MASTER OF SCIENCE IN IMAGING SCIENCES

The Master of Science in Imaging Sciences at The University of Texas at San Antonio is a master's degree program offered within the School of Health Professions (SHP). This program will provide a comprehensive plan of study to prepare graduates for multiple marketable certifications in advanced medical imaging while earning a master's degree and acquiring leadership skills. The purpose of the M.S. in Imaging Sciences program is to develop clinically competent imaging technologists with leadership skills and multi-modality, registry-eligible certifications in Radiography, Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) by the American Registry of Radiologic Technologists (ARRT) to address the technologist shortages that are currently stressing the health care system. After successful completion of the program, the graduates will be eligible for state licensure by the Department of State Health Services to the Texas Medical Board. In addition, the students will be prepared for the Magnetic Resonance Safety Officer (MRSO) credentialing examination by the American Board of Magnetic Resonance Safety (ABMRS). The ABMRS offers (MRSO) Certified™ (MRSC™) credentials to MRI technologists who demonstrate competency in advanced MRI safety (https://abmrs.org/) (https://abmrs.org/).

The program builds upon the foundation of knowledge from a bachelor's degree and specific science-related prerequisites for admission to better prepare students to acquire the advanced skills provided in the curriculum. Application materials must be submitted through ahcas.liaisoncas.com. The following minimum requirements will be applied:

- A baccalaureate degree from an accredited college or university in the United States or proof of an equivalent degree from a foreign institution is required.
- Overall GPA of 3.0.
- Overall Science and Math GPA of 3.0.
- Official transcripts from each college/university currently and previously attended reflecting completed and in progress coursework.
- Transcripts from institutions outside the United States must be submitted in the original language along with an evaluation from a National Association of Credential Evaluation Services (NACES) approved organization.
- International applicants whose native language is not English must present evidence of proficiency in English by satisfactorily completing the Test of English as a Foreign Language examination (TOEFL) with a minimum score of 84, English language test for study (IELTS) score of 7.0, or a Duolingo score of 115. A waiver of this requirement may be requested if the individual has graduated from a United States high school, a higher education degree program (associate's or higher), or one of its English-speaking protectorates.
- Two letters of recommendation, attesting to student's academic experience and personal attributes.
- MRI Safety screening. *
- Required immunizations, criminal background checks, drug screening, health and physical capability and other requirements by the School of Health Professions or UT Health San Antonio.
- Ability to meet the general technical requirements for the field. **
- Perform the essential functions of the job. ***
- Attend an in-person program information session held in a group setting.

Science and Math Prerequisites

In addition to a baccalaureate degree from an accredited college or university in the United States or proof of an equivalent degree from a foreign institution, 26 semester credit hours (SCH) of specific prerequisite work is also required. The aggregate grade point average for the prerequisite courses must be at least a 3.0.

Required Science and Math Prerequisites

Mathematics (6 SCH):

- College Algebra OR Higher-level Mathematics OR Statistics

Natural Sciences (20 SCH):

- Biology lecture with Lab
- General chemistry lecture with Lab
- Physics with Lab
- Human Anatomy with Lab AND Physiology with Lab (covering all body systems)

MRI Safety Screening: Establishment of thorough and effective screening procedures for patients and other individuals is one of the most critical components of a program that guards the safety of all those entering the MRI environment or undergoing MRI procedures. An important aspect of protecting patients and individuals from MRI-related accidents and injuries involves an understanding of the risks associated with the various implants, devices, accessories and other objects that may cause problems in this setting. This requires constant attention and diligence to obtain information and documentation about these objects to provide the safest MRI setting possible. The faculty of the program want to provide the students and patients with a safe clinical environment; therefore, the program requires students to complete the MRI safety screening form prior to acceptance into the program. This form must be completed by a qualified practitioner. Any questions or concerns may be addressed by contacting the program director.

The student must keep these records current for the duration of the program. If he/she has a foreign object (i.e., ferrous material, implants, surgical clip, insulin pump, etc.) located in or on their body after admission, it is the student's responsibility to notify the program director. After notification to the program director, a second MRI safety screening must be completed by a qualified health care practitioner to assure student and personnel safety. Information about the MRI safety screening can be found in the application packet and on the program website.

General Technical Requirements: To graduate from the program, students must be able to meet certain technical requirements. Graduates of this program must be able to meet certain physical and mental requirements to ensure the safe performance of imaging procedures.

