching language		English		1	2	3	2

General objectives:

- Provide students with skills to deal with basic office applications and create office files and documents.
- Use of operating system as well as the basics of working within the digital environment.

Specific objective:

- Providing the student with knowledge in managing and using various computer applications.

Week	Theoretical	Practical
1	Microsoft Word 2010, operating Microsoft word 2010	Many texts, train students on these activities
2	Microsoft office Word 2010 interface	Train the student to create texts in different formats and print them on the printer.
3	File tab, Home page tab	- Practical exercises on texts within the document. - Giving names to companies or students and training the student to search for a specific name and replace it.
4	Page Layout tab, View tab	Student training on page layout, view tab, training on writing texts
5	Objects in Microsoft Word 2010	Giving practical examples of inserting objects and training in writing texts in a more professional way
6	Insert tab, Pages group	Give practical examples of the Insert tab group.
7	Tables	Give practical examples on tables group
8	Tables	Give more examples on tables group
9	Illustrations group	Student training on a set of illustrations
10	Header & Footer	-Include a specific image and assign the student to carry out those activities.

11	Texts, Symbols	-Training the student to write texts that include currency symbols, special letters, scientific symbols, etc.
12	Microsoft Word 2010 extra tasks	-Training the student to write equations that include addition, multiplication, and raising formulas for exponents and matrices in different forms. - Training the student to create different tables with data entry
13	Microsoft PowerPoint 2010 Open a new file and save it on the desktop. - Add and edit slides (title slide, title with content, subtitle, two contents, comparison, title only, blank slide, content with comment, picture with comment.	- Training on opening a new file and saving it on the desktop. - Adding and editing slides (title slide, title with content, subtitle, two contents, comparison, title only, blank slide, content with comment, image with comment.) - Adding and editing types of content slide (table, chart, shapes and charts, images, images from the Internet , video files.)
14	Training on deleting, moving and rearranging slides. - Adding a theme - Applying the Slide Master function - Adding animations and adjusting the time and repetition for all slides and in a different way for each slide.	Add a theme - Master view group - Add animations and adjust the time and repetition for all slides and in a different way for each slide.
15	Adding animations to slides	-Add to each part of the slide an entry, stability, exit and other movements with setting the repetition, time and other options. And save the presentation file in Adobe PDF format.

Sources;

Computer Fundamentals & Office Applications (Part 1)

Phd. Zyad Mohammed Aboud, Phd. Ghasan Hameed Abdul Majeed, Phd. Ameer Hussain,

Phd. Bilal Kamal Ahmed

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Al Rafidain University College

Department of Radiology Techniques

Subject's name	English	Medical Terminology	First Stage / Second Semester	Theory	Practical	Total	Units
	Arabic	مصطلحات طبية					
Teaching language		English		2	-	2	2

Objectives:

- Identify the four word elements used to build medical words.
- Divide medical words into their component parts.
- Apply the basic rules to define and build medical words.
- Locate the pronunciation guidelines chart and interpret pronunciation marks.
- Pronounce medical terms
- Determine how to link combining forms and word roots to various types of suffixes
- List and identify the terms related to direction, position, and planes of the body.
- Describe pathological conditions, diagnostic and therapeutic procedures, and other terms related the body system.

Theoretical Syllabus	
Week	Detiales
1	Structural analysis: Basic Elements of a Medical Word
2	suffixes
3	Prefixes
4	Roots , Word terminals , Conditions
5	Terms concerning Body Structure
6	Terms concerning Integumentary System
7	Terms concerning Digestive System
8	Terms concerning Respiratory System
9	Terms concerning the skin & its appendages
10	Terms concerning Cardiovascular System
11	Terms concerning Blood, Lymph, and Immune Systems
12	Terms concerning Musculoskeletal System
13	Terms concerning the endocrine system
14	Terms concerning the special senses
15	Terms concerning the oncology

References:

1. David Andersson, M***edical Terminology: The Best and Most Effective Way to Memorize, Pronounce and Understand Medical Terms***: Second Edition

2. Barbara A. Gylys ***Medical Terminology Systems: A Body Systems Approach*** Eighth Edition.

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Al Rafidain University College

Department of Radiology Techniques

Subject's name	English	Arabic language	First Stage / Second Semester	Theory	Practical	Total	Units
	Arabic	اللغة العربية					
Teaching language		English		2	-	2	2

Objectives:

- Identify the four word elements used to build medical words.
- Divide medical words into their component parts.
- Apply the basic rules to define and build medical words.
- Locate the pronunciation guidelines chart and interpret pronunciation marks.
- Pronounce medical terms
- Determine how to link combining forms and word roots to various types of suffixes
- List and identify the terms related to direction, position, and planes of the body.
- Describe pathological conditions, diagnostic and therapeutic procedures, and other terms related the body system.

Theoretical Syllabus	
Week	**Detiales**
1	مقدمة عن الاخطاء اللغوية – التاء المربوطة والطويلة والتاء المفتوحة
2	قواعد كتابة االلف الممدودة والمقصورة – الحروف الشمسية والقمرية
3	الضاد والظاء
4	كتابة الهمزة
5	علامات الترقيم
6	الاسم والفعل والتفريق بينهما
7	المفاعيل
8	العـــدد
9 + 10	تطبيقات أألخطاء اللغوية الشائعة
11	النون والتنوين ـ معاني حروف الجر
12	الجوانب الشكلية للخطاب الاداري
13 + 14	لغة الخطاب الاداري
15	نماذج من المراسالت الادارية

Department of Radiology Techniques

Second Stage

Semester System

Vocabulary

Department of Radiological Techniques

Second Stage

First Semester

Second Stage						
First Semester						
#	**Subject's name**	**Theory**	**Practical**	**units**	**Level**	**Teaching language**
1	Conventional Radiological Equipment techniques	2	5	4	Specialized	English
2	Radiographic techniques for upper limbs	2	5	4	Specialized	English
3	Special radiological procedures of gastrointestinal tract and bones	2	5	4	Specialized	English
4	Radiological anatomy of head and upper limbs	2	4	4	Specialized	English
5	Fundamentals of Radio-physics	2	3	3	Assistant	English
6	Fundamentals of radiation protection	2	3	3	Assistant	English
		12	25	22		
Total Theory = 12 / Total Practical 25 / Total units = 22						

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Department of Radiology Techniques

Subject's name	English	Conventional Radiological Equipment Techniques	Second Stage / First Semester	Theory	Practical	Total	Units
	Arabic	تقنيات الاجهزة الشعاعية التقليدية					
Teaching language		English		2	5	6	4

Objectives:

1. Identify the components of the x-ray imaging system operating console.
2. Explain the operation of the high-voltage generator.
3. Define the essential components of X-ray tube.
4. Explain the important techniques types used in radiographic imaging.
5. Determine the methods of scatter control in x-ray imaging system.

