Molecular Imaging & Therapeutics (MIT)

MIT 5110 - Physical Principles
Credit(s): 3 Credits
This class will cover the history of magnetic resonance imaging, magnetism, signal production, and the physics related to imaging. This will include, but it not limited to: tissue characterization; T1 and T2 relaxation; signal decay; k-space; Fourier transformation; spatial encoding; and image characteristics.

MIT 5120 - Cross Sectional Anatomy and Pathology
Credit(s): 3 Credits
Students will become familiar with cross-sectional anatomy and will learn how to view and to image the human body in multiple planes. The pathology of the various body regions (including neurological, visceral, musculoskeletal, soft tissue, and vasculature) will be discussed as it relates to MR imaging.

MIT 5130 - Instrumentation and Quality Analysis
Credit(s): 3 Credits
This class covers all components of MR imaging equipment including the magnet, the acquisition console, and all ancillary equipment. The various types of magnets, gradients, shims, radiofrequency coils, and magnetic and RF shielding will be covered, as well as maintenance, quality analysis and operational workflows.

MIT 5140 - Clinical MRI and Image Production
Credit(s): 5 Credits
Students will learn the clinical aspects of MRI. This includes the imaging parameters for intrinsic image contrast characteristics; proper sequence selection; adjustments of imaging options; administration of contrast media; and use of post-processing applications.

MIT 5150 - Patient Care and MRI Safety
Credit(s): 3 Credits
This class will cover the handling and care of patients, visitors, and staff in the MRI environment. This includes the proper education and screening of anyone or any equipment entering the magnetic field. Emergency procedures and their effect on patients, staff, and the public will also be discussed.

MIT 5210 - Clinical MRI Practicum
Credit(s): 9 Credits
Students will perform a wide variety of magnetic resonance imaging procedures in multiple clinical setting under the direct supervision of qualified medical professionals. Students will interact with patients ranging from infants to geriatrics. Clinical experience will include venipuncture and the administration of contrast media.

MIT 5220 - Advanced/Emerging Technologies
Credit(s): 3 Credits
An exploration of the emerging technologies and advances in MRI including their impact on imaging and healthcare, will be presented. In addition, a correlation between MRI and other imaging modalities (Computed Tomography, Nuclear Medicine/PET, Ultrasound, etc.) will be discussed.

MIT 5300 - Treatment Technique
Credit(s): 3 Credits
This course will introduce concepts and terminology of radiography and radiation therapy treatment set-ups. It will examine anatomy, positioning, immobilization, field boundaries, and standard beam arrangements for site-specific anatomical areas. Laboratory experiences include virtual simulation demonstrations and conventional/CT simulator practice with a phantom.

MIT 5310 - Radiation Physics
Credit(s): 2 Credits
This course is intended for those who may be interested in the fundamental concepts of physics that apply to the field of Nuclear Medicine and Radiation Therapy. During this course the student is introduced to the fundamental structure of the atom and its associated binding energies. The course includes a comprehensive coverage of the types and mathematics of radioactive decay. Interactions of charged particles and photons with matter are discussed to provide a basis for the understanding of radiation detectors. X-ray production as well as internal radiation dosimetry will be covered.

MIT 5320 - XRT Radiation Therapy Practice I
Credit(s): 3 Credits
This course provides the student with an overview of the foundations in radiation therapy and practitioner’s role. Principles of radiation, health safety, ethics and the professional responsibilities of the radiation therapist will be discussed and examined. Basic operational issues in radiation therapy will be examined. The role of the radiation therapist in the health care organization, the treatment prescription, the documentation of treatment parameters and delivery, emergency procedures and patient condition and education needs will be presented, discussed, and evaluated. The students are expected to observe and gain practical experience in the areas of patient care, patient safety, department operation, localization, treatment, dosimetry, and quality assurance as these are all components of the daily responsibilities of the radiation therapist.

MIT 5330 - Treatment Planning
Credit(s): 2 Credits
This course will introduce concepts and terminology of radiography and radiation therapy treatment set-ups. It will examine anatomy, positioning, immobilization, field boundaries, and standard bean arrangements for site-specific anatomical areas. Laboratory experiences include virtual simulation demonstrations and conventional/CT simulator practice with a phantom.

MIT 5340 - Treatment Planning
Credit(s): 2 Credits
Introduces concepts and terminology of radiation therapy treatment planning. Describes anatomical site-specific treatment planning, which incorporates imaging; target volume delineation and dose prescription; organs at risk delineation and respective dose limitations; beam arrangement, energy, modality, and modifiers; related calculations; and dose evaluation. Laboratory experiences include demonstrations and practice with computer treatment planning systems. Offered every fall.

