MEDICAL PHYSICS • MEDP

General education courses are marked with stars (★).

★2051 Radiation Science for Medical Applications (3) F,S Matter and energy; structure of the atom and nucleus; radioactivity; types of radiation; radiation interactions; dose and biological effects; radiation detection and safety; background radiation; applications of nuclear science in medicine, cancer therapy, and imaging.
4101 Tracer Methodology for Biological Sciences (3) F,S *2 hrs. lecture; 3 hrs. lab. Specially for students in the biological sciences.* Properties of ionizing radiation, instruments for detection and measuring radiation, and biological use of radioisotopes.
4111 Introduction to Medical Imaging (3) S *Prereq.: PHYS 2002 or equivalent; MATH 1550 or equivalent.* Physics and engineering aspects of medical imaging systems: X-ray imaging, computed tomography, magnetic resonance imaging, ultrasound, and nuclear medicine; clinical applications and limitations of the modalities.
4331 Radiation Protection and Exposure Evaluation (3) F *Prereq.: PHYS 2102 or equivalent.* Control and evaluation of radiation exposure, including external and internal dosimetry, techniques of dose reduction, and consequences of radiation exposure.
4332 Radiation Detection Laboratory (1) F *Prereq.: credit or registration in MEDP 4351. 3 hrs. lab.* Laboratory exercises covering fundamental principles of radiation detection systems and data analysis techniques used for radiation measurements in radiation therapy, radiological imaging, and medical health physics.
4351 Radiation Detection and Instrumentation (2) F *Prereq.: PHYS 4098 or equivalent, credit or registration in MEDP 4331 or equivalent; consent of instructor.* Introduction to the physics of detection, instrumentation, and data analysis used to measure ionizing radiation (gamma rays, x-rays, neutrons, and charged particles) using scintillation crystal, solid state, film, and gas detectors. Provides understanding of underlying principles
of detection systems used in radiation therapy, radiological imaging, and health physics.
4991 Special Problems in Medical Physics and Health Physics (1-4) *Prereq.: thorough knowledge of mathematics, science, and engineering related to the topic or proposed problem; and consent of instructor. May be taken for a max. of 12 sem. hrs. of credit when topics vary.* Theoretical or experimental problems involving the application of medical physics and health physics technology.
4995 Seminar (1) F,S *Elective seminar especially for undergraduate minors in nuclear science, and undergraduate majors in physics and astronomy with a concentration in medical physics. Course may be repeated on audit basis only.*
7101 Advanced Tracer Methodology for Biological Sciences (3) F,S *Prereq.: MEDP 4101. 2 hrs. lecture/demonstration; 3 hrs. lab.* Qualitative and quantitative aspects of tracer applications in modern biological research; combining tracer techniques with other analytical methods.
7111 Advanced Medical Imaging Physics (3) F *Prereq.: MEDP 4111, MATH 1552.* Topics related to advanced research and clinical imaging physics; theory of image formation; quantitative analysis of imaging systems by Fourier methods and QC/acceptance testing; Radon transform and theory of image reconstruction; tracer methodology for quantitative imaging.
7121 Radiobiology (3) S *Prereq.: MEDP 4331 or consent of instructor. 2 hrs. lecture; 3 hrs. lab.* Effects of ionizing radiation on cellular, molecular, and organ systems levels of biological organization; study of x-rays, gamma rays, accelerator beams, and neutrons in interaction with living systems; cohesive treatment of radiation biophysics with applications in medical physics and radiation oncology.
7210 Clinical Principles of Radiation Therapy (3) S *Prereq.: MEDP 7121, 7331. Open only to students currently enrolled in the Master of Science in Medical Physics and Health Physics program.* Introduction by practicing radiation oncologists to the evolution of radiation therapy, general oncology considerations, tumor radiobiology, non-intentional effects of radiation, and altered fractionation. Discussion of tumor biopsy and behavior, normal tissue effects, and treatment planning and delivery techniques for specific organ systems.
