MEDICAL PHYSICS (MED PHYS)

MED PHYS/PHYSICS 265 — INTRODUCTION TO MEDICAL PHYSICS
2 credits.

Primarily for premeds and other students in the medical and biological sciences. Applications of physics to medicine and medical instrumentation. Topics: biomechanics, sound and hearing, pressure and motion of fluids, heat and temperature, electricity and magnetism in the body, optics and the eye, biological effects of light, use of ionizing radiation in diagnosis and therapy, radiation safety, medical instrumentation. Two lectures with demonstrations per week. Enroll Info: A yr crse of college level intro physics

Requisites: None
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2018

MED PHYS/H ONCOL 410 — RADIOBIOLOGY
2-3 credits.

Effects of ionizing radiations of living cells and organisms, including physical, chemical, and physiological bases of radiation cytotoxicity, mutagenicity, and carcinogenesis; lecture and lab. Enroll Info: None

Requisites: None
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2018

MED PHYS/B M E/H ONCOL/PHYSICS 501 — RADIOLOGICAL PHYSICS AND DOSIMETRY
3 credits.

Interactions and energy deposition by ionizing radiation in matter; concepts, quantities and units in radiological physics; principles and methods of radiation dosimetry. Enroll Info: Calculus and modern physics

Requisites: None
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2017

MED PHYS/N E 506 — MONTE CARLO RADIATION TRANSPORT
3 credits.

Use of Monte Carlo technique for applications in nuclear engineering and medical physics. Major theory of Monte Carlo neutral particle transport is discussed. Standard Monte Carlo transport software is used for exercises and projects. Major emphasis is on analysis of real-world problems. Enroll Info: NEEP 305 or equiv and one of NEEP 405, 408, MED PHYS/B M E/H ONCOL/PHYSICS 501 or 569, or consent of instructor

Requisites: None
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2018

MED PHYS/B M E 530 — MEDICAL IMAGING SYSTEMS
3 credits.

2D Fourier image representation, sampling, and image filtering with applications in medical imaging. Principles of operation, impulse responses, signal-to-noise, resolution and design tradeoffs in projection radiography, tomography, nuclear medicine, ultrasound, and magnetic resonance imaging. Enroll Info: ECE 330 or Med Phys 473 or equiv or cons inst. Knowledge of linear signals & systems, convolution, basic probability, ID Fourier Transforms

Requisites: None
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2018

MED PHYS/B M E 535 — INTRODUCTION TO ENERGY-TISSUE INTERACTIONS
3 credits.

Explore physical interactions between thermal, electromagnetic and acoustic energies and biological tissues with emphasis on therapeutic medical applications. Enroll Info: Graduate student or senior level in Engineering or Medical Physics or consent of instructor

Requisites: None
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2017
MED PHYS/I SY E 559 — PATIENT SAFETY AND ERROR REDUCTION IN HEALTHCARE
2 credits.

Techniques for evaluating and reducing risks in medical procedures, including probabilistic risk assessment methods, failure mode and effects analysis, human factors analysis, and quality management. Discussions of patient safety standards, recommendations from agencies, and continual quality improvement. Enroll Info: Jr st or cons inst

Requisites: Enrollment limited to students with junior standing or higher or University Special Students
Course Designation: Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2018

MED PHYS/PHYSICS 563 — RADIONUCLIDES IN MEDICINE AND BIOLOGY
2-3 credits.

Physical principles of radioisotopes used in medicine and biology and operation of related equipment; lecture and lab. Enroll Info: PHYSICS 205, PHYSICS 241, or PHYSICS 249, or Graduate Standing

Requisites: None
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2017

MED PHYS/B M E 566 — PHYSICS OF RADIOTHERAPY
4 credits.