Theoretical & Practical Syllabus	
Week	**Detiales**
1	**X**-Ray machine system: • Operating console: – line compensation, – autotransformer, – KVp adjustment, – mA control – Exposure timer
2	• High voltage generators: – transformers, – voltage rectification, – phase power types, – x-ray circuits – Effect of waveform on radiation output & image quality
3	• X-ray tube: – Basic design – Line focus principle – Heel effect
4	**X**- ray tube failure: – Causes of X-ray Tube Failure – Results – Remedy
5	• Construction of film, Intensifying screens, cassette. • Processing the latent image: – Manually – Automatically

6	⧫ Filters – Types – Half-value layers – Control of scatter radiation: – Beam restrictors, – The grid (Characteristics of grid construction, grid ratio, grid frequency)
7	⧫ Grid types: – linear, crossed, focused, moving grids
8	⧫ Digital radiography: Computed Radiography (CR): – System apparatus, – mechanism of work – Image processing
9	⧫ Direct to digital radiography (DDR): • Flat Panel Detectors (DR): • Indirect conversion detector (a-Si) • Direct conversion detector (a-Se)
10	• Image quality: – Contrast – Resolution – Noise
11	– Unsharpness – Magnification – Distortion – Artefacts
12	⧫ Mammography: – Imaging system equipments, – Types of mammography systems. Film-sceen system
13	– Digital mammography (FFDM) – CEDM – Breast tomosynthesis – Computer-aided detection (CAD) – Scintimammography
14	⧫ Fluoroscopy: – Traditional imaging system apparatus & mage Intensification – Digital Fluoroscopy – Digital subtraction angiography

15	• Bone density scan (DEXA scan): – Imaging system apparatus – Mechanism • Orthopantomogram (OPG): – Types, – Mechanism

References:

1. Stewart Carlyle Bushong, ***"Radiologic Science for Technologists Physics, Biology, and Protection"*** Elsevier, Inc. , 7th edition, 2017.
2. Chris Guy & Dominic ffytche, ***"An Introduction to The Principles of Medical Imaging"*** , Imperial College Press, 2005.
3. Perry Sprawls, ***"Physical principles of medical imaging"***, 2nd Edition 1996.

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Al Rafidain University College

Department of Radiology Techniques

Subject's name	English	Radiographic techniques for upper limbs	Second Stage / First Semester	Theory	Practical	Total	Units
	Arabic	تقنيات التصوير الشعاعي للاطراف العليا					
Teaching language		English		2	5	6	4

Objectives:

1. To teach the students how to direct the patient in particular way to photograph to see diseases in the best way for upper limbs

Theoretical & Practical Syllabus	
Week	**Detiales**
1	• Terminology • Body planes, section • Lines, body position special projections
2	• Image quality - Exposure factor - Brightness - Contrast - Resolution - Distortion, noise
3	Shoulder joint, AP, lateral, supero – inferior & oblique
4	Glenohumeral joint postions
5	Acromioclavicular joints
6	Clavicle positions
7	Sternoclavicular joints
8	Scapula & coracoid process positions
9	Humerus distal and proximal fracture
10	Forearm, radius and ulna, type of fracture
11	Elbow joint, AP, lateral, oblique, shown structure
12	Hand positions, shown structures
13	Thumb & fingers positions
14	Scaphoid bone postions, shown structures

15	Wrist postions, shown structures

References:

1. Whitley, A. S., Jefferson, G., Holmes, K., Sloane, C., Anderson, C., & Hoadley, G. (2015). ***Clark's Positioning in Radiography*** 13E. crc Press.

2. Bontrager, K. L., & Lampignano, J. (2013). ***Bontrager's handbook of radiographic positioning and techniques.*** Elsevier Health Sciences.

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Al Rafidain University College

Department of Radiology Techniques

Subject's name	English	Special radiological procedures of gastrointestinal tract and bones	Second Stage / First Semester	Theory	Practical	Total	Units
	Arabic	فحوصات شعاعية خاصة للجهاز الهضمي و العظام					
Teaching language		English		2	5	6	4

Objectives:

1. To teach the students how to use the contrast media and perform the radiological examination of the gastrointestinal tract and bones

Theoretical & Practical Syllabus	
Week	**Detiales**
1	• Intravascular contrast media • Adverse effect of Intravenous (IV) water soluble contrast media on specifc organs
2	Contrast Agents in Magnetic Resonance Imaging • Mechanism of Action • Gadolinium Gastrointestinal Contrast Agents
3	Methods of imagings of Gastrointestinal tract (GIT) with barium water soluble contrase agents
4	Barium examination: swallow and meal Barium examination: follow through,small bowel anema.
5	Barium examin ation: barium enema,instant enema,air enema.
6	Reduction of intussusception
7	Computed Tomography of the Gastrointestinal Tract
8	Magnetic Resonance Imaging of the Gastrointestinal Tract
9	Imaging modalities of bones & joints.
10	Muscloskeletal MRI –general points
11	Arthrography – general points
12	Arthrography of the knee & hip
13	Arthrography of the shoulder &elbow
14	Arthrography of the wrist & ankle

15	Radionuclide bone scan

References:

1. Watson, N. & Jones, H. chapman& Nakielnys ***''Guide to Radiological procedures''*** , 7th edition, Elsevier Health Sciences, 2017.

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Department of Radiology Techniques

Subject's name	English	Radiological anatomy of head and upper limbs	Second Stage / First Semester	Theory	Practical	Total	Units
	Arabic	التشريح الشعاعي للراس و الاطراف العليا					
Teaching language		English		2	4	6	4

Objectives:

At the end of the course, the student will be able to know:

1. The general anatomy and radiological features of the cranial bones.
2. The general anatomy and radiological features of the facial bones.
3. The general anatomy and radiological features of the nasal cavity and paranasal sinuses.
4. The general anatomy and radiological features of the upper limbs.
5. The general anatomy and radiological features of the upper limbs joints.
6. The general anatomy and radiological features of the arterial blood supply of upper limbs as well as venous drainage.

Theoretical & Practical Syllabus	
Week	**Detiales**
1	Normal anatomy of the skull (cranial) bones.
2	Radiological features of the skull (cranial) bones.
3	Normal anatomy of the facial bones.
4	Radiological features of the facial bones.
5	Normal anatomy of nasal cavity & paranasal sinuses. Radiology of the nasal cavity and paranasal sinuses.
6	shoulder girdle (scapula and clavicle bones). Radiological features of the scapula and clavicle bones. Ossification centers.
7	Normal anatomy of the humerus, radiological features of the humerus. Ossification center.
8	Normal anatomy of the radius and ulna bones, radiological features of the radius and ulna bone. Ossification centers.
9	Normal anatomy of the hand, radiological features of the hand. Ossification centers.
10	Shoulder joint: components, type of joint, articulating surfaces, joint capsule, labrum, ligaments, radiological features of shoulder joint.
11	Elbow joint: components, articulating surfaces, ligaments & radiological feature of the elbow joint.

12	Wrist joint: components, articulating surfaces, ligaments & radiological features of the wrist joint.
13	Blood supply of upper limbs: Arteries of the upper limb.
14	Radiological features of the upper limb arteries.
15	Veins of the upper limb, Radiological features of the upper limb veins.

References:

1. Kelley, L. L., & Petersen, C. (2018). ***Sectional Anatomy for Imaging Professionals***. Third & fourth edition.
2. Ryan, S., McNicholas, M., & Eustace, S. (2011). ***Anatomy for diagnostic imaging.***
3. Lazo, D. L. (2015). ***Fundamentals of sectional anatomy: an imaging approach.***

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Al Rafidain University College

Department of Radiology Techniques

Subject's name	English	Fundamentals of Radio Physics	Second Stage / First Semester	Theory	Practical	Total	Units
	Arabic	اساسيات الفيزياء الشعاعية					
Teaching language		English		2	3	5	3

Objectives:

1. Explain the method of production the tube voltage.
2. Define the effect of heating & cooling the x-ray tube.
3. Explain the methods of x-ray production.
4. State the interaction processes of x-rays.
5. Define factors affecting on electron beam.
6. Determine the factors influencing x-ray output and image contrast.
7. Explain the quality assurance of exposure parameters.

