

# NANOSCIENCE AND NANOTECHNOLOGY, DOCTOR OF PHILOSOPHY (PH.D.) [DEPARTMENT OF PHYSICS]

## Program goals

- In teaching, the purpose is to provide high quality education in chemistry and/or physics in preparation for professional careers in nanoscience and nanotechnology.
- In research, the goals are to advance nanoscience research, to keep faculty on the forefront of the field and to maintain an educational program consistent with the latest technology and development of the discipline.

## Student learning outcomes

- Develop effective oral and written communication skills
- Demonstrate expertise (breadth and depth) in nanoscience
- Demonstrate appropriate ability to design and conduct experimental research
- Demonstrate ability to analyze data critically and to design experiments independently
- Develop competency in the responsible conduct of research

## 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** 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.**

## 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.**

## 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.**

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

## Admission requirements

Degree:	Semester(s) of entry:	Deadline dates:	Test requirements:
Ph.D.	Fall	Apr 15	GRE
	Spring	Oct 15	

In addition to the general admission requirements of the VCU Graduate School (<http://bulletin.vcu.edu/graduate/study/admission-graduate-study/admission-requirements/>) and the College of Humanities and Sciences, students are expected to have a bachelor's degree from an accredited college or university with 30 credit hours in chemistry, physics or engineering.

Admission on a provisional basis is possible for a student temporarily lacking the expected background. Acceptance is based upon undergraduate performance, satisfactory scores on the GRE and letters of recommendation.

Graduate students in the nanoscience and nanotechnology Ph.D. program may receive financial support via teaching or research assistantships or fellowships available from the home department.

## Degree requirements

In addition to the VCU Graduate School graduation requirements (<http://bulletin.vcu.edu/academic-regs/grad/graduation-info/>), students preparing for the Doctor of Philosophy degree in nanoscience and nanotechnology must earn a minimum of 72 credit hours consisting of core courses (12 credit hours), elective courses (six credit hours), seminar (five credit hours) and research (49 credit hours). The minimum GPA is the same as the one mandated by VCU's Graduate School. However, students may receive no more than one grade of C and below. Similarly, no more than one grade of U for directed research is admissible (consecutive or nonconsecutive). Note: A student who receives more than one grade of C or below or two U grades will be automatically dismissed from the program.

Before admission to candidacy for the Ph.D., students must have:

- Completed at least 12 credit hours of their required course work
- Successfully completed a candidacy examination

- c. Successfully completed an oral candidacy examination based on a research proposal

Students will be required to complete a written candidacy examination in the area of nanoscience and nanotechnology, which will normally occur at the end of the student's first year in residence. After passing the written candidacy examination, an oral candidacy examination is then required to become a Ph.D. candidate. The oral examination, which is administered by the student's graduate dissertation committee, is based upon a written proposal describing the proposed dissertation research project. The proposal is intended to evaluate the adequacy of the proposed project, the student's level of understanding of the project and the likelihood that the dissertation can be completed successfully. Students must conduct a substantial original investigation under the supervision of their advisers and must submit to the graduate dissertation committee a written dissertation reporting the results of the research and analyzing its significance in relation to existing scientific knowledge. The oral dissertation defense, conducted under the direction of the dissertation committee, will examine the candidate's research, dissertation documentation and underlying fundamental knowledge encompassed by the candidate's research. Upon successful completion of the defense and the dissertation, the student may apply for graduation with the Ph.D. in Nanoscience and Nanotechnology. Full-time students should complete the degree requirements in four to five years.

## Curriculum requirements

Course	Title	Hours
<b>Core courses</b>		
NANO 570	Nanoscale Physics	3
NANO 571	Nanoscale Chemistry	3
NANO 630	Experimental Techniques in Nanoscience	3
PHYS 560	Fundamentals of Semiconductor Nanostructures	3
<b>Seminar</b>		
CHEM 693	Chemistry Perspectives and Ethics	1
NANO 690	Research Seminar in Nanoscience and Nanotechnology (one credit hour taken three times)	3
NANO 692	Nanoscience Seminar Presentation	1
<b>Research</b>		<b>49</b>
CHEM 697	Directed Research	
or PHYS 697	Directed Research	
or HUMS 701	Post-candidacy Doctoral Research	
<b>Elective courses</b>		
Select a minimum of six credit hours from the following list. Other courses may be chosen, but only upon written approval from the program director.		6
CHEM 511	Chemical Thermodynamics and Kinetics	
CHEM 620	Advanced Inorganic Chemistry I	
CHEM 622	Solid State and Materials Chemistry	
CHEM 637	Electrochemistry Applications	
PHYS 522	Optics and Laser Physics	
PHYS 641	Solid State Physics	

PHYS 680	High Bandwidth Nanoscale Control, Positioning and Dynamics
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**Total Hours**

**72**

**The minimum number of graduate credit hours required for this degree is 72.**

### Contact

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**Program website:** [nano.vcu.edu \(http://nano.vcu.edu/\)](http://nano.vcu.edu/)