Radiation Sciences

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**Undergraduate major:** radiation sciences (B.S.)

**Web site:** [http://www.medicine.uiowa.edu/radsci/](http://www.medicine.uiowa.edu/radsci/)

Radiation sciences professionals work with physicians to gather accurate patient information for diagnosis, treatment, and/or research of disease and injury. They provide direct patient care, produce quality images, and deliver treatment using a variety of radiation sources. The radiation sciences professional must apply knowledge, skill, and mature judgment while operating complex equipment safely and efficiently.

The University of Iowa’s radiation sciences educational programs are designed to provide students with opportunities for intellectual, professional, and social growth. Students learn with faculty members and instructors who are committed to radiation sciences education.

Radiation sciences is one of two undergraduate majors in the field of medical imaging offered by the Carver College of Medicine. It encompasses radiologic technology, computed tomography, magnetic resonance imaging, cardiovascular interventional, diagnostic medical sonography, and radiation therapy programs. The other undergraduate major in medical imaging is nuclear medicine technology; see Nuclear Medicine Technology in the Catalog.

The Carver College of Medicine is located on the University of Iowa health sciences campus, which includes University of Iowa Hospitals and Clinics, one of the nation’s largest university-owned teaching hospitals. For information about the college’s academic programs and resources, see Carver College of Medicine in the Catalog.

**Undergraduate Program of Study**
- Major in radiation sciences (Bachelor of Science)

The Radiation Sciences Program offers two paths toward completing the major: an on-campus program for students who have not completed a radiation sciences modality (see “Bachelor of Science” below) and an online program for registered radiologic technologists who would like to earn a Bachelor of Science degree by distance education; see “RT to B.S. (Online)” later in this Catalog section.

Undergraduate study in radiation sciences is guided by the academic rules and procedures outlined under "Undergraduate Programs of Study" in the Carver College of Medicine section of the Catalog.

**Bachelor of Science**

The Bachelor of Science with a major in radiation sciences requires a minimum of 120 s.h. Work for the degree includes a set of courses that are prerequisite to entering the radiation sciences major, completion of one of several radiation sciences professional programs, and elective course work sufficient to complete the minimum of 120 s.h. required for graduation. Students must complete the radiation sciences professional program at the University of Iowa.

Admission to the radiation sciences major is competitive. Students who wish to enter the major must first be admitted to the University of Iowa as College of Liberal Arts and Sciences (CLAS) students with a radiation sciences interest. As CLAS students, they must apply to the radiation sciences professional program of their choice by January 15 of the year in which they wish to enter it (see "Radiation Sciences Professional Programs" below). Students who are accepted enter the professional program, the radiation sciences major, and the Carver College of Medicine the following fall semester.

Applicants for admission to the University of Iowa whose first language is not English are strongly encouraged to complete the University of Iowa English proficiency evaluation and satisfy the University’s English proficiency requirements before they apply to a professional program. Students must have permission to register for a full academic load before they may be admitted to a radiation sciences professional program.

The radiation sciences major requires students to complete a minimum of two years of a high school world language prior to admission.

For additional information on UI admission requirements, contact the University’s Office of Admissions.

First-year and transfer applicants who are admitted to CLAS as radiation sciences interest students must complete all courses that are prerequisite to the radiation sciences major (including approved transfer equivalents) by June 1 before they may begin one of the radiation sciences professional programs and enter the major. Prerequisite courses vary slightly depending on which professional program a student wishes to enter.

Students who have declared a radiation sciences interest but have not yet applied and been accepted to a professional program are advised at the University’s Academic Advising Center. After they have been accepted to a professional program, they are advised by the Radiation Sciences Program.

When students complete the professional multimodality program, they are eligible to take national certification exams for their program’s specialty area(s). Once they have completed the professional program and all other requirements for graduation, they are granted a Bachelor of Science degree.

The Bachelor of Science with a major in radiation sciences requires the following work.
PREREQUISITES TO THE RADIATION SCIENCES MAJOR

Students who wish to enter a radiologic technology or diagnostic medical sonography professional program must complete the following prerequisite courses (25-27 s.h.) before they may enter the program and the major. Students who wish to enter the radiation therapy professional program must complete a total of 60 s.h. of college course work, including the following prerequisites, before they may enter the program and the major.

Rhetoric:

RHET:1030 Rhetoric 4 s.h.

Anatomy—one of these:

ACB:1199 Human Anatomy and Basic Physiology for Radiation Science 4 s.h.
ACB:3110 Principles of Human Anatomy 3 s.h.
ACB:3113 Human Anatomy Online 4 s.h.
HHP:1100 Human Anatomy 3 s.h.

Natural sciences—one of these (students who wish to enter a diagnostic medical sonography program or the radiation therapy program must choose PHYS:1400 or PHYS:1511):

BIOL:1140 Human Biology 4 s.h.
CHEM:1070 General Chemistry I 3 s.h.
CHEM:1110 Principles of Chemistry I 4 s.h.
HHP:1300 Fundamentals of Human Physiology 3 s.h.
HHP:3500 Human Physiology 3 s.h.
PHYS:1400 Basic Physics 3-4 s.h.
PHYS:1511 College Physics I 4 s.h.

Quantitative or formal reasoning—one of these:

MATH:1020 Elementary Functions 4 s.h.
MATH:1440 Mathematics for the Biological Sciences 4 s.h.

Social science:

PSY:1001 Elementary Psychology 3 s.h.

Medical terminology:

CLSA:3750 Medical and Technical Terminology 2 s.h.

Culture, society, and the arts—3 s.h. each in two of these areas (total of 6 s.h.):

Historical Perspectives approved course work 3 s.h.
International and Global Issues approved course work 3 s.h.
Literary, Visual, and Performing Arts approved course work 3 s.h.
Values, Society, and Diversity approved course work 3 s.h.

