MEDICAL PHYSICS

The Doctorate of Medical Physics (D.M.P.) program aims to enhance and standardize clinical training for medical physicists. Whereas the medical physics Ph.D. program offered at the Health Science Center prepares the students for a research career in medical physics, the D.M.P. is a professional degree that prepares the students for a clinical career in either imaging or therapeutic medical physics. This four year degree program is similar in structure to other professional degrees, such as the M.D., D.D.S., D.V.M., in that it combines a didactic and clinical training curriculum throughout the four years of studies. A student is admitted to either the imaging or the therapy track and must remain in that track for the duration of their studies.

This is an interdisciplinary program that is housed in the Graduate School and is administered through the Departments of Radiation Oncology and Radiology, with faculty from both departments contributing to the didactic and clinical training. The program is accredited by the Commission on Accreditation of Medical Physics Education Programs (CAMPEP).

Admissions Requirements

Graduate Record Exam (GRE) general test and a minimum GPA of 3.0/4.0 are required. Three letters of recommendation are required. During the application process, essays stating the reasons for your interest in medical physics, description of professional goals and an outline of your undergraduate, industrial or summer research, teaching experience and clinical experience are required.

A Baccalaureate degree in a natural science or engineering discipline is required. A degree in any other field must include sufficient science and mathematics courses to give the applicant the equivalent of a degree in natural science or engineering. Applicants must have undergraduate credit for the following courses: 1) Biology: One semester of general biology; 2) Chemistry: One semester of general chemistry; 3) One semester of Human Anatomy OR Physiology; 4) Physics: Include at a minimum Modern Physics, Modern Physics Lab, Electricity & Magnetism, Classical Mechanics, and Quantum Mechanics; 5) Mathematics: Through calculus and ordinary differential equations; 6) Computer Science: Introduction to Computer Science (one semester). Admission process includes review of academic history as well as experience and goals of the applicant. Telephone and on-campus interviews are conducted for qualified applicants that are selected by the Admissions Committee.

Degree Requirements

A minimum of 100 credit hours (48 of which are clinical rotations) and a minimum overall GPA of 3.0 are required for the D.M.P. degree. The student is required to demonstrate intellectual command of the subject area and proficiency in all aspects of their chosen clinical specialization. A Core Knowledge Exam is offered at the end of the first year of studies that has to be passed for the student to remain in the program.

D.M.P. - Therapy Track

First Year		
Fall		**Credit Hours**
RADI 5015	Physics Of Diagnostic Imaging 1	3
RADI 6030	Physics Of Radiotherapy	3
RADI 5005	Fundamentals Of Radiation Dosimetry	3
RADI 6023	Introduction To Clinical Medical Physics Practice	2
RADI 6049	Intro To Magnetic Resonance	2
	Total Credit Hours:	13.0

First Year		
Spring		**Credit Hours**
RADI 6033	Advanced Radiotherapy Physics	3
RADI 5020	Principles of Health Physics 1	3
RADI 6012	Phys Nuclear Medi Imaging	3
RADI 6023	Introduction To Clinical Medical Physics Practice	1
RADI 6016	Physics of Diagnostic Imaging 2	3
	Total Credit Hours:	13.0

Second Year		
Fall		**Credit Hours**
RADI 5025	Molecular Oncology & Radiobiology	3
RADI 6031	Physics Measurements In Radiotherapy I	3
RADI 7005	Treatment Planning Techniques In Radiation Therapy	3
RADI 6023	Introduction To Clinical Medical Physics Practice	3
	Total Credit Hours:	12.0

Second Year		
Spring		**Credit Hours**
RADI 7006	Treatment Planning Techniques in Radiotherapy 2	3
RADI 6035	Physics Measurements In Radiotherapy 2	3
RADI 6024	Radiological Anatomy & Physiology	3
RADI 6023	Introduction To Clinical Medical Physics Practice	1
RADI 5007	Statistics in the Radiological Sciences	2
	Total Credit Hours:	12.0

Third Year		
Fall		**Credit Hours**
RADI 6025	Therapy Clinical Rotation 1	12
	Total Credit Hours:	12.0

Third Year		
Spring		**Credit Hours**
RADI 6026	Clinical Therapy Rotation 2	12
	Total Credit Hours:	12.0

