

THE HASHEMITE UNIVERSITY

Faculty of Allied Health Sciences
Department of Medical Imaging

Degree of Study: B.Sc in *Radiological and Medical Imaging*

Year: 2014-2015

Minumum Requirements: Completion of 136 Credit Hours Successfully

Credit Hours		
1.	University requirements	27
	a) Compulsory	12
	b) Elective	15
2.	Faculty requirements	22
	a) Compulsory	22
	b) Elective	-
3.	Department requirements	84
	a) Compulsory	71
	b) Elective	13
4.	Free elective	3
TOTAL		136

Fields of Knowledge in Medical Imaging

Course Number	1. Quality Control and Radiation Protection in Medical Imaging	Minimum number of credit hours		
		Credit hours	Theoretical	Practical
140508111	Fundamentals of Medical Imaging	3	3	-
140508212	Radiographic image Processing & Exposure	3	2	3
140508213	Principles of Radioactivity	3	2	3
140508214	Radiation Biology and Protection	3	3	-
140508315	Quality Control of Radiological Images	3	2	3
140508316	Methods in Patient Care	2	2	-

Course Number	2. Conventional Medical Imaging Applications	Minimum number of credit hours		
		Credit hours	Theoretical	Practical
140508221	Radiological Imaging Procedures (1)	3	2	3
140508322	Radiological Imaging Procedures (2)	3	2	3
140508323	Radiological Imaging Procedures (3)	3	2	3
140508324	Nuclear Medicine	3	2	3

Course Number	3. Advanced Medical Imaging Applications	Minimum number of credit hours		
		Credit hours	Theoretical	Practical
140508331	Computed Tomography (1)	3	3	-
140508332	Magnetic Resonance Imaging (1)	3	3	-
140508433	Cross Sectional Anatomy	3	2	3
140508434	Computed Tomography (2)	3	2	3
140508435	Magnetic Resonance Imaging (2)	3	2	3

Course Number	4. Analysis and Diagnosis of Medical Images	Minimum number of credit hours		
		Credit hours	Theoretical	Practical
140508341	Digital Imaging	3	2	3
140508342	Quantitative Analysis of Medical Images	3	2	3
140508443	Principles of Radiological Diagnosis	3	3	-

Course Number	5. Medical Imaging Internship	Minimum number of credit hours		
		Credit hours	Theoretical	Practical
140508351	Medical Imaging Internship (1)	4	-	12
140508452	Medical Imaging Internship (2)	6	-	18
140508453	Medical Imaging Internship (3)	6	-	18

Course Number	6. Allied Fields	Minimum number of credit hours		
		Credit hours	Theoretical	Practical
110701353	Health Services Administration	1	1	-
110701405	Ethics of Science and Technology	1	1	-
110108103	Principles of Statistics	3	3	-
140501314	Pathology	3	3	-

First: University Requirements:

(27) Twenty Seven credit hours distributed as follows:

1- Compulsory Requirements:-

(12) Twelve credit hours distributed as follows:

Course No.	Course Name	Credit Hours	Weekly Hours		Pre-requisite
			Theory	Practical	
111404117	Military Sciences	3	3	-	-
111404118	National Education	3	3	-	-
121601101	Arabic Language	3	3	-	or 111405098) or (2110099 121601099
121602101	English Language	3	3	-	or 111405099) or (2120099 121602099

2- Elective Requirements:-

(15) Fifteen credit hours the student will select the following list, and the student takes a minimum of one course from each group, and a maximum two courses from each group include the following list:

- A) Fields of the humanities.
- B) Fields of social and economic sciences.
- C) Fields of science and technology, agriculture, health.