Theoretical & Practical Syllabus	
Week	**Detiales**
1	• Generating the tube voltage – Exposure timing – Falling load – Filament voltage
2	• Limitation of the x-ray tube – Line focus – Rotation anode tube – Heat rating
3	• X-Ray Tube Heating and Cooling – Heat production – Heat capacity • Factors affecting the heat capacity – Focal spot area – Focal spot size – Rotating anode speed – Anode body

4	• X-Ray Production – Characteristic radiation – Bremsstrahlung radiation • Emission spectrum • Bremsstrahlung – Importance in Imaging and Dose – Influence of Electron Energy • Influence of Target Material – Influence of Filtration
5	• Characteristic Radiation – Importance in Imaging and Dose – Influence of Electron Energy – Influence of Target Material – Influence of Filtration
6	• Luminescence phenomenon – X-ray fluorescence – X - ray phosphorescence
7	• Electron tube energy • Factors affecting electron emission spectrum – mA and mAs – kVp – Voltage Waveform – Target Material – Added Filtration
8	• X-ray Emission: Factors Influencing x-ray spectra and output **X**-ray quantity – X-ray intensity – Factors affecting x-ray quantity
9	**X**-ray quality – Penetrability – Photon range – filteration – Half-Value Layer
10	• The Linear X-ray Attenuation Coefficient • Interaction X-ray with matter processes – Photoelectric Absorption – Compton process (Modified scatter) – Effect of the angle of scattering • Unmodified scatter

11	• Factors affecting image contrast – Linear attenuation coefficient of subject – Photon energy (KVp) – Soft Tissue Radiography – Calcium – Iodine and Barium Contrast Media – Scatter Radiation and Contrast
12	• Attenuation of X-ray by: – The patient – Contrast media
13	• Differential absorption – Dependence on Atomic Number – Dependence on Mass Density
14	• Quality assurance of exposure parameters – X-ray tube output factors – X-ray tube output – kilovoltage – milliampere-seconds – automatic exposure control – Filtration • Focal spot measurement
15	• Equipment tests • Speed of film processor

References:

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. W. R. Hendee and E. R. Ritenour ***"Medical Imaging Physics"***, 4th Edition, Wiley-Liss, Inc., (2002).

3. Allisy-Roberts PJ, Williams J. Farr's "***physics for medical imaging"***. Elsevier Health Sciences; 2007 Nov 14.

4. Stewart Carlyle Bushong, ***"Radiologic Science for Technologists Physics, Biology, and Protection"*** Elsevier, Inc. , 7th edition, 2017.

5. Perry Sprawls, ***"Physical principles of medical imaging"***, 2nd Edition 1996.

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Department of Radiology Techniques

Subject's name	English	Fundamentals of Radiation protection	Second Stage / First Semester	Theory	Practical	Total	Units
	Arabic	اساسيات الوقاية من الاشعاع					
Teaching language		English		2	3	5	3

Objectives:

1. Explains the basic concepts of ionizing radiation.
2. Define the Radiation Measurement Units & International SI Units.
3. List the principles of radiological protection (ALARA concept).
4. Explain the meaning of the concept of dose limits, and name the recommended dose limits for radiation workers and the public.
5. Discuss the dose management for pregnancy & obese peoples
6. Describe the types of radiation detectors and measurement.
7. Explain how to estimate the radiation dose in CT & fluoroscopy.

Theoretical & Practical Syllabus	
Week	**Detiales**
1	• Classification of ionizing radiation • Sources of ionization Radiation (background radiation) – Natural sources – Human-made (artificial) sources • Comparison of Radiation Doses
2	• Radiation Measurement Units & International SI Units – Activity – Exposure – Absorbed dose – Kerma – Equivlant dose – Effective dose – Committed Equivlant & effective dose
3	• The Principles of Radiological Protection – Justification of a practice – Optimisation of Protection (ALARA principles) ❖ Time ❖ Distance ❖ Shielding

4	– Dose limits – Maximum Permissible Occupational Doses – Maximum Permissible public Doses – Maximum Permissible patient Doses – Whole-Body Dose Limits – Dose Limits for Tissues and Organs
5	⧫ Radiation protection for classification of exposure: – Occupational – Medical – Public • Whole body non-occupational exposure • Partial-body occupational exposure
6	⧫ Occupational Radiation Exposure in: – Fluoroscopy – Mammography – Computed Tomography – Surgery
7	⧫ Patient Radiation Dose Descriptions – Entrance Skin Exposure (ESE) – Mean Marrow Dose (MMD)
8	⧫ Dose and management principles in Special cases: – X-ray and pregnancy ❖ Pregnancy patient ❖ Pregnancy technologist – X-ray and obesity ❖ Obese patient ❖ Obese technologist
9	⧫ Design of Protective Barriers in X-Ray Installations – Design of Primary Protective Barrier – Design of Secondary Protective Barrier ❖ Leakage Radiation ❖ Scattered Radiation
10	⧫ Factors That Affect Barrier Thickness

11	⧫ Radiation Detection and Measurement – Ionization gases detectors (Gas-Filled Detectors) ❖ Geiger Counters ❖ Proportional counting ❖ Ion Chambers
12	– Scintillation detectors ❖ Organic Scintillators ❖ Inorganic Scintillators – Semiconductor Detectors ⧫ Instrument Calibration
13	⧫ Personnel Dosimeters – Film Badges – Thermoluminescence Dosimeters (TLDs) – Optically stimulated luminescence (OSL) – Pocket Dosimeters – Direct Ion Storage (DIS) – Radiophotoluminescence – Electronic personal dosimeter (MOSFET dosimeters)
14	⧫ CT Dose Metrics and Calculation – CT dose index (CTDI) – dose-length product(DLP) Effective Dose – Factors affecting dose in CT
15	• Fluoroscopy dose: – To patient – To staff • methods of minimizing fluoroscopy dose

References:

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. W. R. Hendee and E. R. Ritenour ***"Medical Imaging Physics"***, 4th Edition, Wiley-Liss, Inc., (2002)
3. Allisy-Roberts PJ, Williams J. Farr's ***"physics for medical imaging".*** Elsevier Health Sciences; 2007 Nov 14.
4. Stewart Carlyle Bushong, ***"Radiologic Science for Technologists Physics, Biology, and Protection"*** Elsevier, Inc. , 7th edition, 2017.

Department of Radiological Techniques

Second Stage

Second Semester

Second Stage						
Second Semester						
#	**Subject's name**	**Theory**	**Practical**	**units**	**Level**	**Teaching language**
1	Computed tomography Equipment Techniques	2	5	4	Specialized	English
2	Radiographic techniques for lower limbs	2	5	4	Specialized	English
3	Special radiological procedures of biliary and reproductive system	2	5	4	Specialized	English
4	Radiological anatomy of lower limbs	2	4	4	Specialized	English
5	Physics of computed tomography	2	3	3	Assistant	English
		10	22	19		
Total Theory = 10 / Total Practical / Total units = 19						
Summer training 1 month (30 days) , 180 hours during summer holiday						

Ministry of Higher Education & Scientific Research

Al Rafidain University College

Department of Radiology Techniques

Subject's name	English	Computed Tomography Equipment Techniques	Second Stage / Second Semester	Theory	Practical	Total	Units
	Arabic	تقنيات احهزة التصوير المقطعي المحوسب					
Teaching language		English		2	5	7	4

Objectives:

1. List and describe the various generations of computed tomography (CT) imaging systems.
2. Relate the CT imaging system components to their functions. Discuss image reconstruction via interpolation, back projection, and iteration.
3. Explain the helical imaging & multidetector-row CT.
4. Describe CT image characteristics of image matrix.
5. Clarify the factors affects the CT image quality, as it relates to spatial resolution, contrast.
6. Determine the common CT image artefacts.
7. Identify other technical applications of CT Imaging.