Fourth Year		
Fall		**Credit Hours**
RADI 6032	Therapy Clinical Rotation 3	12

RADI 6097	Research	1
	Total Credit Hours:	13.0

Fourth Year

Spring		**Credit Hours**
RADI 6034	Therapy Clinical Rotation 4	12
RADI 6097	Research	1
	Total Credit Hours:	13.0

D.M.P. - Imaging Track

First Year

Fall		**Credit Hours**
RADI 5015	Physics Of Diagnostic Imaging 1	3
RADI 6030	Physics Of Radiotherapy	3
RADI 5005	Fundamentals Of Radiation Dosimetry	3
RADI 6023	Introduction To Clinical Medical Physics Practice	2
RADI 6049	Intro To Magnetic Resonance	2
	Total Credit Hours:	13.0

First Year

Spring		**Credit Hours**
RADI 6033	Advanced Radiotherapy Physics	3
RADI 5020	Principles of Health Physics 1	3
RADI 6012	Phys Nuclear Medi Imaging	3
RADI 6023	Introduction To Clinical Medical Physics Practice	1
RADI 6016	Physics of Diagnostic Imaging 2	3
	Total Credit Hours:	13.0

Second Year

Fall		**Credit Hours**
RADI 5025	Molecular Oncology & Radiobiology	3
RADI 6038	Methods in Dosimetry & Shielding Design	2.5
RADI 6051	Statistical Parametric Mapping	3
RADI 6023	Introduction To Clinical Medical Physics Practice	3
	Total Credit Hours:	11.5

Second Year

Spring		**Credit Hours**
RADI 6015	Physics Measurements in Imaging 2	3
RADI 6050	Magnetic Resonance Imaging	2
RADI 6024	Radiological Anatomy & Physiology	3
RADI 6023	Introduction To Clinical Medical Physics Practice	3
RADI 5007	Statistics in the Radiological Sciences	2
	Total Credit Hours:	13.0

Third Year

Fall		**Credit Hours**
RADI 6027	Imaging Physics Clinical Rotation 1	12
	Total Credit Hours:	12.0

Third Year

Spring		**Credit Hours**
RADI 6039	Imaging Physics Clinical Rotation 2	12
	Total Credit Hours:	12.0

Fourth Year

Fall		**Credit Hours**
RADI 6040	Imag Physics Clin Rotation 3	12
RADI 6097	Research	1
	Total Credit Hours:	13.0

Fourth Year

Spring		**Credit Hours**
RADI 6043	Imaging Physics Clinical Rotation 4	12
RADI 6097	Research	1
	Total Credit Hours:	13.0

Objectives/Program Outcomes

1. Proficiency in core biomedical and radiological science principles
2. Critically review and interpret literature on clinical research in your chosen study discipline
3. Conduct clinical research in an ethical manner
4. Demonstrate competence in written communication
5. Demonstrate competence in verbal communication
6. Demonstrate competence as a clinician in your chosen study discipline

Courses

RADI 4001. General Diagnostic Radiology. 4 Credit Hours.
This course is designed as an introduction to diagnostic radiology. The primary goals of the course are directed toward introducing the student to the different diagnostic imaging modalities available and teaching the student to select the appropriate radiologic examinations for different clinical problems. Students will have the opportunity to receive a working knowledge of diagnostic radiology through lectures, individual projects, reading assignments, participation in subspecialty rotations, teaching conferences, and study of the American College of Radiology teaching file.

RADI 4006. Pediatric Radiology. 4 Credit Hours.
By being with the pediatric radiologist on a one-on-one basis through most of the working day, the student will have the opportunity to gain some insight as to the radiologist's role as a clinician, consultant, and teacher; and acquire some knowledge of general pediatrics, neonatology, urology, orthopaedics, and other specialties. The student may attend Diagnostic Radiology Lectures.

RADI 4007. Review Of Radiology for the Intern. 0.5 Credit Hours.
This is a refresher course in Clinical Diagnostic Radiology. In a large group format, a Radiology faculty member will review with the participants the basics of evaluating the chest X-ray, chest CT, abdominal CT, spinal, head, and pediatric cases. In addition, time will be spent on reviewing the appropriate studies to order for the work-up of various clinical scenarios.

