

# مشروع الدليل الإرشادي لطلاب الدراسات العليا بجامعة حائل

## مقدمة

تشهد المملكة العربية السعودية بصفة عامة تطوراً مضطرباً في مناحي الحياة، ويشهد الحقل الصحي خصوصاً طفرة كمية ونوعية في تقديم الخدمات الصحية العامة والمتخصصة في القطاعين الحكومي والخاص، وفي المؤسسات التي تقدم الرعاية الطبية بكافة مستوياتها مما جعل الجامعات في كلياتها الطبية والصحية في نمو متسارع كماً وكيفاً.

وقد كان لزاماً أن يواكب هذا التوسع الخدمي النوعي توسعاً متخصصاً يتمثل في إنشاء برامج تلبي حاجة المؤسسات الخدمية في تقديم مستويات مختلفة من الرعاية الطبية حسب ما يحتاجه المجتمع، بالتزامن مع وجود رعاية صحية نامية، متطورة ومتخصصة. ظهرت الحاجة إلى إطلاق برنامج التحول الوطني كأحد البرامج التنفيذية لرؤية ٢٠٣٠. ويتضمن برنامج التحول الوطني ثمانية أبعاد في غاية الأهمية ويأتي في مقدمتها الارتقاء بالرعاية الصحية والذي بدوره يحتوي على عدة مبادرات أهمها المشروع الوطني لتخطيط وتطوير برامج الدراسات العليا الصحية، وتهدف هذه المبادرة إلى وضع برامج لتخطيط وتطوير العملية التدريبية بما يزيد أعداد المقاعد التدريبية ويحسن جودة مخرجات التدريب للمساهمة في تأهيل الكوادر الصحية المتخصصة في مجال الرعاية الطبية في المملكة العربية السعودية.

من أجل ذلك فإن البرامج التعليمية المتطورة على مستوى الماجستير لا بد أن تلبي رؤية المملكة العربية السعودية خصوصاً من منظور رؤية ٢٠٣٠ الطموحة والتي تشمل تلبية حاجة المجتمع في تقديم خدمة متميزة، وبناء قدرات وكفاءات قادرة على مواكبة التطور الدائم في تقديم الخدمات والرعاية الطبية.

لذلك يقدم برنامج ماجستير الأشعة التشخيصية بجامعة حائل زيادةً كبيرة في علم الأشعة التشخيصية وفي مجالات عرفت بالتطور المضطرب في العالم المتطور وهي الأشعة التشخيصية العادية والأشعة المقطعية وأشعة الرنين المغناطيسي والموجات فوق الصوتية والحماية الإشعاعية والذكاء الاصطناعي بمجال الأشعة الطبية وذلك على مستوى أعلى وبدرجة كبيرة مما اكتسبه الدارس على درجة البكالوريوس، ثم تضاف إلى خبرة الطالب العملية السابقة خبرةً إضافية تخصصية متقدمة، وإيضاً زيادة في قدراته على إجراء البحوث الميدانية مما يجعل الخريج ذو إسهام متخصص ومتميز ومرغوب فيه من كافة القطاعات الطبية.

## الرؤية

يقود هذا البرنامج إلى تدعيم رؤية القسم والكلية والجامعة في الريادة في مجال تخصصات الأشعة الطبية المختلفة على المستوى المحلي والإقليمي والعالمي.

## الرسالة

يسهم هذا البرنامج في تطوير الرعاية والخدمات الطبية المقدمة للمجتمع من خلال تخريج دارسين ذوي قدرات مهنية تنافسية عالية في مجال علوم الأشعة المختلفة والتصوير الطبي وذلك بتقديم بيئة مشجعة للتعليم والإبداع وتطوير القدرات البحثية لبناء مجتمع علمي متطور.