Ionizing radiation use in radiation therapy to cause controlled biological effects in cancer patients. Physics of the interaction of the various radiation modalities with body-equivalent materials, and physical aspects of clinical applications; lecture and lab. Enroll Info: None

Requisites: B M E/H ONCOL/MED PHYS/PHYSICS/B M E/H ONCOL/MED PHYS 501
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2018

MED PHYS/B M E 567 — THE PHYSICS OF DIAGNOSTIC RADIOLOGY
4 credits.

Physics of x-ray diagnostic procedures and equipment, radiation safety, general imaging considerations; lecture and lab. Enroll Info: Modern physics, calculus, and Fourier analysis, or consent of instructor

Requisites: None
Course Designation: Breadth - Biological Sci. Counts toward the Natural Sci req
Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2017

MED PHYS/B M E 568 — MAGNETIC RESONANCE IMAGING (MRI)
2 credits.

Core course covering the physics associated with magnetic resonance imaging emphasizing techniques employed in medical diagnostic imaging. Major MRI topics include: physics of MR, pulse sequences, hardware, imaging techniques, artifacts, and clinical applications. At the completion of this course, students should have an understanding of the technical and scientific details of modern magnetic resonance imaging and its use in diagnosing disease. Graduate students who have not taken MATH 222 and PHYSICS 202 at UW-Madison must have the equivalent coursework in order to be successful in this course. Enroll Info: None

Requisites: (MATH 222 and PHYSICS 202, 208, 241, 244, 248 or 249) or graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2018

MED PHYS/N E 569 — HEALTH PHYSICS AND BIOLOGICAL EFFECTS
3-4 credits.

Physical and biological aspects of the use of ionizing radiation in industrial and academic institutions; physical principles underlying shielding instrumentation, waste disposal; biological effects of low levels of ionizing radiation; lecture and lab. Enroll Info: None

Requisites: None
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2018

MED PHYS 570 — ADVANCED BRACHYTHERAPY PHYSICS
3 credits.

The use of radioactive sources for radiotherapy including: materials used, source construction dosimetry theory and practical application, dosimetric systems, localization and reconstruction. The course covers low dose rate, high dose rate and permanently placed applications. Enroll Info: None

Requisites: B M E/H ONCOL/MED PHYS/PHYSICS/B M E/H ONCOL/MED PHYS 501 and B M E/MED PHYS/B M E 566
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2016

MED PHYS 571 — ADVANCED EXTERNAL RADIATION ONCOLOGY
PHYSICS
3 credits.

Physics of ionizing radiation therapy with emphasis on external beam dosimetry and treatment planning. Enroll Info: None

Requisites: B M E/H ONCOL/MED PHYS/PHYSICS/B M E/H ONCOL/MED PHYS 501 and B M E/MED PHYS/B M E 566
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2011
MED PHYS 572 — ADVANCED RADIATION TREATMENT PLANNING
3 credits.

Physics of clinical, computer-based radiotherapy planning is taught. Topics include dose algorithms, measurement data, commissioning, contouring and volume definition, beam placement, modifiers and apertures and plan evaluation. Forward based and inverse planning (including IMRT optimization) are taught. Enroll Info: MED PHYS/B M E/H ONCOL PHYSICS 501 and MED PHYS/B M E 566
Requisites: None
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2017

MED PHYS/B M E 573 — MEDICAL IMAGE SCIENCE: MATHEMATICAL AND CONCEPTUAL FOUNDATIONS
3 credits.

The conceptual and mathematical foundations of medical imaging, including both deterministic and stochastic aspects. Enroll Info: 1 yr each of undergrad physics & calc or cons inst
Requisites: None
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2017

MED PHYS/B M E 574 — IMAGINE IN MEDICINE: APPLICATIONS
3 credits.

Continuation of 573, with application of concepts to practical medical imaging problems and emerging quantitative imaging techniques. Enroll Info: None
Requisites: B M E/MED PHYS/B M E 573
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2018

MED PHYS/B M E 575 — DIAGNOSTIC ULTRASOUND IMAGING
2 credits.