RADI 4020. Mammography- A Multidisciplinary Approach. 4 Credit Hours.
This elective is intended to educate students in the subject of mammography with a multidisciplinary approach. Students will be allowed to spend 2 days each week in medical oncology, surgical oncology, or radiation therapy. Students will primarily be assigned to the mammography section of radiology, learning what criteria are used to detect breast cancer and participating in the work-up of lesions and witnessing biopsies. In addition, they will attend tumor board once a week that is multidisciplinary one day per week will set aside for library student and the students will be asked to research a topic or participate in a project regarding mammography. We intend that this elective will thoroughly educate those who are interested in mammography and help them understand how our specialty is integrated with many other disciplines.

RADI 4202. General Diagnostic Radiology. 4 Credit Hours.
By being with the pediatric radiologist on a one-on-one basis through most of the working day, the student will have the opportunity to gain some insight as to the radiologist's role as a clinician, consultant, and teacher; and acquire some knowledge of general pediatrics, neonatology, urology, orthopaedics, and other specialties. The student may attend Diagnostic Radiology Lectures.

RADI 5001. Basic Radiation Safety. 1 Credit Hour.
This course provides the student with the opportunity to gain a conceptual understanding of the radiation protection principles involved in the research, diagnostic, and therapeutic uses of radiation sources. This course will cover the safe receipt, use, storage, and disposal of radiation sources in the biomedical research setting. The contents of this course fulfill HSC training requirements in order to use radioactive materials on campus. Successful participants will earn three HSC safety certificates of completion: Basic Radiation Safety Training, Basic Laser Safety Training, and Basic Laboratory Safety Training.

RADI 5005. Fundamentals Of Radiation Dosimetry. 3 Credit Hours.
The aim of this course is to introduce the students to the fundamentals of radiation dosimetry, including dosimetry quantities, interactions with matter, cavity theory and calibration protocols. More specifically, the topics that will be covered during this course are the following: 1) Introduction/Ionizing Radiation, 2) Quantities for describing interactions, 3) Exponential attenuation, 4) Charged particle and radiation equilibria, 5) Absorbed dose in radioactive media, 6) Radioactive decay, 7) X-ray interactions with matter, 8) Charged particle interactions with matter, 9) Cavity theory, 10) Dosimetry Fundamentals, and 11) Calibration protocols.

RADI 5007. Statistics in the Radiological Sciences. 2 Credit Hours.
An overview of biomedical statistics methods and basic applications to experimental design with special emphasis given to those methods used in radiation detection, image analysis, and evaluations of diagnostic efficacy. Students will learn the theory behind these methods and apply them to actual and simulated problems in the Radiological Sciences using the R statistical programming environment.

RADI 5010. Medical Biophysics. 3 Credit Hours.
This course is an introduction to the basic principles of biophysics as applied to medicine and biology. Emphasis will be placed on non-imaging topics of medical biophysics such as mechanics, thermodynamics, diffusion, electrical conduction, biomagnetism, and light spectroscopy.

RADI 5011. Radiation And Nuclear Physics. 3 Credit Hours.
This course reviews nuclear structure, interactions of radiation with matter, and the statistical nature of radiation. The course covers gas, scintillation, and solid-state detector technologies and their applications, including spectroscopy.

RADI 5015. Physics Of Diagnostic Imaging 1. 3 Credit Hours.
This course introduces the student to the basic principles and radiological practice using noninvasive imaging systems. Topics include production of x-rays, interaction of radiation with matter, and the physics of imaging using computed tomography, ultrasound, and magnetic resonance. Prerequisites: consent of instructor.

RADI 5018. Physics Measurements In Imaging Lab. 2 Credit Hours.
This is a laboratory course focusing on performance of measurements used in quality assurance (QA), system characterization, and acceptance testing of medical imagers. Corequisites: RADI 5015.

RADI 5020. Principles of Health Physics 1. 3 Credit Hours.
This course covers the basic principles of protection dealing with the major forms of ionizing radiation.

RADI 5025. Molecular Oncology & Radiobiology. 1.5-3 Credit Hours.
This course is an overview of the physics and chemistry of radiation biology; the biological effects of ionizing and non-ionizing radiations and hyperthermia at the cellular and tissue levels and whole body and late effects.

RADI 5030. Neuroscience Imaging Laboratory. 1 Credit Hour.
Students are assigned to rotate in 6 laboratories at the RIC: MRI, PET, TMS, ERP, animal imaging, and optical imaging. In each lab, students will have the opportunity for hands-on experience on subject preparation, data acquisition, and processing.

