**Cluster: Health Science**

**Pathway: Diagnostic Services**

**State Program Name: Medical Imaging**

**Career: Magnetic Resonance**

**OCAS Code: 9358 Medical Imaging**

**CIP Code: 51.0911 Radiologic Technology Science/Radiographer**

**SOC Code: 29-2035 Magnetic Resonance Imaging Technologists**

**Approved Assessments: 8525 Magnetic Resonance Imaging Primary Certification**

**Description**

Students in this major will need to have completed the Radiologic Technologist career major prior to enrollment. Students will learn about Magnetic Resonance Imaging Technologist (MRI) safety, cross-sectional anatomy, and precautions and contraindications related to the administration of MRI contrast media. Patient care, including safety and how to comfort patients will also be covered. Additionally, the student is provided the opportunity to use the theory in practical clinical experiences. Students will need to obtain certification from the American Registry of Radiologic Technologist (ARRT) in order to practice in this field.

**Total Hours Original Framework:** 847 hours

**Total Hour Recommended:** 900 hours

**Prerequisites:** Satisfactory completion of Radiologic Technology program and registration as Radiologic Technician by ARRT

**Requirements in Oklahoma**

**Registered**

**2016 Courses**

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| **Hours** |  | **Course Title** |
| 50.00 |  | Cross- Sectional Anatomy-Brain and Spine, Extremities and Body |
| 6.00 |  | Introduction to Clinical Module-Introduction to MRI Safety and Patient Care |
| 240.00 |  | Clinical MRI I-Brain and Spine |
| 240.00 |  | Clinical MRI II-Extremities |
| 220.00 |  | Clinical MRI III-Body (Thorax, Abdomen and Pelvis) |
| 91.00 |  | Physics |

**Offered at:**

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| --- | --- | --- |
| **District** | **Campus** | **Local Name** |
| Autry Technology Center | Enid | MRI Technician |

**Course Outlines**

**Course Name:** Cross-Sectional Anatomy Brain and Spine, Extremities and Body

**Course Hours:** 50 hours

**Course Description:** Cross-sectional anatomy pertinent to the most common anatomical areas imaged in the MRI suite is learned. Emphasis will be placed on the anatomy associated with the required clinical competency examinations. Actual MRI examinations, as well as computer-assisted-instructional programs are utilized for learning.

**Course Objectives:**

1. Cross-sectional anatomy pertinent to the most common anatomical areas imaged in the MRI suite is learned.
2. Emphasis will be placed on the anatomy associated with the required clinical competency examinations.
3. Actual MRI examinations, as well as computer-assisted-instructional programs are utilized for learning.

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| **Recommended Resources:** |
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| **Course Name:** Introduction to Clinical Module-Introduction to MRI Safety and Patient Care**Course Hours:** 6**Course Description:** Prior to beginning the clinical component of the MRI program, the student must have a basic understanding of the unique hazards associated with MRI procedures. Safety precautions related to the magnetic field, a magnet quench, cryogen use, fire, the pregnant patient, and medical emergencies are emphasized. The care of the patient before and during the performance of an MRI procedure is also addressed in this unit of study. Patient education, preparation, and interview techniques are learned. Patient care and comfort situations unique to MRI, such as claustrophobia, acoustic noise and positioning for motionless scanning are detailed. Precautions and contraindications, related to the administration of MRI contrast media, are addressed.**Course Objectives:**1. Prior to beginning the clinical component of the MRI program, the student must have a basic understanding of the unique hazards associated with MRI procedures. 2.
2. Safety precautions related to the magnetic field, a magnet quench, cryogen use, fire, the pregnant patient, and medical emergencies are emphasized.
3. The care of the patient before and during the performance of an MRI procedure is also addressed in this unit of study.
4. Patient education, preparation, and interview techniques are learned.
5. Patient care and comfort situations unique to MRI, such as claustrophobia, acoustic noise and positioning for motionless scanning are detailed. Precautions and contraindications, related to the administration of MRI contrast media, are addressed.

