

# DOCTOR OF PHILOSOPHY (PHD) DEGREE IN THE FIELD OF APPLIED PHYSICS

## Program Learning Outcomes for the MS and PhD Degrees in the field of Applied Physics

Upon completing the MS and PhD degrees in the field of Applied Physics, students will be able to:

1. Acquire and demonstrate advanced knowledge in the foundational applications of physics including familiarity with past and current scientific literature in their chosen specialization.
2. Develop the ability to conduct independent applied physics research including the aptitude to identify, formulate, and overcome challenging scientific and engineering problems in this endeavor.
3. Make an original and significant technical contribution in their chosen specialization area.

## Requirements for the MS and PhD Degrees in the field of Applied Physics

### MS Degree Program

The Applied Physics Program (APP) does not offer a stand-alone thesis Master of Science (MS) degree. The MS degree is a thesis master's degree. For general university requirements, please see [Thesis Master's Degrees \(https://ga.rice.edu/graduate-students/academic-policies-procedures/regulations-procedures-thesis-masters-degrees/\)](https://ga.rice.edu/graduate-students/academic-policies-procedures/regulations-procedures-thesis-masters-degrees/). For additional requirements, regulations, and procedures for all graduate programs, please see [All Graduate Students \(https://ga.rice.edu/graduate-students/academic-policies-procedures/regulations-procedures-all-degrees/\)](https://ga.rice.edu/graduate-students/academic-policies-procedures/regulations-procedures-all-degrees/). Students admitted to the APP PhD program with a bachelor's degree are required to earn the MS degree within the program before proceeding to the PhD, and the MS thesis is written in lieu of any qualifying exams or preliminaries.

By the end of their third year in the program, each APP student should have completed the university requirements for the MS degree, fulfilled the course requirements, and defended a MS thesis in a public oral examination by a committee approved by the Program Chair and Graduate and Postdoctoral Studies (GPS). The examining committee votes separately on awarding the MS degree and on admission to candidacy for the PhD. Students pursuing the MS degree program in the field of Applied Physics must:

- Complete a minimum of 36 credit hours towards the degree program (both coursework and research credit hours).
- Successfully defend a master's thesis in a public examination by a university-approved committee.

The requirements listed in the General Announcements (GA) satisfy the minimum requirements for this degree program. In certain instances, courses (or requirements) not officially listed here may be substituted upon approval of the program's academic advisor or, where applicable, the department or program's Director of Graduate Studies. Course substitutions or any exceptions to the stated official curricular requirements must be approved by the [Office of Graduate and](#)

[Postdoctoral Studies \(https://graduate.rice.edu/\)](https://graduate.rice.edu/). Students and their academic advisors should identify and clearly document the courses to be taken.

### Summary

Code	Title	Credit Hours
	Total Credit Hours Required for the MS Degree in the field of Applied Physics	36

## Requirements for the PhD Degree in the field of Applied Physics

### PhD Degree Program

The Applied Physics Program (APP) offers a PhD degree. For general university requirements, please see [Doctoral Degrees \(https://ga.rice.edu/graduate-students/academic-policies-procedures/regulations-procedures-doctoral-degrees/\)](https://ga.rice.edu/graduate-students/academic-policies-procedures/regulations-procedures-doctoral-degrees/). For additional requirements, regulations, and procedures for all graduate programs, please see [All Graduate Students \(https://ga.rice.edu/graduate-students/academic-policies-procedures/regulations-procedures-all-degrees/\)](https://ga.rice.edu/graduate-students/academic-policies-procedures/regulations-procedures-all-degrees/).

