

NANOSCIENCE AND NANOTECHNOLOGY, DOCTOR OF PHILOSOPHY (PH.D.)

Program goals

1. In teaching, the purpose is to provide high quality education in chemistry and/or physics in preparation for professional careers in nanoscience and nanotechnology.
2. 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

1. Develop effective oral and written communication skills
2. Demonstrate expertise (breadth and depth) in nanoscience
3. Demonstrate appropriate ability to design and conduct experimental research
4. Demonstrate ability to analyze data critically and to design experiments independently
5. 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 (<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](http://bulletin.vcu.edu/academic-regs). (<http://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](http://bulletin.vcu.edu/academic-regs/grad/candidacy). (<http://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](http://bulletin.vcu.edu/academic-regs/grad/graduation-info). (<http://bulletin.vcu.edu/academic-regs/grad/graduation-info>)

Apply online at graduate.admissions.vcu.edu (<http://www.graduate.admissions.vcu.edu>).

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 (nine credit hours), elective courses (nine credit hours), seminar (eight credit hours) and research (46 credit hours).

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

1. completed at least 12 credit hours of their required course work,
2. successfully completed cumulative exams and
3. successfully completed an oral candidacy examination based on a research proposal

The student will be required to complete a series of cumulative exams in the area of nanoscience and nanotechnology, which will normally occur during the student's second year in residence. After completion of the cumulative exams, 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. It 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
Core courses		
NANO 570	Nanoscale Physics	3
NANO 571	Nanoscale Chemistry	3
NANO 660 or NANO 650 & NANO 651	Theoretical Studies of Nanostructures Experimental Techniques in Nanoscience I and Experimental Techniques in Nanoscience II	3
Seminar		
NANO 690	Research Seminar in Nanoscience and Nanotechnology (one credit hour taken six times)	8
NANO 692	Nanoscience Seminar Presentation (one credit hour taken twice)	
Research		46
CHEM 697 or PHYS 697	Directed Research Directed Research	
Elective courses		
Select nine credit hours of the following, or other courses approved by program director:		9
CHEM 510	Atomic and Molecular Structure	
CHEM 511	Chemical Thermodynamics and Kinetics	
CHEM 580	Mechanical Properties of Plastics and Polymers	
CHEM 591	Topics in Chemistry	
CHEM 610	Applied Quantum Chemistry	
CHEM 611	Molecular Spectroscopy	
CHEM 612	Modern Statistical Mechanics: Fundamentals and Applications	
CHEM 634	Surface Science	
CHEM 635	Spectrochemical Analysis	
CHEM 691	Topics in Chemistry	
CLSE 645	Biosensors and Bioelectronic Devices	

CLSE 675	Polymers in Medicine	
EGRB 613	Biomaterials	
EGRE 525	Fundamentals of Photonics Engineering	
EGRE 621	Spintronics	
EGRE 623		
ENGR 691	Special Topics in Engineering	
PHYS 550	Techniques in Material Research	
PHYS 580	Quantum Mechanics	
PHYS 591	Topics in Physics	
PHYS 641	Solid State Physics	
PHYS 661	Surface and Materials Physics	
PHYS 691	Special Topics	
Total Hours		72

Total graduate credit hours required (minimum) 72

Students will attend NANO 690 Research Seminar in Nanoscience and Nanotechnology throughout their degree programs, receiving an S (satisfactory) or U (unsatisfactory) grade based on attendance and participation. Students will also give two seminar presentations, one on a literature topic and one on their dissertation research, which will be graded on the A/B/C/D/F scale.

Graduate program director

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Additional contact

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Program website: nano.vcu.edu (<http://nano.vcu.edu>)