Due to the nature of typical employment assignments, a graduate of this program must be able to:

1. Work in a clinical setting for eight (8) to ten (10) hours performing physical tasks requiring physical energy without jeopardizing patient safety. Examples of these tasks include but are not limited to: pushing wheelchairs, stretchers, carts and mobile radiographic equipment; lifting and carrying imaging coils weighing up to twenty (20) pounds, wearing a five ten (5-10) pound, lead apron when needed; reaching, manipulating, and operating patient positioning tables, radiographic

tables, stands, tubes, and other radiographic and imaging equipment to obtain the requested radiographic or diagnostic image; cleaning and preparing patient positioning tables, radiographic tables, stands, and other accessory equipment; and moving and assisting patients on and off radiographic tables, carts and stretchers, or in/out of wheelchairs.

2. Interact with patients and other medical personnel in providing appropriate patient care and in performing imaging procedures. Examples of these interactions include but are not limited to: effectively communicating with patients and medical staff; providing patients with a clear and complete explanation of procedures; providing oral and written information, reading written information, and receiving oral and written information from patients and medical staff relevant to patient care; responding appropriately to unusual patient situations; and making appropriate judgments in critical and non-critical patient care situations.

Essential Job Functions: The following essential functions are required of all students enrolled in the program. Medical imaging science specialists are responsible for the care of patients, some of whom are critically ill. They are often required to manage complex pieces of equipment, as well as interact with patients to make assessments. Medical imaging science specialists must also be able to communicate with other health care professionals. Therefore, to be successful in the program, all applicants should be able to perform, or learn to perform, the following functions:

- Spending much of the day traveling in between imaging departments.
- Moving and positioning bedridden patients.
- Performing physically demanding tasks-lifting and positioning imaging equipment.
- Communicating effectively with patients and staff.
- Responding to alarms.
- Accurately measuring contrast media, reading patient records, evaluating information displayed on patient monitors, and making observations of patients as required.
- Manipulating equipment and perform tasks-venipuncture and IV-line management.
- Applying sufficient intellectual and emotional skills to plan and exercise independent judgment, and to respond quickly to medical emergencies.

The program reserves the right to require applicants or students to demonstrate any of these essential functions with or without accommodation. Accreditation standards, program resources and availability of clinical practicum sites will influence enrollment capacity.

The program curriculum will begin with Radiography principles and practice, followed by academic and clinical instruction in CT and culminating in the acquisition of the knowledge and skills needed to perform MRI. The didactic content will be provided in-person with a traditional classroom mode of delivery while capitalizing on the ample availability of supervised clinical experiences.

Clinical Practicum

The clinical practicums will occur clinically affiliated medical centers, hospitals, and outpatient imaging centers. Prior to the first clinical practicum, students will be given the training necessary to obtain current certification in Basic Life Support for Health Care Providers by the American Heart Association. The clinical hours are required for program completion, and the students must arrange their schedules accordingly to ensure attendance as outlined by each course syllabus. The clinical hours are based on the clinical site's designated hours of operation-Monday-Sunday, days, evenings, and weekends, as necessitated by the facility. The length of specific clinical rotations is determined by the clinical site (hours may vary by site) and the clinical coordinator to ensure that the students meet the competency requirements for the program. Students will receive appropriate academic advising and mentoring to complete didactic and clinical course materials in a timely manner.

The clinical requirements are as follows:

- Radiography Clinicals I, II and III
- CT Clinicals IV and V
- MRI Clinicals V and VI

The program will provide students the opportunity to acquire marketable skills while progressing sequentially and earning multimodality credentials along with a master's degree. The curriculum will include didactic content in anatomy and pathophysiology, patient assessment, pathophysiology, positioning & protocols, principles & instrumentation, radiographic technique, MRI safety, radiation biology, pharmacology, contrast media agents, venipuncture, patient safety, health care policies, emergency procedures, quality assurance, professional standards and supervised clinical training in radiography, CT and MRI.

In order to foster the development of clinically competent, imaging technologists with multi-modality, registry-eligible ARRT certifications in Radiography, CT and MRI, the program will be structured in phases-Phase 1: radiography proficiency (student earns ARRT radiography exam eligibility after phase 1 completion), Phase 2: CT proficiency (student earns ARRT CT exam eligibility after phase 2 completion), and Phase 3: MRI proficiency (student earns ARRT MRI exam eligibility after phase 3 completion). Learning outcomes will exceed the minimum ARRT structured educational requirements in the advanced imaging modalities. After successful completion Phase1 of the program, the students who successfully pass the ARRT Radiography exam will be eligible for state licensure by the Texas Medical Board (TMB) (https://www.tmb.state.tx.us/page/licensing-full-medical-radiologic-technologist (https://www.tmb.state.tx.us/page/licensing-full-medical-radiologic-technologist/)).

