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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

Program Description

The Department of Physics offers the Professional Science Master in Medical Physics (PSMMP) degree. The PSMMP 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 PSMMP is a 41 credit hours program (plus the 3 credits prerequisite course). It provides professional training, in partnership with area hospitals, and focuses on the Radiation Therapy track that absorbs ~75% of Medical Physicists. Typical duration is two years.

Admission Requirements

A BS or BA 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. Have taken the general portion of the GRE. No minimum score is required (or equivalent). Scores must be no more than five years old.

Prerequisite Course for the PSMMP

PCB 3703. Human Morphology and Function 1 (3 credits). Normal structure and physiology of the human skeletal, muscle and nervous systems.

CURRICULUM

- 6 core courses
- 3 track-specific courses
- 1 track-specific practicum course
- 1 graduate research
- Master's Thesis
- Seminar on Safety and Ethics

PSMMP Courses

Core Courses

- RAT 6686. *Radiation Physics* (3 credits)
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 credits) 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 credits) 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 credits)
Course covers the mathematical and physical principles of medical imaging and its applications as recommended by the AAPM. Students obtain a good understanding of Radiography, Computed Tomography (CT), Magnetic Resonance Imaging (MRI), Ultrasound Imaging (US), Fluorescence and Nuclear Medical Imaging.
- RAT 6687. *Nuclear Medical Physics* (3 credits) 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.
- RAT 6888. *Radiation Protection and Safety* (3 credits). Knowledge and technical background to understand the calculation methodology, compliance with the safety standards, and use of quantitative risk assessment for radiation protection & safety.

Radiation Therapy Track-specific Courses

- RAT 6629. *Advanced Photon Beam Radiation Therapy* (3 credits)
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 credits)
Application of medical physics to cancer therapy in a hospital setting under close supervision. Dosimetry, calibrations, commissioning, radiation survey, and treatment planning are covered. Clinically oriented laboratory-type projects are assigned.
- RAT 6376. *Shielding and Commissioning* (3 credits)
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.

Research and Seminar

- PHY 6918. *Graduate Research* (3 credits). Prerequisite: Permission of Instructor. Supervised research towards Thesis.
- RAT 6975. *Master's Thesis Research* (7 credits). Prerequisite: Permission of Instructor. Supervised by the Thesis Advisor.
- RAT 6932. *Seminar in Medical Physics* (1 credit) Prerequisite: Permission of Instructor.
Patient Safety in Radiation Oncology. Code of Ethics for Medical Physicists.

One 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.
- BSC 6936. *Cell Structure and Function*.
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.
- BME 6762. *Bioinformatics: Bioengineering Perspectives*.
Introduction to bio-and genetic engineering. Concepts and definitions of molecular biological terms. Bioinformatics-definition and applications. Information resources and databases: Proteins and genomes. Biological sequence analysis and applications. Sequence search/analyses tools and protocols. Bioinformatics versus modern information networks and the World Wide Web.
- ISC 5453. *Nonlinear Dynamic Systems*.
2 Scalar autonomous equations, elementary bifurcations, scalar maps, one-dimensional chaos, scalar non-autonomous 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).
- PCB 6239. *Tumor Immunology*. Prerequisite: Permission of Instructor.
Explores the role of the immune system in cancer and the implications for the host. The effect of the tumor-host interactions on the developing neoplasm are studied by considering related topics such as angiogenesis, MMPs, chemokines and metastasis. Additionally, the course explores the role of the immune system in defense against the tumors and the mechanism by which cancer cells escape the surveillance system.

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Medical Physics Graduate Certificate Program for Ph.D. holders

Description

This certificate program offered by a CAMPEP-accredited program is designed to provide the essential didactic elements of medical physics to Ph.D. holders seeking to pursue an alternative pathway to medical physics residency. It is intended to enable individuals with a doctoral degree in physics or a related discipline to meet the didactic requirements needed to enter a CAMPEP-accredited residency program.

Students enrolled in the Certificate program may also register for Part I of the American Board of Radiology board exam in Medical Physics.

Students with a Ph.D. in physics, physical sciences, mathematics or engineering who are interested in this program may apply for admission to the regular graduate program of the Physics Department. Also, students who are officially admitted as doctoral students in the above-mentioned fields may apply.

Prerequisites for entering the program

Applicants must have a Ph.D. in Physics or a related discipline. Applicants are also required to have successfully completed or must be enrolled in an independent course in anatomy/physiology when they begin the Certificate program. BSC 2085 Anatomy and Physiology 1 (3 credits)

Courses Description

1. RAT 6686. *Radiation Physics* (3 credits)

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.

2. BSC 6834. *Introduction to Radiation Biology* (3 credits)

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.

3. RAT 6628. *Radiation Therapy Physics* (3 credits)

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.

4. RAT 6616. *Medical Imaging Physics* (3 credits)

Course covers the mathematical and physical principles of medical imaging and its applications as recommended by the AAPM. Students obtain a good understanding of Radiography, Computed Tomography (CT), Magnetic Resonance Imaging (MRI), Ultrasound Imaging (US), Fluorescence and Nuclear Medical Imaging.

5. RAT 6310. *Radiation Protection and Safety* (3 credits)

Knowledge and technical background to understand the calculation methodology, compliance with the safety standards, and use of quantitative risk assessment for radiation protection & safety.