## الأهداف

يهدف برنامج ماجستير الأشعة التشخيصية الى:

- ١- تقديم مادة علمية في مجالات التخصصات المذكورة وبناء القدرات المتميزة في كل مجالات التخصص الاشعة التشخيصية العادية والاشعة المقطعية وأشعة الرنين المغناطيسي والموجات الصوتية
- ٢- إعداد خريجين بكفاءة عالية في مجالات الاشعة التشخيصية للإسهام لمواكبة متطلبات التقدم ولتطوير في مجالات تخصصهم المختلفة في اقسام الاشعة الطبية بالمستشفيات الحكومية والخاصة والمرافق الطبية.
- ٣- إعداد خريجين متميزين في مجال البحث العلمي في مجال الاشعة التشخيصية.
- ٤- إكتساب مهارات متقدمة في مجالات الاشعة التشخيصية ومن اهمها أشعة الرنين المغناطيسي والاشعة المقطعية واشعة الموجات فوق الصوتية والحماية الاشعاعية والذكاء الاصطناعي.
- ٥- تكوين قاعدة مستهدفة في المستقبل للإلتحاق ببرامج الدكتوراة في قسم الاشعة التشخيصية.

## مكونات الخطة الدراسية (أطروحة)

النسبة المئوية	الساعات المعتمدة	عدد المقررات	مكونات الخطة الدراسية	
41%	18	7	إجباري	المقررات الدراسية
21%	9	3	اختياري	
0	0	0	مشروع التخرج (إن وجد)	
19%	8	1	الرسالة العلمية(إن وجدت)	
19%	8	2	التدريب الميداني (إن وجد)	
			أخرى ( ..... )	
100%	43	13	الإجمالي	

## ١. مكونات الخطة الدراسية (بدون أطروحة)

النسبة المئوية	الساعات المعتمدة	عدد المقررات	مكونات الخطة الدراسية	
43%	18	7	إجباري	المقررات الدراسية
21%	9	3	اختياري	
7%	3	1	مشروع التخرج (إن وجد)	
		0	الرسالة العلمية(إن وجدت)	
29%	12	3	التدريب الميداني (إن وجد)	
			أخرى ( ..... )	
100%	42	14	الإجمالي	

## A. Thesis option

### First Year

#### First Level

##### Compulsory courses

#	Course Code	Name	Th.	Pr.	Total	Pre-requisite
1	MDR511	Sectional & Radiographic Anatomy التشريح المقطعي والاشعاعي	2	1	3	
2	MDR513	Physical Principles of Diagnostic Radiology I المبادئ الفيزيائية في الأشعة التشخيصية (١)	2	0	2	
3	MDR...	Elective Course (1) مادة اختيارية (١)	2	1	3	
Total			8			

##### Elective courses

#	Course Code	Name	Th.	Pr.	Total	
1	MDR514	Advance MRI Physics & Instrumentation فيزياء واجهزة التصوير بالرنين المغناطيسي المتقدمة	2	1	3	
2	MDR515	Advance CT Physics & Instrumentation فيزياء واجهزة التصوير بالأشعة المقطعية المتقدمة	2	1	3	
3	MDR516	Advance US Physics & Instrumentation فيزياء واجهزة التصوير بالموجات فوق الصوتية المتقدمة	2	1	3	

#### Second Level

##### Compulsory courses

#	Course Code	Name	Th.	Pr.	Total	Pre-requisite
1	MDR512	Pathophysiology علم الامراض ووظائف الاعضاء	4	0	4	
2	MDR522	Physical Principles of Diagnostic Radiology II المبادئ الفيزيائية في الأشعة التشخيصية (٢)	2	0	2	MDR513
3	MDR...	Elective Course (2) مادة اختيارية (٢)	2	1	3	
Total			9			

##### Elective courses

#	Course Code	Name	Th.	Pr.	Total	
1	MDR524	Advance MRI procedures تقنيات التصوير المتقدمة للرنين المغناطيسي	2	1	3	MDR514
2	MDR525	Advance CT procedures تقنيات التصوير المتقدمة للأشعة المقطعية	2	1	3	MDR515
3	MDR526	Advance US Procedures تقنيات التصوير المتقدمة للموجات فوق الصوتية	2	1	3	MDR516

### Third Level

#### Compulsory courses

#	Course Code	Name	Th.	Pr.	Total	Pre-requisite
1	MDR521	Total Quality Management and Safety in Radiology إدارة الجودة والسلامة في الأشعة الطبية	2	1	3	
2	MDR523	Advance techniques & Clinical practice I التقنيات المتقدمة والتدريب السريري	1	3	4	
Total			7			