Candidates earn a PhD after successfully defending a MS thesis, fulfilling course requirements, and completing at least 90 semester credit hours of advanced study and research, culminating in a thesis that describes an original and significant investigation in the student's chosen field of specialization. The thesis must be satisfactorily defended in a public oral examination. Barring a written exemption from the Applied Physics Curriculum Committee, the student must pass the thesis defense before the end of the 12th semester (6 years) OR before the end of the 8th semester (4 years) if the student has a previous MS degree that was accepted by the Program Chair. Students pursuing the PhD degree program in the field of Applied Physics must:

- Successfully defend a Master of Science (MS) thesis (or have an accepted MS degree).
- Complete all coursework as specified for a student's matriculating class as well as any additional courses as required by the thesis advisor and host department. This includes completion of at least 9 semester-long courses at the graduate-level (500-level or above), taken for at least three credit hours each (4 Core Requirements and 5 Elective Requirements comprise the 9 required courses).
- Complete a minimum of 90 semester credit hours, including research, towards the degree.
- Successfully complete a research project involving independent and original work. The work must be reported in an approved thesis and defended in a public oral examination.

Complete information about research opportunities, courses, and other requirements can be found on the program's website, at: <https://appliedphysics.rice.edu/>.

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academic advisors should identify and clearly document the courses to be taken.

## Summary

Code	Title	Credit Hours
Total Credit Hours Required for the PhD Degree in the field of Applied Physics		90

## Degree Requirements

Code	Title	Credit Hours
<b>First Year Seminar</b>		
APPL 500	INTRODUCTION TO APPLIED PHYSICS <sup>1</sup>	3
<b>Core Requirements</b>		
<i>Select 4 courses from the following, depending on area of research.<sup>2,3</sup></i>		12
BIOE 502 / BIOS 505 / SSPB 501	PHYSICAL BIOLOGY	
CHBE 501	FLUID MECHANICS AND TRANSPORT PROCESSES	
CHBE 602	PHYSICO-CHEMICAL HYDRODYNAMICS	
CHBE 611	ADVANCED TOPICS-THERMODYNAMICS	
PHYS 515	CLASSICAL DYNAMICS	
PHYS 516	MATHEMATICAL METHODS	
PHYS 521 or CHEM 530	QUANTUM MECHANICS I <sup>2</sup> QUANTUM CHEMISTRY	
PHYS 522 or CHEM 531	QUANTUM MECHANICS II ADVANCED QUANTUM CHEMISTRY	
PHYS 526 or CHEM 520	STATISTICAL PHYSICS <sup>2</sup> CLASSICAL AND STATISTICAL THERMODYNAMICS	
PHYS 532	CLASSICAL ELECTRODYNAMICS	
PHYS 563 / ELEC 563	INTRODUCTION TO SOLID STATE PHYSICS I	
<b>Elective Requirements</b>		
<i>Select 5 elective courses, depending on area of research <sup>4</sup></i>		15
<b>Additional Requirements as Defined by Department</b>		<b>60</b>
<b>Total Credit Hours</b>		<b>90</b>

## Footnotes and Additional Information

<sup>1</sup> Beginning with Fall 2022 matriculants, all entering students are required to register for APPL 500 (3 credit hours) during their first semester. These 3 credit hours will count towards the total number of hours required for the degree, but the course is in addition to the Core and Elective Requirements.

<sup>2</sup> Any course taken beyond the four-course requirement for the Applied Physics Core Requirements can be applied towards the Applied Physics Elective Requirement. No courses may count toward both Core Requirements and Elective Requirements.

<sup>3</sup> Due to overlap of curricula, only 1 course from each of these groups (PHYS 521 or CHEM 530; PHYS 526 or CHEM 520) may be used for the 9 required courses (the 9 required courses are comprised of the 4 Core Requirements and 5 Elective Requirements combined).

<sup>4</sup> A full list of elective courses can be found on the [Applied Physics website \(https://appliedphysics.rice.edu/current-students/elective-courses/\)](https://appliedphysics.rice.edu/current-students/elective-courses/). Students may also request approval from the Applied Physics Curriculum Committee (APCC) to add additional electives.

## Advancement to Candidacy

After completing the required coursework and total required hours, a student must petition for candidacy, separately for both the MS degree and for the PhD degree. Upon Advancement to Candidacy, a student chooses a thesis committee of at least three faculty members with the guidance and approval of the research advisor and Program Chair.

