

# DEPARTMENT OF RADIOLOGY AND DEPARTMENT OF RADIATION ONCOLOGY

## Accreditations

The MSBS program in Medical Physics and the PhD in Physics and Astronomy with specialization in Medical Physics are accredited by the Commission on Accreditation of Medical Physics Educational Programs ([www.campep.org](http://www.campep.org) (<http://www.campep.org>)).

### Degrees Offered

- MSBS Medical Physics (Diagnostic Imaging Track) (<https://catalog.utoledo.edu/graduate/medicine-life-sciences/departments-divisions/radiology-radiation-oncology/msbs-medical-physics/>)
- MSBS Medical Physics (Radiation Oncology Track) (<https://catalog.utoledo.edu/graduate/medicine-life-sciences/departments-divisions/radiology-radiation-oncology/msbs-medical-physics/>)
- Also PhD in Physics and Astronomy with specialization in medical physics in both tracks is offered through the College of Natural Sciences & Mathematics.

### MPHY 6010 Survey of Diagnostic Medical Imaging I

[3 credit hours]

This course provides a survey of diagnostic imaging modalities including the physical principles and instrumentation of diagnostic imaging equipment. Radiographic and fluoroscopic imaging systems, x-ray computed tomography, Ultrasound, MRI, and basic of Nuclear Medicine will be covered. The course builds upon basic review of atomic and nuclear properties, production of x-rays, and interaction of radiation with matter.

**Term Offered:** Fall

### MPHY 6020 Survey of Diagnostic Medical Imaging II

[3 credit hours]

This course builds on the materials taught in MPHY 6010/8010, and discusses advanced concepts in medical imaging including functioning MRI, SPECT, and PET imaging. Details of radioactivity and nuclear transformation, radionuclide production and radiopharmaceuticals, radiation detection and measurement and scintillation camera will be covered. Advanced discussions on CT and US will also be presented.

**Term Offered:** Spring

### MPHY 6040 Diagnostic Radiological Physics

[0-5 credit hours]

This course considers the physical principles and instrumentation of diagnostic image formation including radiography, fluoroscopy, computed tomography, ultrasound, nuclear medicine and magnetic resonance imaging.

**Term Offered:** Spring, Fall

### MPHY 6060 Nuclear Medicine

[3 credit hours]

Course covers the physical aspects of diagnostic and therapeutic applications of radionuclides. This includes radiation detectors and imaging systems, emission tomography, counting statistics, equipment testing, radiopharmaceuticals and internal radiation dosimetry.

**Term Offered:** Summer, Fall

### MPHY 6100 Clinical Imaging Review

[0-4 credit hours]

Review of the clinical aspect of diagnostic imaging of clinical modalities and anatomy as approved by instructor. Review typically will include reading, discussion, and clinical image review covering radiological anatomy, physiology, disease states, and considerations for diagnostic interpretation of images. May be repeated for credit.

**Term Offered:** Summer

### MPHY 6110 Survey Clinical Radi Therapy

[2 credit hours]

A series of lectures on various topics in radiation therapy give an overview of radiation therapy in the clinical care of patients and familiarize students with a variety of options for treatment of cancer patients.

**Term Offered:** Spring, Fall

### MPHY 6120 Radiation Dosimetry I

[3 credit hours]

Series of lectures covering basic concepts of radiation physics, interactions of ionizing radiation physics, interactions of ionizing radiation with matter, and fundamentals of radiation dosimetry techniques and instrumentation. An overview of principles of radiation therapy, radiation protection, nuclear medicine, and diagnostic radiology is given.

**Term Offered:** Fall

### MPHY 6130 Radiation Dosimetry II

[3 credit hours]

Series of lectures covering interactions of ionizing radiation with matter and radiation dosimetry physics fundamentals in-depth. Cavity theories, integrating and pulse-mode dosimeters, dosimetry and calibration of photon and electron beams, and neutron dosimetry are considered in details.

**Term Offered:** Spring

### MPHY 6160 Radiation Biology

[3 credit hours]

A series of introductory lectures on radiation biology with emphasis on the effects of radiation on cells and cellular components, tissues, and organisms. Dose-response relationships, dose-effect modifiers, and considerations applicable to radiation therapy treatments are among covered topics.

**Term Offered:** Spring

### MPHY 6180 Physics of Radiation Therapy

[3 credit hours]

Basic radiation physics and physical aspects of treatment planning, using photon and electron beams as well as brachytherapy sources will be taught.

**Term Offered:** Spring, Fall

**MPHY 6190 Brachytherapy**

[3 credit hours]

Fundamental information about the physical characteristics of the sources used in brachytherapy, the methods used for implant planning and evaluation of plans.

