

## Medical Physics Program at Duke University

### MP Courses (Offering in 05-06 and 06-07 academic years)

**MP 200. Radiation physics (3 c.h.).** A course covering the basics of ionizing and non-ionizing radiation, atomic and nuclear structure, basic nuclear and atomic physics, radioactive decay, interaction of radiation with matter, and radiation detection and dosimetry.

**MP 205. Anatomy and physiology for medical physicists (3 c.h.).** A course focused on medical terminology, biochemistry pertaining to MP, basic Anatomy and physiology, elementary tumor and cancer biology, and overview of disease in general. Upon completion, the student should: (a) understand anatomic structures, their relationships, their cross-sectional and planar projections, and how they are modified by attenuation and artifacts in the final images; (b) understand the physiology underlying radionuclide images, (c) understand how (a) – (b) are modified by disease, (d) identify anatomical entities in medical images (different modalities), and (e).identify basic disease features in medical images (e.g., Pneumothorax in chest radiographs, microcalcifications in mammograms).

**MP 210. Radiation protection (3 c.h.).** Course discusses the principles of radiation protection dealing with major forms of ionizing and non-ionizing radiation, the physics and chemistry of radiation biology, biological effects of ionizing and non-ionizing radiations (lasers, etc.) at cellular and tissue levels, radiation protection quantities and units, medical HP issues in clinical environments, radiation safety regulations, and basic problem solving in radiation safety.

**MP 220. Radiation therapy physics (3 c.h.).** This introductory course has a clinical orientation, and reviews the rationale, basic science, methods, instrumentation techniques and applications of radiation therapy to the treatment of a wide range of human diseases. Major radiation modalities are covered including low and high energy photon therapy, electron and proton therapy, and low and high-dose rate brachytherapy. The clinical process of treatment, methods of calculating dose to patient, and the role of the medical physicist in radiation oncology clinic, are covered in detail.

**MP 228. Clinical practicum and shadowing (Radiation Therapy) (3 c.h.).** The course gives hands on experience in practical aspects of medical physics as applied to radiation therapy. Special emphasis is given to the operation of various therapy units and dose measuring devices, techniques of measuring the characteristics of radiation beams, commissioning and quality assurance checks for radiation producing devices in the clinic. The course includes shadowing a clinician, technologist, or physicist, while performing their routine clinical tasks.

**MP 230. Medical imaging physics (3 c.h.).** A course describing basics of imaging science, x-ray imaging modalities including basic principles, detectors, scattered radiation, planar imaging, CT, fluoroscopic imaging, nuclear medicine imaging, US and MRI, and computers in imaging.

**MP 248. Clinical practicum and shadowing (Nuclear Medicine) (3 c.h.).** The course gives hands on experience in clinical nuclear medicine. Students will work with gamma cameras, PET systems, surgical probes, dose calibrators, technetium generators, well counters to learn operation principles, calibration, and quality control methods. Students will spend time in the PET facility, nuclear cardiology, nuclear medicine, and the radiopharmacy. The course includes shadowing a clinician, technologist, or physicist, while performing their routine clinical tasks.

**MP 251. Medical physics seminar (1 c.h.).** Weekly seminar on various topics pertaining to medical physics.

**MP 259/359. Independent study.** An independent research project with a faculty advisor.

**MP 322. Advanced photon beam radiation therapy (3 c.h.).** This course will cover the physics and clinical application of advanced external beam photon therapies with special emphasis on IMRT. Prerequisite: MP 220.

**MP 323. Advanced brachytherapy and special procedures (3 c.h.).** This course will cover advanced LDR and HDR brachytherapy, and other, selected special procedures and special topics. Prerequisite: MP 220.

**MP 331. Advanced medical imaging physics (3 c.h.).** The course includes advanced topics in diagnostic imaging including linear system theory, image quality metrology, digital radiography and mammography, new advances on three-dimensional imaging modalities, MRI, CT, ultrasound, and evaluation of diagnostic imaging methods. Prerequisite: MP 230.

**MP 341. Nuclear medicine physics (3 c.h.).** Topics include basics of nuclear medicine imaging, gas, scintillation, and solid state radiation detectors, counting statistics, gamma camera principles including modern digital designs, SPECT, coincidence imaging principles, PET instrumentation, radionuclide and x-ray CT transmission scanning techniques, nuclear medicine treatments, and surgical probes.

**MP 360. Public speaking for medical physicists (1 c.h.).** An overview of effective communication techniques for scientists and engineers. Course will focus on speech and delivery, structure of effective presentations, and proper use of visual aids. Students will be required to actively participate in exercises on extemporaneous speaking, formal research presentations, and question and answer sessions.

**MP 361. Biostatistics for medical physicists (3 c.h.).** The course covers topics in biostatistics foundational to all sub-specialties of medical physics.