Theoretical & Practical Syllabus	
Week	**Detiales**
1	• History of Computed tomography – Limitations of conventional radiography
2	• Basic principles of CT Scanners : Generations of CT – First-generation – Second-generation – Third-generation – Forth-generation – Fifth-generation CT , electron beam (EBCCT)
3	• Helical/Spiral CT Scanners: Requirements for Volume Scanning: – Slip-ring technology – Dual source
4	– Interpolation Algorithms – Pitch
5	Multislice Computed tomography (MSCT) (Multidectector-Row) CT
6	• CT system design : (SSCT & MSCT) – X-Ray imaging system (gantry) : – X-Ray Tube, X-Ray tubes in MSCT (Stration X-Ray Tube)

7	– Collimation. – Filtration – Detector : Detector Characteristics & types
8	• Control Console • Computer system : image display, recording, storage, and communication system • Patient Table or Couch
9	• Reconstruction methods: – Bakprojection reconstruction – Filtered Backprojectoin
10	– Iterative reconstruction
11	• CT image quality: – Image contrast – Spatial resolution
12	– Image noise
13	– Image artifacts: – Types and causes Common artifacts and correction techniques
14	• Position Emission Tomography / CT (PET/CT) Single-Photon Emission ?CT (SPECT/CT)
15	• Advanced technical CT application: – CT Angiography – Cardiac CT Imaging – CT fluoroscopy

References:

1. Stewart Carlyle Bushong, ***"Radiologic Science for Technologists Physics, Biology, and Protection"*** Elsevier, Inc. , 7th edition, 2017.
2. Chris Guy & Dominic ffytche, ***"An Introduction to The Principles of Medical Imaging"*** , Imperial College Press, 2005.
3. Perry Sprawls, ***"Physical principles of medical imaging"***, 2nd Edition 1996.
4. J. Hsieh, ***"Computed Tomography: Principles, Design, Artifacts, and Recent Advances"***, 2nd ed. Wiley Inter-science, Bellingham, Washington, USA, (2009)
5. Euclid Seeram, " Computed tomography : physical principles, clinical applications, and quality control" 4th edition, Elsevier Inc. 2016.

Ministry of Higher Education & Scientific Research

Al Rafidain University College

Department of Radiology Techniques

Subject's name	English	Radiographic Techniques for Lower Limbs	Second Stage / Second Semester	Theory	Practical	Total	Units
	Arabic	تقنيات التصوير الشعاعي للأطراف السفلى					
Teaching language		English		2	5	7	4

Objectives:

1. To teach the students how to direct the patient in particular way to photograph to see diseases in the best way for lower limbs

Theoretical & Practical Syllabus	
Week	**Detiales**
1	Pelvis
2	Ilum
3	Symphysis pubis
4	Sacro-Ilaiac joints
5	Acetabulum
6	Femur
7	Hip joint, AP, Lateral, frog-leg infro-superior view, shown structure
8	Tibia & fibula, AP, Lateral
9	Knee joint, AP, Lateral, skyline for patella, erect AP
10	Patella positions
11	Foot, AP, lateral, oblique, shown structure
12	Metatarsal-phalangeal sesamoid bones
13	Ankle joint, AP, lateral, oblique & AP with inversion
14	Subtalar joints
15	Calcaneum postions

References:

1. **Whitley, A. S., Jefferson, G., Holmes, K., Sloane, C., Anderson, C., & Hoadley, G. (2015). Clark's Positioning in Radiography 13E. crc Press.**
2. **Bontrager, K. L., & Lampignano, J. (2013). *Bontrager's handbook of radiographic positioning and techniques*. Elsevier Health Sciences.**

Ministry of Higher Education & Scientific Research

Al Rafidain University College

Department of Radiology Techniques

Subject's name	English	Special Radiological procedures of biliary and reproductive system	Second Stage / Second Semester	Theory	Practical	Total	Units
	Arabic	فحوصات شعاعية خاصة للجهاز الصفراوي و التناسلي					
Teaching language		English		2	5	7	4

Objectives:

1. To teach the students how to perform the radiological examination of the biliary and reproductive system.

Theoretical & Practical Syllabus	
Week	**Detiales**
1	Methods of imaging of hepatobiliary system
2	U/S of the liver, gall bladder and biliary system
3	CT for the liver biliary tree
4	MRI of the liver
5	Intraoperative & postoperative T-Tube, Cholangeography
6	Biliary drainage
7	Methods of imaging of urinary tracts Exceretion urography
8	CT urinary tract
9	MRI of the urinary tract
10	Micturating Cystourethrography
11	Ascending urethrography in the male
12	Retrograde pylouretrography
13	Percutaneous nephrostomy & nephrolithotomy
14	Methods of imagings of male & female reproductive system
15	CT & MRI of the reproductive system

References:

Watson, N. & Jones, H. chapman& Nakielnys ***''Guide to Radiological procedures''*** , 7th edition, Elsevier Health Sciences, 2017.

Ministry of Higher Education & Scientific Research

Al Rafidain University College

Department of Radiology Techniques

Subject's name	English	Radiological anatomy of lower limbs	Second Stage / Second Semester	Theory	Practical	Total	Units
	Arabic	التشريح الشعاعي للاطراف السفلى					
Teaching language		English		2	4	6	4

Objectives:

At the end of the course, the student will be able to know:

1. The general anatomy and radiological features of the lower limbs.
2. The general anatomy and radiological features of the lower limbs joints.
3. The general anatomy and radiological features of the arterial blood supply of lower limbs as well as venous drainage.

Theoretical & Practical Syllabus	
Week	**Detiales**
1	Bony pelvis (pelvic girdle) : sacrum, coccyx & hip bones.
2	Differenes between male & female pelvis, radiological features of the pelvic bones.
3	Normal anatomy of the femur, radiological features of femur bone.\ossification centers.
4	Normal anatomy of the tibia bone, radiological features of the tibia bone. Ossification centers.
5	Normal anatomy of the fibula bone, radiological features of fibula bone. Ossification center. Normal anatomy of patella, radiological features of patella & ossification center of patella.
6	Normal anatomy of the foot: components: tarsals, metafarsals & phalanges.
7	Radiological features of the Foot: tarsal, metatarsal & phalanges.
8	Hip joint: type of joint, articular surfaces, capsule & ligaments of hip joint.
9	Hip joint: Radiological features of hip joint. Dislocation of hip joint.
10	Knee joint: type of joint, articular surfaces, capsule, ligaments of knee joint.
11	Knee joint: internal structures of knee joint. Radiological features of knee joint.
12	Ankle joint: type of join, articular surfaces, capsule, ligament. Radiological features of ankle joint.
13	Blood supply of lower limbs: Arteries of the lower limb.
14	Radiological features of the lower limbs: Artiries of the lower limb.

15	Veins of the lower limb, Radiological featurews of the lower limb veins.

References:

1. Kelley, L. L., & Petersen, C. (2018). ***Sectional Anatomy for Imaging Professionals***. Third & fourth edition.
2. Ryan, S., McNicholas, M., & Eustace, S. (2011). ***Anatomy for diagnostic imaging.***
3. Lazo, D. L. (2015). ***Fundamentals of sectional anatomy: an imaging approach.***

Ministry of Higher Education & Scientific Research

Al Rafidain University College

Department of Radiology Techniques

Subject's name	English	Physics of Computed Tomography	Second Stage / Second Semester	Theory	Practical	Total	Units
	Arabic	فيزياء التصوير المقطعي المحوسب					
Teaching language		English		2	3	5	3

Objectives:

1. Describe and illustrate the basic physics of the ray projection.
2. Describe the scan-and step slice acquisition method and the general characteristics of the data sets it produces.
3. Describe the helical/spiral volume acquisition method and the general characteristics of the data set it produces.
4. Describe and illustrate the general concept of the back-projection method of image reconstruction.
5. Explain the reconstruction methods.
6. Illustrate the concept of voxels that are formed during image reconstruction.
7. Describe and illustrate the general range of CT numbers for tissue and materials in a human body.
8. Explain how windowing contributes to high contrast sensitivity.

