

# **Faculty of Allied Medical Sciences**

## **Department of technology of Radiographic Imaging**

### **Study Plan for the Bachelor Degree in Technology of Radiographic Imaging**

**2020 / 2019**

**Vision:**

Excellence in learning and teaching of Technology of Radiographic Imaging, Research, and Community Service

**Mission:**

Graduate specialists in Technology of Radiographic Imaging who possess international standards of scientific capabilities and clinical skills in order to meet the needs of national and regional market.

**Program Objectives:**

1. Prepare qualified graduates specialized in technology of radiographic imaging in order to meet the need of national and regional market.
2. Accomplish international accreditation standards in teaching/learning technology of radiographic imaging.
3. Continuous enhancement of faculty members performance and competencies in the specialty area of technology of radiographic imaging.
4. Promote students' self-reliant learning skills, communication, and scientific thinking.
5. Application of faculty members and students to scientific research skills, participation in scientific conferences and workshops.
6. Provision of continuing education programs, and training sessions in the specialty area of technology of radiographic imaging.
7. Provision of distinguished levels of academic activities and clinical training for the students in the program of technology of radiographic imaging.
8. Reinforce the use of medical ethics, justice, and equity principles.
9. Encourage community service through voluntary work.

**Intended Learning Outcomes (ILOs):**

١.	Knowledge of basic principles in technology of radiographic imaging.
٢.	Familiarity with health-related problems through proper assessment and development of appropriate intervention for the patient's condition
٣.	Handling health-related problems while considering the preventive aspects, and the practice of evidence-based interventions.
٤.	The application of creative thinking as a method in solving problems related to technology of radiographic imaging.
٥.	Work in a team and act responsibly in personal and professional situations
٦.	The ability to apply the rules of behavior and medical ethics in judging and using technology of radiographic imaging.
٧.	Apply general safety measures when dealing with patients in need of radiographic imaging.

### 1. Framework for Technology of Radiographic Imaging Bachelor Degree (136 Cr. Hrs.)

Classification	Credit Hours			Percentage
	Compulsory	Elective	Total	
University Requirements	12	12	24	17.6%
Faculty Requirements	21	-	21	15.4%
Program Requirements	79	9	88	64.7%
Support Courses	-	-	-	0.0%
Free Electives	3	-	3	2.20%
<b>Total</b>	<b>115</b>	<b>21</b>	<b>136</b>	<b>100%</b>

### Course Numbering:

Example: Fundamentals of Medical Imaging (12022111)

1	2	0	2	2	1	1	1
Faculty Code		Dept. Code		Course Level		Knowledge Field	Sequence

### Knowledge Areas

Number	Knowledge Field	Credit Hours
0	Basic Principles	18
1	Quality Control and Radiation Protection in Medical Imaging	17
2	Conventional Medical Imaging Applications	18
3	Advanced Medical Imaging Applications	15
4	Analysis and Diagnosis of Medical Images	12
5		
6		
7		
8	Allied topics	3
9	Clinical Training	12

## 1. University Requirements: (24 Credit Hours)

### 1.1 Compulsory University Requirements: (12 Credit Hours)

Course No.	Course Title	Cr. Hr.	Prerequisite	Corequisite
01101101	**Military Sciences	3		
01101102	English Language	3		
01101111	Arabic Language	3	01100011	
01101112	Civic Education	3	01100012	
<b>Total</b>		<b>12</b>		

### 1.2 Elective: 12 Credit Hours from the following courses.

Course No.	Course Title	Cr. Hr.	Prerequisite	Corequisite
01101103	Traffic Education	3	--	
01101104	Innovation and Entrepreneurship	3		
01101121	Life Skills	3		
01101131	Islamic Education	3		
01101132	Jerusalem and the Hashemite Custodianship	3		
01101141	Sport and Health	3		
01101142	Environment and Society	3		
01101151	Computer Skills	3		
01101152	Internet and Communication	3		
01101161	Economic Systems and Concepts	3		
01101171	Psychology and Society	3		
01101213	Communication Skills in Arabic	3	01101111	
01101214	Communication Skills in English	3	01101112	
01101243	Safety and First Aid	3		
01101281	Scientific Research Methods	3		
01101282	Introduction to Astronomy	3		
03011101	Law in our Life	3		
03021201	Human Rights	3		

## 2. Faculty Requirements: (21 Credit Hours)

### 2.1. Compulsory Faculty Requirements: 21 Credit Hours)

Course No.	Course Title	Cr. hr.	Prerequisite	Corequisite
12012115	Pathology	3	—	
12012216	Clinical Psychology	2		
12011218	Medical Ethics	1		
11021205	General Medical Physics	3		
11011281	General Biology	3		
11011282	General Biology (Laboratory)	1		11011281
12011211	Anatomy	3	11011282	
12011212	Anatomy (Laboratory)	1		12011211

11011107	General Chemistry	3	—	
11011108	General Chemistry (Laboratory)	1		11011107
<b>Total</b>		<b>21</b>		

## 2.2. Faculty Requirements Electives: (Credit Hours)

Course No.	Course Title	Cr. hr.	Prerequisite	Corequisite
	None	--	--	--

## 3. Department Requirements (88 Credit Hours)

### 3.1. Compulsory Department Requirements: (79 Credit Hours)

Course No.	Course Title	Cr. hr.	Prerequisite	Corequisite
12011213	Human Physiology	3	11011282 12011211	
12011214	Human Physiology (laboratory)	1	12011213 <sub>p</sub>	
12021111	Diagnostic Radiation Physics	3 (2+3)	11021205	
12021211	Fundamentals of Medical Imaging	3 (2+3)		
12022101	Computers in Medical Imaging	1	---	
12022102	Computers in Medical Imaging (Laboratory)	2	12022101 <sub>p</sub>	
12022112	Radiographic Film Processing & Exposure	4(3+3)	12021211 <sub>p</sub>	
12022113	Radiobiology	3	12011213	
12022213	Radiation Protection	2	12021111	
12022244	Digital radiography	3	12022112	
12022225	Nuclear Medicine Imaging (1)	3 (2+3)	12021211	
12022226	Radiological Imaging Procedures (1)	3 (2+3)	12022112 12022244 <sub>p</sub>	
12023111	Quality Control of X-Ray Radiographs	4 (2+6)	12022112 12022244 <sub>p</sub>	
12023122	Radiological Imaging Procedures (2)	3 (2+3)	12022226	
12023133	Computerized Tomography (1)	3	12022226 <sub>p</sub>	
12023124	Nuclear Medicine Imaging (2)	3 (2+3)	12022225	
12023115	Methods of Patient Care	1	---	
12023236	Computerized Tomography (2)	3 (2+3)	12023133	
12023227	Radiological Imaging Procedures (3)	3 (2+3)	12023122	
12023238	Magnetic Resonance Imaging (1)	3	12023122 <sub>p</sub>	
12024267	Health Service Management	1		
12024131	Cross Sectional Anatomy	3 (2+3)	12023133 12023238	
12024132	Magnetic Resonance Imaging (2)	3 (2+3)	12023238	
12024243	Principles of Radiological Diagnosis	3	12024131	
12024244	Quantitative Analysis of Medical images	3 (2+3)	12023133 12023238 12022225	
12024196	Medical Imaging Internship (1)	6	12023133	

			12023227	
12024297	Medical Imaging Internship (2)	6	12024196	
<b>Total</b>		<b>79</b>		

### 3.2. Department Electives: (9 Credit Hours)

Course No.	Course Title	Cr. hr.	Prerequisite	Corequisite
11031164	Statistics and Probability	3	---	---
12013161	Research Methods	3	---	---
12022221	Radiotherapy	3(2+3)	---	---
12022142	Diagnostic Ultrasound	3(2+3)	---	---
12023281	Special Topics in Medical Imaging	3	---	---
12023231	Molecular imaging	3	---	---
<b>Total</b>				

### 4. Support Courses (... Credit Hours)

Course No.	Course Title	Cr. hr.	Prerequisite	Corequisite
<b>Total</b>				

### 5. Free Electives: 3 Credit Hours

Course No.	Course Title	Cr. hr.	Prerequisite	Corequisite
	To be selected by student from the University's list of schedule classes.	3		
<b>Total</b>				