## Second Year

### Forth Level

#	Course Code	Name	Th.	Pr.	Total	Pre-requisite
1	MDR531	MRI and Molecular Imaging أشعة الرنين المغناطيسي والتصوير الجزيئي	2	0	2	
2	MDR533	Advance techniques & Clinical practice II التقنيات المتقدمة والتدريب السريري (٢)	1	3	4	MDR523
3	MDR...	Elective Course (3) مادة اختيارية (٣)	2	1	3	
Total			9			
Elective courses						
#	Course Code	Name	Th.	Pr.	Total	
1	MDR534	New trends In MRI التقنيات الحديثة في التصوير بالرنين المغناطيسي	2	1	3	MDR524

### Sixth Level

2	MDR535	New trends In CT التقنيات الحديثة في التصوير بالأشعة المقطعية	2	1	3	MDR525
3	MDR536	New trends In US التقنيات الحديثة في التصوير بالموجات الصوتية	2	1	3	MDR526
4	MDR537	Artificial intelligence in Radiology الذكاء الاصطناعي في الأشعة	3	0	3	

### Fifth Level

#### Compulsory courses

#	Course Code	Name	Th.	Pr.	Total	Pre-requisite
1	MDR532	Research Methodology & Biostatistics طرق البحث العلمي والاحصاء الحيوي	2	0	2	
2	MDR600	Thesis (1) رسالة الماجستير	4	0	4	
Total			6			

#	Course Code	Name	Th.	Pr.	Total	Pre-requisite
1	MDR601	Thesis (2) رسالة الماجستير	4	0	4	
Total			4			
Total Program Hours			43			

## B. Non-thesis option

### First Year

#### First Level

##### Compulsory courses

#	Course Code	Name	Th.	Pr.	Total	Pre-requisite
1	MDR511	Sectional & Radiographic Anatomy التشريح المقطعي والاشعاعي	2	1	3	
2	MDR513	Physical Principles of Diagnostic Radiology I المبادئ الفيزيائية في الأشعة التشخيصية (١)	2	0	2	
3	MDR...	Elective Course (1) مادة اختيارية (١)	2	1	3	
Total			8			

##### Elective courses

#	Course Code	Name	Th.	Pr.	Total	
1	MDR514	Advance MRI Physics & Instrumentation فيزياء واجهزة التصوير بالرنين المغناطيسي المتقدمة	2	1	3	
2	MDR515	Advance CT Physics & Instrumentation فيزياء واجهزة التصوير بالأشعة المقطعية المتقدمة	2	1	3	
3	MDR516	Advance US Physics & Instrumentation فيزياء واجهزة التصوير بالموجات فوق الصوتية المتقدمة	2	1	3	

#### Second Level

##### Compulsory courses

#	Course Code	Name	Th.	Pr.	Total	Pre-requisite
1	MDR512	Pathophysiology علم الأمراض ووظائف الأعضاء	4	0	4	
2	MDR522	Physical Principles of Diagnostic Radiology II المبادئ الفيزيائية في الأشعة التشخيصية (٢)	2	0	2	MDR513
3	MDR...	Elective Course (2) مادة اختيارية (٢)	2	1	3	
Total			9			

##### Elective courses

#	Course Code	Name	Th.	Pr.	Total	
1	MDR524	Advance MRI procedures تقنيات التصوير المتقدمة للرنين المغناطيسي	2	1	3	MDR514
2	MDR525	Advance CT procedures تقنيات التصوير المتقدمة للأشعة المقطعية	2	1	3	MDR515
3	MDR526	Advance US Procedures تقنيات التصوير المتقدمة للموجات فوق الصوتية	2	1	3	MDR516

### Third Level

#### Compulsory courses

#	Course Code	Name	Th.	Pr.	Total	Pre-requisite
1	MDR521	Total Quality Management and Safety in Radiology إدارة الجودة والسلامة في الأشعة الطبية	2	1	3	
2	MDR523	Advance techniques & Clinical practice I التقنيات المتقدمة والتدريب السريري	1	3	4	
Total			7			

## Second Year

### Forth Level

#	Course Code	Name	Th.	Pr.	Total	Pre-requisite
1	MDR531	MRI and Molecular Imaging أشعة الرنين المغناطيسي والتصوير الجزيئي	2	0	2	
2	MDR533	Advance techniques & Clinical practice II التقنيات المتقدمة والتدريب السريري (٢)	1	3	4	MDR523
3	MDR...	Elective Course (3) مادة اختيارية (٣)	2	1	3	
Total			9			
Elective courses						
#	Course Code	Name	Th.	Pr.	Total	
1	MDR534	New trends In MRI التقنيات الحديثة في التصوير بالرنين المغناطيسي	2	1	3	MDR524
2	MDR535	New trends In CT التقنيات الحديثة في التصوير بالأشعة المقطعية	2	1	3	MDR525

**Sixth Level**

3	MDR536	New trends In US التقنيات الحديثة في التصوير بالموجات الصوتية	2	1	3	MDR526
4	MDR537	Artificial intelligence in Radiology الذكاء الاصطناعي في الأشعة	3	0	3	

**Fifth Level****Compulsory courses**

#	Course Code	Name	Th.	Pr.	Total	Pre-requisite
1	MDR532	Research Methodology & Biostatistics طرق البحث العلمي والاحصاء الحيوي	2	0	2	
2	MDR541	Clinical practice III التدريب السريري (٣)	0	4	4	MDR٥33
Total			6			

#	Course Code	Name	Th.	Pr.	Total	Pre-requisite
1	MDR542	Research project مشروع التخرج	3	0	3	MDR532
Total			3			
Total Program Hours			42			



**Courses No: MDR511**

**Credits: 3**

**Title: Sectional & Radiographic Anatomy**

This course begins with a review of gross anatomy. It is designed to build the knowledge of sectional anatomy of human body regions from a three dimensional perspective. During this course student will learn the identification of gross anatomical structures in axial (transverse), sagittal, coronal and orthogonal (oblique) planes and the clinical application of this knowledge to imaging modalities of Computed Tomography images, Magnetic Resonance images. Also characteristic appearance of each anatomical structure on post contrast images of CT and different sequences of MR images will be stressed.

The student should be able to:

1. Identify anatomical structures of human body regions on CT, MR.
2. Describe the characteristic appearance of different anatomical structures on plain and post contrast images of CT and on different sequences of MR images.

**Courses No: MDR513**

**Credits: 2**

**Title: Physical Principles of Diagnostic Radiology I**

The objective of this course is to provide students with an overview of the computational and mathematical methods in medical image processing. The course covers the main sources of medical imaging data (CT, MRI, and ultrasound). Students will study many of the current methods used to enhance and extract useful information from medical images. A variety of radiological diagnostic scenarios will be used as examples to motivate the methods.

Students interested in medical imaging, as well as health and medicine, will find this course useful. The course has some crossover with other fields of image and signal processing, and students interested in remote sensing and computer graphics might find this course helpful.

**Courses No: MDR514**

**Credits: 3**

**Title: Advance MRI Physics & Instrumentation**

The course introduces the students with greater emphasis on those concepts and theories pertinent to radiology such as the structure and function of the devices incorporated in MRI. Also it introduces the student to the theory of MRI and types of magnets and its utilization in diagnostic radiography it consists of a review of the various forms of imaging procedures.

Also it will include an explanation of the difference between conventional radiography and MRI scan.

**Courses No: MDR515**

**Credits: 3**

**Title: Advance CT Physics & Instrumentation**

The course introduces the students with greater emphasis on those concepts and theories pertinent to radiology such as the structure and function of the devices incorporated in CT scan, the types and function of CT tubes, detectors, gantry and its components.

Also it introduces the student to the theory of beam collimation and types of detectors and its utilization in diagnostic radiography it consists of a review of the various forms of imaging procedures.

Also it will include an explanation of the difference between conventional radiography and CT scan.