Propagation of ultrasonic waves in biological tissues; principles of ultrasonic measuring and imaging instrumentation; design and use of currently available tools for performance evaluation of diagnostic instrumentation; biological effects of ultrasound. Enroll Info: Graduate or professional standing or (MATH 234, 319, or 320 and PHYSICS 202 or 208)
Requisites: Graduate/professional standing or (MATH 234, 319, or 320 and PHYSICS 202 or 208)
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2018

MED PHYS 577 — PRINCIPLES OF X-RAY COMPUTED TOMOGRAPHY
3 credits.

Provides a basic foundation of x-ray computed tomography (CT) for those who are interested in the principles and applications of CT in Medical Physics. Focuses on the physics of CT, system design, image artifacts, and recent advances in CT techniques. Enroll Info: Grad st; Modern physics, calculus, and Fourier analysis, or cons inst
Requisites: None
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2017

MED PHYS/B M E 578 — NON-IONIZING DIAGNOSTIC IMAGING
3 credits.

This is a graduate level core course covering the physics associated with magnetic resonance imaging and diagnostic ultrasound emphasizing techniques employed in medical diagnostic imaging. Major MRI topics include: physics of MR, pulse sequences, hardware, imaging techniques, artifacts, and spectroscopic localization. Ultrasound based topics covered include: propagation of ultrasonic waves in biological tissues, principles of ultrasonic measuring and imaging instrumentation, design and use of currently available tools for performance evaluation of diagnostic instrumentation, and biological effects of ultrasound. At the completion of this course, students should have an understanding of the technical and scientific details of modern non-ionizing medical magnetic resonance and ultrasound devices and their use in diagnosing disease.Medical Physics 573 ("Imaging in Medicine") is useful but not a specific prerequisite. Enroll Info: MATH 222, PHYSICS 202
Requisites: None
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2017

MED PHYS/ANATOMY/B M E/PHMCOL-M/PHYSICS/RADIOL 619 — MICROSCOPY OF LIFE
3 credits.

Survey of state of the art microscopic, cellular and molecular imaging techniques, beginning with subcellular microscopy and finishing with whole animal imaging. Enroll Info: None
Requisites: PHYSICS 104, 202, 208, or 248 or MED PHYS/PHYSICS/MED PHYS 265
Course Designation: Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2017
MED PHYS/B M E/CHEM 650 — BIOLOGICAL OPTICAL MICROSCOPY
3 credits.

This course for graduate students will cover several aspects of state of the art biological and biophysical imaging. We will begin with an overview of geometrical optics and optical and fluorescence microscopy, with an emphasis on instrumentation. The bulk of the course will focus on advanced imaging techniques including nonlinear optical processes (multi-photon excitation, second harmonic generation, and stimulated Raman processes) and emerging super-resolution methods. Special emphasis will be given to current imaging literature and experimental design. Enroll Info: None
Requisites: Senior or Graduate standing, and CHEM 104 or 109 or 116 and, PHYSICS 104 or 202 or 208
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2018

MED PHYS/NTP 651 — METHODS FOR NEUROIMAGING RESEARCH
3 credits.

Provides a practical foundation for neuroimaging research studies with statistical image analysis. Specific imaging methods include functional BOLD MRI, structural MRI morphometry, and diffusion tensor imaging. Lectures and associated in-class computer exercises will cover the physics and methods of image acquisition, steps and tools for image analyses, the basis for statistical image analyses and interpretation of the results. Enroll Info: None
Requisites: Junior standing
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2017

MED PHYS 662 — RAD LAB - DIAGNOSTIC RADIOLOGICAL PHYSICS
1 credit.

Enroll Info: None
Requisites: B M E/MED PHYS/B M E 567
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2018

MED PHYS 663 — RAD LAB - NUCLEAR MEDICINE PHYSICS
1 credit.

Enroll Info: None
Requisites: MED PHYS/PHYSICS 463
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2015

MED PHYS 664 — RAD LAB - HEALTH PHYSICS
1 credit.