## 6. Study Plan Guide for the Bachelor Degree in Technology of Radiographic Imaging

First Year				
First Term				
Course No.	Course Title	Cr. hrs.	Prerequisite	Corequisite
01101112	English Language	3	01100012	
01101111	Arabic Language	3	01100011	
11011281	General Biology	3		
11011282	General Biology Laboratory	3	11011281	
11011107	General Chemistry	3		
11011108	General chemistry Laboratory	1	11011107	
	University Elective Course	3		
<b>Total</b>		<b>17</b>		

Second Term				
Course No.	Course Title	Cr. hrs.	Prerequisite	Corequisite
12011211	Anatomy	3		
12011212	Anatomy Laboratory	1		12011211
12011213	Human Physiology	3	11011282 12011211	<b>12011211</b>
12011214	General Physiology Laboratory	1		12011213
11021205	General Medical Physics	3		
01101101	Military Sciences	3		
12021211	Fundamentals of Medical Imaging	3		
<b>Total</b>		<b>17</b>		

Second Year				
First Term				
Course No.	Course Title	Cr. hrs.	Prerequisite	Corequisite
12021111	Radiation Physics	3	11021205	
01101102	Civic Education	3	12021111	
12022112	Radiographic Film Processing & Exposure	4	12021211	
12022113	Radiobiology	3	12011213	
12022114	Radiation protection	2	12021111	
	University Elective Course	3		
<b>Total</b>		<b>18</b>		

Second Term				
Course No.	Course Title	Cr. hrs.	Prerequisite	Corequisite
12022101	Computers in Medical Imaging	1		
12022102	Computers in Medical Imaging Laboratory	2	12022201	
12022243	Digital Radiography	3	12022112	
12022225	Nuclear Medicine Imaging (1)	3	12021211	
12022226	Radiological Imaging Procedures (1)	3		
	Department Elective Course	3		

University Elective Course	3		
<b>Total</b>	<b>18</b>		

Third Year				
First Term				
Course No.	Course Title	Cr. hrs.	Prerequisite	Corequisite
12023111	Quality Control of X-Ray Radiographs	4	12022112	
12023122	Radiological Imaging Procedures (2)	3	12022226	
12023133	Computerized Tomography (1)	3	12022226	
12023124	Nuclear Medicine Imaging (2)	3	12022235	
12023115	Methods of Patient Care	1	---	
12012115	Pathology	3	---	
12011218	Medical Ethics	1		
	<b>Total</b>	<b>18</b>		

Second Term				
Course No.	Course Title	Cr. hrs.	Prerequisite	Corequisite
12023236	Computerized Tomography (2)	3	12023133	
12023227	Radiological Imaging Procedures (3)	3	12023122	
12023238	Magnetic Resonance Imaging (1)	3	12023122	
12024267	Health Service Management	1		
12012216	Clinical Psychology	2		12012216
	Department Elective Course	3		
	University Elective Course	3		
	<b>Total</b>	<b>18</b>		

Fourth Year				
First Term				
Course No.	Course Title	Cr. hrs.	Prerequisite	Corequisite
12024131	Cross Sectional Anatomy	3	12023133 12023238	
12024132	Magnetic Resonance Imaging (2)	3	12023238	
12024196	Medical Imaging Internship (1)	6	12023133 <b>12023227</b>	
	Department Elective Course	3		
	<b>Total</b>	<b>15</b>		

Second Term				
Course No.	Course Title	Cr. hrs.	Prerequisite	Corequisite
12024243	Principles of Radiological Diagnosis	3	12024131	
12024244	Quantitative Analysis of Medical images	3	12023133 12023238 12022225	
12024297	Medical Imaging Internship (2)	6	12024196	
	Free Course	3		
<b>Total</b>		<b>15</b>		

