Professional Science Master in Medical Physics (PSMMP)

Accredited by the Commission on the Accreditation of Medical Physics Education Programs (CAMPEP)
Recognized by the Council of Graduate Schools (CGS) as a Professional MS

CATALOG DESCRIPTION

Description
The Department of Physics offers the Master of Science in Medical Physics (MSMP) degree. The MSMP is a Professional MS innovative program that develops advanced scientific knowledge and professional skills. It is interdisciplinary and provides hands-on learning through on the site training. It aims to engage students with professional goals and help them become scientists uniquely suited to the 21st-century workplace.

Medical Physics is an applied branch of physics devoted to the application of concepts and methods from physics to the diagnosis, treatment of human disease, planning and development of treatment equipment. A qualified Medical Physicist is competent to practice independently one or more of the subfields (tracks) of medical physics.

The MSMP is a 41 credit hours program (plus the 3 credits prerequisite course). It provides professional training in partnership with area hospitals focusing on the Radiation Therapy track which absorbs ~75% of Medical Physicists.

Admission Requirements
A BS in Physics. Candidates with a BS in Biology, Chemistry, Computer Science, or Engineering with a minor in Physics are considered.
- At least a 3.0 (of a 4.0 maximum) grade point average (GPA) in Science and Mathematics, courses. A combined minimum score of 1000 on the verbal and quantitative portions of the Graduate Record Examination (GRE), (or equivalent). Scores must be no more than five years old.

Prerequisite Course for the MSMP
PCB 3703. Human Morphology and Function 1 (3 credit hours). Normal structure and physiology of the human skeletal, muscle and nervous systems.
CURRICULUM

- 5 core courses
- 2 track-specific courses
- 1 track-specific practicum course
- 1 frontier course
- 1 elective course
- 1 graduate research
- Master’s Thesis
- Seminar on Safety and Ethics

Total of 41 credit hours (plus the prerequisite). Typical duration is two years.

MSMP Courses

Core Courses

- RAT 6686. Radiation Physics (3 credit hours)
  Course covers the basics of ionizing and non-ionizing radiation, atomic and nuclear structure, basic nuclear and atomic physics, radioactive decay, interaction of radiation with matter, radiation detection, and dosimetry.

- BSC 6834. Introduction to Radiation Biology (3 credit hours)
  Prerequisite: permission of Instructor.
  An overview of the effects of ionizing radiations on human and other biological systems. The course involves consideration of cell survival after exposure to ionizing radiations, repair of radiation damage, radiosensitizers and radioprotectors, doses and risks in diagnostic radiology, cardiology, nuclear medicine, and basic safety rules. A student seminar is required at the end of the course.

- RAT 6628. Radiation Therapy Physics (3 credit hours)
  Prerequisite: RAT 6686
  Introductory course with a clinical orientation that reviews the rationale, basic science, methods, and applications of radiation therapy to the treatment of human diseases. Low- and high-energy photon therapy, electron and proton therapy, and low- and high-dose rate brachytherapy.

- RAT 6616. Medical Imaging Physics (3 credit hours)
  Course describes the basics of noninvasive imaging techniques, including Magnetic Resonance Imaging (MRI), functional MRI, Diffusion Tensor Imaging (DTI), electro- and magneto-encephalography (EEG, MEG). Course also covers analysis and visualization of high-dimensional datasets.

- RAT 6687. Nuclear Medical Physics (3 credit hours)
  Prerequisite: PHY 4604 (Quantum 1) or permission of Instructor.
Covers the fundamentals of nuclear physics and its application in the medical field as recommended by the AAPM. Students gain understanding of the physics and instrumentation of nuclear medicine.

**Radiation Therapy Track-specific Courses**

- **RAT 6629.** Advanced Photon Beam Radiation Therapy (3 credit hours)
  Prerequisite: RAT 6628.
  This course will cover the physics and clinical application of advanced external beam photon therapies with special emphasis on IMRT (Intensity Modulated Radiation Therapy).

- **RAT 6947.** Radiation Therapy: Clinical Practicum and Shadowing (3 credit hours)
  Application of medical physics to cancer therapy in a hospital setting under close supervision. Dosimetry, calibrations, commissioning, radiation survey, and treatment planning. Clinically oriented laboratory-type projects are assigned.

- **RAT 6376.** Shielding and Commissioning (3 credit hours)
  Covers the science of opening a new radiation oncology center. Covers shielding calculations, installing and running the acceptance testing of a linear accelerator, high dose rate brachytherapy afterloader, CT simulator, treatment planning systems, commissioning of the treatment planning systems.

**Frontier course**

- **BME 6762.** Bioinformatics: Bioengineering Perspectives 3 credits
  Prerequisite: Engineering/Science B.S.

**Research and Seminar**

- **PHY 6918.** Graduate Research 3 credit hours
  Prerequisite: Permission of Instructor. Supervised research for M.S.

- **RAT 6975 Master’s Thesis Research 7 credit hours**
  Prerequisite: Permission of Instructor. Supervised by the Thesis Advisor.

- **RAT 6932 Seminar in Medical Physics 1 credit hour**
  Prerequisite: Permission of Instructor.
1 elective course

Students may choose from the following 3 credit hours courses offered by an FAU department or center. All program electives are regular catalog courses. Students select with advisor’s approval.

STA 5195. Biostatistics 1
Prerequisite: STA 4234 or STA 4102.
An introduction to statistical tools used routinely for inference and data analysis in the health sciences. Topics include biostatistical design of medical studies, measure of disease occurrence and association, methods for rates and proportions, ROC analysis for screening and diagnosis, discrimination and classification, principal component analysis and factor analysis, log-linear models and survival analysis.

This course provides a clear in-depth look into the discoveries made in the recent past and present especially focusing on the key concepts in the exciting areas of Eukaryotic Cell Structure and Function and Molecular Biology while studying a variety of biological processes at the cellular and molecular levels.

PHZ 5715. Introduction to Biophysics.
Prerequisites: PHY 2049 or PHY 2054 or equivalent. A survey of the ideas and application of physics in the realm of biology designed to be accessible to physics or biology students. Emphasis on how the ideas of statistical physics can be used to give physical insights into complex biological problems with quantitative understanding and prediction.

MAP 6211. Introduction to Dynamical Systems and Chaos.
2 Scalar autonomous equations, elementary bifurcations, scalar maps, one-dimensional chaos, scalar nonautonomous equations, bifurcations of periodic equations, equations on tori and circle maps, planar autonomous systems.

PCB 6207. Advanced Cell Physiology.
Prerequisite: Permission of Instructor. Course describes in-depth membrane physiology, intracellular signaling pathways, and cellular function, with an emphasis on neurons and human muscle cells (skeletal, smooth, and cardiac muscle cells).

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