Theoretical & Practical Syllabus	
Week	**Detiales**
1	Introduction and overview
2	• Basic Physics: - Projected Ray - Radiation attenuation - Energy Dependence
3	• CT numbers: Accuracy & uniformity - Hounsfield unit, scale
4	• CT image : Windowing - Window width and level
5	• Data Acquisition, - Basic concepts for data acquisition - Sampling
6	• Data Acquisition Geometries: Data acquisition in: - First generation Scanners - Second generation Scanners - Third generation Scanners - Forth generation Scanners
7	- Fifth generation Scanners - Spiral-Helical Geometry - Dual source CT Scanner
8	- Multislice Computed Tomography (MSCT)
9	• Data Processing: - Image reconstruction

	- Views
10	• Data Flow in a CT Scanner - Sequence of Ebents
11	• Image Display, Storage, and Communication
12	• Format the CT image, - Image matrix - Pixel - Voxel
13	• Field of View (FOV) in CT: - Display field of view (DFOV) - Scan field of view (SFOV)
14	Basic CT Physics
15	Image Axes

References:

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. W. R. Hendee and E. R. Ritenour ***"Medical Imaging Physics"***, 4th Edition, Wiley-Liss, Inc., (2002).
3. Stewart Carlyle Bushong, ***"Radiologic Science for Technologists Physics, Biology, and Protection"*** Elsevier, Inc. , 7th edition, 2017.
4. Chris Guy & Dominic ffytche, ***"An Introduction to The Principles of Medical Imaging"*** , Imperial College Press, 2005.
5. Perry Sprawls, ***"Physical principles of medical imaging"***, 2nd Edition 1996.
6. Euclid Seeram, ***" Computed tomography : physical principles, clinical applications, and quality control"*** 4th edition, Elsevier Inc. 2016.

Department of Radiology Techniques

Third Stage

Annual System

Vocabulary

Ministry of Higher Education & Scientific Research

Al Rafidain University College

Department of Radiology Techniques

Subject's name	English	Radiologic Anatomy (2)	Third Stage	Theory	Practical	Total	Units
	Arabic	التشريح الشعاعي					
Teaching language		English		2	2	4	6

Objectives:

General: The student will be able to identify the anatomical parts of the body that appear in different X-ray images and slides.

Special: At the end of the lesson, the student will be able to:

1. Describe the different structures and parts of the body that are seen in slides and X-ray images.
2. Identify the anatomical parts that appear in slides and X-ray images.

Theoretical & Practical Syllabus	
Week	**Detiales**
1	The abdomen: Anterior abdominal wall Stomach
2	Duodenum Small intestine
3	lleocaecal valve Appendix
4	Large intestine
5	Liver
6	Biliary system
7	Pancreas
8	Spleen
9	Portal venous system
10	The kidneys
11	The ureter
12	The adrenal glands
13	The abdominal aorta
14	The inferior vena cava Veins of the posterior abdominal wall
15	The peritoneal spaces of the abdomen
16	Cross-sectional anatomy of the upper abdomen
17	The pelvis: The bony pelvis, muscles and ligaments The pelvic floor
18	The sigmoid colon, rectum and anal canal Blood vessels, lymphatics and nerves of the pelvis

19	The lower urinary tract The male urethra
20	The male reproductive organs
21	The female reproductive tract
22	Cross-sectional Pelvic anatomy
23	The upper limb: The bones of upper limb
24	The joints of upper limb The muscles of upper limb
25	The arteries of upper limb The veins of upper limb
26	The lower limb: The bones of lower limb
27	The joints of lower limb The muscles of lower limb
28	The arteries of lower limb The veins of lower limbs
29	The breast: General anatomy Lobular structure Blood supply Lymphatic drainage
30	Radiology of the breast Age changes in the breast

Ministry of Higher Education & Scientific Research

Al Rafidain University College

Department of Radiology Techniques

Subject's name	English	Radiographic Techniques (2)	Third Stage	Theory	Practical	Total	Units
	Arabic	تقنيات التصوير الشعاعي (2)					
Teaching language		English		2	4	6	8

Objectives:

The aim is to teach the student the skull and spine positioning with normal and pathological finding

Theoretical & Practical Syllabus	
Week	**Detiales**
1	Lines & planes of projection of the skull
2	Skull AP , Lateral ,townes and basal view
3	Sinuses, face , and nose PA and lateral projection , shown structure
4	Paranasal sinuses, waters view & lateral view, shown structure main finding
5	Mandible PA and oblique projection, shown structure, main finding
6	Chin ventro- dorsal , TMJ view, maxillary bone
7	Main skull pathology, image interpretation of special cases
8	Cases for skull and facial bones
9 + 10	Cervical spine ,AP , lateral , AP for C1-C3 , AP view for C3- C7, shown structure
11	Cervico-thorasic region lateral waterskiing position, oblique view
12	Main cervical spine finding , image interpretation of cervical fractures
13 + 14	Cases review for cervical spine
15 + 16	Midyear exam
17	Thoracic spine , AP , Lateral, lateral decubitus , shown structure
18	Image interpretation and main pathology of the thoracic spine
19	Lumber spine , AP , Lateral ,oblique projection, shown structure
20	Main finding ,fractures , pathology, image interpretation of the lumber spine
21	Sacrum and coccyx , AP , lateral , shown structure, main finding
22 + 23	Cases review for the spinal column

24	Second terms exams
25	Abdomen , AP, PA erect , lateral view, Urinary tract KUB, shown structure
26	Pediatric imaging,
27 + 28	Mammography , main position, finding, image interpretation
29	Cases review,
30	Final exam

Ministry of Higher Education & Scientific Research

Al Rafidain University College

Department of Radiology Techniques

Subject's name	English	Radiographical Medical Equipment Technologies (2)	Third Stage	Theory	Practical	Total	Units
	Arabic	تقنيات اجهزة شعاعية (2)					
Teaching language		English		2	4	6	8

Objectives:

To introduce the student to the Radiological Devices components and how they work.

Theoretical & Practical Syllabus	
Week	**Detiales**
1	Historical introduction The Hardware
2	Magnet Types Permanent magnets
3	Resistive Magnets Superconducting magnets
4	RF Coils Volume RF Coils
5	Surface coils Quadrature Coils
6	Phased Array Coils Other Hardware
7	Acquisition Computing and Display
8	Gradient Coils Signal Coding
9	Slice Encoding Gradient Phase Encoding Gradient
10	Frequency Encoding Gradient Gradient Specifications
11	Pixel, Voxel, Matrix Slice Thickness
12	Receiver bandwidth Inter-slice gap
13	Size of the (image) matrix pixel size,
14	Field of slice thickness.

15	Matrices types: • Coarse matrices: • Fine matrices:
16	Number of acquisitions Selection of the transmit and receive coil (RF coil)
17	Field of View Number of Excitations
18	About CT Scan History of Computed Tomography Operating steps
19	Different Generations of CT Scanners First-generation CT Second-generation
20	Third-generation CT Fourth-generation CT Fifth-generation CT (Electron-beam)
21	CT image Principles of helical CT scanning operation
22	Data acquisition: Patient positioning:
23	Basic CT scanner components • Scanning unit (gantry) • X-Ray Tube, Collimation, Filtration
24	• Detector • Control Console
25	Data Acquisition System (DAS) CT Patient Table or Couch
26	Scanner Design X-ray tubes and collimators
27	Computed tomography radiation detectors First-and second-generation scanners Electron-beam computed tomography
28	Axial computed tomography scanning Helical (spiral) computed tomography
29	Multislice computed tomography Computed tomography fluoroscopy
30	Final exam

Ministry of Higher Education & Scientific Research

Al Rafidain University College

Department of Radiology Techniques

Subject's name	English	Special Rdiological Procedures (2)	Third Stage	Theory	Practical	Total	Units
	Arabic	فحوصات شعاعية خاصة (2)					
Teaching language		English		2	4	6	8

Objectives:

To teach the student how to use the staining material and perform radiological examination of the various body systems.