See General Education Program (College of Liberal Arts and Sciences) in the Catalog for approved courses in the culture, society, and arts areas listed above.

RECOMMENDED PRE-MAJOR WORK

The Radiation Sciences Program recommends that before students enter a radiation sciences professional program and the major, they job-shadow a professional who works in their area of interest, gain hands-on experience with patient care, and complete the following additional preparatory courses.

This course:

RSP:1100 Introduction to the Radiation Sciences 1 s.h.

One of these:

CS:1020 Principles of Computing 3 s.h.
CS:1110 Introduction to Computer Science 3 s.h.

One of these:

STAT:1020 Elementary Statistics and Inference 3 s.h.
STAT:3510 Biostatistics 3 s.h.
STAT:4143 Introduction to Statistical Methods 3 s.h.

For students interested in entering the radiation therapy professional program, one of these sequences:

CHEM:1070 & CHEM:1080 General Chemistry I-II 6 s.h.
CHEM:1110 & CHEM:1120 Principles of Chemistry I-II 8 s.h.

ELECTIVES

In order to earn the minimum of 120 s.h. required for graduation, students may need to complete elective course work in addition to the prerequisite course work listed above and one of the professional programs in medical imaging described below. They should plan their elective courses in consultation with their advisor.

RADIATION SCIENCES PROFESSIONAL PROGRAMS

Students must complete one of the following radiation sciences professional programs at University of Iowa Hospitals and Clinics. Each program offers modality-specific didactic and supervised clinical education courses. Graduates of the professional programs and associated internships are eligible to take one or more certification exams.

The radiologic technology programs and diagnostic medical sonography programs last three years, and the radiation therapy program lasts two years. Each program begins in fall.

Students must apply to the program of their choice by January 15 of the year in which they intend to enter the program.

Admission to all radiation sciences professional programs is competitive; each program accepts a limited number of students. In addition to the prerequisite courses listed above, students must have earned a cumulative college g.p.a. of at least 2.50 prior to professional program admission.

Radiologic Technology and Computed Tomography

The radiologic technology component of this program provides education in pathology, radiation biology, radiation protection, patient care, and ethics. Students learn about radiographic procedures, imaging, and evaluation. They become acquainted with imaging equipment, study quality assurance, and participate in supervised clinical education in radiography and computed tomography.
tomography (CT). The computed tomography component concentrates on sectional anatomy, single and multislice CT, electron beam CT, physiologic and 3-D imaging, CT simulation, physics and imaging, and procedures and pathology.

Upon completing the program, graduates are eligible to take the national certification exams in radiography and computed tomography.

Students typically apply to this three-year program during their first year and begin it in fall of their sophomore year. Application deadline is January 15.

Radiologic Technology and Magnetic Resonance Imaging

The radiologic technology component of this program provides education in pathology, radiation biology, radiation protection, patient care, and ethics. Students learn about radiographic procedures, imaging, and evaluation. They become acquainted with imaging equipment, study quality assurance, and participate in supervised clinical education in radiography and magnetic resonance imaging (MRI). The magnetic resonance imaging component offers intensive study and practice in MRI, including patient care procedures, pathophysiology, physics, sectional anatomy, and instrumentation.

Upon completing the program, graduates are eligible to take the national certification exams in radiography and magnetic resonance imaging.

Students typically apply to this three-year program during their first year and begin it in fall of their sophomore year. Application deadline is January 15.

Radiologic Technology and Cardiovascular Interventional

The radiologic technology component of this program provides education in pathology, radiation biology, radiation protection, patient care, and ethics. Students learn about radiographic procedures, imaging, and evaluation. They become acquainted with imaging equipment, study quality assurance, and participate in supervised clinical education in radiography, cardiac interventional, and peripheral/neurological interventional. The cardiovascular interventional component concentrates on imaging equipment; pharmacology; sterile techniques; cardiac monitoring; vascular anatomy and physiology; cardiovascular, peripheral, and neurological procedures and pathology; therapeutic intervention techniques; and digital angiography.

Upon completing the program, graduates are eligible to take the national certification exams in radiography, vascular interventional technology, and cardiac interventional technology.

Students typically apply to this three-year program during their first year and begin it in fall of their sophomore year. Application deadline is January 15.

Diagnostic Medical Sonography and General and Vascular Sonography

The diagnostic medical sonography program and general and vascular sonography provides a multispecialty education in obstetrical, abdominal, and vascular sonography (ultrasound imaging). Students learn about sonographic imaging and evaluation, hemodynamics and Doppler evaluation, sonography equipment, sectional anatomy, pathology, patient care, medical ethics, and quality assurance methods. They become proficient in using sonographic imaging equipment and in performing obstetrical and gynecological, abdominal, and vascular sonographic procedures, including invasive procedures, emergency exams, and 3-D imaging. They also participate in supervised clinical education. Elective courses are available in neurosonography and breast sonography.

Upon completing the program, graduates are eligible to take the national certification exams in diagnostic medical sonography in the specialty areas of obstetrics and gynecology, abdomen, and vascular technology.

Students typically apply to this three-year program during their first year and begin it in fall of their sophomore year. Application deadline is January 15.
Science degree with a major in radiation sciences by distance education. The program requires a minimum of 120 s.h. Students are awarded 60 s.h. of credit for the completed radiologic technology program plus course work that is prerequisite to entering the major. Upon admission to the major, students complete an online modality, advanced courses, and electives to complete the credit required for graduation.

Students choose one of three online modalities: cardiovascular interventional (CVI), computed tomography (CT), or magnetic resonance imaging (MRI). The modalities do not require an internship.

