RADIOLOGICAL SCIENCES, PH.D.

Overview

Medical physics is an applied branch of physics that deals with medical imaging and applications in the treatment of disease and is closely allied with bioengineering and health physics. Medical imaging covers multiple modalities including diagnostic radiology, nuclear medicine, ultrasound, computed tomography, and magnetic resonance imaging while radiation therapy, a major subspecialty in medical physics, is concerned with the treatment of disease.

The medical physics program strives to provide a rigorous well rounded and clinically based training that is current in both diagnostic and radiation therapy physics. The graduate program in the Department of Radiological Sciences offers MS degrees in medical physics. The MS and PhD programs in Radiological Sciences are accredited by the Commission on Accreditation of Medical Physics Educations Programs, Inc.

Areas of Specialization

- Medical Physics, subspecializing in the Physics of
  - Radiation Therapy
  - Diagnostic Radiology
  - Nuclear Medicine
  - Ultrasound
  - Computed Tomography
  - Magnetic Resonance Imaging

Career Opportunities

Medical Physicists contribute in the subspecialty areas of Diagnostic Radiological Imaging, Radiation Oncology and Nuclear Medicine. Graduation from this program with the MS or PhD degree qualifies the individual for an entry level position in Medical Physics working with experienced individuals within medical facilities and with private medical physics groups across the United States. Currently, a significant number of openings exist nationally, with the majority of these being in the radiation oncology medical physics area. Position openings are advertised in a number of professional publications such as those of the American Association of Physicists in Medicine (AAPM) (www.aapm.org (http://www.aapm.org)). The individual's marketability increases with experience and with professional certification. Professional Certification is offered through the American Board of Radiology (ABR) (www.theabr.org (http://www.theabr.org)), the same board providing professional certification of radiologists and radiation oncologists, and is recognized by the prestigious American Board of Medical Specialties (www.abms.org (http://www.abms.org)).

It is the student's responsibility to ensure they are enrolled in the prescribed courses and to pay tuition and fees at the time designated by the Bursar's Office. Details regarding tuition/fee charges and collection are available from the Bursar's Office.

Admission Requirements

In addition to the general requirements listed in the Graduate College bulletin, applicants must present clear evidence of a strong foundation in chemistry and mathematics, as well as in both written and spoken English. Applicants must have also acquired a high degree of proficiency in physics with coursework equivalent to a baccalaureate minor in physics.

Applicants to the doctor of philosophy program must meet additional requirements. They should present evidence of highly successful completion of a master's degree with a thesis option in medical physics or related fields. Three reference letters are also required.

Doctor of Philosophy Degree Requirements

Candidates for doctoral degree must complete a minimum of 90 post-baccalaureate semester credit hours. Doctoral students are required to complete the Radiological Sciences core courses (or their equivalents) for the master's degree described above.

All doctoral students are required to complete 10 additional hours beyond the core courses required for the masters students. They consist of

1. BMSC 5001 Integrity in Scientific Research or equivalent,
2. RADI 5303 Clinical and Radiological Anatomy,
3. a 3 credit hour graduate course from one of the three area, mathematical physics/advanced statistics/numerical modeling, and
4. a 3 credit hour medical imaging course, currently offered as RADI 6960 Directed Reading in Advanced Topics.

Two tracks of study, namely, diagnostic and radiation therapy, are available for doctoral students. Doctoral students are expected to complete 6 credit hours in their track specialization. For the diagnostic track this consists of RADI 5643 Physics of Magnetic Resonance Imaging and a 3 credit hour course in MRI/CT/PET or a course recommended by the advisory committee. For the radiation therapy track, this consists of 3 hours selected from Radiobiologic modeling / Monte Carlo modeling / advisory committee recommended course and another 3 credit hours selected from Proton Therapy / IMRT / IGRT / advisory committee recommended course. Apart from the advisory committee recommended courses, the other courses are currently offered as RADI 6960 Directed Reading in Advanced Topics.