**Courses No: MDR516**

**Credits: 3**

**Title: Advance US Physics & Instrumentation**

This course introduces the student to the Advance ultrasound physics; sound wave, sound propagation media, frequency, wavelength, amplitude, velocity, pulse of ultrasound and echo. Interaction of ultrasound with tissues; attenuation, absorption, refraction, scatter, reflection. Characteristics of ultrasound beam; beam width, focusing, beam intensity, attenuation, Doppler Effect, pulse duration, pulse repetition period, pulse repetition frequency, harmonic ultrasound. Physical principles of ultrasound imaging. Pulsed and continuous ultrasound. Advance Ultrasound equipment, ultrasound transducer construction, ultrasound generation, receiving echo, signal and image processing by processor, image display on monitor, Scanning modes A-mode, B-mode, M-mode, real time. Control panel. Biologic effects. Quality control of ultrasound equipment.

**Title: Pathophysiology**

- Introduction: The subject “pathophysiology” implies that the process of pathology is taking a physiological pathway to make the morbidity and usually we consider the understanding of how diseases occur and get into the different modes of acute, subacute, and chronic is important for radiology students. All of these stages might have different radiological appearances that can lead to discriminative diagnosis of the same disease or give a pattern for differential diagnosis.
- Radiology is concerned with the disease of the whole body systems been demonstrated by the different radiology modalities using the most suitable modality to demonstrate the disease with the least possible risk factors. The effect of the diseases of the physiology of the organs of the system is monitor to decide the stage and effect of the diseases on physiology of that organ or system. The organs and systems involve in this course include introduction of terms met throughout the course. This is started with skeletal diseases, congenital physiological dysplasia and inherited malformations, goes into inflammatory process, environmental, endocrinal, traumatic process and healing, tumors including the maps and sides of expected secondary's in the skeleton.
- In the respiratory system the diseases effect on respiratory process physiology like exchange of  $O_2$  and  $CO_2$  is studied and monitor by CT or NM or MRI in which the fibrosis of the lung tissue and impairment of gas exchanges are studied as well as monitoring of the vascular follow in and out the of the pulmonary vasculature.
- The space occupying lesions diseases making effect in the volume of the lungs or collapse of the part or total lung will lead to physiological changes as well which could be studied by any of the above monitor.
- The GIT, hepatobiliary, urinary tract, CNS and hemopoiosis physiological changes due to effect of diseases have multiple methods of imaging modalities, studying, and follow ups.

**Courses No: MDR522**

**Credits: 2**

**Title: Physical Principles of Diagnostic Radiology II**

This course covers the basic to more advanced principles, algorithms and techniques that are commonly used in medical image processing. The student will learn how to analyze concrete medical questions that arise from medical images, and that can be solved by mathematical analysis of MRI, US and CT images. It helps students to get more knowledge about computer-aided imaging diagnosis systems. Examples of such systems are those that automatically detect tumors in CT and MRI scans, that automatically detect micro-aneurysms in retinal images, or that estimate the prognosis of breast-cancer patients based on imaging features that cannot be picked up by the human eye. Image analysis methods on medical imaging modalities (MRI, CT, and ultrasound) will be covered.

Upon completion of the course the student is able to

- select the most appropriate technique for medical image processing and image analysis
- evaluate image processing and analysis techniques using standardized methodology
- implement solutions for new medical imaging problems
- Know the benefits and pitfalls of computer-aided diagnosis processing systems

**Courses No: MDR524**

**Credits: 3**

**Title: Advance MRI procedures**

The course content begins with thorough coverage of advance protocol for MRI examinations that include patient history and assessment, indications for procedure, patient education, scan preparation, preferred orientation and positioning, contrast media use, selectable scan parameters, post processing images, filming and archiving of image.

The imaging technique for each organ/ region to match the criteria for diagnostic image and modification of technique in clinical condition that affects image quality.

Evaluation of image for any artifact, quality, anatomy and pathology.

Assignment to MRI facility to provide student with opportunity to observe, assist and perform MRI procedures under supervision and guidance of qualified MRI specialist.

The course includes body and vascular MRI scan procedures (Angiography) for neuroimaging, cardiac, virtual colonoscopy and bronchoscopy and MRI guide biopsy.