In order to be admitted to the radiation sciences major, students must pass the American Registry of Radiologic Technologists (ARRT) radiography board certification exam. They also must have completed all course work prerequisite to entering the major with a g.p.a. of at least 2.50; see “Prerequisites to the Radiation Sciences Major” under “Bachelor of Science” above. Students may count approved transfer credit toward the required prerequisites; learn more by visiting Transfer Courses in ISIS.

Once students are admitted to the Carver College of Medicine and the radiation sciences major, they must complete at least 30 s.h. of University of Iowa course work: two advanced courses (6 s.h.), an online modality (19-25 s.h., depending on the modality), and sufficient elective course work to complete the 120 s.h. of credit required for graduation.

**ADVANCED COURSES**

Management and leadership—the online section of one of these:

- COMM:1819 Organizational Leadership 3 s.h.
- MGMT:2100 Introduction to Management 3 s.h.
- MGMT:3500 Nonprofit Organizational Effectiveness I 3 s.h.

Statistics—the online section of one of these:

- STAT:1020 Elementary Statistics and Inference 3 s.h.
- STAT:4143 Introduction to Statistical Methods 3 s.h.

**ONLINE MODALITY**

Students complete one of the following three online modalities.

**Cardiovascular Interventional Program**

The cardiovascular interventional online modality requires the following course work (total of 23 s.h.).

- RSCI:4110 Vascular Anatomy 3 s.h.
- RSCI:4120 CVI Principles 4 s.h.
- RSCI:4130 Electrocardiogram and Hemodynamics 3 s.h.
- RSCI:4140 CVI Peripheral Procedures and Pathology 3 s.h.
- RSCI:4150 CVI Neurology and Nonvascular Procedures and Pathology 3 s.h.
- RSCI:4160 CVI Cardiac Procedures and Pathology 4 s.h.
- RSCT:4100 Sectional Anatomy for Imaging Sciences 3 s.h.

**Computed Tomography**

The computed tomography online modality requires the following course work (total of 19 s.h.).

- RSCT:4110 Vascular Anatomy 3 s.h.
- RSCT:4100 Sectional Anatomy for Imaging Sciences 3 s.h.
- RSCT:4110 CT/MRI Pathology 3 s.h.
- RSCT:4120 Computed Tomography Procedures I 3 s.h.
- RSCT:4125 Computed Tomography Procedures II 3 s.h.
- RSCT:4130 Computed Tomography Physical Principles and QC 4 s.h.

**Magnetic Resonance Imaging**

The magnetic resonance imaging online modality requires the following course work (total of 25 s.h.).

- RSMR:4110 Fundamentals for the MRI Technologist 3 s.h.
- RSMR:4120 MRI Procedures I 4 s.h.
- RSMR:4130 MRI Procedures II 3 s.h.
- RSMR:4140 MRI Acquisition and Principles I 3 s.h.
- RSMR:4150 MRI Acquisition and Principles II 3 s.h.

**ELECTIVES**

Students choose elective course work to complete the 120 s.h. required for graduation.

**Courses**

**Cardiovascular Interventional Program**

- **RSCI:4110 Vascular Anatomy** 3 s.h.
  Normal arterial and venous anatomy of the circulatory system, illustrated through angiographic, magnetic resonance imaging (MRI), and computed tomography (CT) images; common variants. Prerequisites: ACB:3110 or ACB:3113 or HHP:1100 or ACB:1199.

- **RSCI:4120 CVI Principles** 4 s.h.
  Imaging and accessory equipment for vascular interventional and cardiac interventional procedures; imaging equipment quality control; fundamental principles of vascular and cardiac procedures; patient preparation and care, radiation safety, contrast medium, pharmacology, and sedation. Corequisites: RSCI:4110. Requirements: acceptance to B.S. radiation science RT/CVI track or ARRT primary RT certification.

- **RSCI:4130 Electrocardiogram and Hemodynamics** 3 s.h.
  ECG analysis, hemodynamic principles and waveform analysis, cardiac output, vascular resistance, calculations of stenotic valves. Prerequisites: ACB:3110 or ACB:3113 or HHP:1100 or ACB:1199.

- **RSCT:4140 CVI Peripheral Procedures and Pathology** 3 s.h.
Computed Tomography Program

**RSCT:4100 Sectional Anatomy for Imaging Sciences** 3 s.h.
Sectional anatomy identifiable on computed tomography and magnetic resonance imaging, including transverse, coronal, and sagittal planes. Prerequisites: ACB:3110 or ACB:3113 or HHP:1100 or ACB:1199.

**RSCT:4105 Computed Tomography Clinical Internship I** 1.6 s.h.
Clinical internship scheduled at UI Hospitals and Clinics; rotation through CT scanners, 3-D lab, and radiation therapy departments; competency and objective-based education with required clinical performance evaluations; clinical coordinator facilitates schedules, rotations, learning objectives, evaluations, and competencies; experience facilitated by CT technologists, radiologists, residents, and coordinator; participation in routine and advanced CT scans; performance expectations become progressively higher as student gains experience and skills. Requirements: acceptance to B.S. radiation sciences RT/CT track.

**RSCT:4110 CT/MRI Pathology** 3 s.h.
Common pathological conditions found in CT and MRI images; protocol appearance variations; units of CNS, musculoskeletal, neck/thorax, and abdominopelvic pathology; textbook readings, in-class discussions, special projects including case studies and presentations. Requirements: concurrent enrollment in RSCT:4100, if not taken as a prerequisite, or at least 3 months fulltime CT/MRI clinical experience.

**RSCT:4115 Computed Tomography Clinical Internship II** 3 s.h.
CT scanners, 3-D lab, and radiation therapy department rotation at University of Iowa Hospitals and Clinics; competency and objective-based education with required clinical performance evaluations; clinical coordinator facilitates schedule, rotations, learning objectives, evaluations, and competencies; experience facilitated by CT technologists, radiologists, residents, and coordinator; participation in routine and advanced CT scans; performance expectations become progressively higher as students gain experience and skills. Prerequisites: RSCT:4105.