### Master's Candidacy Requirements

- The student's petition must be submitted before the end of year 2 (counted as 4 full-time semesters, not including summers).
- The student must have completed at least 36 credit hours within the APP PhD course plan (with at least 21 credit hours of coursework, in addition to APPL 800).

### Doctoral Candidacy Requirements

- The student's petition must be submitted before the end of year 4 (counted as 8 full-time semesters, not including summers).
- The student must have completed all course requirements and at least 72 credit hours within the APP PhD course plan.

The Thesis Committee must include at least three members. Students may also select a fourth committee member who does not conform to the requirements below:

- Thesis Director/Committee Chair – typically a student's advisor.  
**Note:** if the primary advisor is outside of Rice University, they can still be the Thesis Director, but a different Committee Chair will need to be selected (either the APP Program Chair or another APP faculty member).
- Member within the department - another APP faculty member, inside or outside of a student's host department.
- MS:** Member inside OR outside of the department (host department or APP faculty);  
**PhD:** Member outside the department - outside of the student's host department AND a non-APP faculty member (a Rice faculty member (not adjunct) who is not currently advising an APP student). Students may also elect to keep their MS Thesis Committee members, if desired.

## Research

The PhD in Applied Physics is awarded for original research. During their first semester, students select a research advisor; APP students have the opportunity to work with professors in any department of the George R. Brown School of Engineering and Computing and the Wiess School of Natural Sciences at Rice and with faculty at four institutions in the Texas Medical Center. Students will submit an affiliation form and research proposal; approval of the Program Chair is required to formalize these advising relationships. The research advisor will guide the student in the choice of an appropriate research topic and in the detailed training required to complete that project. After affiliation, students must successfully complete APPL 800 every semester of residence; advisors will direct the number of credit hours per term for this variable credit course.

## Responsible Conduct of Research

APP students planning on biophysics, biochemistry, or bioengineering research should register for UNIV 594 during their first semester (or when possible). All other APP students are not required to sign up but are encouraged to take this course as well. **Note:** this course does not count toward the Core Requirements or Elective Requirements coursework.

## Evaluation of Progress in Graduate Study

At the end of each academic year, all APP students and faculty complete an annual performance review. The Program Chair meets with each student individually to review student goals and progress in lab practice, formal coursework, papers/presentations, and other initiatives. Students must maintain at least a B average (GPA  $\geq 3.00$ ) overall and should demonstrate outstanding motivation and potential for research.

## Teaching

The APP does not have a teaching requirement; however, a student's host department and advisor may require teaching/grading as part of their participation in that lab/department.

## Qualifying Examination

The APP does not have a qualifying exam. Instead, students must earn the MS degree and defend a MS thesis.

# Policies for the PhD Degree in the field of Applied Physics

## Applied Physics Graduate Program Handbook

The General Announcements (GA) is the official Rice curriculum. As an additional resource for students, Applied Physics publishes a graduate program handbook, which can be found here: [https://gradhandbooks.rice.edu/2024\\_25/Applied\\_Physics\\_Graduate\\_Handbook.pdf](https://gradhandbooks.rice.edu/2024_25/Applied_Physics_Graduate_Handbook.pdf).

## Transfer Credit

For Rice University's policy regarding transfer credit, see [Transfer Credit \(https://ga.rice.edu/graduate-students/academic-policies-procedures/regulations-procedures-all-degrees/#transfer\)](https://ga.rice.edu/graduate-students/academic-policies-procedures/regulations-procedures-all-degrees/#transfer). Some departments and programs have additional restrictions on transfer credit. Requests for transfer credit must be approved for Rice equivalency by the appropriate academic department offering the Rice equivalent course (corresponding to the subject code of the course content) and by the Office of Graduate and Postdoctoral Studies (GPS). Students are encouraged to meet with their academic program's advisor when considering transfer credit possibilities.

## Additional Information

For additional information, please see the Applied Physics website: <https://appliedphysics.rice.edu/>.

# Opportunities for the PhD Degree in the field of Applied Physics

Students who have completed the PhD program in Applied Physics establish careers in industry, government laboratories, and academia.

## Additional Information

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