This course will also prepare students to describe protocol for advance MRI scan procedures and its applications.

**Courses No: MDR525**

**Credits: 3**

**Title: Advance CT procedures**

The course content begins with thorough coverage of advance protocol for CT examinations that include patient history and assessment, indications for procedure, patient education, scan preparation, preferred orientation and positioning, contrast media use, selectable scan parameters, post-processing images, filming and archiving of image.

The imaging technique for each organ/ region to match the criteria for diagnostic image and modification of technique in clinical condition that affects image quality.

Evaluation of image for any artifact, quality, anatomy and pathology.

Assignment to CT facility to provide student with opportunity to observe, assist and perform CT procedures under supervision and guidance of qualified CT specialist.

The course includes body and vascular CT scan procedures (Angiography) for neuroimaging, cardiac, virtual colonoscopy and bronchoscopy and CT guide biopsy.

**This course will prepare students to:**

1. Describe protocol for advance CT scan procedures and its applications.
2. Identify CT guided procedures for body organs
3. Perform CT scanning to produce high quality images.

**Courses No: MDR526**

**Credits: 3**

**Title: Advance Ultrasound Procedures**

The course content includes advance sonographic procedures and imaging techniques including medical terms used in, sonographer ethics, and limitations of ultrasound examination. Cross-sectional sonographic anatomy of abdominal structures, Small parts, Female pelvis, Fetal appearance, and neonatal brain. This course also provides student to know about the new trends on imaging techniques and updated clinically emerging method that offers additional tissue contrast.

**This course will prepare students to:**

1. Understand medical terms and abbreviations used in sonography.
2. Demonstrate sonographer ethics.
3. Describe protocol for ultrasound procedures and its applications.
4. Identify sectional anatomy of female pelvis, fetus, neonatal brain, abdominal structures, and small parts.
5. Perform sonographic scanning on phantom to produce high quality images.

**Courses No: MDR521**

**Credits: 3**

**Title: Total Quality Management and Safety in Radiology**

- Quality Assurance can be considered as part of total quality management program in the department of radiology, which includes quality assurance, quality control, and continuous improvement of the quality of the performance of the radiological departments. These are important principles of the TQM. QA is monitored, controlled, and improved by check list sheet filled by qualified personnel in quality. This is done by a method of checking the performance of the equipment staff by their type of job and the outcome of the radiological process in each room or control area and involves the customers who attend the department, then the performance is rated by the quality staff as being excellent, very good, good, average, and below average. Then any variation or deviations from the standards and objectives set out is studied and improved using a known sequence of events called Ishikawa diagram consisting of a circular pattern of steps: plan, do, check, and act continuously. These checks and changes involve:
  - People who are involved with the process
  - Methods of how the process is performed
  - Machines and raw materials that are involved in the process to do the job
  - Measurements and data generated from the process that are used to evaluate its quality
  - Environment of the quality checking

Safety from the energy used in diagnostic radiology involves the understanding of the basics of energy decay in the body involved in the radiological procedures, interaction of energy of matter, effects of kinetic energy of secondary electrons, dissociation of body molecules like water and formation of radicals, measurement of the dose and dose equivalent and other concepts of radiation physics and IAEA publications on radiation hazards, radiation measurements, and risk preventing regulations are restudied. The simple idea is to maximize the benefit of using radiation for the immediate welfare of patient and to minimize the risk.

**Courses No: MDR523**

**Credits: 4**

**Title: Advance techniques & Clinical practice I**

This course introduces the student to new or updated radiology equipment, techniques, and recent trends towards computerized management in the health services to respond to the demand for cost efficient and rapid communication between departments of radiology and their users. Also helps student to recognize digital image acquisition that has become the standard for modern equipment used in angiography, ultrasonography, computed tomography, magnetic resonance imaging etc...

This course provides practical experience to student in real advance clinical situation, advance radiographic examinations to have a good training on the new technologies & trends in radiology field.