**RSCT:4120 Computed Tomography Procedures I** 3 s.h.
Computed tomography procedures of the head, neck, thorax, mediastinum, abdomen, and pelvis; positioning techniques, patient preparation, monitoring and care, indications and contraindications for procedures; contrast media usage; basic protocol information with adjustments to tailor procedures for patient's indications; brief units on patient care relevant to CT; CT parameters and equipment. Corequisites: RSCT:4100. Requirements: acceptance to B.S. radiation sciences RT/CT track or ARRT primary certification in radiologic technology, nuclear medicine, or radiation therapy.

**RSCT:4125 Computed Tomography Procedures II** 3 s.h.
Imaging information in musculoskeletal exams, 3-D reconstruction, CTAs; cardiac, including gating, biopsies, drains, post-myelography, radiation therapy planning, and 4-D imaging; CT arthrography, PET/CT, SPECT/CT, virtual colonoscopy; procedure indications and contraindications, patient and room preparation, positioning techniques, contrast media usage, and scan parameters; basic protocol information and how to tailor procedures to a patient's indications. Prerequisites: RSCT:4120. Corequisites: RSCT:4110, if not taken as a prerequisite.

**RSCT:4130 Computed Tomography Physical Principles and QC** 4 s.h.
Physical principles and instrumentation; historical development and evolution of CT; characteristics of radiation, beam attenuation, linear attenuation coefficients, tissue characteristics, Hounsfield numbers, data acquisition, image manipulation techniques, tube configuration, collimation design and function, detectors, image quality factors, functions of CT computer and array processor; image processing and display examined from data acquisition through postprocessing and archiving; radiation protection practices and QC. Requirements: acceptance to B.S. radiation sciences RT/CT degree track or ARRT primary certification in radiologic technology, nuclear medicine, or radiation therapy.

**RSMR:4140 MRI Procedures II**

MRI techniques related to neck, thorax, breast, abdomen, and pelvis; specific clinical applications; available coils and their use; considerations in imaging parameters; specific choices in protocols and positioning criteria. Prerequisites: RSMR:4120.

**RSMR:4140 MRI Acquisition and Principles I**

Physics and hardware used in obtaining a magnetic resonance signal, including magnetism, NMR signal production, tissue characteristics, spatial localization, pulse sequencing, imaging parameters and options, and special applications; exploration of skills useful in maximizing MR image quality. Prerequisites: RSMR:4110. Requirements: concurrent registration in RSMR:4110, if not taken as a prerequisite; or three months MRI experience.

**RSMR:4150 MRI Acquisition and Principles II**

Advanced MRI techniques; MR angiography and further investigation of fast image acquisition sequences; overview of MR magnets, installation, operation, and facility design; computers and digital image acquisition as they apply to MR; outline of quality assurance procedures. Prerequisites: RSMR:4140.

**RSMR:4160 MRI Clinical Internship I**

MRI clinical internship scheduled at UI Hospitals and Clinics; rotation through each MRI department scanning room; competency and objective-based education with required clinical performance evaluations; clinical preceptor facilitates schedules, rotations, learning objectives, evaluations, and competencies; experience facilitated by MRI technologists, radiologists, residents, and preceptor; participation in routine and advanced MRI scans; performance expectations become progressively higher as students gain experience and skills. Prerequisites: RSMR:4120 and RSMR:4140, if not taken as prerequisites. Requirements: acceptance to B.S. radiation sciences RT/MRI track.

**RSMR:4170 MRI Clinical Internship II**

MRI clinical internship scheduled at UI Hospitals and Clinics; rotation through each MRI department scanning room; competency and objective-based education with required clinical performance evaluations; clinical preceptor facilitates schedules, rotations, learning objectives, evaluations, and competencies; experience facilitated by MRI technologists, radiologists, residents, and preceptor; participation in routine and advanced MRI scans; performance expectations become progressively higher as student gains experience and skills. Prerequisites: RSMR:4160. Corequisites: RSMR:4120 and RSMR:4140, if not taken as prerequisites. Requirements: concurrent registration in RSMR:4110, if not taken as a prerequisite; or three months MRI experience.
**RSMR:4175 MRI Clinical Internship III**  
4 s.h.  
Rotation through MRI department scanning rooms at University of Iowa Hospitals and Clinics; competency and objective-based education with required clinical performance evaluations; clinical preceptor facilitates schedules, rotations, learning objectives, evaluations, and competencies; experience facilitated by MRI technologists, radiologists, residents, and preceptor; participation in routine and advanced MRI scans; performance expectations become progressively higher as students gain experience and skills. Prerequisites: RSMR:4170.

**Diagnostic Medical Sonography Program**

**RSMS:3100 Cardiac Sonography I**  
3 s.h.  
Normal sonographic anatomy, exam protocols, imaging techniques, and basic pathology of human heart. Prerequisites: RSCT:4100. Corequisites: RSMS:3110, if not taken as a prerequisite. Requirements: acceptance to radiation sciences MS degree track or successful completion of two-year radiologic technology or diagnostic medical sonography program.

**RSMS:3101 Cardiac Sonography I Lab**  
1 s.h.  
Simulated application of basic sonographic cardiac imaging; clinical history analysis. Corequisites: RSMS:3100. Requirements: acceptance to radiation sciences MS degree track.

**RSMS:3110 Foundations of Sonography**  
3 s.h.  
Sonography history, ergonomics, terminology, image orientation; basic theories of sound waves, echo production, transducers, equipment operation, body imaging, Doppler, hemodynamics. Requirements: PHYS:1400 or radiologic technology program physics course or diagnostic medical sonography physics course.

**RSMS:3111 Foundations of Sonography Lab**  
1 s.h.  
Sonography history, ergonomics, terminology, image orientation; basic theories of sound waves, echo production, transducers, equipment operation, body imaging, Doppler, and hemodynamics. Corequisites: RSMS:3110.

