MAGNETIC RESONANCE IMAGING (MRI)

Course Descriptions

MRI 101. Magnetic Resonance Imaging Clinical Applications I. 5 Credit Hours.
Magnetic Resonance Imaging (MRI) Clinical Applications I provides an introduction to the fundamentals of magnetic resonance image production. Students learn the characteristics of common image weightings, including T1, T2, and proton density. The components and steps of MRI pulse sequences are presented and students learn to diagram pulse sequences. The similarities and differences between spin echo and gradient echo pulse sequences are discussed. Students learn about intrinsic and extrinsic MRI scan parameters, including time to repetition, time to echo, and flip angle. Students learn to adjust scan parameters to control image weighting, image quality, and scan duration. Flow mechanisms and phenomena are presented, and angiographic imaging using time of flight enhancement is explained. Students learn about tissue saturation and how to select pulse sequences and adjust scan parameters to nullify signal from target tissues.
Prerequisites: Entry into the Magnetic Resonance Imaging Program and Reading Proficiency

MRI 102. Magnetic Resonance Imaging Anatomy & Pathology I. 3 Credit Hours.
Magnetic Resonance Imaging (MRI) Anatomy Pathology I provides an introduction to cross-sectional anatomy and viewing the human body in multiple imaging planes. Image orientations and the characteristics of transverse, sagittal, coronal, and oblique planes are discussed. Students learn to identify normal anatomical structures and abnormal pathophysiological processes within the brain, the nervous system, the cervical spine, the thoracic spine, the lumbar spine, and the sacrum. Common indications for performing MRI of these body regions are also detailed.
Prerequisites: Entry into the Magnetic Resonance Imaging Program and Reading Proficiency

MRI 103. Magnetic Resonance Imaging Instrumentation I. 3 Credit Hours.
Magnetic Resonance Imaging (MRI) Instrumentation I provides an introduction to the technical components of MRI hardware and how these elements interact during image production. Students learn about the common types of main magnet systems and explore differences in their operation. Additional system components, including gradient coils, radiofrequency coils, shimming systems, and shielding systems, are studied.
Prerequisites: Entry into the Magnetic Resonance Imaging Program and Reading Proficiency

MRI 104. Magnetic Resonance Imaging Safety & Patient Care I. 3 Credit Hours.
Magnetic Resonance Imaging (MRI) Safety Patient Care I provides an introduction to appropriate care and safety for all individuals within the MRI environment. Best practices for departmental safety policies and procedures are described. Students learn about the levels of MRI personnel and their associated qualifications and responsibilities. The categories and characteristics of safe, unsafe, and conditional objects and medical devices are detailed, and students learn how to obtain device information. Students learn about safety risks and appropriate signage associated with each of the four MRI zones. Hazards and adverse outcomes associated with operation of imaging equipment are also described, including exposures to static and time-varying magnetic fields, acoustic noise, and cryogens. Students learn the components of effective safety screening and simulate screening procedures.
Prerequisites: Entry into the Magnetic Resonance Imaging Program and Reading Proficiency

MRI 105. Magnetic Resonance Imaging Physics I. 3 Credit Hours.
Magnetic Resonance Imaging (MRI) Physics I introduces students to the physical principles involved in magnetic resonance image formation. The concepts of magnetism, electromagnetism, magnetic permeability, and magnetic susceptibility are explored. Students learn how to calculate the intensity of magnetic fields. Students learn how radiofrequency excitation produces MRI signals which are detected and encoded for image formation. The mechanisms and timing for T1 relaxation and T2 decay are introduced and compared. Students explore differences in intrinsic tissue properties and how differences in signal intensity affect tissue appearance on magnetic resonance images.
Prerequisites: Entry into the Magnetic Resonance Imaging Program and Reading Proficiency

MRI 201. Magnetic Resonance Imaging Clinical Applications II. 2 Credit Hours.
Magnetic Resonance Imaging (MRI) Clinical Applications II reinforces and expands on concepts introduced in MRI 101. Advanced imaging techniques, including diffusion weighted imaging, perfusion imaging, and functional MRI are introduced. Students learn the clinical applications of MRI contrast media for image enhancement. Timing mechanisms for dynamic contrast media enhancement are described. Students learn to identify physiologic image artifacts and to apply correction techniques to improve image quality.
Prerequisites: MRI 101 with a minimum grade of "C" and Reading Proficiency

MRI 202. Magnetic Resonance Imaging Anatomy & Pathology II. 2 Credit Hours.
Magnetic Resonance Imaging (MRI) Anatomy Pathology II reinforces concepts introduced in MRI 102 and expands to cover additional body regions and systems. Students learn to identify normal anatomical structures and pathophysiological processes within the musculoskeletal system and the cardiovascular system, as well as organs of the chest, the abdomen, and the pelvis. Common indications for performing MRI of these body regions are also detailed.
Prerequisites: MRI 102 with a minimum grade of "C" and Reading Proficiency

MRI 203. Magnetic Resonance Imaging Instrumentation II. 2 Credit Hours.
Magnetic Resonance Imaging (MRI) Instrumentation II reinforces and continues the concepts introduced in MRI 103. Students explore the purpose and frequency of quality control procedures that are performed on MRI hardware components. The relationship between hardware malfunction and image artifacts is explained. Students learn best practices for MRI department design and layout, and their impact on procedural workflows. Departmental quality assurance practices and techniques are also introduced.
Prerequisites: MRI 103 with a minimum grade of "C" and Reading Proficiency

MRI 204. Magnetic Resonance Imaging Safety & Patient Care II. 2 Credit Hours.
Magnetic Resonance Imaging (MRI) Safety Patient Care II expands on concepts introduced in MRI 104. The characteristics and applications of MRI contrast media are presented, including categories of contrast media and best practices for safe administration. Topics include vascular access device identification and selection, contrast media extravasation, and reactions to contrast media administration. Emergent situations in the MRI environment and applicable response activities are discussed.
Prerequisites: MRI 104 with a minimum grade of "C" and Reading Proficiency

MRI 205. Magnetic Resonance Imaging Physics II. 2 Credit Hours.
Magnetic Resonance Imaging (MRI) Physics II builds on the concepts introduced in MRI 105 and explores advanced topics in magnetic resonance image formation. Physical and mathematical principles for slice selection, phase encoding, and frequency encoding are applied to signal formation. Students learn how Fourier transformation is used to convert MRI signals between time and frequency domains. The characteristics of data space and k-space are discussed, and differences in signal storage between the two spaces are explained. Students apply mathematical calculations to determine scan parameters for a given pulse sequence, including slice thickness, maximum number of slices, field of view, pixel size, and sampling interval.
Prerequisites: MRI 105 with a minimum grade of "C" and Reading Proficiency

MRI 211. Magnetic Resonance Imaging Practicum I. 3 Credit Hours.
Magnetic Resonance Imaging (MRI) Practicum I introduces students to the MRI clinical environment. Students are placed in a clinical setting under the direct supervision of a registered MRI technologist where they observe departmental operational workflows, MRI safety practices, and a variety of MRI procedures. Students are introduced to quality control procedures performed on MRI systems and ancillary equipment. Students correlate their concurrent didactic education and training with real-world clinical experiences.
Prerequisites: MRI 101, MRI 102, MRI 103, MRI 104, and MRI 105 with minimum grades of "C" and Reading Proficiency

MRI 212. Magnetic Resonance Imaging Practicum II. 5 Credit Hours.
Magnetic Resonance Imaging (MRI) Practicum II advances the clinical experience of students in the MRI Program. Students are placed in a clinical setting under the direct supervision of a registered MRI technologist where they assist with MRI safety screenings and a variety of MRI procedures. Students review pertinent laboratory values and assess the patency of venous access devices prior to administering MRI contrast media. Students determine the volume of contrast media to be administered and prepare for administration through hand injection or power injector methods.
Prerequisites: MRI 211 with a minimum grade of "C" and Reading Proficiency

MRI 213. Magnetic Resonance Imaging Practicum III. 4 Credit Hours.
Magnetic Resonance Imaging (MRI) Practicum III is the culmination of the clinical experience for students in the MRI Program. Students are placed in a clinical setting under the supervision of a registered MRI technologist where they perform all aspects of a variety of MRI procedures. Students plan and execute the imaging protocol and administer contrast media per organizational guidelines. Students review acquired images for quality and artifacts. All procedures are documented to satisfy eligibility requirements for the American Registry of Radiologic Technologists MRI registry examination.
Prerequisites: MRI 212 with a minimum grade of "C" and Reading Proficiency

MRI 214. Magnetic Resonance Imaging Capstone. 3 Credit Hours.
Magnetic Resonance Imaging (MRI) Capstone is a comprehensive review of fundamental concepts and materials learned throughout the MRI Program. Students demonstrate their knowledge and comprehension of key MRI content areas, including image formation and processing, cross-sectional anatomy, primary and secondary hardware systems, clinical procedures, and patient safety. Students complete summative assessments in written, oral, and simulation formats to prepare for MRI Program completion and to assess readiness for the American Registry of Radiologic Technologists MRI registry examination.
Prerequisites: MRI 212 with a minimum grade of "C" and Reading Proficiency