**Term Offered:** Summer**MPHY 6200 Radiation Protection and Regulation**

[3 credit hours]

Course considers the hazards associated with radioactivity and electromagnetic radiation, including types and sources of radiation, radiation measurement and units, dosimetry, radiation protection practices required by governmental regulation and medical facility accrediting bodies.

**Term Offered:** Summer**MPHY 6240 Physics of Medicine and Biol**

[3 credit hours]

Overview of physics as applied to physiological and biological systems, including body mechanics, osmosis, respiratory and cardiovascular mechanisms, electric signals, speech, hearing, and sight.

**Term Offered:** Spring**MPHY 6260 Computers Radiation Therapy**

[2 credit hours]

Computer fundamentals and problem solving through programming. Typical problems include PDD, TAR, TMR, MU calculations, scatter summation, TMR for arc and dose distributions.

**MPHY 6280 Electronics for Med Physicists**

[2 credit hours]

Basics of electronics circuit design to perform specific tasks as it relates to medical physics applications.

**MPHY 6300 Radiation Detection/Measurement**

[3 credit hours]

Introduces the student to the various equipment and methods used in radiation detection and measurement. Introduces advanced concepts in error analysis, energy spectra unfolding, fit results with function, etc. The lab portion of this course, PHYS6180, is taught through the University of Toledo.

**Term Offered:** Spring**MPHY 6310 Anatomy/Physiology**

[4 credit hours]

The course will cover an overview of physiology at a cellular, and organ system levels. This will include normal function of human body and some clinical manifestations of human diseases. There will also be some introduction to basic skeletal system.

**Term Offered:** Fall**MPHY 6320 Practical Measurements in Rad**

[2 credit hours]

Basic practical considerations in measurements of photon and electron beam parameters of the linear accelerator.

**Term Offered:** Summer**MPHY 6400 Intro to LINAC in Radiation Th**

[3 credit hours]

The electron linear accelerator will be described in theory and operation as it relates to medical physics and cancer patients. The physics aspect of particle acceleration and x-ray and electron generation using these units as well as dose delivery to the patient is considered.

**MPHY 6500 Medical Physics Seminar**

[1 credit hour]

Recent developments, special topics, critical analysis of recent publications, and literature reviews in specific areas of medical physics. May be repeated for credit.

**Term Offered:** Spring, Fall**MPHY 6520 Radiation Safety and Measurement**

[3 credit hours]

Review of fundamentals of radiation safety and protection, instrumentation, radioactivity, radiation interaction with matter, and biological effects of radiation. Also, measurement methods, safety practices and regulations for use of radiation in research and medicine is presented.

**MPHY 6610 Clin Trng Radi Oncol Physics I**

[4 credit hours]

This course offers clinical training in radiation oncology physics to graduate students. This will include clinical dosimetry concepts, anatomy & physiology, clinical radiobiology, and overview of special procedures including SRS, SBRT, IORT, HDR, LDR, Rad Safety and Regulations. QA of equipment and clinical responsibilities; review of TG 142, 51, 66 and other related reports.

**Term Offered:** Fall**MPHY 6620 Clin Trng Radi Oncol Physics II**

[4 credit hours]

This course offers advanced clinical training in radiation oncology physics to senior level graduate students. Advanced dosimetry concepts, Brachytherapy, IMRT, IGRT, adaptive IGRT. Other special procedures are covered. Also, lectures and hands-on training are provided so that students can fine tune their techniques in Treatment Planning, QA Issues, daily clinical responsibilities and operation as a medical physicist are taught.

**Term Offered:** Spring, Summer, Fall**MPHY 6630 Clin Trng Radi Oncol Physics III**

[5 credit hours]

Clinical training in radiation therapy physics to graduate students who have obtained an MS or Ph.D. degree in the field of medical physics or related area. May be repeated for credit

**Term Offered:** Summer**MPHY 6730 Medical Physics Research**

[0-4 credit hours]

Students will participate in selected ongoing research programs of members of the department faculty. May be repeated for credit.

**Term Offered:** Summer**MPHY 6840 Independent Study: Med Physics**

[0-12 credit hours]

Combination of reading, lecture and discussion within a defined area of medical physics. Defined topics are: dosimetry, internal dosimetry, radiobiology, monte carlo analysis, image processing, topical study. May be repeated for credit.

**Term Offered:** Spring, Summer, Fall

**MPHY 6860 Independent Study in Radiology**

[0-12 credit hours]

Combination of reading, lecture and discussion within a defined area of radiology. Defined topics are: radiographic imaging, computed tomography, magnetic resonance imaging, nuclear medicine, diagnostic ultrasound, diagnostic quality control, digital imaging. May be repeated for credit.