**RSMS:3115 Diagnostic Medical Sonography Clinical Internship I**  
2 s.h.  
Development of basic understanding of sonography clinical environment and professional practice standards; experience in health care setting. Requirements: acceptance to radiation sciences MS degree track.

**RSMS:3120 Abdominal Sonography I**  
3 s.h.  
Embryology, anatomy, and physiology of various abdominal structures imaged sonographically; abdominal vasculature, hepatobiliary system, pancreas, urinary system, adrenals, spleen, male anatomy; proper sonographic imaging techniques, including appearance of normal anatomy, imaging protocol, proper instrument settings. Prerequisites: RSCT:4100. Corequisites: RSMS:3110, if not taken as a prerequisite. Requirements: successful completion of a two-year radiologic technology or diagnostic medical sonography program.

**RSMS:3121 Abdominal Sonography I Lab**  
1 s.h.  
Simulated application of basic sonographic abdominal imaging, normal anatomy, examination protocols, and clinical history analysis. Corequisites: RSMS:3120. Requirements: acceptance to radiation sciences MS degree track.

**RSMS:3130 Obstetrical and Gynecological Sonography I**  
3 s.h.  
Embryology, anatomy, and physiology of the female reproductive system and developing fetus; proper sonographic imaging techniques, including appearance of normal anatomy, imaging protocol, proper instrument settings. Prerequisites: RSCT:4100. Corequisites: RSMS:3110, if not taken as a prerequisite. Requirements: successful completion of a two-year radiologic technology or diagnostic medical sonography program.

**RSMS:3131 Obstetrical and Gynecological Sonography I Lab**  
1 s.h.  
Simulated application of basic sonographic obstetrical and gynecological imaging; clinical history analysis. Corequisites: RSMS:3131. Requirements: acceptance to radiation sciences MS degree track.

**RSMS:3140 Vascular Sonography I**  
3 s.h.  
Embryology, anatomy, and physiology of peripheral and cerebral vascular system; normal and abnormal hemodynamics, Doppler waveforms, pressure measurements, plethysmography, sonographic appearance, scanning techniques; common types of pathology of the lower extremity arterial and venous system, cerebrovascular system. Prerequisites: RSCI:4110. Corequisites: RSMS:3110, if not taken as a prerequisite. Requirements: successful completion of a two-year radiologic technology or diagnostic medical sonography program.

**RSMS:3141 Vascular Sonography I Lab**  
1 s.h.  
Simulated application of basic sonographic vascular imaging, vascular physiologic testing, and clinical history analysis. Corequisites: RSMS:3140. Requirements: acceptance to radiation sciences MS degree track.

**RSMS:3150 Cardiac Physiology and Hemodynamics**  
3 s.h.  
Analysis of cardiac physiology, hemodynamics, diagnostic testing, and evaluation techniques specifically related to sonographic imaging. Prerequisites: RSCI:4130. Corequisites: RSMS:3110, if not taken as a prerequisite. Requirements: acceptance to radiation sciences MS degree track, or successful completion of two-year radiologic technology or diagnostic medical sonography program.

**RSMS:3205 Cardiac Sonography II**  
3 s.h.  
Sonographic evaluation of advanced pathophysiology of human heart; sonographic appearance, imaging techniques, and exam modification. Prerequisites: RSMS:3100.

**RSMS:3206 Cardiac Sonography II Lab**  
1 s.h.  
RSMS:3215 Diagnostic Medical Sonography Clinical Internship II
Development of basic skills for sonographic imaging and physiologic vascular testing in health care setting. Prerequisites: RSMS:3115. Requirements: acceptance to radiation sciences MS degree track.

RSMS:3230 Sonography Principles, Physics, and Instrumentation
Physical principles of sound waves, their applications to imaging of the human body, operation and physical characteristics of various ultrasound transducers, method by which the sound wave is converted into a visual image, instrumentation components and their functions, Doppler principles, image artifacts, advanced hemodynamics, and spectral Doppler waveform analysis. Prerequisites: RSMS:3110.

RSMS:3231 Sonography Principles, Physics, and Instrumentation Lab
Simulated application of sonographic imaging; emphasis on physics principles; instrumentation and quality assurance testing. Corequisites: RSMS:3230. Requirements: acceptance to radiation sciences MS degree track.

RSMS:3240 Abdominal Sonography II
Pathophysiology of abdominal structures imaged sonographically, including the GI system, abdominal wall, peritoneal, retroperitoneal, and superficial structures from RSMS:3120; interventional sonographic procedures (aspirations, biopsies, intraoperative procedures, sterile technique, needle-guide use); post-procedure protocol; clinical findings, laboratory studies, prognosis correlated with sonographic findings; appropriate image analysis and documentation of pathology. Prerequisites: RSMS:3120.

RSMS:3250 Obstetrical and Gynecological Sonography II
Sonographically-related pathological and abnormal congenital conditions of gynecology and obstetrics, infertility, assisted reproductive therapy, invasive procedures in obstetrics and gynecology, postpartum complications and maternal-fetal bonding; clinical findings, laboratory studies, and prognosis correlated with sonographic findings; appropriate image analysis and documentation of pathology. Prerequisites: RSMS:3130.

RSMS:3260 Breast Sonography
Embryology, anatomy, physiology, and pathophysiology of the breast as it relates to sonographic imaging; proper sonographic imaging techniques, including appearance of normal anatomy, imaging protocol, proper instrument settings; sonographic findings of diseases involving the breast. Prerequisites: RSMS:3110. Requirements: successful completion of a two-year radiologic technology or diagnostic medical sonography program.