Theoretical & Practical Syllabus	
Week	**Detiales**
1	Methods of imaging of the heart and angiocardiography.
2	Coronary arteriography & cardiac C.T including coronary angiography.
3	Methods of imagings the arterial system &introduction to catheter techniques.
4	Femoral ,brachial &axilary punctures for catheterization .
5	General complications of catheter techniques.
6	Ascending aortoraphy and lower limb arteriography.
7	Balloon angiography .
8	Vascular emolization .
9	C.T &MRI angiography .
10	Methods of imaging the venous system &peripheral venography.
11	Central venography.
12	Portal venography.
13	Position emission tomography imaging .
14	18f-FDG PET scanning .
15	Lymph node imaging .
16	Imaging modalities of bones & joints.
17	Muscloskeletal MRI –general points .
18	Arthrography –general points .
19	Arthrography of the knee & hip .
20	Arthrography of the shoulder &elbow .
21	Arthrography of the wrist & ankle .

22	Radionuclide bone scan .
23	Method of imaging the brain .
24	C.T &MRI of the brain .
25	Cerebral &lumber myelography.
26	Methods of imaging the spine.
27	Cervical &lumber myelography.
28	Methods of imaging of the salivary glands .
29	Methods of imaging the thyroid &parathyroid glands with C.T & MRI of the thyroid and parathriod Glands.
30	Methods of imaging of the breast & mammary glands.

Ministry of Higher Education & Scientific Research

Al Rafidain University College

Department of Radiology Techniques

Subject's name	English	Pathology	Third Stage	Theory	Practical	Total	Units
	Arabic	علم الامراض					
Teaching language		English		2	2	4	6

Objectives:

To teach the student the important foundations of pathology and to teach the student the tissue changes that occur in the body's organs.

Theoretical – Syllabus	
Week	**Detiales**
1	Necrosis –cell death
2	Inflammation
3	Repair process
4	Infection
5 + 6	Body response to infection
7	Carcinogenesis
8	Radiation effect –early
9	Radiation effect – late
10	Homodynamic disorders
11	Blood disorders- WBC, RBC
12	Blood disorders -coagulation
13	Diseases of bones & joints
14	Bone fracture
15	Pathological diseases of the kidneys
16	Pathological diseases of the ureters& Urinary bladder
17	Pathological diseases of the esophagus & stomach
18	Pathological diseases of the small & large bowel
19	Pathological diseases of the liver
20	Pathological diseases of the lung & pleura
21	Pathological diseases of the upper respiratory tract
22	Pathological diseases of the brain
23	Pathological diseases of the spinal cord

24	Pathological diseases of the gall bladder & biliary tract
25	Pathological diseases of the cardiovascular system
26	Pathological diseases of the endocrine system
27	Pathological diseases of the pituitary gland & adrenals
28	Pathological diseases of the lymphatic system
29	Pathological diseases of the female reproductive system
30	Pathological diseases of the breast

Pathology – Practical Syllabus	
Week	**Detiales**
1	Slide examination of different normal cells
2	Slide examination of abnormal cells
3	Slide examination of genetic diseases
4	Slide examination of acute inflammation
5	Film about repair mechanism, discussion
6	Slide examination about connective tissues , normal & abnormal
7	Mechanism of body defense to infection
8	Film about body response to infection
9	Mechanism by which the organism overcome the body defense mechanism
10	Slide examination of hemorrhage
11	Slide examination of abnormal white blood cells
12	Some examples of irradiation effect on the tissues
13	Report discussion
14	Slide examination about irradiation effect on the tissues
15	Report discussion
16	Report discussion with slide examination of carcinogenesis
17	Report discussion
18	Slide projector about bone types
19	Report discussion
20	Types of fractures & stages of healing
21	Types of joints with report discussion
22	Slide examination about renal failure
23	Renal agenesis , renal hyperplasia, horseshoe kidney, congenital polycystic kidney
24	Film about temperature regulation with report discussion
25	Slide examination about respiratory failure

26	Slide examination about hepatic failure
27 + 28	Disturbances of endocrine function
29	Disease of thyroid gland
30	General revision

Ministry of Higher Education & Scientific Research

Al Rafidain University College

Department of Radiology Techniques

Subject's name	English	Radiation Physics (2)	Third Stage	Theory	Practical	Total	Units
	Arabic	الفيزياء الشعاعية (2)					
Teaching language		English		2	2	4	6

Objectives:

General :

On completing the year, the student will:

- Have a broad overview of MRI & US systems and basic MRI & US physics
- Acquire a basic understanding of how MR & US images are created
- Develop knowledge of MRI & US pulse sequences
- Obtain a detailed background in MRI & US physics and paradigm design

Special:

PHYSICS OF ULTRASOUND

After studying the first unit, the student will be able to:-

1. State the Physical and Medical Definition of ultrasound.
2. Explain how the operator Piezoelectric.
3. Identify the Properties of Ultrasound.
4. Briefly describe the Piezoelectric Materials
5. Explain the Piezoelectric Effect and reverse Piezoelectric Effect.

ULTRASOUND IMAGING SYSTEMS

After studying the second unit, the student will be able to:-

1. Name and describe the basic physical characteristics of an ultrasound pulse that have an effect on it's imaging properties.
2. Describe the basic function of a transducer and how it forms an ultrasound pulse.
3. Describe the general relationship between wavelength and image quality.
4. Describe the factors that determine the intensity of a reflected pulse.

ULTRASOUND TECHNIQUES

After studying the third unit, the student will be able to:-

1. State the Modes Ultrasound
2. Briefly describe the Color Flow Mapping
3. Identify the Modes Ultrasound
4. Discuss the Doppler Effect.
5. Explain the advantage and disadvantage of CW Doppler

MAGNETIC RESONANCE IMAGING

After studying the fourth unit, the student will be able to:-

1. Explain the principles of MRI
2. Understand the role of MRI for the detection and characterization of malignant liver lesions and to learn about the relevant MR imaging features
3. Explain how different tissues have different T1 relaxation times and how this affects the overall image that is created.
4. Define the meaning of TR (repetition time) and TE (echo delay time).
5. Discuss the differences between T1-weighted images, proton density-weighted images, and T2- weighted images.

<table>
<tr><th colspan="3">Detailed Sullybus</th></tr>
<tr><th>Week</th><th>Theoretical</th><th>practical</th></tr>
<tr><td>1–3</td><td>PHYSICS OF ULTRASOUND
Definition
• Physical Definition
• Medical Definition
Properties of Ultrasound
• Type of Waves Depends on the Medium
• Phase Velocity–Group Velocity
1. Phase velocity
2. Group Velocity
3. Wavelength and Speed of Propagation</td><td rowspan="2">1. Determination of the velocity of sound (sonar principle)</td></tr>
<tr><td>4 – 5</td><td>Diagnostic Ultrasound
Piezoelectric Materials
• Historical
• Piezoelectric Crystals or Materials
Piezoelectric Effect
Reverse Piezoelectric Effect
Detection of Ultrasound</td></tr>
</table>

6 – 8	**ULTRASOUND IMAGING SYSTEMS** Ultrasound Transducers • Ultrasonic Transducer Structures • Types of Ultrasound Transducers 1. Linear Transducer 2. Sector Transducer 3. Convex Transducer Amplification Scan Generator Scan Converter Image Processor Display	2. Stationary ultrasonic waves, determination of wavelength
9 – 10	Things to Consider • Thickness Range • Geometry • Temperature • Accuracy Ultrasound Modalities • Ultrasound Pulse Generator • Short Pulse • Continuous Wave Mode	