Phase 1: Radiography (44 Semester Credit Hours)

Radiographers use electromagnetic radiation to produce radiographs (X-rays). X-rays have higher energy and can pass through most objects, including the body's internal structures. X-rays are the most frequently used form of imaging for routine follow-up exams, such as chest X-rays due to much lower radiation doses compared to CT. X-rays are used to diagnose fractured bones, injury, or infection and to locate foreign objects in soft tissue. Some X-ray exams may require the use of iodine-based contrast material or barium to help improve the visibility of specific organs, blood vessels, tissues or bone.

The underlying scientific theory, sectional anatomy, pathophysiology, and clinical protocols will be discussed. Emphasis is placed on patient care and radiation protection, principles of electromagnetic radiation and physical interactions with living matter. The phase 1 plan of study in radiography will consist of 13 courses totaling 44 semester credit hours. The didactic courses will be offered at The University of Texas at San Antonio. The clinical courses will be provided at affiliated clinical sites during the day, night and/or weekends, and students must be able to commit to participating in clinical rotations during each semester. Students must successfully pass the ARRT radiography registry examination in order to proceed into phase 2 CT.

Phase 2: Computed Tomography (25 Semester Credit Hours)

Computed Tomography (CT) is an advanced radiographic imaging modality that utilizes highly collimated fan-shaped x-ray beam and array of radiation detectors to produce cross-sectional images of human body structures and organs for diagnostic purposes. CT images can be reconstructed in various anatomical orientations for better visualization of pathology, diagnostic analysis, and interpretations. Phase 2 plan of study in CT will consist of 6 courses totaling 25 semester credit hours. The didactic courses will take place at the SHP during the day while the clinical practicums will be provided at affiliated clinical sites during the day, night and/or weekends. The CT clinical practicum enables students to solidify the didactic education while mastering patient care skills, CT principals & instrumentation, CT protocols & procedures, disease identification, and advanced imaging techniques which offer graduates an employment edge and increased career mobility. The clinical courses will be provided at affiliated clinical sites during the day, night and/or weekends, and students must be able to commit to participating in clinical rotations during each semester. Students must successfully pass the ARRT CT registry exam in order to proceed into phase 3.

Phase 3: Magnetic Resonance Imaging (29 Semester Credit Hours)

Magnetic resonance technologists use the resonant frequency properties of atoms within a magnetic field to image anatomic and/or physiologic conditions of the body to assist physicians in the diagnosis and treatment of disease. MRI is an imaging modality that produces exceptionally detailed images of the tissues and organs of the body in a variety of imaging planes. This course of study focuses on the underlying scientific theory, sectional anatomy, pathophysiology and clinical protocols. Emphasis is placed on patient care and safety, and principles of magnetism.

Phase 3 plan of study in MRI will consist of 6 courses totaling 29 semester credit hours. The didactic courses will be offered at the SHP during the day. The clinical courses will be provided at affiliated clinical sites during the day, night and/or weekends, and students must be able to commit to participating in clinical rotations during each semester. The curriculum is designed to enable students to acquire knowledge in MRI physics, equipment operation/methodology, cross or sectional anatomy, pathophysiology, patient care, and MRI imaging skills. Students are eligible to sit for the post-primary pathway MRI registry exam by the ARRT.

To graduate, students must successfully complete all courses (98 SCH) with a minimum cumulative GPA of 3.0 or better and successful completion of the clinical competencies required of the program. In addition, each student must successfully complete a research capstone project as a part of their last clinical practicum course completion requirement.

Master of Science in Imaging Sciences Graduation Requirements

The imaging program will provide students the opportunity to acquire marketable skills while progressing sequentially and earning multimodality credentials along with a master's degree. The curriculum will include didactic content in anatomy and pathophysiology, patient assessment, pathophysiology, positioning & protocols, principles & instrumentation, radiographic technique, MRI safety, radiation biology, pharmacology, contrast media agents, venipuncture, patient safety, health care policies, emergency procedures, quality assurance, professional standards and supervised clinical training in radiography, CT and MRI.

Sample Plan of Study

First Year Fall		Credit Hours
MSIS 5001	Patient Assessment and Management	3
MSIS 5002	Radiographic Procedures I with Lab	3
MSIS 5003	Image Production & Evaluation	2
MSIS 5004	Radiobiology & Protection	3
MSIS 5010	Clinical I	6
	Total Credit Hours:	**17.0**

First Year Spring		Credit Hours
MSIS 5000	Radiation Physics	3
MSIS 5006	Radiographic Procedures II with Lab	3
MSIS 5008	Special Radiographic Procedures	2
MSIS 5009	Ethics and Law	2
MSIS 5012	Clinical II	6
	Total Credit Hours:	**16.0**

First Year Summer		Credit Hours
MSIS 5011	Research	3
MSIS 5013	RAD Registry Review	2
MSIS 5014	Clinical III	6
	Total Credit Hours:	**11.0**