7260 Clinical Radiation Therapy Physics Rotation (3) F *Prereq.: MEDP 7331. Open only for students currently enrolled in the Master of Science in Medical Physics and Health Physics program.* Under the direction of clinical staff, introduction to the radiation therapy clinic and clinical duties of the medical physicist in patient treatment planning, monitor unit calculations, construction of treatment aids, treatment delivery techniques, in-vivo dosimetry, dose measurements, and quality assurance associated with external beam photon and electron therapy.
7270 Advanced Radiation Therapy Physics (3) F *Prereq.: MEDP 7331. 3 hrs. lecture.* Basic principles of clinical indications, radiation delivery, treatment planning, dose calculations, dose measurements, and quality assurance for advanced treatment techniques used in radiation therapy (external beam electron, proton, and photon therapy and internal brachytherapy).
7280 Advanced Clinical Radiation Therapy Physics Rotation (2) S *Prereq.: MEDP 7260, MEDP 7270. Open only for students currently enrolled in the Master of Science in Medical Physics and Health Physics program.* Under the supervision of clinical medical physics staff, introduction to the planning, delivery, and dosimetric aspects of advanced radiation therapy treatments such as brachytherapy, stereotactic radiosurgery, total skin electron therapy, intensity modulated radiotherapy, and image guided radiotherapy and to the advanced physical practices of accelerator quality assurance and radiation therapy shielding design.
7331 Radiation Therapy Physics (3) S *Prereq.: MEDP 4331.* Fundamental physical principles, operation of delivery equipment, treatment planning principles, methods of dose calculations, determination of irradiation time from dose prescription, dose measurements, and quality assurance for external beam therapy (photons and electrons) and internal brachytherapy.
7530 Radiation Shielding (2) S *Prereq.: MEDP 4331, 7537.* Calculation of source term, geometric transformations, and attenuating factors associated with photon, neutron, and charged particle shielding; calculation of dose and dose equivalents; current governmental regulations and professional recommendations for shielding; shielding design for medical radiation facilities.
7537 Radiation Interactions and Transport (3) F *Prereq.: PHYS 2203 or equivalent, CSC 2262 or equivalent experience in computer programming. Also offered as PHYS 7537.* Photon, neutron, and electron interactions and energy deposition, the Boltzmann equation, elementary analytical solutions; deterministic computational methods including spherical harmonics and discrete ordinates techniques; continuous slowing down
and Fokker-Planck approximations.
7538 Monte Carlo Simulation of Radiation Transport (3) S *Prereq.: MEDP 7537 or consent of instructor, CSC 2262 or equivalent experience in computer programming. Also offered as PHYS 7538.* Radiation transport simulation by the Monte Carlo method; phase-space tracking; dose response estimators, biasing methods; integral form of the Boltzmann equation; condensed-history method for charged particles; neutron, photon, and electron transport calculations for shielding and medical physics applications.
7991 Advanced Projects in Medical Physics and Health Physics (1-3) *Prereq.: MEDP 4111 or 7331 and consent of instructor. May be taken for a max. of 6 sem. hrs. credit.* Medical physics or health physics projects that study particular aspects of radiation therapy, medical imaging, or medical health physics.
7992 Advanced Topics in Medical Physics and Health Physics (1-3) *Prereq.: consent of instructor. May be taken for a max. of 6 sem. hrs. of credit when topics vary.* Advanced treatment of a specific area of medical physics or health physics technology of current interest.
7995 Seminar (1) F,S *Required every semester for degree candidates in medical physics and health physics. Only 1 sem. hr. of credit may be counted toward degree.*
7999 Report Investigation (1-6) *Prereq.: MEDP 4111 or 7331 and consent of instructor. May be taken for a max. of 12 sem. hrs credit.* Detailed investigation of a research problem or a technical design project.
8000 Thesis Research (1-12 per sem.) *"S"/"U" grading.*