A) Fields of the Humanities

Course No.	Course Name	Credit Hours	Weekly Hours		Pre-requisite
			Theory	Practical	
111404110	Islam & Contemporary Issues	3	3	-	-
111404111	Islamic Concepts	3	3	-	-
111404112	Jerusalem: History and Civilization	3	3	-	-
111404113	Principles of Art & Beauty in Literature	3	3	-	-
111404114	Jordan: History and Civilization	3	3	-	-
121601105	Applied Arabic Language	3	3	-	-
121602102	Applied English Language	3	3	-	-
121602103	Artistic Translation	3	3	-	-

B) Fields of Social and Economic Sciences

Course No.	Course Name	Credit Hours	Weekly Hours		Pre-requisite
			Theory	Practical	
111404101	Student & the University	3	3	-	-
111404102	Introduction to Psychology	3	3	-	-
111404103	Life Skills	3	3	-	-
111404104	Family and Child Rearing	3	3	-	-
111404115	Sociology	3	3	-	-
111404116	Heritage & Tourism	3	3	-	-
111404120	Economics & Management	3	3	-	-
111404121	Law in Our Life	3	3	-	-
111404122	Principles of sign language	3	3	-	-

C) Fields of Science and Technology, Agriculture, Health

Course No.	Course Name	Credit Hours	Weekly Hours		Pre-requisite
			Theory	Practical	
110108104	Energy & its Sources	3	3	-	-
110108113	Biotechnology in the community	3	3	-	-
110108114	Principles of Vehicle Mechanics	3	3	-	-
110108115	Computer Ethics	3	3	-	-
110108130	Health Promotion & Nutrition	3	3	-	-
110108131	Health Education & First Aids	3	3	-	-
110108132	Sports & Health	3	3	-	-
110108133	Environmental Awareness	3	3	-	-

Second: Faculty Requirements:

(22) Twenty Two compulsory credit hours distributed as follows:

Course Number	Course Name	Weekly hours		Prerequisite
		Theor.	Pract.	
140501211	Human Anatomy	3	-	140104105
140501212	Practical Human Anatomy	-	3	140501211 concurrent
0110103107	Basics of General Chemistry	3	-	-
0110103108	Basics of General Chemistry laboratory	-	3	0110103107 or Concurrent
140104105	General Biology for Medical Sciences	3	-	-
140104106	Practical General Biology for Medical Sciences	-	3	140104105 or Concurrent
140501221	Human Physiology	3	-	140501211
140501222	Practical Human Physiology	-	3	140501221 concurrent
0110102109	General Medical Physics	3	-	-
0110108116	Computer Skills	3	-	(1001103 or 1001104) or (110108099 or 1011100)

Third: Department Requirements:

(84) Eighty four credit hours as follows:

A) Compulsory Courses:

(71) Seventy One compulsory credit hours including the following courses:

Course Number	Course Name	Weekly hours		Credit hours	Prerequisite
		Theor.	Pract.		
140508111	Fundamentals of Medical Imaging	3	-	3	0110102109 Or Concurrent
140508212	Radiographic image Processing & Exposure	2	3	3	140508111 Or Concurrent
140508213	Principles of Radioactivity	2	3	3	140508111
140508214	Radiation Biology and Protection	3	-	3	140508111
140508221	Radiological Imaging Procedures (1)	2	3	3	140508212 and 140501211 Or Concurrent
140508315	Quality Control of Radiological Images	2	3	3	140508212
140508316	Methods in Patient Care	2	-	2	-
140508322	Radiological Imaging procedures (2)	2	3	3	140508221
140508324	Nuclear Medicine	2	3	3	140508213
140508341	Digital Imaging	2	3	3	140508212
140508351	Medical Imaging Internship (1)	-	12	4	140508322
140508331	Computed Tomography (1)	3	-	3	140508221
140508332	Magnetic Resonance Imaging (1)	3	-	3	140508221
140508342	Quantitative Analysis of Medical Images	2	3	3	140508341
140508323	Radiological Imaging procedures (3)	2	3	3	140508322 Or Concurrent
140508452	Medical Imaging Internship (2)	-	18	6	140508331 and 140508332 and 140508351
140508433	Cross Sectional Anatomy	2	3	3	140508331 and 140508332
140508434	Computed Tomography (2)	2	3	3	140508331
140508435	Magnetic Resonance Imaging (2)	2	3	3	140508332
140508453	Medical Imaging Internship (3)	-	18	6	140508434 and 140508435 and 140508452
140508443	Principles of Radiological Diagnosis	3	-	3	140508433
110701353	Health Services Administration	1	-	1	-
110701405	Ethics of Sciences and Technology	1	-	1	-

B) Elective Courses:

(13) Thirteen credit hours from the following courses:

Course Number	Course Name	Weekly hours		Credit hours	Prerequisite
		Theor.	Pract.		
110108103	Principles of Statistics	3	-	3	-
140501314	Pathology	3	-	3	140501221
140508371	Special Topics in Medical Imaging	3	-	3	Student must complete 60 credit hours
140508272	Radiotherapy	2	3	3	140508111
140508273	Diagnostic Ultrasound	2	3	3	140508111
140508374	Research Methods in Medical Imaging	3	-	3	Student must complete 70 credit hours
140508376	Molecular imaging	3	-	3	140508324
140508377	Seminar in Medical Imaging	1	-	1	Student must complete 70 credit hours

Fourth: Free Elective

Medical Imaging students must pass 3 credit hours of courses offered by the university.

Courses Offered by Medical Imaging Department

Course Number	Course Name	Weekly hours		Credit hours	Prerequisite
		Theor.	Pract.		
140508111	Fundamentals of Medical Imaging	3	-	3	0110102109 Or Concurrent
140508212	Radiographic image Processing & Exposure	2	3	3	140508111 Or Concurrent
140508213	Principles of Radioactivity	2	3	3	140508111
140508214	Radiation Biology and Protection	3	-	3	140508111
140508221	Radiological Imaging Procedures (1)	2	3	3	140508212 and 140501211 Or Concurrent
140508315	Quality Control of Radiological Images	2	3	3	140508212
140508316	Methods in Patient Care	2	-	2	-
140508322	Radiological Imaging procedures (2)	2	3	3	140508221
140508324	Nuclear Medicine	2	3	3	140508213
140508341	Digital Imaging	2	3	3	140508212
140508351	Medical Imaging Internship (1)	-	12	4	140508322
140508331	Computed Tomography (1)	3	-	3	140508221
140508332	Magnetic Resonance Imaging (1)	3	-	3	140508221
140508342	Quantitative Analysis of Medical Images	2	3	3	140508341
140508323	Radiological Imaging procedures (3)	2	3	3	140508322 Or Concurrent
140508452	Medical Imaging Internship (2)	-	18	6	140508331 and 140508332 and 140508351
140508433	Cross Sectional Anatomy	2	3	3	140508331 and 140508332
140508434	Computed Tomography (2)	2	3	3	140508331
140508435	Magnetic Resonance Imaging (2)	2	3	3	140508332
140508453	Medical Imaging Internship (3)	-	18	6	140508434 and 140508435 and 140508452
140508443	Principles of Radiological Diagnosis	3	-	3	140508433
140508371	Special Topics in Medical Imaging	3	-	3	Student must complete 60 credit hours
140508272	Radiotherapy	2	3	3	140508111
140508273	Diagnostic Ultrasound	2	3	3	140508111
140508374	Research Methods in Medical Imaging	3	-	3	Student must complete 70 credit hours
140508376	Molecular Imaging	3	-	3	140508324
140508377	Seminar in Medical Imaging	1	-	1	Student must complete 70 credit hours

Description of Courses Offered By Department of Medical Imaging

Course Number	Course Name	Weekly hours		Credit hours	Prerequisite
		Theor.	Pract.		
140508111	Fundamentals of Medical Imaging	3	-	3	0110102109 Or Concurrent
This course explains the basics of medical imaging and introduces the students to the various medical imaging modalities such as (X-ray machine, CT, MRI, US) and their principle of operations. Furthermore, this course explains the different types of medical radiations used in medical imaging and the mechanism of their production and interaction with the materials					
140508212	Radiographic image Processing & Exposure	2	3	3	140508111 Or Concurrent
This course is concerned with building up the knowledge of planner X-Ray Imaging. The course starts by revising some of radiation physics before it moves to explain the required tools before the X-ray beam hits the film. This includes intensifying screen, beam restrictors, and grid. Radiographic Film is the major tool for displaying the X-Ray radiographic information (which is connected to the human tissue clinical situation). Therefore, the course explains in details the structure of the radiographic film. Then, the course moved to describe how the X-Ray radiation are transformed to silver depositions (i.e. the formation of the latent image). Later, the course concentrates on how the latent image is "processed" to form the visible radiographic shades (i.e. final radiographic film). The "processing" procedures and the necessarily chemical components are explained in details. This covers both the manual and automated "processing". Then, the course explains the main characteristics of the radiographic film such as the optical density, film contrast, film gamma, and the film Latitude. These parameters are of great importance since they determine both "how to use film optimally" and "what are the required imaging factors?". The understanding of these parameters controls the quality of the resulting radiographic film.					
140508213	Principles of Radioactivity	2	3	3	140508111
This course aims to study the phenomenon of radioactivity and radioactive decay. It discusses the interactions between charged particles as well as neutrons with matter and identifies the types of radiation and particles resulting from the radioactive decay and their medical uses, and introduces students to the devices of medical imaging that uses these rays and particles such as (Gamma Camera, SPECT, PET, PET- CT). In addition, this course introduces students to the process of radiation detection and explains the different types of detectors (gaseous and scintillation). Finally, the production and medical use of radionuclides will also be explained					
140508214	Radiation Biology and Protection	3	-	3	140508111
This course covers different topics; the sources of ionizing radiation and radioactivity, the X-ray dose concept, dose limitation and dose reduction, methods of reducing exposure to patients and workers from radiation in radiographic centers, general procedures used for prevention and protection from radiation, design and layout of diagnostic radiology equipments, and the use of radiation survey monitoring for occupational exposures. In addition, this course explains the basic concepts of radiation dosimetry, radiation chemistry and effects of ionizing radiation on human body including both the genetic and somatic effects, the radiation effects at the subcellular, cellular, tissue and organs levels, the response and sensitivity of cells and tissues to radiation, theories and models for cell survival and modification of the biological effects of radiation, safety procedures when using radiation at the individual and community levels, and the proper use of radioactive materials					
140508221	Radiological Imaging Procedures (1)	2	3	3	140508212 and 140501211 Or Concurrent
Specific skills are required to perform and evaluate radiographic examinations of the chest, abdomen, upper extremities, and lower extremities with emphasis on image quality, patient care, and adaptation to a variety of client conditions					
140508315	Quality Control of Radiological Images	2	3	3	140508212
This course introduces the student to the principles of radiographic techniques which producing the best diagnostic image quality. Therefore, Quality control is the use of diagnostic tools to detect trends that will eventually cause repeated exposures to the patient, and correct them before such unnecessary exposures come about. By definition, then, QC plays a vital role in minimizing patient exposure					
140508316	Methods in Patient Care	2	-	2	-
This course develops knowledge and skills in basic concepts of patient care. Includes emergency care procedures, vital sign assessment, body mechanics, sterile techniques, intravenous equipment and administration, infection control, patient safety and transfers, communication, and patient education					
140508322	Radiological Imaging procedures (2)	2	3	3	140508221
Studies a variety of radiographic procedures of the skull, sinuses, spines, lumbosacral, sacrum, coccyx, breast mammography, and tomographic demonstration. Independent decision making regarding trauma radiography is also included					

140508324	Nuclear Medicine	2	3	3	140508213
Nuclear Medicine Imaging (NMI or NM) is a major branch of medical imaging systems. There are three main NMI devices. These are Gamma Camera (Planner NM Imaging), Single Photon Emission Computerized Tomography SPECT, Positron Emission Tomography PET. Basically, these systems are concerned of observing the distribution of a radiopharmaceutical within human. The resulting NM images give clinical information about certain functions of human organs. This matter is not achievable, or is not easily achievable by other medical imaging modalities such as CT and MRI. Recently nuclear medicine (NM) has made many major advances in both the radiopharmaceuticals and instrumentation. These advances have led to widespread of many clinical applications of NM imaging that give valuable diagnostic information. This course serves as a review of basic concepts of NM imaging instrumentation (Gamma Camera, SPECT, PET). Also, it provides explanation of the all associated issues related to radio- pharmaceuticals including the process of production, localization, uptake, clearance, and other associated aspects					
140508341	Digital Imaging	2	3	3	140508212
This course forms an introduction into the principles of computed and digital radiography and their applications in the field of medical imaging. The advantages and disadvantages of digital over screen-film radiography will also be covered in this course. Furthermore, this course provides an insight and an understanding of different digital-based imaging modalities such as; digital fluoroscopy, digital mammography, computed tomography and magnetic resonance imaging and their clinical applications. In addition, this course covers the different digital image pre-processing and post-processing techniques used to improve the interpretation of different medical images					
140508351	Medical Imaging Internship (1)	-	12	4	140508322
In this training course, the student will spend 12 hours per week at different attached hospitals and medical centers and during which the student will have the chance to practice the skills gained while studying the radiological imaging procedures (1 and 2). These include imaging the respiratory system, abdomen, pelvis, upper and lower extremities, skull, neck, sinuses, vertebral column.					
140508331	Computed Tomography (1)	3	-	3	140508221
This course introduces the students to the basic principles of computed tomography (CT), including the physics and instrumentation related to CT. CT image quality and patient dose are also covered in this course					
140508332	Magnetic Resonance Imaging (1)	3	-	3	140508221
This course covers different basic topics such as basic physics of NMR, relaxation phenomena, relaxation time measurement, basic NMR imaging theory and methods, biophysical background of tissue NMR, image contrast manipulation, basic imaging pulse sequences, spatial encoding, k-space, hardware for MRI, quality control and MR safety					
140508342	Quantitative Analysis of Medical Images	2	3	3	140508341
Quantitative imaging provides clinicians with more accurate picture of disease state by applying algorithms, that precisely measure various aspects of an abnormality in medical images to allow clinicians to extract quantitative information from images in an effort to help identify disease earlier, predict prognosis, and assess treatment efficacy as well. So, this course is planned to offer the student with the various image processing and analysis methods commonly used in medical imaging applications such as image smoothing, spatial co-registration, normalization, segmentation, and fusion. Furthermore, different quantitative analysis methods such as region of interest, volume of interest, histogram-based analysis, voxel-based morphometry will also be covered in this course					
140508323	Radiological Imaging procedures (3)	2	3	3	140508322 Or Concurrent
Radiographic procedures of the excretory system, reproductive system, and the alimentary canal. This includes patient preparation for Imaging and use of contrast media and drugs. In addition this courses explains the different angiographic procedures used to diagnose and treat patients with cardiovascular problems					
140508452	Medical Imaging Internship (2)	-	18	6	140508331 and 140508332 and 140508351
In this training course, students will spend 18 hours per week at different attached hospitals and medical centers and during which students will have the chance to practice the skills gained while studying the radiological imaging procedures (1, 2, 3), Magnetic Resonance Imaging (MRI) and Computed Tomography (CT).					
<ul style="list-style-type: none"> • Radiological Imaging Procedures (1,2,3): 2 credit hours (6 practical hours) • Computed Tomography (CT): 2 credit hours (6 practical hours) • Magnetic Resonance Imaging (MRI): 2 credit hours (6 practical hours) 					

