

# MEDICAL PHYSICS, DOCTOR OF PHILOSOPHY (PH.D.)

## Program accreditation

Commission on Accreditation of Medical Physics Educational Programs (<http://campep.org>)

## Program goals

The Ph.D. in Medical Physics offers students course work and research training in physics as it is applied to the diagnosis and treatment of human diseases. The mission of the doctoral program is to serve the commonwealth of Virginia and the nation by helping to meet the demand for competent medical physicists in both the health care delivery and biomedical research settings. The program will prepare students for careers as independent investigators in the field of medical physics and jointly for careers in university departments, research institutes, laboratories and hospitals as trainee clinical medical physicists. Research areas include brachytherapy, hyperthermia, image-guided radiation therapy, intensity-modulated radiation therapy, proton therapy, medical imaging technologies, radiomics, image processing and reconstructions, functional imaging, novel treatment device fabrications, robotics, and 4-D treatment technology development.

**Professional competency:** To develop professional competency in medical physics by providing a framework in which students progressively develop a mastery of the current state of medical physics and an ability to synthesize this information and apply it in research and clinical settings. Additionally, the program aims to develop skills in the various means of communicating both the core of medical physics knowledge and expression of experimental design, results, and interpretation to a variety of potential audiences.

**Scientific competency:** To develop scientific competency in medical physics by providing a framework by which candidates develop skills to design, conduct and implement theoretical and clinical research which answers identified questions. The research focus may lead to new and/or improved applications of physics for diagnosis and treatment of diseases. In broad terms, candidate research will be directed toward advancing "minimally invasive medicine" through applications of ionizing and non-ionizing radiation.

## Student learning outcomes

1. Communication skills: The candidate should demonstrate that an appropriate level of oral, written and visual communication skills have been acquired. The candidate will demonstrate the achievement of an appropriate level of oral communication skills with respect to the content, organization, logical flow, presentation and appropriate use of language incorporating the use of visual aids, as measured by rubric. The candidate will demonstrate the achievement of an appropriate level of written communication skill with respect to grammar, syntax, spelling and use of vocabulary to effectively present information including the use of figures, tables and citations as measured by rubric.
2. Experimental design: The candidate should demonstrate an appropriate level of skill in the theoretical and technical design of experimental procedures and the technical conduct of experimentation related to his or her research. This includes demonstration of an appropriate level of competence in the ability to appraise, modify and/or create, and implement experimental

protocols and to design and develop experiments as measured by rubric.

3. Knowledge of medical physics literature: The candidate should demonstrate a general knowledge of medical physics literature and a more detailed knowledge of his or her area of research, including an appropriate familiarity with the research literature and the ability to evaluate and critique publications as measured by rubric.
4. Problem-solving: The candidate should demonstrate an appropriate level of skill in the identification of meaningful medical physics research problems, including the ability to defend said identifications, and the design and implementation of appropriate problem-solving methods as measured by rubric.

## VCU Graduate Bulletin, VCU Graduate School and general academic policies and regulations for all graduate students in all graduate programs

The VCU Graduate Bulletin website documents the official admission and academic rules and regulations that govern graduate education for all graduate programs at the university. These policies are established by the graduate faculty of the university through their elected representatives to the University Graduate Council.

It is the responsibility of all graduate students, both on- and off-campus, to be familiar with the VCU Graduate Bulletin as well as the Graduate School website (<http://www.graduate.vcu.edu/>) and academic regulations in individual school and department publications and on program websites. However, in all cases, the official policies and procedures of the University Graduate Council, as published on the VCU Graduate Bulletin and Graduate School websites, take precedence over individual program policies and guidelines.

**Visit the academic regulations section for additional information on academic regulations for graduate students.** (<https://bulletin.vcu.edu/academic-regs/>)

## Degree candidacy requirements

A graduate student admitted to a program or concentration requiring a final research project, work of art, thesis or dissertation, must qualify for continuing master's or doctoral status according to the degree candidacy requirements of the student's graduate program. Admission to degree candidacy, if applicable, is a formal statement by the graduate student's faculty regarding the student's academic achievements and the student's readiness to proceed to the final research phase of the degree program.

Graduate students and program directors should refer to the following degree candidacy policy as published in the VCU Graduate Bulletin for complete information and instructions.

**Visit the academic regulations section for additional information on degree candidacy requirements.** (<https://bulletin.vcu.edu/academic-regs/grad/candidacy/>)

## Graduation requirements

As graduate students approach the end of their academic programs and the final semester of matriculation, they must make formal application to graduate. No degrees will be conferred until the application to graduate has been finalized.

Graduate students and program directors should refer to the following graduation requirements as published in the Graduate Bulletin for a complete list of instructions and a graduation checklist.

Visit the **academic regulations section for additional information on graduation requirements**. (<https://bulletin.vcu.edu/academic-regs/grad/graduation-info/>)

## Other information

### School of Medicine graduate program policies

The School of Medicine provides policies applicable to all programs administratively housed in the school. Information on doctoral programs is available in the Graduate Bulletin.