MIT 5350 - XRT Clinical Practicum I
Credit(s): 6 Credits
Content and clinical practice experiences shall be designed for sequential development, application, analysis, integration, synthesis and evaluation of concepts and theories in radiation therapy. Clinical practice experiences shall be designed to provide care to the patient in the therapeutic setting for simulation, treatment planning and administration of a prescribed course of treatment. Levels of competency and outcomes measurement shall assure the well-being of the patient preparatory to, during and following delivery of radiation therapy treatment and services. Through structured assignments in clinical facilities, concepts of team practice, patient-centered clinical practice and professional development shall be discussed, examined and evaluated.
MIT 5360 - Emerging Technologies  
Credit(s): 2 Credits  
This course will introduce basic x-ray production and its uses plus advanced imaging technologies. A study of human anatomy as it relates to radiographic films and cross sectional human anatomy is also covered.

MIT 5400 - Radiation Oncology Patient Care and Quality Management  
Credit(s): 3 Credits  
This course introduces the student to the roles and responsibilities of the radiation therapist in meeting the general needs of the patient undergoing radiotherapy, including nursing, patient safety and quality management. The student will be provided with foundation concepts and competencies in assessment and evaluation of the patient for service delivery. Psychological and physical needs and factors affecting treatment outcomes will be presented and examined. Incorporated into patient care, the course reviews principles and guidelines of a quality management program in radiation, incorporating clinical process, equipment, and documentation that demonstrate patient care outcomes. Additionally, regulatory agencies and respective rules affecting the radiation oncology workplace, staff, and patients are emphasized. The role of the radiation therapist in patient care, safety and quality management is stressed.

MIT 5410 - Radiobiology and Radiation Protection  
Credit(s): 2 Credits  
The radiobiology course content is designed to present basic concepts and principals of radiation biology. The interactions of radiation with cells, tissues and the body as a whole and resultant biophysical events will be presented. Discussion of the theories and principals of tolerance dose, time-dose relationships, fractionation schemes and relationship to the clinical practice of radiation therapy will be discussed, examined and evaluated. The radiation protection section of this course covers the basic concepts of radiation protection, types of radiation, personnel and facility radiation monitoring, environmental protection, the safe handling of radioactive materials, equipment use, quality control, and how these concepts relate to radiation protection. Radiation safety practices in radiation therapy departments, and regulations that govern the use of radioactive materials in the clinical setting will also be covered. The entirety of the course will provide the student with an understanding of the significance of protecting themselves and the patients that they serve.

MIT 5420 - XRT Radiation Therapy Practice II  
Credit(s): 3 Credits

MIT 5430 - XRT Capstone  
Credit(s): 1 Credit  
This course integrates previous knowledge and skills with significant, relevant issues and subjects in professional practice. Emphasizes professional role development of the new graduate and preparation for the national credentialing board exam. Only MIT MIRT students can register for this course. Course offered in spring and summer.

MIT 5440 - XRT Clinical Dosimetry  
Credit(s): 3 Credits  
Reviews basic concepts introduced in Treatment Planning, further examining factors that influence and govern dose determination and planning treatment for radiation therapy patients. Emphasizes clinical application of photon and electron beam characteristics, dose calculations, and related factors to safely and optimally treat the radiation therapy patient. Several laboratory sessions supplement the lectures. Some focus is directed on clinical dosimetry and treatment planning for radiation oncology special procedures.

MIT 5450 - Clinical Practicum II  
Credit(s): 0 Credits  
Content and clinical practice experiences shall be designed for sequential development, application, analysis, integration, synthesis and evaluation of concepts and theories in radiation therapy. Clinical practice experiences shall be designed to provide care to the patient in the therapeutic setting simulation, treatment planning and administration of the prescribed course of treatment. Levels of competency and outcomes measurement shall assure the well-being of the patient preparatory to, during, and following delivery of radiation therapy treatment and services. Through structured assignments in clinical facilities, concepts of team practice, patient-centered clinical practice and professional development shall be discussed, examined and evaluated. Continuation of Clinical Practicum I.

MIT 5510 - NMT Radiation Physics and Radiation Protection  
Credit(s): 0 or 4 Credits  
This course is intended for those who may be interested in the fundamental concepts of physics that apply to the field of Nuclear Medicine and Radiation Therapy. During the physics portion of the course the student is introduced to the fundamental structure of the atom and its associated binding energies. The course includes a comprehensive coverage of the types of mathematics of radioactive decay. Interactions of charged particles and photons with matter are discussed to provide a basis for the understanding of radiation detectors. X-ray production as well as internal radiation dosimetry will be covered. The radiation biology section of this course covers the basic concepts of radiobiology, sources and types of radiation, and the effects of radiation exposure to humans. The radiation protection section covers the safe handling of radioactive materials, radiation safety practices in the nuclear medicine and radiation therapy departments, and regulations that govern the use of radioactive materials in the clinical setting. The entirety of the course will provide the student with an understanding of the significance of protecting themselves and the patients that they serve.

MIT 5520 - Radiochemistry  
Credit(s): 3 Credits  
This course will focus on the methods of production and compounding radiopharmaceuticals and their biodistribution in the human body. There will also be sections on general nomenclature of the radiopharmaceutical, aseptic technique and pertinent regulations.