**This course will prepare students to:**

Recognize all types of diagnostic images can now be acquired as digital signals

Know digital imaging and developments in computer technology and telecommunications mean that the “filmless” radiology department is technically feasible  
Identify faster image acquisition in computed tomography has extended its diagnostic applications, but has implications for the population radiation dose from medical imaging  
Run-through the new or updated radiology equipment and techniques are expensive and may not be cost effective in every radiology department.

**Courses No: MDR531**

**Credits: 2**

**Title: MRI and Molecular Imaging**

This course covers fundamental of applying MRI of specific biological processes at the molecular and cellular level in living organisms. A main goal of molecular Imaging detect of disease early in its time course. The multiple and numerous potentialities of this field are applicable to the diagnosis of diseases such as cancer, and neurological and cardiovascular diseases. Molecular imaging with MRI also contributes to improving the treatment of these disorders by optimizing the pre-clinical and clinical tests of new medication. Magnetic resonance imaging (MRI) is uniquely suited to play a large role in molecular imaging. When compared with other imaging modalities, the excellent anatomical resolution, multiplanar capabilities and no ionizing radiation.

**This course will prepare students to:**

- Understanding the basic concept and scope of MRI with molecular imaging and functional imaging
- Understanding the basic mechanism, methods and indications of MRI with molecular imaging and functional imaging
- Introduction of MR Contrast Agents
- The design and application of the MR molecular probe

**Courses No: MDR533**

**Credits: 4**

**Title: Advance techniques & Clinical practice II**

This course introduces the student to new or updated radiology equipment, techniques, and recent trend towards computerized management in the health services to respond to the demand for cost efficient and rapid communication between departments of radiology and their users. Also helps student to recognize digital image acquisition that has become the standard for

modern equipment used in angiography, ultrasonography, computed tomography, magnetic resonance imaging etc...

This course provides practical experience to student in real advance clinical situation, advance radiographic examinations to have a good training on the new technologies & trends in radiology field.

**This course will prepare students to:**

- Recognize all types of diagnostic images can now be acquired as digital signals
- Know digital imaging and developments in computer technology and telecommunications mean that the “filmless” radiology department is technically feasible
- Identify faster image acquisition in computed tomography has extended its diagnostic applications, but has implications for the population radiation dose from medical imaging
- Run-through the new or updated radiology equipment and techniques are expensive and may not be cost effective in every radiology department.

**Courses No: MDR534**

**Credits: 3**

**Title: New trends in In MRI**

This course familiarizes the student to new or updated MRI equipment, techniques, and recent trend Advancements in MRI.

It allows student to get knowledge about image quality improvements, new generations of MRI machines.

Describe protocol and advance technique for advance MRI examinations.

Find out cause of artifacts and eliminate it by modifying technique.

Apply knowledge of MRI protocol and technique in real clinical situation.

Analyze MRI image for quality to match diagnostic criteria.

**This course will prepare students to:**

- Recognize the newer technologies advancements in functional MRI
- Know reconstruction for neuro imaging & cardiac MRI image.
- Identify faster image acquisition in MRI has extended its diagnostic applications, with reduction population radiation dose.
- Run-through the new MRI visualization methods.



**Courses No: MDR535**

**Credits: 3**

**Title: New trends in In CT**

This course familiarizes the student to new or updated CT equipment, techniques, and recent trend Advancements in CT.

It allows student to get knowledge about image quality improvements, new generations of CT machines.

Describe protocol and advance technique for advance CT examinations.

Find out cause of artifacts and eliminate it by modifying technique.

Apply knowledge of CT protocol and technique in real clinical situation.

Analyze CT image for quality to match diagnostic criteria.

**This course will prepare students to:**

- Recognize the newer technologies advancements in 3 D volume rendering CT
- Know reconstruction MPR of CT scan image.
- Identify faster image acquisition in computed tomography has extended its diagnostic applications, with implications for the population radiation dose.
- Run-through the new CT visualization methods

**Courses No: MDR536**

**Credits: 3**

**Title: New trends in US**

This course familiarizes the student to new or updated US equipment, techniques, and recent trend Advancements in Ultrasound. It allows student to get knowledge about image quality improvements, new generations of US machines, Newer technologies are set to revolutionize ultrasound practice. One such technology is sonoelastography, a technique that has been in development for almost two decades. How to utilize the same machine that does b-mode ultrasound to measure tissue stiffness. In addition, how it measures the mechanical characteristics of tissues and then displays those mechanical characteristics overlaid on the conventional b-mode ultrasound image.