Apply online today. (<https://www.vcu.edu/admissions/apply/graduate/>)

## Admission requirements

Degree:	Semester(s) of entry:	Deadline dates:	Test requirements:
Ph.D.	Fall	Jan 15	

In addition to the general admission requirements of the VCU Graduate School (<https://bulletin.vcu.edu/graduate/study/admission-graduate-study/admission-requirements/>) and the School of Medicine, students are expected to satisfy the following minimum standards for admission.

1. Students must have a minimum of 30 credit hours in undergraduate physics, physical science or engineering, of which at least 18 credit hours must be at the upper level. Background courses should include calculus one and two, linear algebra, differential equations, modern physics, and electricity and magnetism.

Provisional admission may be granted where deficiencies exist. These deficiencies must be removed by the end of the first year of residence, or its part-time equivalent, when the student's application will be re-examined. Courses that are designed to remove deficiencies will not be accepted for credit hours toward the graduate degree.

## Degree requirements

In addition to the general VCU Graduate School graduation requirements (<https://bulletin.vcu.edu/academic-regs/grad/graduation-info/>), students entering the program with an undergraduate degree are required to earn a minimum of 42 credit hours of graduate medical physics course work. At least 19 credit hours must be earned at the 600 level or higher. Detailed degree requirements are listed below and in the medical physics graduate handbook.

All new Ph.D. students entering the program will be assigned an adviser. After successful completion of courses by the end of first year with a minimum GPA of 3.0, students and advisers will develop a graduate advisory committee. The committee will direct the students in their research and subsequent course selection. Advisers will report once each semester of student enrollment to the program director on the academic progress of their students, will participate in the oral candidacy examinations of students and chair the students' dissertation defense examinations.

The student is required to successfully complete both written comprehensive and oral candidacy examinations to be granted Ph.D. candidate status. The written comprehensive examination covers core knowledge and applications in medical physics course work, as well as

basic concepts in physics, chemistry and biology. The oral candidacy examination, administered by the student's graduate advisory committee, is based upon a written prospectus describing the proposed dissertation research project. Examiners evaluate the adequacy of the proposed project, the student's level of understanding of the project and the likelihood that the dissertation research project can be completed successfully.

After being approved for degree candidacy, the student must conduct a substantial original investigation under the supervision of the advisers and must prepare a dissertation reporting the results of the research in the context of existing scientific knowledge. After the dissertation has been completed and unanimously accepted for defense by the graduate advisory committee, the candidate will appear before the committee for an oral dissertation defense. The oral defense examines the candidate's research, dissertation documentation and underlying fundamental knowledge. Successful completion and defense of the dissertation is required for degree completion.

## Course requirements

Course	Title	Hours
<b>Required core courses</b>		
MEDP 561	Topographical Anatomy and Physiology	1
MEDP 563	Radiological Physics and Radiation Dosimetry	3
MEDP 564	Radiological Physics and Radiation Dosimetry Lab	1
MEDP 567	Introduction to Radiation Therapy Physics	3
MEDP 601	Health Physics	3
MEDP 630	Radiobiology for the Medical Physicist	3
MEDP 633	Advanced Radiation Therapy Physics	4
MEDP 635	Physics of Diagnostic Imaging	3
MEDP 636	Physics of MRI	3
MEDP 637	Physics of Nuclear Medicine	2
MEDP 689	Medical Physics Literature Review	1
<b>Additional required course</b>		<b>1</b>
OVPR 602 or OVPR 601 or OVPR 603	Responsible Scientific Conduct Scientific Integrity Responsible Conduct of Research	
<b>Elective courses</b>		
Select a minimum of three credit hours from the following:		<b>3</b>
BIOS 543	Graduate Research Methods I	
BIOS 544	Graduate Research Methods II	
HGEN 611	Data Science I	
HGEN 612	Data Science II	
MEDP 682	Clinical Rotations in Medical Physics	
STAT 543	Statistical Methods I	
STAT 544	Statistical Methods II	
STAT 641	Applied Data Analysis	
<b>Dissertation research</b>		
MEDP 697	Directed Research (11 credits minimum)	<b>11</b>
<b>Total Hours</b>		<b>42</b>

Variable credit hours; clinical rotations may be repeated.

**The minimum total of graduate credit hours required for this degree is 42.**

Students who complete the requirements for this degree will receive a Doctor of Philosophy in Medical Physics.

## Typical plan of study

Many students often end up taking more than the minimum number of hours required for a degree program. The total number of hours may vary depending upon the program, nature of research being conducted by a study, or in the enrollment or funding status of the student. Students should refer to their program websites and talk with their graduate program directors or advisers for information about typical plans of study and registration requirements.

### Contact

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### Additional contact

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**Program website:** [radonc.vcu.edu/education/graduate-education](https://radonc.vcu.edu/education/graduate-education/)  
(<https://radonc.vcu.edu/education/graduate-education/>)