MIT 5530 - Nuclear Medicine Instrumentation  
Credit(s): 2 Credits  
During the basis instrumentation part of the course the student is introduced to the principles and operation of various types of radiation detectors and imaging devices in nuclear medicine. The series of basic events by which the energy of a detected gamma or x-ray photon is transformed into electrical pulses will be discussed. The theory and operation of SPECT and PET/CT imaging instruments will be discussed. Quality control procedures will be emphasized through a series of instrumentation experiments, the students will have an opportunity to calibrate a single channel analyzer and identify the detection characteristics influencing the counting of radioactivity.
MIT 5540 - NMT Clinical Nuclear Medicine
Credit(s): 3 Credits
This course is divided into four sections, which are taught simultaneously in units. These sections are imaging, nonimaging, patient care and administrative procedures. The imaging portion of the course includes a review of concepts in anatomy, physiology and pathology as they relate to clinical applications in nuclear medicine. Through a team teaching approach (physicians and technologists), indications for nuclear medicine exams, procedural techniques and analysis of laboratory data are presented. Students learn how basic image appearance and/or numerical data are altered by specific pathologic states. The nonimaging portion of the course includes an introduction to basic laboratory equipment, its proper operation and necessary quality control procedures. Principals of immunology are presented prior to discussing individual procedures. Lecture presentations are reinforced with companion clinical application experiments performed in the student laboratory.

MIT 5550 - Nuclear Medicine Information Systems
Credit(s): 3 Credits
In this course the basic principles of computer design and operation will be presented. The student will gain an understanding of how these principles are applied to Nuclear Medicine computer applications.

MIT 5610 - Imaging Practicum
Credit(s): 7 Credits
During the imaging rotation the student is expected to have observed the following procedures and be capable of performing same under the supervision of the staff technologist. A record is kept as to the number of procedures a student has observed, participated in and performed.

MIT 5620 - Radiochemistry Practicum
Credit(s): 3 Credits
During the radiopharmacy rotation the student is expected to observe all procedures and be capable of performing same under the supervision of the radiopharmacist or the responsible individual. A record is kept as to the number of times each task has been observed, participated in and performed.

MIT 5630 - Emerging Technologies
Credit(s): 3 Credits
The Advanced Imaging course is designed to provide students with a working knowledge of the contribution of Computed Tomography, Magnetic Resonance Imaging and PET/CT imaging.

MIT 5880 - NMT Clinical Practicum
Credit(s): 0 Credits
This course follows the same content and objectives as NMT 561. It is offered during the summer semester to complete the 12 month program.

MIT 5890 - Clinical MRI Practicum II
Credit(s): 0 Credits
Students will perform wide variety resonance imaging procedures in multiple clinical settings under the direct supervision of qualified medical professionals. Students will interact with patients ranging from infants to geriatrics. Clinical experience will include venipuncture and administration of contrast media. Continuation of Clinical Practicum I.

MIT 5930 - Special Topics
Credit(s): 3 Credits (Repeatable for credit)

MIT 5980 - Independent Study
Credit(s): 1 or 3 Credits (Repeatable for credit)

MIT 6000 - Masters Seminar I
Credit(s): 1 Credit
This course is the first of three masters level seminar courses that build upon each other, culminating in a scholarly project suitable for publication in a peer-reviewed journal, professional presentation or equivalent. It will emphasize clinical research design including extensive statistical methods and conclusions. The student must select a topic that combines both of their undergraduate and graduate areas of study. Each student is assigned a scholarly mentor to provide guidance in planning, coordinating, conducting and presenting the project.

MIT 6100 - Masters Seminar II
Credit(s): 2 Credits
This course is the second of the three masters level seminar courses that build upon each other, culminating in a scholarly project suitable for publication in a peer-reviewed journal, professional presentation or equivalent. It will emphasize clinical research design including extensive statistical methods and conclusions. The student must select a topic that combines both their undergraduate and graduate areas of study. Each student is assigned a scholarly mentor to provide guidance in planning, coordinating, conducting and presenting the project.

MIT 6200 - Masters Seminar III
Credit(s): 3 Credits
This course is the final course of three masters level seminar courses that build upon each other, culminating in a scholarly project suitable for publication in a peer-reviewed journal, professional presentation or equivalent. It will emphasize clinical research design including extensive statistical methods and conclusions. The student must select a topic that combines both their undergraduate and graduate areas of study. Each student is assigned a scholarly mentor to provide guidance in planning, coordinating, conducting and presenting the project.

MIT 6930 - Special Topics
Credit(s): 3 Credits (Repeatable for credit)

MIT 6980 - Independent Study
Credit(s): 1-3 Credits (Repeatable for credit)
This course is intended for MIT students who undertake a research project in which the complexity of the work extends the project beyond the traditional MIT schedule. The length of this course may not extend the entire semester and the course will end upon completion of the contracted work.