RADI 5050. Human Neuroelectrophysiology. 3 Credit Hours.
A detailed study of the electrophysiological basis of human behavior, with an emphasis on event-related brain potentials associated with cognitive function, perception, and action. See instructor for prerequisite coursework.

RADI 5090. Sem Radiological Science. 1-9 Credit Hours.
Each student is required to register a minimum of two terms if following an M.S. degree plan or four terms if following a Ph.D. plan. Seminars will review current findings in the field.

RADI 6012. Phys Nuclear Medi Imaging. 3 Credit Hours.
This course is a study of physical principles of planar, SPECT, and PET radionuclide imaging; instrument theory; dosimetry; computer uses; and safety considerations. Prerequisites: RADI 5011.

RADI 6014. Physics Of Dental Imaging. 2 Credit Hours.
This course is a survey of imaging procedures used in modern dentistry with an emphasis on the clinical objectives and physical principles underlying intraoral, panoramic, cephalometric, and digital dental radiography. Prerequisites: consent of instructor.

RADI 6015. Physics Measurements in Imaging 2. 3 Credit Hours.
Students will become study and work with advanced methods for evaluating the performance of clinical imagining systems, including x-ray imagining, fluoroscopy, mammography, ultrasound, x-ray CT and MRI. Testing will follow procedures described in publications of the AAPM and ACR and used to achieve compliance with the regulations and recommendations the DSA, MQSA, ACR, NRC, MIPPA and State of Texas' Radiation Control Program. Students will study the procedures and then use "best practices" to perform the tests in a clinical setting. Methods for evaluating nuclear medicine equipment shall also be reviewed and carried out, but in a less intensive manner. Prerequisites: RADI 5015, RADI 6049, RADI 6012, RADI 6016.

RADI 6016. Physics of Diagnostic Imaging 2. 3 Credit Hours.
This course includes theory and applications of various forms of electronic imaging systems; advanced diagnostic imaging principles involving mathematical image analysis, digital image processing, digital image display, and concepts of electronic imaging. Prerequisites: consent of instructor.

RADI 6017. Neuroimaging Methods. 3 Credit Hours.
This course will deal extensively with several noninvasive brain imaging techniques to study the functional organization of the human and animal brains. Methods covered include positron-emission tomography (PET), event-related potentials, magneto-encephalography, optical imaging, voltage and calcium imaging, autoradiography, as well as transcranial magnetic stimulation. The course will only touch upon anatomical and functional MRI as well as high field MRI, as students will receive exhaustive MRI training from other classes. Course format will include both lectures on the several methods and seminars in which recent technical advances in the field are discussed. Prerequisites: consent of instructor.

RADI 6018. Foundations Of Neuroscience Imaging. 3 Credit Hours.
This course will explore several advanced topics in cognitive neuroimaging techniques. Examples of such topics include strategies to study the functional and/or anatomical organization of the human brain and paradigms used for studying a variety of brain functions. Students interested in functional MRI as well as DTI will have an opportunity to gain extensive knowledge and experience.

RADI 6019. Pulse Sequence Programming For MRI. 3 Credit Hours.
This course is an introduction to the basic principles of image processing as applied to digital radiography, computed tomography, ultrasound imaging, and magnetic resonance images. Prerequisites: RADI 6016.

RADI 6020. Advanced Topics In Cognitive Neuroscience. 3 Credit Hours.
This course will explore several advanced topics in cognitive neuroscience. It includes exhaustive study of a brain function in normal and in disease states. Brain functions include but are not limited to sensation, perception, action, language, motion, and cognition.

RADI 6021. Prin/Health Physics 2. 3 Credit Hours.

RADI 6022. Programming Medical for Physics. 1 Credit Hour.
The purpose of the course is to demonstrate to students the usefulness of programming for medical physics. The Matlab programming language is chosen because it enables rapid coding and data visualization. Students will first be taught basic programming techniques. Then , they will be shown specific examples of these techniques being applied to medical physics. Finally, they will create a final program, which performs a task of the student's choosing and utilizes several concepts from the course. Students will be graded based on their attendance and programming projects. Must have familiarity with the field of medical physics.

RADI 6023. Introduction To Clinical Medical Physics Practice. 1-9 Credit Hours.
This course allows students to observe professional medical physicists in a clinical setting and learn the roles of various other medical professionals in the Radiology and Radiation Oncology medical clinic. Students participate in simple tasks related to medical physics data and are shown how to evaluate data to provide reports and tables. Students are also trained in basic safety and ethical issues in clinical medicine and the professional conduct of the medical physicist, following the guidelines established in AAPM Report 109. This material is intended to cover ethical issues in clinical medicine and in the professional conduct of the medical physicist .The term ethics is used here in the sense of a permissible standard of conduct for members of profession. While different people may have different opinions of what is ethical professions always have certain ethical standards or codes of conduct that are complied in written form and are generally by practitioners. In addition to becoming familiar with written codes of conduct, the student shall be introduced to commonly encountered situations in which a choice of actions is available, some of which would be considered unethical and some of which be considered ethical, according to current standards of care of practice. These would include more specific issues that arise with respect to recent patient privacy concerns and legislation specific to the Health Insurance Portability and Accountability Act (HIPAA) and compliance both in clinical practice and research. A case-based approach in a seminar setting with class participation is utilized. This allows the student to put him or herself in the place of an individual who faces an ethical dilemma and to explore variations of the case that is presented. Other faculty members are also encouraged to attend, to offer comments, and to relate situations that they encountered either first- or secondhand.

RADI 6024. Radiological Anatomy & Physiology. 3 Credit Hours.
This course will provide students with an opportunity to learn anatomy, physiology, and commonly used medical terminology as it relates to radiologic imaging. Anatomic and physiologic features will be illustrated with radiologic images in formats commonly encountered in clinical radiology. By the end of the course, students are expected to be familiar with basic medical terminology and have a good understanding of medical anatomy, physiology, and some basic pathology as related to specific organs for which radiologic images are commonly applied.

RADI 6025. Therapy Clinical Rotation 1. 12 Credit Hours.
The first clinical rotation is designed to give an introduction and an overview of all the clinical processes and the basic safety training. In detail the student will cover the following topics: employe orientation, radiation oncology orientation, HIPAA training, introduction to radiation protection, introduction to nursing and introduction to simulation, introduction to LINACs, LINAC QA and warm up, monitor unit calculations, electronic medical records orientation, regulations and professional recommendations.

RADI 6026. Clinical Therapy Rotation 2. 12 Credit Hours.
In the second semester of the clinical rotation, the students will cover the following topics: on board MV and kV imaging, ExacTrac design, function and daily, monthly QA, Linac Annual QA and the RPC process, TBI and TSE, IMRT planning, LDR planning and the COMS eye plaque process, patient safety, and learn shielding techniques for CT, kV imaging, LINAC and isotopes.

RADI 6027. Imaging Physics Clinical Rotation 1. 12 Credit Hours.
The first clinical rotation is designed to give an introduction and an overview of all the clinical processes and the basic safety training. In detail the student will cover the following topics: employee orientation, clinical radiology department orientation, HIPAA & MIPPA training, introduction to safety in the radiology clinic, introduction to general radiography, introduction to hard copy devices and image displays, electronic medical records orientation, introduction to ultrasounds imaging, introduction to mammography, regulations and professional recommendations.

RADI 6030. Physics Of Radiotherapy. 3 Credit Hours.
Theory, design, and operation of radiation-producing equipment used in radiation therapy are introduced. Exposure and absorbed dose calculations, patient dosimetry, treatment planning, and use of computers in radiation therapy are covered.

RADI 6031. Physics Measurements In Radiotherapy I. 3 Credit Hours.
Performance of measurements on radiation therapy equipment used to determine therapy treatment parameters is the opportunity for study in this course.

RADI 6032. Therapy Clinical Rotation 3. 12 Credit Hours.
In the third semester of the clinical rotation, the students will cover the following topics: treatment plan checks, weekly chart checks, brachytherapy planning and QA, LINAC design, SRS Treatment Planning (SRS) and daily, monthly and annual QA, participation in all aspects of SBRT treatment and treatment planning QA.

RADI 6033. Advanced Radiotherapy Physics. 3 Credit Hours.
This course includes the coverage of advanced radiation therapy special topics: intensity modulated radiation therapy, advanced brachytherapy, and radiation therapy shielding.

RADI 6034. Therapy Clinical Rotation 4. 12 Credit Hours.
In the fourth semester of the clinical rotation, the students will cover the following topics: medical dosimetry rotation, ultrasound, PET, MRI, SPECT imaging in radiotherapy and acceptance and commissioning of major equipment.

RADI 6035. Physics Measurements In Radiotherapy 2. 3 Credit Hours.
In this course students will have the opportunity to gain further didactic and hands-on familiarity with radiation therapy measurement equipment (ion chambers, films, TLDs, water tanks, profilers, etc.) and learn daily clinical practices. Students will have the opportunity to learn the roles of a radiation oncology team, the generation of radiation therapy treatment plans, patient quality assurance, and advanced, specialized radiation therapy techniques. Learning can be accomplished through attendance of didactic lectures, homework assignments, presentations of class projects, and a comprehensive oral exam. Prerequisites: RADI 5005, RADI 6030, and RADI 6031.

RADI 6038. Methods in Dosimetry & Shielding Design. 2.5 Credit Hours.
The goal of the course is to teach students the guidelines established by the American Association of Physicists in Medicine (AAPM) and the National Council of Radiation Protection (NCRP) relating to patient dosimetry and shielding design of radiological facilities. Students will be responsible to read, comprehend, and learn the selected Task Group reports. Students will be evaluated of their knowledge by weekly quizzes and a final oral evaluation held at the end of the course. Successful completion of the course will be accomplished when the student is knowledgeable and understands the recommendations for a practicing clinical physicist. Learning is accomplished through attendance of weekly lectures, assignments (presentation of assigned reports and guidelines), and class discussion.

RADI 6039. Imaging Physics Clinical Rotation 2. 12 Credit Hours.
In the second semester of the clinical rotation, topics covered include safety in the radiological clinic, nuclear medicine and MRI, introduction to fluoroscopy, computed tomography, magnetic resonance imaging, nuclear medicine and regulations, professionalism and ethics.

RADI 6040. Imag Physics Clin Rotation 3. 12 Credit Hours.
The third clinical rotation will include safety in radiology clinic, advanced general radiography, advanced breast imaging and image-guided stereotactic breast biopsy, dental radiography and cone beam CT, dual-energy x-ray absorptiometry (DEXA), advanced fluoroscopic imaging and special procedures, intermediate nuclear medicine and regulations, professionalism and ethics.

RADI 6042. Non-Ionizing Radiation Biology. 1-9 Credit Hours.
This course is an overview of the biological and known or potential health effects of non-ionizing radiation, with attention to radio frequency radiation in the microwave range, extremely low frequency (ELF) field exposures, LASER emissions, and ultraviolet (UV) light exposure.

RADI 6043. Imaging Physics Clinical Rotation 4. 12 Credit Hours.
The fourth clinical rotation will include safety in radiology clinic, imaging informatics, advanced imaging informatics, advanced magnetic resonance imaging, advanced nuclear medicine physics, regulations, professionalism and ethics.

RADI 6049. Intro To Magnetic Resonance. 2 Credit Hours.
This course presents the basics of the practice of magnetic resonance as the experimentalist or clinician first meets them. The approach begins with images, equipment, and scanning protocols. The student will have the opportunity to face issues pertinent to practice with theoretical background added as experience grows. Through this approach, key ideas are introduced in an intuitive style that is faithful to the underlying physics.

RADI 6050. Magnetic Resonance Imaging. 2 Credit Hours.
This course explores the physics of magnetic resonance image formation through discussion of imaging problems, reviews of current research topics with an emphasis on quantitative methods using MRI, and hands-on experience in MRI laboratories. Prerequisites: RADI 6049.

RADI 6051. Statistical Parametric Mapping. 3 Credit Hours.
Course content includes principles of NMR Spectroscopy as applied to the resolution of molecular structural problems in chemistry, biology, and medicine; and principles and methods for designing BOLD contrast MRI experiments and evaluating fMRI data.

RADI 6060. Biophotonics and Optical Imaging. 3 Credit Hours.
Optical methodologies for imaging, diagnosis, and therapy are rapidly advancing in biology and medicine. This course will review basic elements of optics and optical sources, especially lasers and light-emitting solid state devices, in the context of biomedical applications. Dosimetry, tissue optics, and the principles of laser-tissue interaction will be considered in depth. Current medical uses of lasers will be surveyed, along with their scientific and technical foundations. The course will conclude with several case studies of research areas that are currently hot topics in biomedical optics.