A maximum of 30 semester hours for enrollment in RADI 6980 Doctor's Dissertation Research count towards the total requirement of 90 hours. The remainder of program requirement may be completed with graduate level courses from Radiological Sciences or graduate studies in appropriate academic areas which have been approved by the advisory

committee. Every student in the graduate programs of the Department must present a seminar every year.

Doctoral students must pass the departmental General Qualifying Examination before they can be admitted to candidacy. This examination consists of a written and an oral portion and may contain questions on any aspect of the Radiological Sciences. The General Examination consists of six subjects:

1. production and absorption of radiation,
2. radiation detection and measurement,
3. physics in diagnostic radiology (including magnetic resonance imaging and ultrasound),
4. physics in nuclear medicine,
5. physics in radiation therapy and
6. radiation biology.

Questions on radiation safety will be included. The General Examination should be satisfied within 3 years of enrollment into the program. Once a student becomes a candidate, the student will be expected to complete original research which represents a significant contribution to the field of Medical Radiological Sciences (Research for the Doctoral Dissertation).

For a doctoral student who has failed the General Examination, does not hold the master's degree in medical physics, but has otherwise met all the departmental and graduate college requirements for the master's degree, the following option is available: if the student has achieved satisfactory performance in at least four subject categories in the written portion of the general examination and has achieved grades of B or better in the graduate courses of the remaining subjects, he or she may request to be considered for a non-thesis master's degree in Radiological Sciences.

Code	Title	Hours
Core Competencies		
RADI 5024	Radiation Measurements	4
RADI 5222	Introduction to Radiation Biology and Chemistry	2
RADI 5824	Production and Absorption of Ionizing Radiation	4
RADI 6864	Radiological Physics I	4
RADI 6874	Radiological Physics II	4
RADI 6884	Radiological Physics III	4
Substantive Courses		
BMSC 5001	Integrity in Scientific Research	1
RADI 5303	Clinical and Radiological Anatomy	3
RADI 6960	Directed Reading in Advanced Topics	1-6
Specialization elective from mathematical physics, advanced statistics, or numerical modeling		3
Specialization Track		
Diagnostic		
RADI 5643	Physics of Magnetic Resonance Imaging	
RADI 6960	Directed Reading in Advanced Topics (Elective from MRI/CT/PET)	
Radiation Therapy		
RADI 6960	Directed Reading in Advanced Topics (Elective from Radiobiologic modeling/Monte Carlo modeling/or approved by advisory committee)	
RADI 6960	Directed Reading in Advanced Topics (Elective from Proton Therapy/IMRT/IGRT)	
Dissertation		
RADI 6960	Directed Reading in Advanced Topics	1-6
Electives		
The remainder of program requirements may be completed with graduate-level courses from Radiological Sciences or graduate studies in appropriate academic areas which have been approved by the advisory committee. Every student in the graduate program must present a seminar every year.		22-32

Prerequisites

The required coursework consists of the following courses and semester hours:

1. Calculus (at least 8 semester hours) and Differential Equations (3 semester hours)
2. Calculus-based General College Physics (at least 8 semester hours), Modern Physics (3 semester hours) and at least two other Upper Level Undergraduate Physics Courses (3 semester hours each for a total of 6 hours)
3. General College Chemistry (at least 4 semester hours)
4. College Level Anatomy and Physiology (at least 4 semester hours)

A maximum of two courses may be missed from this list prior to application. The missing course(s) must be completed with grade(s) of not less than a B within one calendar year of first enrollment in the graduate program. Credits acquired before or after enrollment to meet these minimum entrance requirements do not count towards degree-granting program.

In addition to the course requirements, applicants are expected to have taken the Graduate Records Exam (GRE). A minimum score of 400 in the verbal portion and a combined score (verbal plus quantitative) exceeding 1100 are required for admission.