**Term Offered:** Spring, Summer, Fall**MPHY 6880 Independent Study: Rad Therapy**

[0-12 credit hours]

Combination of reading, lecture, and discussion within a defined area of radiation therapy. Defined topics are: 3-D conformal treatment planning, 3-D dose compensators, stereotactic radiosurgery, electron arc therapy, photon and electron algorithms, treatment planning dosimetry verification, total body irradiation, total body skin. May be repeated for credit.

**MPHY 8010 Survey of Diagnostic Medical Imaging I**

[3 credit hours]

This course provides a survey of diagnostic imaging modalities including the physical principles and instrumentation of diagnostic imaging equipment. Radiographic and fluoroscopic imaging systems, x-ray computed tomography, Ultrasound, MRI, and basic of Nuclear Medicine will be covered. The course builds upon basic review of atomic and nuclear properties, production of x-rays, and interaction of radiation with matter.

**Term Offered:** Fall**MPHY 8020 Survey of Diagnostic Medical Imaging II**

[3 credit hours]

This course builds on the materials taught in MPHY 6010/8010, and discusses advanced concepts in medical imaging including functioning MRI, SPECT, and PET imaging. Details of radioactivity and nuclear transformation, radionuclide production and radiopharmaceuticals, radiation detection and measurement and scintillation camera will be covered. Advanced discussions on CT and US will also be presented.

**Term Offered:** Spring**MPHY 8040 Diag Radiological Physics**

[0-5 credit hours]

This course considers the physical principles and instrumentation of diagnostic image formation including radiography, fluoroscopy, computed tomography, ultrasound, nuclear medicine and magnetic resonance imaging.

**Term Offered:** Spring, Fall**MPHY 8060 Nuclear Medicine**

[3 credit hours]

Course covers the physical aspects of diagnostic and therapeutic applications of radionuclides. This includes radiation detectors and imaging systems, emission tomography, counting statistics, equipment testing, radiopharmaceuticals and internal radiation dosimetry.

**Term Offered:** Fall**MPHY 8110 Survey Clinical Radi Therapy**

[2 credit hours]

A series of lectures on various topics in radiation therapy give an overview of radiation therapy in the clinical care of patients and familiarize students with a variety of options for treatment of cancer patients.

**Term Offered:** Spring, Fall**MPHY 8120 Radiation Dosimetry I**

[3 credit hours]

Series of lectures covering basic concepts of radiation physics, interactions of ionizing radiation with matter, and fundamentals of radiation dosimetry techniques and instrumentation. An overview of principles of radiation therapy, radiation protection, nuclear medicine, and diagnostic radiology is given.

**Term Offered:** Fall**MPHY 8130 Radiation Dosimetry II**

[3 credit hours]

Series of lectures covering interactions of ionizing radiation with matter and radiation dosimetry physics fundamentals in-depth. Cavity theories, integrating and pulse-mode dosimeters, dosimetry and calibration of photon and electron beams, and neutron dosimetry are considered in details.

**Term Offered:** Spring**MPHY 8160 Radiation Biology**

[3 credit hours]

A series of introductory lectures on radiation biology with emphasis on the effects of radiation on cells and cellular components, tissues, and organisms. Dose-response relationships, dose-effect modifiers, and considerations applicable to radiation therapy treatments are among covered topics.

**Term Offered:** Spring**MPHY 8180 Physics of Radiation Therapy**

[3 credit hours]

Basic radiation physics and physical aspects of treatment planning, using photon and electron beams as well as brachytherapy sources will be taught.

**Term Offered:** Spring, Fall**MPHY 8190 Brachytherapy**

[3 credit hours]

Fundamental information about the physical characteristics of the sources used in brachytherapy, the methods used for implant planning and evaluation of plans.

**Term Offered:** Summer**MPHY 8200 Radiatn Protect and Regulation**

[3 credit hours]

Course considers the hazards associated with radioactivity and electromagnetic radiation, including types and sources of radiation, radiation measurement and units, dosimetry, radiation protection practices required by governmental regulation and medical facility accrediting bodies.

**Term Offered:** Summer**MPHY 8240 Physics of Medicine and Biol**

[3 credit hours]

Overview of physics as applied to physiological and biological systems, including body mechanics, osmosis, respiratory and cardiovascular mechanisms, electric signals, speech, hearing, and sight.

