## APPLIED PHYSICS PHD

### Degree Requirements

The following requirements are in addition to, or further elaborate upon, those requirements outlined in The Graduate School Policy Guide (https://catalogs.northwestern.edu/tgs/academic-policies-procedures).

#### Master’s

The Applied Physics Program does not offer a terminal master’s program, and only students who intend to pursue the PhD are admitted. However, PhD students who satisfactorily complete the first year of classes and pass a comprehensive examination are eligible to receive a Master of Science degree.

#### PhD

The formal requirements for a PhD in Applied Physics are:

- The core courses
- The oral qualifying exam
- The teaching experience
- The prospectus or thesis proposal
- The thesis defense

### Core Courses

**Total Units Required: 10**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
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<tbody>
<tr>
<td>MAT_SCI 401-0</td>
<td>Chemical &amp; Statistical Thermodynamics of Materials</td>
</tr>
<tr>
<td>or PHYSICS 416-0</td>
<td>introduction to Statistical Mechanics</td>
</tr>
<tr>
<td>PHYSICS 412-1</td>
<td>Quantum Mech</td>
</tr>
<tr>
<td>&amp; PHYSICS 412-2</td>
<td>and Quantum Mechanics</td>
</tr>
<tr>
<td>PHYSICS 411-1</td>
<td>Methods of Theoretical Physics</td>
</tr>
<tr>
<td>GEN_ENG 519-0</td>
<td>Responsible Conduct for Research Training required but not for credit</td>
</tr>
<tr>
<td>or CHEM 519-0</td>
<td>Responsible Conduct of Research Training</td>
</tr>
<tr>
<td>or PHYSICS 519-0</td>
<td>Responsible Conduct of Research Training</td>
</tr>
<tr>
<td>PHYSICS 414-1</td>
<td>Electrodynamics</td>
</tr>
<tr>
<td>MAT_SCI 405-0</td>
<td>Physics of Solids</td>
</tr>
<tr>
<td>or PHYSICS 422-1</td>
<td>Condensed-Matter Physics</td>
</tr>
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**List of course options for Computational Methods of Applied Physics**

- CHEM 448-0: Computational Chemistry
- CHEM_ENG 451-0: Applied Molecular Modeling
- ES_APPM 446-2: Numerical Solution of Partial Differential Equations
- MAT_SCI 458-0: Atomic Scale Computational Materials Science
- MECH_ENG 417-0: Multi-scale Modeling and Simulation in Solid Mechanics
- MECH_ENG 418-0: Multi-Scale Modeling and Simulation in Fluid Mechanics
- MECH_ENG 423-0: Intro to Computational Fluid Dynamics
- MECH_ENG 426-1: Advanced Finite Element Methods I

**List of course options for Experimental Methods of Applied Physics**

- MECH_ENG 433-0: Advanced Mechatronics
- MAT_SCI 460-0: Electron Microscopy
- MAT_SCI 461-0: Diffraction Methods in Material Science
- MAT_SCI 465-0: Advanced Electron Microscopy & Diffraction
- MAT_SCI 466-0: Analytical Electron Microscopy

### Oral Qualifying Exam

Students are required to pass a qualifying exam before advancing to the second year of the program. This exam takes the form of a short presentation made to an examining committee, followed by a closed question session before the committee. There is no written qualifier.

### Teaching Experience

One quarter of teaching experience is required by the Graduate School. Since AP is a graduate-only program, our students gain this experience by serving as TAs in a variety of undergraduate departments.

### Prospectus or Thesis Proposal and Defense

Students must submit and defend their thesis proposal before the end of the spring quarter of the third year. This includes a written proposal and a 30 mins defense followed by questions from the faculty committee.

### Thesis Defense

Each PhD candidate must pass a Thesis Defense based on the work presented in the candidate’s dissertation. The faculty committee assembled previously for the thesis proposal and defense conducts the examination. The examination involves a mandatory open and publicized oral presentation and discussion during the first hour, followed by a closed examination with only the faculty committee. A conference room should be reserved for three hours by the candidate.