Another recent development is contrast-enhanced ultrasound (CEUS) . CEUS grants much more sensitivity for the detection of tumors, allowing ultrasound use to expand into many of the functions currently performed by CT and MRI.

**This course will prepare students to:**

- Recognize the Newer technologies advancements in 3-d ultrasound
- Know integration of artificial intelligence into ultrasound

- Identify faster image acquisition in computed tomography has extended its diagnostic applications, but has implications for the population radiation dose from medical imaging
- Cc Run-through the new ultrasound visualization methods

**Courses No: MDR537**

**Credits: 3**

**Title: Artificial intelligence in Radiology**

The ultimate goal of AI is to make a digital improvement in different medical diagnostic imaging fields that can allow planning and solve problems regarding image and data processing and medical communicating systems that leads to increase diagnostic value. The AI course topics include problem solving, reasoning, planning, dealing with related digital systems and applications and fundamentals of medical imaging machines set up and operation. Of course, these topics are closely related with each other.

- **Course objective**

The main purpose of this course is to provide the most fundamental knowledge - related to the field of specialty- to the students so that they can understand how AI can make a difference in improving medical diagnostic value.

**Courses No: MDR532**

**Credits: 2**

**Title: Research Methodology & Biostatistics**

This course covers basics of biostatistics, discussion of basic research skills, Data collection skills, statistical analysis skills, Report writing skills, Conclusion skills....

The students are supposed to suggest a health related research topic, collect and organize data, and write a research report with appropriate documentation. At the end of the project, the student will gain experience in research skills and reporting his/her finding in a scientific way. Research project selected by the student in the specialty.

**Courses No: MDR541**

**Credits: 4**

**Title: Advance techniques & Clinical practice III**

This course introduces the student to new or updated radiology equipment, techniques, and recent trend towards radiology field, management in the health services to respond to the demand for cost efficient and rapid communication between departments of radiology and their users. Also helps student to recognize digital image acquisition that has become the standard for modern equipment used in angiography, ultrasonography, computed tomography, magnetic resonance imaging etc...

This course provides practical experience to student in real advance clinical situation, advance radiographic examinations to have a good training on the new technologies & trends in radiology field.

**This course will prepare students to:**

- Recognize all types of diagnostic images can now be acquired as digital signals
- Know digital imaging and developments in computer technology and telecommunications mean that the “filmless” radiology department is technically feasible
- Identify faster image acquisition in computed tomography has extended its diagnostic applications, but has implications for the population radiation dose from medical imaging
- Run-through the new or updated radiology equipment and techniques are expensive and may not be cost effective in every radiology department.

**Courses No: MDR542**

**Credits: 3**

**Title: Research Project**

Each student conducts an independent small research project in the area of nutrition under the supervision of academic staff. Research projects can include small surveys, literature reviews, or clinical trials. The project should be written in a journal format.

**Courses No: MDR600**

**Credits: 8**

**Title: Thesis**

This module is compulsory for all students following the MSc Thesis option program. The independent, empirical study of an issue of health, disease or healthcare utilizing appropriate research tools is central to the program and consequently accounts for one third of the total assessment. This module provides an opportunity for the students to apply the knowledge and skills gained in the rest of the program, in particular the research methods modules and the practical modules. Therefore, students are required to choose a dissertation topic that relates clearly to their program specialization. The opportunity to learn about the research process by

carrying out research within a supportive framework is frequently the main reason given by candidates for wishing to read for an MSc.

The overarching project idea may come from the student with a supervisor agreeing to help the student develop the research idea into a suitable project. Alternatively, in many cases project areas will be suggested by a supervisor as students will work on, ongoing research themes within the university. In either case student input will be encourage and acknowledged by the supervisor when considering marks awarded for effort and engagement. It is possible more than one student will work on a larger research project. However, all student's analysis and background research will be performed independently, and where possible each student will focus on a different aspect of the project and analyze separate data.