**MPHY 8260 Computer in Radiation Therapy**

[2 credit hours]

Computer fundamentals and problem solving through programming. Typical problems include PDD, TAR, TMR, MU calculations, scatter summation, TMR for arc and dose distributions.

**MPHY 8280 Electronics for Med Physicists**

[2 credit hours]

Basics of electronics circuit design to perform specific tasks as it relates to medical physics applications.

**MPHY 8300 Radiation Detection/Measurement**

[3 credit hours]

Introduces the student to the various equipment and methods used in radiation detection and measurement. Introduces advanced concepts in error analysis, energy spectra unfolding, fit results with function, etc. The lab portion of this course, PHYS6180, is taught through the University of Toledo.

**Term Offered:** Spring

**MPHY 8310 Anatomy & Physiology**

[4 credit hours]

The course will cover an overview of physiology at a cellular, and organ system levels. This will include normal function of human body and some clinical manifestations of human diseases. There will also be some introduction to basic skeletal system.

**Term Offered:** Fall

**MPHY 8320 Practical Measurements in Rad**

[2 credit hours]

Basic practical considerations in measurements of photon and electron beam parameters of the linear accelerator.

**Term Offered:** Summer

**MPHY 8400 Intro to LINAC in Radiation Th**

[3 credit hours]

The electron linear accelerator will be described in theory and operation as it relates to medical physics and cancer patients. The physics aspect of particle acceleration and x-ray and electron generation using these units as well as dose delivery to the patient is considered.

**MPHY 8500 Medical Physics Seminar**

[1 credit hour]

Recent developments, special topics, critical analysis of recent publications, and literature reviews in specific areas of medical physics. May be repeated for credit.

**Term Offered:** Spring, Fall

**MPHY 8520 Radiation Safety and Measurement**

[3 credit hours]

Review of fundamentals of radiation safety and protection, instrumentation, radioactivity, radiation interaction with matter, and biological effects of radiation. Also, measurement methods, safety practices and regulations for use of radiation in research and medicine is presented.

**MPHY 8610 Clin Trng Radi Oncol Physics I**

[4 credit hours]

This course offers clinical training in radiation oncology physics to graduate students. This will include clinical dosimetry concepts, anatomy & physiology, clinical radiobiology, and overview of special procedures including SRS, SBRT, IORT, HDR, LDR, Rad Safety and Regulations. QA of equipment and clinical responsibilities; review of TG 142, 51, 66 and other related reports.

**Term Offered:** Fall

**MPHY 8620 Clin Trng Radi Oncol Physcs II**

[4 credit hours]

This course offers advanced clinical training in radiation oncology physics to senior level graduate students. Advanced dosimetry concepts, Brachytherapy, IMRT, IGRT, adaptive IGRT, other special procedures are covered. Also, lectures and hands-on training are provided so that students can fine tune their techniques in Treatment Planning, QA Issues, daily clinical responsibilities and operations as a medical physicist are taught.

**Term Offered:** Spring

**MPHY 8630 Clin Trng Radi Oncol Physcs III**

[5 credit hours]

Clinical training in radiation therapy physics to graduate students who have obtained an MS or Ph.D. degree in the field of medical physics or related area. May be repeated for credit

**Term Offered:** Summer

**MPHY 8730 Medical Physics Research**

[0-4 credit hours]

Students will participate in selected ongoing research programs of members of the department faculty. May be repeated for credit.

**MPHY 8840 Independent Study: Med Physics**

[0-12 credit hours]

Combination of reading, lecture and discussion within a defined area of medical physics. Defined topics are: dosimetry, internal dosimetry, radiobiology, monte carlo analysis, image processing, topical study. May be repeated for credit.

**Term Offered:** Summer, Fall

**MPHY 8860 Independent Study in Radiology**

[0-12 credit hours]

Combination of reading, lecture and discussion within a defined area of radiology. Defined topics are: radiographic imaging, computed tomography, magnetic resonance imaging, nuclear medicine, diagnostic ultrasound, diagnostic quality control, digital imaging. May be repeated for credit.

**MPHY 8880 Independent Study: Rad Therapy**

[0-12 credit hours]

Combination of reading, lecture, and discussion within a defined area of radiation therapy. Defined topics are: 3-D conformal treatment planning, 3-D dose compensators, stereotactic radiosurgery, electron arc therapy, photon and electron algorithms, treatment planning dosimetry verification, total body irradiation, total body skin. May be repeated for credit.

**MPHY 8960 Dissertation Research**

[0-15 credit hours]

Disciplinary or interdisciplinary investigation of significant problems at the doctoral level leading to the preparation of a scientific project for presentation as a dissertation.

**Term Offered:** Spring, Summer, Fall