RSMS:3270 Vascular Sonography II
Pathophysiology of peripheral, cerebral, and abdominal vascular systems as evaluated sonographically; normal and abnormal hemodynamics, Doppler waveforms, pressure measurements, plethysmography, sonographic appearance, scanning techniques; sonographic findings of diseases involving the lower extremity arterial and venous system, upper extremity arterial and venous system, cerebrovascular system, and abdominal vascular system. Prerequisites: RSMS:3140.

RSMS:3300 Neurosonography
Normal sonographic anatomy, exam protocols, imaging techniques, and pathology of neonatal brain and pediatric spinal cord. Prerequisites: RSMS:3110. Requirements: acceptance to a radiation sciences degree track, or successful completion of two-year radiologic technology or diagnostic medical sonography program.

RSMS:3315 Diagnostic Medical Sonography Clinical Internship III
Development of skills for sonographic imaging and physiologic vascular testing in health care setting. Prerequisites: RSMS:3215. Requirements: acceptance to radiation sciences MS degree track.

RSMS:3325 Abdominal Sonography II Lab
Simulated application of advanced sonographic abdominal imaging and clinical history analysis. Corequisites: RSMS:3240, if not taken as prerequisite. Requirements: acceptance to radiation sciences MS degree track.

RSMS:3376 Vascular Sonography II Lab
Simulated application of advanced sonographic vascular imaging; non-imaging vascular physiologic testing; clinical history analysis. Corequisites: RSMS:3270, if not taken as prerequisite. Requirements: acceptance to radiation sciences MS degree track.

RSMS:4100 Diagnostic Medical Sonography I
0,9 s.h.

RSMS:4110 Advanced Sonography
3 s.h.
Exploration of advanced sonographic imaging techniques and new technologies. Prerequisites: RSMS:3240 and RSMS:3250.

RSMS:4111 Advanced Sonography Lab
1 s.h.
Simulated application of advanced sonographic imaging techniques and new technologies. Prerequisites: RSMS:4110. Requirements: acceptance to radiation sciences MS degree track.

RSMS:4115 Diagnostic Medical Sonography Clinical Internship IV
Development of high-level skills for sonographic imaging and physiologic vascular testing in health care setting. Prerequisites: RSMS:3315. Requirements: acceptance to radiation sciences MS degree track.

RSMS:4120 Advanced Cardiac Sonography
3 s.h.
Advanced cardiac sonographic imaging techniques, quantifications, and new technologies. Prerequisites: RSMS:3205.

RSMS:4121 Advanced Cardiac Sonography Lab
1 s.h.

**RSMS:4150 Diagnostic Cardiac Sonography** 0 s.h.  
Principles, methods in using ultrasound; specialties including adult and stress echocardiography; six-month program; national certification examination required at completion of program. Requirements: completion of an accredited medical sonography or vascular technology program.

**RSMS:4200 Diagnostic Medical Sonography II** 0,9 s.h.  
Principles and methods in using ultrasound as an imaging modality; abdomen, obstetrics and gynecology, neurosonography, and vascular technology specialties; 18-month program; national certification required at completion. Prerequisites: RSMS:4100. Requirements: completion of an allied health program or bachelor's degree with course work in physics, anatomy, patient care, and algebra.

**RSMS:4215 Diagnostic Medical Sonography Clinical Internship V** 5 s.h.  
Development of advanced skills for sonographic imaging and physiologic vascular testing in health care setting. Prerequisites: RSMS:4115. Requirements: acceptance to radiation sciences MS degree track.

**RSMS:4220 Multidisciplinary Capstone Seminar** 3 s.h.  
Completion of student preparation for professional work environment; case-based learning. Prerequisites: RSMS:4110.

**RSMS:4250 Cardiac Sonography Clinical Course** 0 s.h.  
Using ultrasound as an imaging modality; specialties, including adult echocardiography, stress echocardiography; six-month program; national certification examination required at completion. Requirements: completion of an accredited medical sonography or vascular technology program.

**RSMS:4300 Diagnostic Medical Sonography III** 0,3 s.h.  
Prerequisites: RSMS:4200. Requirements: completion of an allied health program or bachelor's degree with course work in physics, anatomy, patient care, medical technology, and algebra.

**RSMS:4400 Diagnostic Medical Sonography IV** 0,9 s.h.  
Principles and methods in using ultrasound as an imaging modality; specialties including abdomen, pediatrics, obstetrics, gynecology, interventional procedures, vascular imaging, neurosonography; 18-month program; national certification examination required at completion. Prerequisites: RSMS:4300. Requirements: completion of an allied health program or bachelor's degree with course work in physics, anatomy, patient care, medical technology, and algebra.

**RSMS:4500 Diagnostic Medical Sonography V** 0,6 s.h.  
Prerequisites: RSMS:4400. Requirements: completion of an allied health program or bachelor's degree with course work in physics, anatomy, patient care, medical technology, and algebra.

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**Radiation Sciences Program**

**RSP:1100 Introduction to the Radiation Sciences** 1 s.h.  
Exploration of radiation sciences field (radiologic technology, nuclear medicine and PET, diagnostic medical sonography, radiation therapy, computed tomography, magnetic resonance imaging, cardiovascular interventional); introduction to basic principles and modalities associated with the field in preparation for application to radiation sciences or nuclear medicine technology major.

**RSP:2110 Pathology for Radiation Sciences** 2 s.h.  
General pathologic processes; introduction to imaging modalities; pathological terms that describe the body's response to stress and disease; how the body responds to and forms pathological diseases (e.g., infectious and parasitic diseases, inflammation and repair, immunopathology, neoplasia, genetic disorders, dietary deficiencies and excesses, hemodynamic disorders, trauma and emergencies). Requirements: acceptance to radiation science degree track.