**Description of Courses offered by the  
Department of Technology of Radiographic Imaging**

**Course Number                      Course Name (Prerequisite: -)                      (.....) Cr. Hrs**

Course Number	Course Name (prerequisite)	Credit hours
<b>1202111</b>	<b>Diagnostic Radiation Physics (11021205)</b>	
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		
<b>1202121</b>	<b>Fundamentals of Medical Imaging</b>	
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		
<b>1202212</b>	<b>Radiographic Film Processing &amp; Exposure (12021211)</b>	
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.		
<b>1202213</b>	<b>Radiobiology (1202111)</b>	
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		
<b>1202213</b>	<b>Radiation Protection (1202111)</b>	
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 equipment, and the use of radiation survey monitoring for occupational exposures.		
<b>1202244</b>	<b>Digital radiography (1202112)</b>	
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		

<b>12022226</b>	<b>Radiological Imaging Procedures (1)</b>	<b>(12022112+12022244)</b>
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		
<b>12023111</b>	<b>Quality Control of X-Ray Radiographs</b>	<b>(12022112+12022244)</b>
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		
<b>12023115</b>	<b>Methods of Patient Care</b>	
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		
<b>12023122</b>	<b>Radiological Imaging procedures (2)</b>	<b>(12022226)</b>
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		
<b>12022225</b>	<b>Nuclear Medicine Imaging (1)</b>	<b>(120121211)</b>
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 radiopharmaceuticals including the process of production, localization, uptake, clearance, and other associated aspects.		
<b>12023133</b>	<b>Computed Tomography (1)</b>	<b>(12022226<sup>a</sup>)</b>
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.		
<b>12023238</b>	<b>Magnetic Resonance Imaging (1)</b>	<b><u>12023122<sup>a</sup></u></b>
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		
<b>12023124</b>	<b>Nuclear Medicine Imaging (2)</b>	<b>(12022225)</b>
This course further explain the combination of nuclear medicine imaging methods (PET and SPECT) integrated with CT and MRI (PET/CT, SPECT/CT, and PET/MRI) to become a single Imaging scanner (i.e. Multi-modality imaging). Instrumentation, advantages, and main clinical applications are introduced.		
<b>12023227</b>	<b>Radiological Imaging procedures (3)</b>	<b>(12023122)</b>
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		
<b>12023236</b>	<b>Computed Tomography (2)</b>	<b>(12023133)</b>
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.		
<b>12024132</b>	<b>Magnetic Resonance Imaging (2)</b>	<b>(12023238)</b>
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		

<b>12024131</b>	<b>Cross Sectional Anatomy (12023133+12023238)</b>	
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		
<b>12024243</b>	<b>Principles of Radiological Diagnosis (12024131)</b>	
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		
<b>12024244</b>	<b>Quantitative Analysis of Medical Images (12023133+12023238+1202225)</b>	
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.		
<b>12024196</b>	<b>Medical Imaging Internship (1) (12023133 + 12023227)</b>	
In this training course, the student will spend 18 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.		
<b>12024297</b>	<b>Medical Imaging Internship (2) (12024196)</b>	
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 (3), Magnetic Resonance Imaging (MRI) and Computed Tomography (CT).		
<b>12023281</b>	<b>Special Topics in Medical Imaging</b>	
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		
<b>12022221</b>	<b>Radiotherapy</b>	
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		
<b>12022142</b>	<b>Diagnostic Ultrasound</b>	
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		
<b>12013161</b>	<b>Research Methods</b>	
This course is an introduction to the research methods in physiotherapy profession. Topics covered include: research design, hypothesis, Identify research problems and sampling procedures, literature review, and writing skills.		
<b>12023231</b>	<b>Molecular Imaging</b>	
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		
<b>11031164</b>	<b>Statistics</b>	

Introduction to statistics, populations and samples, frequency distributions; measures of centrality, dispersion, skewness and kurtosis; correlation & regression; principles of probability, laws of addition and multiplication, total probability rule, Bayes rule, random variables, discrete and continuous probability distributions, binomial distribution, poisson distribution.

12022101

### Computers in Medical Imaging

This course revise the basic hardware of computers. It explains common operating systems, then it moves to introduce application of computers in medicine. The course also rehearse students how to use common softwares such as Microsoft Excell, Image platforms (e.g. ImageJ), and famous statistical packages.