**Recommended Resources:** |
| **Course Name:** Clinical MRI I—Brain and Spine**Course Hours:** 240**Course Description:** This is the first clinical rotation for the MRI program.**Course Objectives:** **Recommended Resources:** |
| **Course Name:** Clinical MRI II--Extremities**Course Hours:** 240**Course Description:** This is the second clinical rotation for the MRI program**Course Objectives:****Recommended Resources:** |
| **Course Name:** Clinical MRI III—Body (Thorax, Abdomen and Pelvis)**Course Hours:** 220**Course Description:** This is the third clinical rotation for the MRI program**Course Objectives:****Recommended Resources:** |
| **Course Name:** Physics**Course Hours:** 91**Course Description:** Upon completion of this course, students will understand the principles of physics used during magnetic resonance imaging.**Course Objectives:**PHYSICS UNIT I (5 Hours): Principles of Magnetism and ElectromagnetismCompletion of this unit is necessary for the student=s understanding of the physics of MRI. Thefundamental physical concepts of electricity and magnetism are learned. The interaction between the electric field and the magnetic field, as the basis for electromagnetism, is studied. Electromagnetism and electromagnetic radiation are studied, as they relate to the production of the MRI signal.PHYSICS UNIT II (13 Hours): MRI System HardwareThis unit involves the study of the equipment used in the process of magnetic resonance imaging. The student=s understanding of the purpose, function, operation, and operating standards/parameters of magnetic imaging hardware is necessary for the performance of a quality MRI examination, as well as the safety of the patient and operator. The major components of the MRI imager and their subsystems are studied in detail, to include the gantry, operating console, computer, permanent, resistive and superconducting magnets, shim and gradient coils and the radiofrequency probe. Emphasis will be on superconducting magnets, since they are the most common type of magnet in use today. PHYSICS UNIT III (9 Hours): MRI SafetyThe safety of the patient and operator, during the performance of an MRI procedure, is addressed in this unit of study. The principal mechanisms of interaction of the three MRI energy fields with tissue are learned. The Food and Drug Administration (FDA) and International Society of Magnetic Resonance in Medicine (ISMRM) regulations and recommended guidelines are detailed. General safety considerations relating to patient evaluation, ferromagnetic projectiles, cryogen safety, in vivo safety hazards, patient and employee pregnancy and emergency procedures in the MRI suite are studied. PHYSICS UNIT IV (9 Hours): Nuclear MagnetismThis unit discusses atomic structure, with an emphasis on the nucleus and its properties that are of specific interest to MRI. The interaction between the atomic nucleus and the static magnetic and RF fields of an MRI imager are discussed. The quantum and classical mechanical descriptions are presented and contrasted.PHYSICS UNIT V (10 Hours): Resonance and RelaxationThis unit discusses the fundamental MRI principles of resonance and the relaxation of hydrogen protons after RF excitation. The free induction decay (FID) and spin echo are introduced. T1, T2, and T2\*(star) relaxation are discussed.PHYSICS UNIT VI (6 Hours): Image Weighting and Contrast ParametersThis unit discusses the image contrast created by the differing relaxation times of tissues. Spin echo, gradient echo, and inversion recovery imaging are discussed. The contrast parameters of repetition time (TR), echo time (TE), inversion time (TI), and flip angle are introduced. Basic pulse sequence diagrams are explained. PHYSICS UNIT VII (12 Hours): Spatial Localization and Data AcquisitionThis unit explains the process of spatial localization of the MR signal, by way of slice select,frequency encoding, and phase encoding (logical) gradients. The pulse sequence parameters related to data encoding and acquisition are discussed. The concepts of Fourier transformation and k-space are introduced.PHYSICS UNIT VIII ( 9 Hours): Pulse Sequence Parameters and Image ArtifactsThe interactions between pulse sequence parameters and their effects on image contrast, signal-to-noise ratio (SNR), and scan time are learned. Image artifacts and their correction solutions by varying sequence parameters will also be discussed.PHYSICS UNIT IX ( 9 Hours): Advanced Pulse SequencesThis unit will detail the design of pulse sequences. Fast spin echo is introduced, including its applications in fast inversion recovery sequences. The different types of gradient echo sequences are explained, as well as their applications to MR Angiography and cardiac MRI. Echo planar imaging (EPI) is briefly discussed.PHYSICS UNIT X (9 HOURS): Advanced ApplicationsAs MRI evolves, more clinical and research applications are developed and refined. This unit will discuss advanced applications of MR imaging.**Recommended Resources:** |