**RSP:2120 Patient Care for the Radiation Sciences** 3 s.h.  
Foundation for providing care to clients during radiographic examinations; taking medical histories, basic life support, medical emergencies, vital sign assessment, body mechanics, infection control, sterile techniques, intravenous equipment, administration; advance concepts in client assessment and monitoring, including evaluation and monitoring of clients in pain, and clients in acute and chronic states of illness; communication techniques, role playing. Requirements: acceptance to radiation science degree track.

**RSP:3130 Radiation Safety and Radiobiology** 2 s.h.  
Instruction on safe operation of radiation producing equipment and handling of radioactive materials; origin and/or derivation of certain formulae and techniques useful in radiation protection programs; regulatory agencies, regulations, and regulatory guides pertinent to student's field; emphasis on applied aspects of radiation protection; characteristics and biological effects of ionizing radiations, properties and uses of radioisotopes, medical applications, and biological basis for protection procedures. Requirements: enrollment in radiation sciences or nuclear medicine technology program. Same as FRRB:3130.

**RSP:3210 Medical Ethics and Law** 2 s.h.  
Introduction to ethical reasoning and problem solving; integration of knowledge about patient care and ethical/legal issues which occur in process of providing care; ethical principles of autonomy, beneficence, justice, nonmaleficence, paternalism, Patient's Bill of Rights, resolving moral dilemmas; legal principles of malpractice, intentional torts, negligence. Requirements: radiation science or nuclear medicine technology major.
RSP:3220 Radiation Sciences Quality Management and Health Care Administration
Introduction to health care administration; quality management, safety, and patient satisfaction concepts for the radiation sciences professional. Requirements: radiation sciences or nuclear medicine technology major.

RSP:4110 Research Methodology for Radiation Sciences
Introduction to research concepts and methods for the radiation science professional. Requirements: radiation sciences or nuclear medicine technology major.

Radiologic Technology Program
RSRT:2110 Radiographic Procedures and Analysis I
Introduction to radiographic positioning principles; technical, positioning, and analysis information needed to perform and evaluate images of chest and abdomen on adult and pediatric patients; emphasis on quality patient care and adaptation to a variety of client conditions; labs. Prerequisites: (ACB:1199 or ACB:3110 or ACB:3113 or HHP:1100) and CLSA:3750. Requirements: acceptance to radiation sciences RT/CT, CVI, or MRI degree track.

RSRT:2120 Radiologic Technology Clinical Internship I
Student rotations through different radiography-related areas of University of Iowa Hospitals and Clinics; assist, practice, and test radiographic examinations learned in didactic setting; skill building for care and management of patients; conduction of performance assessments and completion of guideline objectives for each rotation; performance expectations become progressively higher as students gain experience and skills. Requirements: acceptance to radiation sciences RT/CT, CVI, or MRI degree track.

RSRT:2215 Radiographic Procedures and Analysis II
Technical, positioning, and analysis information needed to perform and evaluate images of upper and lower extremity, shoulder, and gastrointestinal and biliary radiographic procedures; emphasis on quality patient care and adaptation to a variety of client conditions; labs. Prerequisites: RSRT:2110.

RSRT:2225 Radiologic Technology Clinical Internship II
Student rotation through different radiography-related areas of University of Iowa Hospitals and Clinics; assist, practice, and test radiographic examinations learned in didactic setting; skill building for care and management of patients; conduction of performance assessments and completion of guideline objectives for each rotation; performance expectations become progressively higher as students gain experience and skills. Prerequisites: RSRT:2120.

RSRT:2325 Radiologic Technology Clinical Internship III
Student rotation through different radiography-related areas of University of Iowa Hospitals and Clinics; assist, practice, and test radiographic examinations learned in didactic setting; skill building for care and management of patients; conduction of performance assessments and completion of guideline objectives for each rotation; performance expectations become progressively higher as students gain experience and skills. Prerequisites: RSRT:2225.

RSRT:3115 Radiographic Procedures and Analysis III
Technical, positioning, and analysis information needed to perform and evaluate images of hip, pelvis, spine, thorax, skull, and GU system radiographic procedures; emphasis on quality patient care and adaptation to a variety of client conditions; labs. Prerequisites: RSRT:2215.

RSRT:3125 Radiologic Technology Clinical Internship IV
Student rotation through different radiography-related areas of University of Iowa Hospitals and Clinics; assist, practice, and test radiographic examinations learned in didactic setting; skill building for care and management of patients; conduction of performance assessments and completion of guideline objectives for each rotation; performance expectations become progressively higher as students gain experience and skills. Prerequisites: RSRT:2325.

RSRT:3140 Radiographic and Digital Imaging
Factors that govern and influence production of radiographic image; X-ray and scatter production; patient interactions; function of kVp, mAs, and distance as applied to contrast and spatial resolution; practical issues concerning automatic exposure control and grid usage; labs to practice and apply theoretical principles associated with production of quality images. Prerequisites: MATH:1020 or MATH:1440. Requirements: acceptance to radiation sciences RT/CT, CVI or MRI degree track.

RSRT:3210 Radiographic and Digital Quality Control Lab
Exploration and performing radiographic and digital quality control tests.

RSRT:3215 Radiographic Procedures IV
Technical, positioning, and analysis information needed to perform and evaluate images performed in advanced radiographic procedures; emphasis on quality patient care and adaptation to a variety of client conditions. Prerequisites: RSRT:3115.

RSRT:3225 Radiologic Technology Clinical Internship V
Student rotation through different radiography-related areas of University of Iowa Hospitals and Clinics; assist, practice, and test radiographic examinations learned in didactic setting; skill building for care and management of patients; conduction of performance assessments and completion of guideline objectives for each rotation; performance expectations become progressively higher as students gain experience and skills. Prerequisites: RSRT:3125.
RSRT:3230 Radiographic Physics and Imaging Equipment 4 s.h.
Characteristics of atomic structure, electricity, and X-ray machines; properties of X-rays and their interaction with matter; measurement of radiation exposure; construction principles and theories of operation of specialized imaging equipment, including fundamentals of acquisition for imaging intensification, geometric tomography, mobile/portable radiography, and magnification principles. Prerequisites: MATH:1020 or MATH:1440.

