MEDICAL PHYSICS (MPHY)

MPHY 6000 Professional Development
Introduction of subspecialties of medical physics (radiation oncology, diagnostic imaging, nuclear medicine and medical health physics), and professional competencies and skills needed for success in a medical physics career. Focus on career placement after graduation with an emphasis on preparation for the medical physics residency application, match, and interview process.
Two Term Class, Student may enter either term; credit given for either
0 Course Units

MPHY 6010 Introduction to Radiation Protection
Introduction to applied nuclear and atomic physics; radioactive decay; radiation interactions; biological effects and safety guidelines; radiation detection, instrumentation and protection.
Fall
0.5 Course Units

MPHY 6020 Physics of Medical / Molecular Imaging
Physical principles of diagnostic radiology, fluoroscopy, computed tomography; principles of ultrasound and magnetic resonance imaging; radioisotope production, gamma cameras, SPECT systems, PET systems; diagnostic and nuclear medicine facilities and regulations. The course includes a component emphasizing the emerging field of molecular imaging.
Fall
1 Course Unit

MPHY 6030 Image-Based Anatomy
Taught by a radiation oncologist, this course covers major organ systems and disease areas and is presented from a radiologic or imaging (including cross-sectional) viewpoint in addition to a standard anatomy and physiology presentation.
Fall
1 Course Unit

MPHY 6040 Radiological Physics
Fundamental concepts underlying radiological physics and radiation dosimetry. Covers photon and neutron attenuation; radiation and charged particle equilibrium; and interactions of photons and charged particles with matter and radiotherapy dosimetry including photographic, calorimetric, chemical and thermoluminescence dosimetry.
Fall
1 Course Unit

MPHY 6050 Medical Ethics / Governmental Regulation
Fundamentals of professional ethics for medical physicists through exploration of Code of Ethics (published by the American Association of Physicists in Medicine); case studies; survey of governmental regulations pertinent to medical physics.
Spring
0.5 Course Units

MPHY 6060 Physics of Radiation Therapy
Clinical radiation oncology physics; principles of radiation- producing equipment; photon and electron beams; ionization chambers and calibration protocols; brachytherapy, dose modeling and calculations; treatment planning.
Spring
1 Course Unit

MPHY 6070 Radiation Biology
Fundamental knowledge of mechanisms and biological responses of human beings to ionizing and non-ionizing radiation through the study of effects of radiation on molecules, cells and humans; radiation lesions and repair; mechanisms of cell death; cell cycle effect, radiation sensitizers and protectors; tumor radiobiology; relative sensitivities of human tissue and radiation carcinogenesis.
Spring
1 Course Unit

MPHY 6080 Radiation Detection and Measurement
Fundamentals of detection and measurement of ionizing radiation; working principles of many detectors used currently in the field including their application in radiotherapy, nuclear medicine, and diagnostic radiology.
Spring
1 Course Unit

MPHY 6090 Biomedical Image Analysis
This course covers the fundamentals of advanced quantitative image analysis that apply to all of the major and emerging modalities in biological/biomaterials imaging and in vivo biomedical imaging. While traditional image processing techniques will be discussed to provide context, the emphasis will be on cutting edge aspects of all areas of image analysis (including registration, segmentation, and high-dimensional statistical analysis). Significant coverage of state-of-the-art biomedical research and clinical applications will be incorporated to reinforce the theoretical basis of the analysis methods. Prerequisite: Mathmatics through multivariate calculus (MATH 241), programming experience, as well as some familiarity with linear algebra, basic physics, and statistics.
Fall or Spring
Also Offered As: BE 5370, CIS 5370
1 Course Unit

MPHY 6100 Computational Medical Physics
Fundamentals of computational calculations with MATLAB on common problems in radiation therapy physics: Compton scattering cross- section and its applications; Bremsstrahlung scattering cross- sections and its applications; 3D photon dose calculation algorithms; 3D electron dose calculation algorithms; CT reconstruction; DICOM format.
Spring
1 Course Unit

MPHY 6110 Medical Physics Laboratory
Lab course offering hands-on experience with a range of measurements commonly encountered in the practice of clinical medical physics. Project offerings may include: Task Group 51 calibration of linear accelerators; 4-Dimensional Computed Tomography (4DCT) imaging and image analysis; Deformable image registration and dose sum reconstruction; Monthly linear accelerator Quality Assurance (QA) procedures; Brachytherapy source calibration and High Dose Rate (HDR) machine QA; Positron emission tomography (PET) imaging and image analysis; MRI imaging and image analysis; Linear accelerator shielding calculations and radiation survey.
Spring
1 Course Unit

MPHY 6990 Independent Study
1 Course Unit

MPHY 7000 Clinical Practicum
Practical experience in a subspecialty of medical physics including radiation therapy, diagnostic imaging, radiation safety, and nuclear medicine. Taking place in a clinical setting and supervised by a qualified medical physicist, the practicum provides an understanding of instrumentation methodology, calibration, treatment planning, and quality assurance; and may include patient interaction, clinical conference attendance, and a review of new techniques in radiation oncology.
Summer Term
1 Course Unit

MPHY 9900 Thesis I
Faculty-mentored research project (extended research paper or original research) resulting in a final paper and short oral presentation that is the culmination of a master student's graduate study.
1 Course Unit

MPHY 9910 Thesis II
Faculty-mentored research project (extended research paper or original research) resulting in a final paper and short oral presentation that is the culmination of a master student's graduate study.
1 Course Unit