Second Year Fall		Credit Hours
MSIS 5005	Sectional Anatomy and Pathophysiology I with Lab	2
MSIS 6000	CT Physics and Instrumentation	3
MSIS 6001	CT Procedures	3
MSIS 6002	Education	3
MSIS 6003	Clinical IV	9
	Total Credit Hours:	**20.0**

Second Year Spring		Credit Hours
MSIS 5007	Sectional Anatomy and Pathophysiology II with Lab	2
MSIS 6004	CT Registry Review II	2
MSIS 6005	Clinical V	10
MSIS 6006	MRI Physics & Safety	3
MSIS 6008	MRI Procedures	3
	Total Credit Hours:	**20.0**

Second Year		
Summer		**Credit Hours**
MSIS 6007	Management and Supervision	3
MSIS 6009	MRI Registry Review III	2
MSIS 6010	Clinical VI	9
	Total Credit Hours:	**14.0**

Assessment of Student Learning Outcomes

The School of Health Professions evaluates student learning outcomes primarily through grades in academic coursework, performance in clinical rotations, and scores on standardized licensure examinations. Below is the plan for how the student learning outcomes (SLOs) will be assessed and evaluation, as well as when the SLOs will be reassessed and evaluated over the duration the two-year program. Also described is the assessment method used to establish learning related to SLOs and the desired target level of performance.

Assessment methods may include faculty-designed comprehensive or capstone exams; performance on faculty developed or external exams; professionally judged performance as in clinical or lab performance; portfolios compiled over time and written assignments. SLOs are defined in terms of the knowledge, skills, and abilities that a student has attained at the end (or as a result) of her or his engagement in a particular set of higher education experiences. In our program, we might refer to these as terminal objectives or competencies. SLOs should not be confused with program outcomes, objectives or goals which might include graduation, employment, satisfaction, certification/licensure rates, and scores on standardized tests. Although such indicators might be used as a proxy for instructional effectiveness, they are not actual measures of learning.

Student Learning Outcomes (SLOs)

- Demonstrate critical inquiry and reasoning in applying the knowledge and skills required by each imaging modality.
- Demonstrate optimal selection of imaging protocols and correction for sub-optimal images.
- Demonstrate appropriate radiation and MRI safety standards of practice.
- Demonstrate the ability to adapt to varying clinical experiences and equipment.
- Appropriately respond to demanding situations in trauma or emergency settings.
- Communicate (orally and written) in an effective and respectful manner.
- Collaborate within interprofessional teams by practicing leadership.
- Demonstrate scholarship and understanding of research principles.
- Integrate ethical principles in professional activities.
- Demonstrate the ability to work effectively in a diverse and global society.

Established policies and procedures will be in place to assure consistency in student evaluations. This will include use of student written evaluations of courses and instructors, student conferences to solicit feedback from students and instructors, as well as the quality of clinical rotations, and graduate exit surveys. In addition, students have a well-defined appeals process should they believe that they have received an unfair grade or evaluation.

Program Outcomes

- To graduate clinically competent, entry-level, and multi-modality registry-eligible radiography, CT, and MRI technology professionals.
- To graduate clinically competent students with critical thinking skills to function as competent healthcare professionals.
- To instill in the student the importance of effective communication, continued education, and professional development.
- To provide the community with qualified, component, and compassionate imaging professionals.

Results of the program outcomes will be continuously disseminated beyond the program director. Program outcome results will be disseminated at the yearly advisory meeting consisting of community members. The outcomes will also be shared openly with potential applicants during the information sessions. Program outcomes will be available on the program website, as well as brochures and marketing advertisement. The program outcomes/results will be used to implement changes in the curriculum based on the results of the assessment. In addition to providing a strong science and technical background, the program will strive to address the growing need of highly trained graduates for leadership roles in medical imaging. The program will adhere to the guidelines that the accrediting body (ARRT) has set.

Program Policies

Established policies and procedures will be in place to assure consistency in student evaluations. This will include use of student written evaluations of courses and instructors, student conferences to solicit feedback from students and instructors as well as the quality of clinical rotations, and graduate exit surveys. In addition, students have a well-defined appeals process should they believe that they have received an unfair grade or evaluation.

The program director and faculty have established program policies and procedures in order to oversee curriculum development. To uphold the program's high standard and relevancy in student education, faculty members teaching courses are actively engage in continuous curricular development and revision using student learning outcome data. The Student Progress Committee of the M.S. in Imaging Sciences degree program will ensure that the degree plan is followed by M.S. in Imaging Sciences students in order to make appropriate progress towards their degree. The Student Progress Committee will grant exceptions from this schedule only under extenuating circumstances.