Enroll Info: None
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2017

MED PHYS 665 — RAD LAB: CT, MRI, AND DSA PHYSICS
1 credit.

Enroll Info: None
Requisites: B M E/MED PHYS/B M E 567
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2017

MED PHYS 666 — RAD LAB - MEDICAL ULTRASOUND PHYSICS
1 credit.

Enroll Info: None
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2017

MED PHYS 671 — SELECTED TOPICS IN MEDICAL PHYSICS
1-3 credits.

Various subjects of interest to medical physics faculty and students. Enroll Info: None
Requisites: None
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2018

MED PHYS 679 — RADIATION PHYSICS METROLOGY
3 credits.

Metrology, the science of measurement, is a critical component of medical physics. Topics covered: measurement statistics, determination of uncertainty, characteristics of ionization chambers, electrometers and other ionizing radiation measurement devices. Effects of instrumentation on clinical measurements. Enroll Info: MED PHYS/B M E/H ONCOL/PHYSICS 501; MED PHYS/B M E 566 & 567 recommended
Requisites: None
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2017
MED PHYS 699 — INDEPENDENT READING OR RESEARCH
1-3 credits.

Enroll Info: None
Requisites: Consent of instructor
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions

MED PHYS 701 — ETHICS AND THE RESPONSIBLE CONDUCT OF RESEARCH AND PRACTICE OF MEDICAL PHYSICS
1 credit.

This course will introduce the concepts of ethics in the daily practice of medical physics and other scientific disciplines and provide tools for identifying resources. Special emphasis will be placed on how these principles have to be applied to ensure the confidentiality of the patients, the safety of the research subjects (human and animals), differentiation between ethical and legal issues, as well as the understanding of the principles that deal with authorships, intellectual property in the academic- and industry-based environment. This will be a 1 credit course (16hs). It will consist of 8 weekly meetings (2 hs each session). Prereq:
Graduate or professional standing
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2018

MED PHYS/B ME 710 — ADVANCES IN MEDICAL MAGNETIC RESONANCE
3 credits.

This course studies in some depth the theory and applications of magnetic resonance (MR) in medicine. It provides the necessary theoretical background to understand advanced MR techniques including magnetic resonance imaging (MRI). Enroll Info: None
Requisites: B ME/MED PHYS/B ME 568
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2017

MED PHYS 719 — MULTI-MODALITY MOLECULAR IMAGING IN LIVING SUBJECTS
3 credits.

This course will give an overview of all major areas in molecular imaging, based on each imaging modality. Additional topics include, but are not limited to, role of molecular imaging in stem cell research, molecular imaging with nanoparticles, theranostics, molecular imaging in drug development, optical imaging and its clinical applications, reporter gene imaging, imaging of apoptosis, PET imaging of cancer, imaging protein-protein interactions. Enroll Info: None
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2013

MED PHYS/B ME/PHYSICS 775 — ADVANCED ULTRASOUND PHYSICS
3 credits.

Foundations of acoustic wave equations, diffraction phenomena and acoustic beam formation, models for acoustic scattering from discrete structures and inhomogeneous continua, speckle statistics including speckle correlation, applications of these topics in medical imaging. Enroll Info: MED PHYS/B ME 575, PHYSICS 311, 322, 325, MATH 234, or cons inst
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2013

MED PHYS/H ONCOL 812 — RADIATION MEDICINE PHYSICS CLERKSHIP
2 credits.

Allows students to observe and participate in the application of medical physics principles in the clinical setting. Under supervision, students will perform the functions of a clinical medical physicist in radiation medicine. Enroll Info: None
Requisites: B ME/H ONCOL/MED PHYS/PHYSICS/B ME/H ONCOL/
MED PHYS 501 and B ME/MED PHYS/B ME 566
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2008

MED PHYS 900 — JOURNAL CLUB AND SEMINAR
1 credit.

Enroll Info: None
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2018

MED PHYS 990 — RESEARCH
1-12 credits.

Enroll Info: None
Requisites: Consent of instructor
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions