

<b>Specialization</b>	<b>Radiologic Technology</b>
<b>Course Number</b>	<b>020810271</b>
<b>Course Title</b>	<b>Physics Of Advanced Imaging Modalities”2”</b>
<b>Credit Hours</b>	<b>(3)</b>
<b>Theoretical Hours</b>	<b>(2)</b>
<b>Practical Hours</b>	<b>(3)</b>

**Brief Course Description:**

- This course provides the students with the knowledge about the basic physical Principles of computed tomography and magnetic resonance imaging enabling them to know how to obtain images by these units and to know the safety measures of these systems.

**Course Objectives:**

Upon the completion of the course, the student will be able to:

1. Know the basic physical principles of these systems.
2. Know hazards and safety measures of these systems.
3. Know how to obtain images by these units.
4. Apply practical skills related to theoretical material.

Unit number	Unit name	Unit content	Time needed
1	<p align="center"><b>Computed Tomography (CT)</b></p>	<ul style="list-style-type: none"> <li>• Historical review EMI Scanners.</li> <li>• Basic principles of CT.</li> <li>• Scanning motions (computed tomography scanner) generations of CT, their characteristics and advantages.</li> <li>• X-ray tubes in CT, and collimators.</li> <li>• Detectors: types of detectors modes of operation of detectors.</li> <li>• Image reconstruction: Mathematical methods of reconstruction, back projection interactive methods, Analytical methods</li> <li>• Principles of CT imaging: CT numbers, scanning the patients, acquiring data, reconstructing the image, windowing, image display.</li> <li>• Image quality: noise, resolution, patient exposure, CT dose index (CTDI).</li> <li>• Artifacts: motion artifacts, streak artifacts, beam hardening effect, ring artifacts, aliasing artifacts.</li> <li>• Three dimensional reconstructions.</li> <li>• Spiral (helical) scanning.</li> <li>• Cine computed tomography scanning.</li> </ul>	
2	<p><b>Magnetic Resonance Imaging ( MRI)</b></p>	<ul style="list-style-type: none"> <li>• Components of MRI system : magnet, console, host computers, pulse sequence controller, digital to analog convertor , RF coils , preamplifier ,</li> <li>• Sample and hold component, analogto digital converter, filter, and array processor storage device.</li> <li>• Types of magnet: permanent magnets, electromagnets, resistive magnets, super conductive magnets.</li> <li>• Requirements for MRI: strong magnet, external energy source suitable metal within the human body .</li> <li>• Precession and Larmor equation.</li> <li>• Radiofrequency and relaxation processes</li> </ul>	

		<p>(proton relaxation) T1, T2.</p> <ul style="list-style-type: none"> <li>• MRI pulse sequence: spine echo, gradient echo, dual central spine echo, T2 contrast. Spoiled gradient echo, steady state gradient echo. Inversion recovery pulse sequence, fat suppressed inversion recovery, fast gradient echo, rapid spin echo.</li> <li>• MRI imaging Parameters :</li> <li>• o Repetition time, echo time, inversion time, RF flip angle, slice thickness, and order, gap, field of view (FOR) matrix.</li> <li>• Artifacts in MRI , and artifact control techniques</li> <li>• Multi-planer reconstruction and volume imaging: 2D, 3D.</li> <li>• MR Angiography : blood flow characteristic, inflow enhancement phase contrast angiography</li> <li>• MRI safety : contra indication, precautions emergency procedures</li> <li>• Paramagnetic contrast agents.</li> </ul>	
3	<b>CLINICAL PART</b>	<ul style="list-style-type: none"> <li>• Patient Care &amp; Communication.</li> <li>• Technical Requirements &amp; Positioning.</li> <li>• Radiation Protection.</li> <li>• Radiofrequency &amp; MRI Safety.</li> </ul>	

**Teaching Methodology:**

1. Lectures.
2. Discussion, Seminars & Quizzes.
3. Home works.
4. Demonstration and practical training.
5. Training field competencies assessment.

**Text Books & References:**

1. MRI in Practice Jul 5, 2011 by Catherine Westbrook and Carolyn Kaut Roth.
2. MRI Made Easy: (For Beginners) (Made Easy (Jaypee Publishing)) Mar 1, 2013 by Govind B Chavhan.
3. Diagnostic Radiology: Recent Advances and Applied Physics in Imaging (Aaims-mamc-pgi Imaging) Aug 1, 2013 by Gupta, Arun Kumar, M.D. and Chowdhury, Veena, M.D.
4. Magnetic Resonance Imaging Handbook Sep 22, 2016 by Luca Saba.
5. CT Imaging: Practical Physics, Artifacts, and Pitfalls Feb 22, 2013 by Alexander C. Mamourian.
6. Bontrager's Textbook of Radiographic Positioning and Related Anatomy, 9 Edition Apr 6, 2017 by John Lampignano and Leslie E. Kendrick .
7. Computed Tomography, 4th Edition
8. Physical Principles, Clinical Applications, and Quality Control by Euclid Seeram 2016.