RADI 6062. Cognitive Neuroscience. 3 Credit Hours.
Cognitive Neuroscience deals with the neural basis of cognition and behavior, including considerations of perception, attention, motor control, language, learning, memory, executive function, spatial cognition, emotion, and social cognition. It also presents discussions on neurocognitive development and the evolution of the human brain. Unlike courses in basic neuroscience, this course has a more human focus, presenting in-depth discussions of neuroimaging techniques and literature. In addition, it focuses on psychological models of cognitive function derived from psychological experimentation, human lesion studies, and computational modeling. Cognitive Neuroscience presents an integrated view of the psychology and neurobiology of human cognition and behavior. By the end of the semester, students will have had the opportunity to: (1) become highly familiar with the structure of the human nervous system; (2) become conversant about the physical basis and limitations of neuroimaging techniques; (3) become familiar with the principal brain areas thought to be involved in a host of human cognitive competencies and behaviors, including perception, action, emotion, and language; and (4) understand how psychological theory and neural theory come together to form the foundation of cognitive neuroscience.

RADI 6071. Supervised Teaching. 1-12 Credit Hours.
This course is a presentation of lectures and supervised teaching under the direction of faculty.

RADI 6091. Special Topics. 1-12 Credit Hours.
This course covers topics of special interest which may include emerging and new modalities in radiological sciences relating to x-ray, nuclear, or magnetic imaging.

RADI 6097. Research. 1-12 Credit Hours.
This course is supervised research under the guidance of a faculty member.

RADI 6098. Thesis. 1-12 Credit Hours.
Registration for at least two terms is required for M.S. candidates. Prerequisites: admission to candidacy for the Master of Science degree.

RADI 7000. Off Campus. 4 Credit Hours.
All off campus rotations must be approved by the designated faculty member prior to the beginning of the rotation (at least one week before the course begins). Credit will not be given for any rotation that has not been approved in advance. Required paperwork includes: "Course Approval" form, a written letter or email for acceptance form the physician preceptor with the start and end dates of the course/rotation, and a course description of your learning objectives and responsibilities during the rotation. Forms must include a complete address and telephone number for the off campus location or residence address for the student while at the off campus site. Forms will not be approved after the rotation has already begun. Contact the department for assistance with enrolling in this course.

RADI 7005. Treatment Planning Techniques In Radiation Therapy. 3 Credit Hours.
The goal of the course is to provide an overview of the physics and clinical elements that contribute to the development of computerized treatment plans in radiation therapy. The commissioning and acceptance testing of a planning system will be discussed and demonstrated in several planning platforms. Anatomy specific treatment planning will be described, including imaging of the specific disease, as well as contouring and plan development. Multiple plans will be generated for each site using different planning modalities, such as 2D, 3D, and IMRT.

RADI 7006. Treatment Planning Techniques in Radiotherapy 2. 3 Credit Hours.
This course is a continuation of RADI 7005. It presents an in-depth study of multidisciplinary treatment of the cancer patient from the clinician's viewpoint. Students are required to master concepts specific to site-specific disease including: histopathology, etiologic and epidemiology factors, detection and diagnosis, tumor stage and grade, routes of metastases, dose fractionation and prognostic factors. This course is designed to approach each cancer type by anatomic system, addressing treatment factors with increasing degrees of complexity. Assigned exercises organized by treatment site and procedure type will be carried out under the direct supervision of an assigned advisor. These will be both simulated and real case assignments. The course is taught as a didactic course with applied planning. Didactic instruction will be provided by medical residents while practical planning instruction will be applied by a medical dosimetrist.

RADI 7010. Motor Learning And Brain Imaging. 3 Credit Hours.
This course is designed for the advanced student (doctoral or postdoctoral) to obtain a comprehensive overview of the field of motor learning from behavioral and brain imaging perspectives. Topic coverage will include general motor learning and speech motor learning (with reference to treatment of motor speech disorders). The course will be structured in a seminar format. The course will explore measurement methods and issues in motor learning and the neural substrates of learning in intact and disordered subject groups.

RADI 7099. Dissertation. 1-12 Credit Hours.
Registration for at least one term is required for Ph.D. candidates. Prerequisites: admission to candidacy for Doctor of Philosophy degree.