140508433	Cross Sectional Anatomy	2	3	3	140508331 and 140508332
This course allows the student to identify different structures of human body on both computed tomography (CT) and magnetic resonance (MR) images in different planes. This course also offers the student with the opportunity to practice viewing the anatomical structures and organs in both two dimensional (2D) and three dimensional (3D) planes in relative to some internal and external landmarks					
140508434	Computed Tomography (2)	2	3	3	140508331
This course aims at introducing the students to the clinical use of computed tomography. In addition, different CT imaging protocols, factors and modifications will be covered in this course. One important aim of this course is to understand how to deal with patients before, during and after CT examination.					
140508435	Magnetic Resonance Imaging (2)	2	3	3	140508332
This course covers advanced and clinical MRI topics such as fast imaging techniques (fast gradient echo, fast spin echo, Echo planar imaging EPI, parallel imaging), tissue suppression techniques, MR artifacts, MR contrast agents, chemical shift imaging, magnetization transfer imaging, diffusion imaging, functional MRI, flow imaging, MR angiography, cardiac gated imaging, clinical imaging protocols, and in vivo NMR spectroscopy					
140508453	Medical Imaging Internship (3)	-	18	6	140508434 and 140508435 and 140508452
In this training course, students will spend 18 hours per week at different attached hospitals and medical centers and during which students will have the chance to practice the skills gained while studying the radiological imaging procedures (1, 2, 3), Magnetic Resonance Imaging (MRI) and Computed Tomography (CT). <ul style="list-style-type: none"> • Radiological Imaging Procedures (1,2,3): 2 credit hours (6 practical hours) • Computed Tomography (CT): 2 credit hours (6 practical hours) • Magnetic Resonance Imaging (MRI): 2 credit hours (6 practical hours) 					
140508443	Principles of Radiological Diagnosis	3	-	3	140508433
Understanding the basic principles of pathology is an essential part of the radiologic technologist's training. Knowing how disease processes work. Recognizing the radiographic appearance of specific disease can aid the technologist in selecting proper modalities and determining the proper imaging technique					
140508371	Special Topics in Medical Imaging	3	-	3	Student must complete 60 credit hours
Advanced study in one of the areas of Medical Imaging chosen at the beginning of the semester to expand the knowledge of students in this area of Medical Imaging and to train them to use the library as well as electronic resources properly					
140508272	Radiotherapy	2	3	3	140508111
This course introduces the student to both basic physical principles of radiation therapy and physical aspects of treatment planning using photon beams, electron beams and brachytherapy sources. For the modern clinical radiation therapy, additional information will be discussed such as Intensity Modulated Radiation Therapy and Stereotactic Radio-surgery					
140508273	Diagnostic Ultrasound	2	3	3	140508111
This course introduces the student to comprehensive coverage of the physical principles of Diagnostic Ultrasound (US) and its clinical applications, the theoretical foundations necessary for the clinical practice of US scanning and understanding of 3D anatomical images as they related					
140508374	Research Methods in Medical Imaging	3	-	3	Student must complete 70 credit hours
This course aims at introducing the Medical Imaging students into the process of research and inquiry. This includes four major steps namely; Critical Thinking, Problem Solving, Analysis and Dissemination. Furthermore, students will be introduced to the processes of work writing up and publishing, citing and referencing systems					
140508376	Molecular Imaging	3	-	3	140508324
This course provides a comprehensive overview of the key concepts in molecular imaging. The course goal is to introduce the imaging methods and concepts that are used in molecular structure and dynamics analysis. Molecular imaging differs from traditional imaging in that probes, known as biomarkers, are used to help image particular targets or pathways. This course will introduce the attendees to the fundamentals of molecular imaging: biological mechanisms and molecular probes, imaging technologies and their applications, with great focus on SPECT, PET, and MRI					
140508377	Seminar in Medical Imaging	1	-	1	Student must complete 70 credit hours
During this course, students will learn how to search for a particular topic in medical imaging and write a detailed report about it in addition to helping students preparing and presenting their work orally					