11 – 12	Ultrasound Characteristics • Frequency • Velocity • Wavelength • Amplitude Intensity and Power • Temporal Characteristics • Spatial Characteristics • Temporal/Spatial Combinations Interactions of Ultrasound with Tissue • Attenuation • Refraction • Reflection • Scattering • Absorption	3. Interference of two identical ultrasonic transmitters
13 –15	Acoustic Impedance Ultrasound Contrast Agents Spatial Resolution • Lateral resolution • Axial resolution Beam forming and transducers • Ultrasound Field Transducer Focusing • Dynamic Receive Focus • Ultrasonic Phased Arrays • Unfocused Transducers • Fixed Focus • Adjustable Transmit Focus Time Gain Compensation (TGC)	
16 – 18	**ULTRASOUND TECHNIQUES** Modes Ultrasound • A-mode • B-Mode • M-mode or TM-mode • B-scan, Two-dimensional • Three- and four-dimensional techniques • B-flow Doppler Effect Basic principles The Doppler Equation Spectral Doppler	4. Absorption of ultrasonic in air

19 – 20	Pulsed and Continuous Wave Doppler • Continuous Wave Doppler • The advantage of CW Doppler • The disadvantage of CW Doppler High PRF Color Flow Mapping Pulsed Wave Doppler Nyquist Limit HPRF Doppler Angle of Incidence Aliasing	5. Ultrasonic Doppler effect
21–23	**CHAPTER ELEVEN: MAGNETIC RESONANCE IMAGING** Historical introduction The Hardware Magnet Types • Permanent Magnets • Resistive Magnets • Superconducting Magnets RF Coils • Volume RF Coils • Surface Coils • Quadrature Coils • Phased Array Coils	6. Basic principles in nuclear magnetic resonance (NMR)
24 – 25	Other Hardware Atomic Structure Magnetization Magnetic Moments Excitation Relaxation • T1 Relaxation • T1 Relaxation Curves • T2 Relaxation Phase and Phase Coherence • T2 Relaxation Curves • T2* Relaxation	7. Magnetic moment in the magnetic field
26	Acquisition Computing and Display Gradient Coils	

27 – 28	Signal Coding • Slice Encoding Gradient • Phase Encoding Gradient • Frequency Encoding Gradient Gradient Specifications MRI Image Quality, Artifacts, and Imaging Parameters Signal to Noise and Contrast Resolution • Pixel, Voxel, Matrix • Slice Thickness • Receiver Bandwidth • Inter-slice gap • Size of the (image) matrix	8. Magnetic resonance imaging (MRI)
29 – 30	Scan parameters (TR, TE, flip angle) Number of acquisitions Selection of the transmit and receive coil (RF coil) Field of View Number of Excitations MRI Contrast Agents K-Space Filling k-Space K-Space Symmetry	

References

1. E. B. Podgorsak, "Radiation physics for medical physicists",springer-Verlag Berlin Heidelberg,Germany, (2006)
2. E. Buscarini, "Manual of diagnostic ultrasound" Vol. 1. 2nd ed., Harald Lutz, World Health Organization (2011)
3. RF Farr and PJ Allisy-Roberts “Physics for Medical Imaging”, Saunders, 4th edition (2001).
4. John E. Aldrich, "Basic physics of ultrasound imaging" Crit Care Med, Vol. 35, No. 5 (Suppl.) (2007)
5. S.C. Bushong “Radiologic Science For Technologists”, Mosby, Fifth edition (1988).
6. C. Westbrook, "MRI at a Glance", Blackwell Science Ltd, (2002)

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Al Rafidain University College

Department of Radiology Techniques

Subject's name	English	Radiation Protection	Third Stage	Theory	Practical	Total	Units
	Arabic	الوقاية من الاشعاع					
Teaching language		English		1	2	3	4

Objectives:

General :

By the end of year, the student will:

- Understand the safety considerations for patients and staff, including pregnant staff, in mobile radiography ("portables").
- Use your knowledge of radiation effects in planning for and reacting to an emergency that includes the exposure of personnel to radiation.

Special:

After studying the chapter one, the student will be able to:-

- Provide information to the public concerning radon.
- Provide clinical examples that demonstrate ALARA principles.
- Discriminate between workers in an area who are occupationally exposed and those who are treated as members of the general public.
- Discuss the factors that determine dose to a pregnant person seated next to a patient injected with a radionuclide for a diagnostic or therapeutic procedure.
- Describe the steps used in applying appropriateness criteria.

Detailed Sullybus		
Week	**Theoretical**	**practical**
1	**Review** – Structure of the Atom – Radiation Units – ALARA principles	
2,3	Diagnostic X-Ray Room Measurement of Area Radiation Levels Leakage Radiation In-room Scattered Radiation Measurement Protective Barrier/Shielding Assessment Area Radiation Level Checklist	1. Equipment used for radiodiagnosis and treatment.
4,5,6	Medical Sources: Occupational and Patient Doses Ionizing radiation interactions with tissue Radiobiological effects at the cellular and whole body level genetic and somatic effects of ionizing radiation • deterministic effects • stochastic effects • probability coefficients for tissues at risk • effective dose Threshold and non-threshold effects.	
7	Radiation protection principles • Justification • Optimization • Limitation	2-Measurement of the half-life of thorium emanation
8,9,10	Radiation protection principles applied to medical diagnostic procedures Radiation protection of patients who are or might be pregnant Practical measures for the reduction of patient dose Some dose-saving equipment Some dose-saving techniques High-risk examinations	

11,12 13	Risks from radiological examinations Explaining radiation risks to patients Personal protection and personal monitoring - how, why, when, where dose limits typical doses to staff and associated risks protection of staff and members of the public protection of patients	2. Ultrasonic Doppler effect
14	physical factors affecting radio-sensitivity 1. Linear energy transfer 2. Relative biologic effectiveness 3. Fractionation and protraction	
15,16	Biologic factors affecting Radio sensitivity 1. Oxygen effect 2. Age effect 3. Sex effect 4. Recovery 5. Chemical agents	3-Estimation of maximum energy of a β-ray stream.
17,18	Early effects of Radiation Acute radiation syndrome • Hematologic syndrome • Gastrointestinal syndrome • Central nervous system syndrome Local tissue damage • Skin • Gonads • Extremities Hematologic depression Cytogenetic damage	4-Linear and mass absorption coefficients for γ-ray.
19,20	Late effects of radiation • Leukemia • Other malignant disease Effect of fetal irradiation • Prenatal death • Neonatal death • Congenital malformation • Childhood malignancy Fetuses irradiated in utero	
21,22 23	Radiation dose-response relationships Linear dose-response relationships Non- Linear dose-response relationships Constructing a dose-response relationships Linear, quadratic dose-response relationships Radiolysis of water Direct and indirect	

24,25	Maximum permissible dose whole body non-occupational exposure Partial-body occupational exposure X-ray and pregnancy 1. The pregnant technologist 2. Management principles 3. The pregnant patient	
26	Designing for radiation protection Design of X-ray apparatus Design of protective barrier thickness	
27	Factors affecting barrier thickness Occupational Exposure	
28,29 30	Patient dose Patient dose in special examinations Reduction of occupational exposure Reduction of unnecessary patient dose Unnecessary examinations	

References

1. RF Farr and PJ Allisy-Roberts "Physics for Medical Imaging", Saunders, 4th edition (2001).
2. S.C. Bushong "Radiologic Science For Technologists", Mosby, Fifth edition (1988).
3. H. Cember "Introduction to Health Physics", Pergamon Press, Third edition (1987).

