PHYSICS AND APPLIED PHYSICS, MASTER OF SCIENCE (M.S.)

Program goal

The Department of Physics teaches graduate students advanced concepts, applications and skills that reach to the frontiers of current research in physics. The master's program offers traditional core physics courses and a variety of specialized electives emphasizing the department's strengths in theoretical and experimental physics. Research interests include theoretical and experimental condensed matter physics, general relativity and cosmology.

Student learning outcomes

1. Students will achieve a broad knowledge of the principles of physics.
2. Students will demonstrate analytical problem-solving skills.
3. Students will demonstrate mastery of a topic at the frontier of physics 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)

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)

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)

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

Admission requirements

Degree:	Semester(s) of entry:	Deadline dates:	Test requirements:
M.S.	Fall	May 1	GRE
	Spring	Dec 1	

In addition to the general admission requirements of the VCU Graduate School (http://bulletin.vcu.edu/graduate/study/admission-graduate-study/admission-requirements), the following requirements represent the minimum acceptable standards for admission:

1. Students must have a minimum of 30 credit hours in undergraduate physics or engineering, of which at least 18 credit hours must be at the upper-level in physics.
2. Students must present satisfactory GRE scores.

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 toward the graduate degree.

Degree requirements

In addition to general VCU Graduate School graduation requirements (http://bulletin.vcu.edu/academic-regs/grad/graduation-info), students are required to complete course work in core and elective courses and to conduct significant research.

1. Credit hour requirements: Students are required to earn a minimum of 30 graduate credit hours with at least 15 credit hours at the 600 level. PHYS 690 and PHYS 697 may not exceed 15 of the required 30 credit hours.
2. M.S. plan of study: Students will choose a primary adviser during the first semester of study. At the end of the first semester, the student and adviser will propose an M.S. plan of study to the physics graduate curriculum committee. This plan will include the graduate courses and research subject matter to fulfill the student's individual career goals. Normally, students will select courses for their individual M.S. plans of study from the list of graduate courses in physics. The courses selected will include no fewer than nine credits of traditional physics core courses, such as PHYS 576 and PHYS 580, to provide a solid foundation in fundamental physics. However, students also may select graduate courses in chemistry, mathematics, computer science and engineering, as well as courses from the School of

Medicine, when such courses are consistent with the student's career goals. The M.S. plan of study must be approved by the physics graduate curriculum committee. Courses taken outside this plan will not count toward the above general course requirements.

3. Thesis or non-thesis option: Each student must select either the thesis option or non-thesis option. Students selecting the thesis option must take at least nine credit hours of PHYS 697. No more than nine credit hours of directed research may be counted toward the 15 credit-hour, 600-level requirement. Students selecting the non-thesis option may take no more than three credit hours of PHYS 697. A student who elects the non-thesis option must pass a written comprehensive exam administered by the physics graduate curriculum committee.

Curriculum requirements

Thesis option

Course	Title	Hours
Core courses		
Select nine credits of the following:		9
NANO 570	Nanoscale Physics	
NANO 650	Experimental Techniques in Nanoscience I	
NANO 651	Experimental Techniques in Nanoscience II	
PHYS 571	Theoretical Mechanics	
PHYS 576	Electromagnetic Theory	
PHYS 580	Quantum Mechanics	
PHYS 641	Solid State Physics	
Additional course work		
PHYS 690	Research Seminar [1,3]	0-4
PHYS 697	Directed Research [2,3]	9
Electives (Choose courses from list of recommended electives below)		8-12
Total Hours		30

1 PHYS 690 may be repeated for a maximum of four credit hours toward the required 30 credit hours.

2 PHYS 697 can only satisfy up to nine credit hours of the 15 credit hours for 600-level and above.

3 PHYS 690 and PHYS 697 may not exceed 15 credit hours of the required 30 credit hours.

Total graduate credit hours required (minimum) 30

Non-thesis option

Course	Title	Hours
Core courses		
Select nine credits of the following:		9
NANO 570	Nanoscale Physics	
NANO 650	Experimental Techniques in Nanoscience I	
NANO 651	Experimental Techniques in Nanoscience II	
PHYS 571	Theoretical Mechanics	
PHYS 576	Electromagnetic Theory	
PHYS 580	Quantum Mechanics	
PHYS 641	Solid State Physics	
Additional course work		
PHYS 690	Research Seminar [1,3]	0-4
PHYS 697	Directed Research [2,3]	0-3
Electives (Choose courses from list of recommended electives below)		14-21
Total Hours		30

1 PHYS 690 may be repeated for a maximum of four credit hours toward the required 30 credit hours.

2 PHYS 697 can only satisfy up to nine credit hours of the 15 credit hours for 600-level and above.

3 PHYS 690 and PHYS 697 may not exceed 15 credit hours of the required 30 credit hours.

Total graduate credit hours required (minimum) 30

Recommended electives

Course	Title	Hours
CHEM 510	Atomic and Molecular Structure	3
CHEM 511	Chemical Thermodynamics and Kinetics	3
CHEM 610	Applied Quantum Chemistry	3
CHEM 612	Modern Statistical Mechanics: Fundamentals and Applications	3
EGRE 521	Advanced Semiconductor Devices	3
EGRE 620	Electron Theory of Solids	3
EGRE 623		3
NANO 570	Nanoscale Physics	3
NANO 571	Nanoscale Chemistry	3
NANO 650	Experimental Techniques in Nanoscience I	1.5
NANO 651	Experimental Techniques in Nanoscience II	1.5
NANO 660	Theoretical Studies of Nanostructures	3
PHYS 550	Techniques in Material Research	3
PHYS 571	Theoretical Mechanics	3
PHYS 573	Analytical Methods in Physics	3
PHYS 576	Electromagnetic Theory	3
PHYS 580	Quantum Mechanics	3
PHYS 591	Topics in Physics	1-3
PHYS 641	Solid State Physics	3
PHYS 661	Surface and Materials Physics	3
PHYS 691	Special Topics	3

Graduate program director
Shiv N. Khanna, Ph.D.
Commonwealth Professor
Email: snkhanna@vcu.edu
Phone: (804) 828-1818

Additional contact
Robert H. Gowdy, Ph.D.
Chair, Department of Physics
Email: rgowdy@vcu.edu
Phone: (804) 828-1818

Program website: physics.vcu.edu (http://physics.vcu.edu)