RSRT:3325 Radiologic Technology Clinical Internship VI 2 s.h.
Student rotation through different radiography-related areas of University of Iowa Hospitals and Clinics; assist, practice, and test radiographic examinations learned in didactic setting; skill building for care and management of patients; conduction of performance assessments and completion of guideline objectives for each rotation; performance expectations become progressively higher as students gain experience and skills. Prerequisites: RSRT:3225.

RSRT:4125 Radiologic Technology Clinical Internship VII 1 s.h.
Student rotation through different radiography-related areas of University of Iowa Hospitals and Clinics; assist, practice, and test radiographic examinations learned in didactic setting; skill building for care and management of patients; conduction of performance assessments and completion of guideline objectives for each rotation; performance expectations become progressively higher as students gain experience and skills. Prerequisites: RSRT:3325.

Radiation Therapy Program

RSTH:3100 Introduction to Radiation Therapy 2 s.h.
Introduction to cancer as a disease; defining methods to treat cancer with emphasis on radiation therapy; simulation, planning, and treatment delivery of radiation therapy. Prerequisites: ACB:1199 and CLSA:3750. Requirements: acceptance to radiation sciences therapy program.

RSTH:3110 Medical Physics I 2-3 s.h.
Introduction to radiation used in clinical setting; fundamental physical units, measurements, principles, atomic structure and types of radiation; X-ray generating equipment, X-ray production, and its interaction with matter. Requirements: acceptance to radiation sciences therapy program, and maxillofacial or radiation oncology resident. Same as FRRB:3110.

RSTH:3120 Radiation Therapy Clinical Internship I 3 s.h.
Student rotations through different radiation therapy related areas; assist, practice, and test radiation therapy principles learned in didactic setting; skill building for care and management of patients; conduction of performance assessments and completion of guideline objectives for each rotation; performance expectations become progressively higher as students gain experience and skills. Requirements: acceptance to radiation sciences therapy program.

RSTH:3205 Principles of Radiation Therapy I 2 s.h.
Didactic and laboratory work in principles of radiation therapy; historic and current aspects of cancer treatment; role of radiation therapist; patient care, treatment delivery accessories, tumor localization treatment delivery protocols. Prerequisites: RSTH:3100. Requirements: enrollment in radiation sciences therapy program.

RSTH:3215 Medical Physics II 2-3 s.h.
Treatment units used in external radiation therapy; beam calculations, isodose distributions, brachytherapy, quality assurance and quality management, protection and safety. Prerequisites: RSTH:3110. Same as FRRB:3215.

RSTH:3225 Radiation Therapy Clinical Internship II 3 s.h.
Student rotations through different radiation therapy related areas; assist, practice, and test radiation therapy principles learned in didactic setting; skill building for care and management of patients; conduction of performance assessments and completion of guideline objectives for each rotation; performance expectations become progressively higher as students gain experience and skills. Prerequisites: RSTH:3120. Requirements: acceptance to radiation sciences therapy program.

RSTH:3325 Radiation Therapy Clinical Internship III 6 s.h.
Student rotations through different radiation therapy related areas; assist, practice, and test radiation therapy principles learned in didactic setting; skill building for care and management of patients; conduction of performance assessments and completion of guideline objectives for each rotation; performance expectations become progressively higher as students gain experience and skills. Prerequisites: RSTH:3225. Requirements: acceptance to radiation sciences therapy program.

RSTH:4100 Radiation Therapy I 0,12 s.h.
Theory and techniques of radiation therapy technology; emphasis on areas of oncology treatment planning, treatment set-up, dosimetry, use of megavoltage radiation-producing equipment to administer treatments. Requirements: completion of radiologic technology program and eligibility for registration with a national certification program.

RSTH:4105 Principles of Radiation Therapy II 2 s.h.
Evaluation and management of neoplastic disease using knowledge in arts and sciences; critical thinking and basis of ethical clinical decision making; epidemiology, etiology, detection, diagnosis, patient condition, treatment and prognosis of neoplastic disease. Prerequisites: RSTH:3205. Requirements: enrollment in radiation sciences therapy program.

**RSTH:4125 Radiation Therapy Clinical Internship IV**

Student rotations through different radiation therapy related areas; assist, practice, and test radiation therapy principles learned in didactic setting; skill building for care and management of patients; conduction of performance assessments and completion of guideline objectives for each rotation; performance expectations become progressively higher as students gain experience and skills. Prerequisites: RSTH:3325. Requirements: acceptance to radiation sciences therapy program.

**RSTH:4200 Radiation Therapy II**

Theory and techniques of radiation therapy technology; emphasis on areas of oncology treatment planning, treatment set-up, dosimetry, use of megavoltage radiation-producing equipment to administer treatment; one-year program ending in eligibility for national certification examination in radiation therapy.

Prerequisites: RSTH:4100. Requirements: graduation from an accredited radiography program and eligibility for registration with a national certification program.

**RSTH:4225 Radiation Therapy Clinical Internship V**

Student rotations through different radiation therapy related areas; assist, practice, and test radiation therapy principles learned in didactic setting; skill building for care and management of patients; conduction of performance assessments and completion of guideline objectives for each rotation; performance expectations become progressively higher as students gain experience and skills. Prerequisites: RSTH:4125. Requirements: acceptance to radiation sciences therapy program.

**RSTH:4230 Radiation Therapy Capstone**

Professional development; review of concepts.

Requirements: acceptance to radiation sciences therapy program.

**RSTH:4300 Radiation Therapy III**

Prerequisites: RSTH:4200.