Department of Radiology Techniques

Forth Stage

Annual System

Vocabulary

Ministry of Higher Education & Scientific Research

Al Rafidain University College

Department of Radiology Techniques

Subject's name	English	Principle of Medicine & Surgery	Forth Stage	Theory	Practical	Total	Units
	Arabic	مبادئ الطب و الجراحة					
Teaching language		English		2	3	5	7

Objectives:

To make student familiar with most internal and surgical diseases, their causes, symptoms, and how to diagnose them.

Theoretical & Practical Syllabus	
Week	**Detiales**
1, 2	Headache :types & imaging of headache
3	Head injury : the role of imaging in head injury
4, 5	Cerebrovascular accident (CVA): imaging in CVA
6	Paranasal sinuses: imaging in paranasal sinuses diseases
7	The orbit: imaging in orbital diseases
8	The spine : imaging of spinal lesions
9	The neck : role of imaging in neck masses
10, 11	Bone disease: infection, tumor .
12	Bone fracture: types & imaging
13	Respiratory tract diseases: infections, chest trauma, lung masses .
14	Pulmonary embolism, pneumothorax, pleural effusion.
15	Urinary tract obstruction: causes, clinical features & imaging.
16	Urinary tact infection: imaging in UTI
17	Renal & vesical tumors : types, features, imaging.
18	Cystic diseases of kidney , congenital anomalies of urinary tract.
19	GIT: diseases of esophagus.
20	Diseases of the stomach: gastric mass, ulcer
21	Diseases of duodenum : Duodenal ulcer (DU).
22	Diseases of jejunum & ileum.
23	Diseases of colon

24	Liver : hepatitis, jaundice , cholecystitis , portal hypertension.
25	Hepatic masses: role of imaging
26	Female reproductive system: infertility, causes & role of imaging.
27	Tumors of uterus& ovaries
28	Breast masses :benign & malignant
29	Diseases of vascular system
30	Final examination

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Department of Radiology Techniques

Subject's name	English	Computed Tomoghraphy	Forth Stage	Theory	Practical	Total	Units
	Arabic	التصوير المقطعي					
Teaching language		English		2	4	6	8

Objectives:

Teach the student how to conduct joint examinations of all parts of the body and the appropriate sections for the patient's needs and the required sulfur material and how to use it.

Theoretical & Practical Syllabus	
Week	**Detiales**
1, 2	General Principles of Computerized Tomography (CT) : conventional (non-helical) CT , Spiral (Helical) CT.
3	Types of CT scanners: first, second, third, fourth generation scanners.
4	Basic terms used in CT scanning
5	Artifacts in multislice scanning
6, 7, 8	Principles of contrast medium delivery and scan timing in MDCT.
9	Cranial CT scanning : routine CT of the brain
10	Imaging of stroke
11, 12	CT of paranasal sinuses and facial skeleton
13, 14	CT of the neck
15, 16	Thoracic CT
17	High resolution CT of the lungs
18	Cardiac CT
19	CT pulmonary angiography
20, 21	CT : of the gastro-intestinal tract
22	CT colonography
23	Virtual CT colonoscopy
24, 25	CT scanning of the liver:non-enhanced CT, single phase contrast enhanced CT,dual phase & triple phase enhanced CT.
26	CT of the pancreas: CT in pancreatic tumors, CT in pancreatitis.
27	CT scan of the urinary tract: non-enhanced CT scanning in urinary tract obstruction. CT urography. CT scanning in bladder injury

28, 29	Musculoskeletal CT
30	CT of trauma patients.

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Subject's name	English	MRI	Forth Stage	Theory	Practical	Total	Units
	Arabic	فحوصات الرنين المغناطيسي					
Teaching language		English		2	4	6	8

Objectives:

Teach the student how to perform MRI examinations of all body parts and sections, the appropriate protocols for each examination, the cases that require the use of the dye and how to use it..

Theoretical & Practical Syllabus	
Week	**Detiales**
1, 2	MRI terms
3, 4	MRI Basic principles
5	Image weighting and contrast
4	Encoding and parameters
5	Pulse sequences
6	Artifacts and their components
7	Safety
9, 8	MRI of the brain
10	MRI of the pituitary gland
11, 12	MRI of the spinal cord
13	MRI of the neck
14	MRI of the abdomen
15	MRI of the liver & biliary system
16, 17	Mid-year examination
18, 19	MRI of the pancreas
20, 21	MRI of the pelvis
22	Role of MRI in obstetrics
23, 24	Second term examination
25, 26	MRI of the thorax (lung, mediastinum, heart, breast)

27, 28	MRI of the musculoskeletal system
29	MRI of the hip & knee joints
30	Final examination

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Department of Radiology Techniques

Subject's name	English	Ultrasound Imaging	Forth Stage	Theory	Practical	Total	Units
	Arabic	التصوير بالموجات فوق الصوتية					
Teaching language		English		2	4	6	8

Objectives:

Teach the student the abdominal and obstetrical ultrasonography, normal pathological finding.

Theoretical & Practical Syllabus	
Week	**Detiales**
1	Basic principle of US , terms in US, gray scale
2	Liver scan , normal pattern
3	Liver abnormality
4	GB and billiard tract , GB abnormalities
5	Peritoneal cavity and gastrointestinal tract
6	Spleen & pancreas
7	Kidneys and ureters
8	Renal pathology
9	Urinary bladder
10	Pelvic US , Uterus and ovaries non pregnant female
11	Scrotum and testis
12	Neonates US
13	Brest US
14	Ultrasound in therapy
15 , 16	Midyear exam
17	Obstetrics US , indication of US
18	Early pregnancy(first trimester US), main finding and measurement,
19	Main abnormalities in the first trimester
20	Second trimester US, normal finding and measurement
21	Abnormalities in the second trimester

22	Second trimester US, normal finding and measurement
23, 24	Second terms exams
25	Third trimester, abnormalities
26	Multiple pregnancy
27	Congenital anomalies 1st
28	Congenital anomalies 2nd
29	Placental and amniotic fluid abnormalities
30	Final exam

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Department of Radiology Techniques

Subject's name	English	Biostatistics	Forth Stage	Theory	Practical	Total	Units
	Arabic	الاحصاء الحياتي					
Teaching language		English		2	2	4	6

Objectives:

The student learns the correct methods for conducting scientific research and the statistical tools used in scientific research.

Theoretical Syllabus	
Week	**Detiales**
1	General introduction: definition of scientific research, classification of research, definition of medical and health survey, types of surveys, selection of research topics, research methods.
2, 3	Scientific research plan: its preparation, elements, parts of the research when writing, stages of the statistical method and its importance.
4 – 7	Methods of collecting, classifying and tabulating information and data, methods of displaying data (frequency tables, graphs, measures of central tendency, relative and absolute stability measures) with applied examples.
8 – 10	Introduction to probability: formulating probability, types of probability, its application in the medical and health field. with practical examples.
11 – 12	Skewness and flatness measures: Definition of skewness measures, definition of flatness measures, methods of calculating them. with practical examples.
13 – 14	Time series: its components, methods of calculating the general trend, its application in the field of medical and health research. With practical examples.
15 – 16	Estimation: Point estimation, interval estimation (confidence intervals). With practical examples
17 – 21	Significance tests: concept of tests, type I and II errors, level of significance, degrees of freedom, tests based on normal distribution, tests based on Student (1) distribution, choices based on (F) distribution, tests based on chi-square distribution. With applied examples.
22 – 24	Analysis of variance: one criterion, two variances (ANOVA). With applied examples.
25 – 26	Simple correlation coefficient, simple regression coefficient. With practical examples.
27 – 30	Vital statistics: rates and proportions of life phenomena (birth rates, death rates, fertility rates).