

# APPLIED PHYSICS, MASTER OF SCIENCE

Concentrations are offered in Materials and Condensed Matter and Photonics. A Concentration can be selected but is not required.

## Admission Requirements

Applicants (degree seeking and special student) must meet the general requirements for admission to a graduate program of study, as outlined in the Admission Requirements (<https://e-catalogue.jhu.edu/engineering/engineering-professionals/admission-requirements/>) section. The applicant's prior education must include:

1. mathematics through vector analysis and ordinary differential equations;
2. general physics;
3. modern physics;
4. intermediate mechanics; and
5. intermediate electricity and magnetism.

Applicants whose prior education does not include the prerequisites listed above may still enroll under conditional status, followed by full admission status once they have completed the conditional requirements. Conditional courses will be selected from the suite of Applied Physics graduate course offerings and once satisfactorily completed count towards the student's degree. Admitted students typically have earned a grade point average of at least 3.0 on a 4.0 scale (B or above) in their undergraduate studies. Transcripts from all college studies must be submitted. When reviewing an application, the candidate's academic and professional background will be considered. A résumé is optional.

The intermediate mechanics and intermediate electricity and magnetism requirements may be waived if the applicant has an exceptional academic record and a strong background in mathematics.

## Program Requirements

Ten courses must be completed within five years. The curriculum consists of four core courses and six electives. At least four of the courses must be at the 700-level or higher. An Applied Physics elective may be substituted for a required course if the student has previously completed an equivalent graduate-level course. Only one C-range grade (C+, C, or C-) can count toward the master's degree. All course selections outside of the Applied Physics core, elective, and/or the relevant concentration course requirements below are subject to advisor approval.

## Courses

### Core Courses

Code	Title	Credits
<b>Four Core courses are required. At least three must be from the first six:</b>		
EN.615.641	Mathematical Methods for Physics and Engineering	3
EN.615.642	Electromagnetics	3
EN.615.651	Statistical Mechanics and Thermodynamics	3
EN.615.653	Classical Mechanics	3

EN.615.654	Quantum Mechanics	3
EN.615.665	Modern Physics	3
EN.615.671	Principles Of Optics	3
EN.615.680	Materials Science	3

## Electives

Code	Title	Credits
<b>Select six of the following: <sup>1</sup></b>		
EN.535.614	Fundamentals of Acoustics	3
EN.615.611	Classical Physics	3
EN.615.644	Physics of Space Systems I	3
EN.615.645	Physics of Space Systems II	3
EN.615.647	Fundamentals of Sensors	3
EN.615.648	Alternate Energy Technology	3
EN.615.662	Introduction to Astrophysics	3
EN.615.731	Photovoltaic & Solar Thermal Energy Conversion	3
EN.615.744	Physics of Space Systems I	3
EN.615.745	Physics of Space Systems II	3
EN.615.747	Sensors and Sensor Systems	3
EN.615.748	Introduction to Relativity	3
EN.615.751	Modern Optics	3
EN.615.755	Space Physics	3
EN.615.757	Solid State Physics	3
EN.615.761	Intro To Oceanography	3
EN.615.762	Applied Computational Electromagnetics	3
EN.615.765	Chaos and Its Applications	3
EN.615.769	Physics of Remote Sensing	3
EN.615.772	Cosmology	3
EN.615.775	Physics of Climate	3
EN.615.778	Optical System Design and Modelling	3
EN.615.780	Optical Detectors & Applications	3
EN.615.781	Quantum Information Processing	3
EN.615.782	Optics and Matlab	3
EN.615.800	Applied Physics Project	3
EN.615.802	Directed Studies in Applied Physics	3

<sup>1</sup> Up to two courses may be selected with advisor approval from the following programs: Applied and Computational Mathematics, Computer Science, or Electrical and Computer Engineering.

## Concentrations

A Concentration can be selected but is not required.

Concentrations are noted on the student's transcript.

### Materials and Condensed Matter

Students can elect to concentrate their studies in materials and condensed matter by completing a combination of courses from the Applied Physics (EN.615.xxx), Electrical and Computer Engineering (EN.525.xxx), and Materials Science and Engineering (EN.515.xxx) programs. Applied Physics students specializing in materials and condensed matter must complete three of the core courses plus EN.615.680 Materials Science.

Of the remaining six courses, four or more must be materials and condensed matter courses selected from Applied Physics (EN.615.xxx),

Electrical and Computer Engineering (EN.525.xxx), and Materials Science and Engineering (EN.515.xxx) programs.

Code	Title	Credits
<b>Core Courses</b>		
<b>Credits</b>		
EN.615.641	Mathematical Methods for Physics and Engineering	3
EN.615.642	Electromagnetics	3
EN.615.651	Statistical Mechanics and Thermodynamics	3
EN.615.680	Materials Science	3
<b>Electives</b>		
<b>Credits</b>		
Select at least four of the following:		
EN.515.617	Nanomaterials	3
EN.515.635	Mechanical Properties of Materials	3
EN.525.606	Electronic Materials	3
EN.525.621	Introduction to Electronics and the Solid State	3
EN.535.684	Modern Polymeric Materials	3
EN.535.732	Fatigue and Fracture of Materials	3
EN.535.748	Stress Waves, Impacts and Shockwaves	3
EN.615.647	Fundamentals of Sensors	3
EN.615.747	Sensors and Sensor Systems	3
EN.615.757	Solid State Physics	3
EN.615.800	Applied Physics Project <sup>1</sup>	3
EN.615.802	Directed Studies in Applied Physics <sup>1</sup>	3

<sup>1</sup> EN.615.800 Applied Physics Project and EN.615.802 Directed Studies in Applied Physics can also be used to allow the student to pursue specialized interests in materials science and condensed matter.

## Photonics

Three Applied Physics core courses (EN.615.xxx), one Electrical and Computer Engineering core course (EN.525.xxx), four Photonics electives, and two electives from the program must be completed.

Code	Title	Credits
<b>Core Courses</b>		
<b>Credits</b>		
EN.615.641	Mathematical Methods for Physics and Engineering	3
EN.615.654	Quantum Mechanics	3
EN.615.671	Principles Of Optics	3
Select one of the following:		
EN.525.613	Fourier Techniques in Optics	3
EN.525.625	Laser Fundamentals	3
EN.525.691	Fundamentals of Photonics	3
<b>Electives</b>		
<b>Credits</b>		
Select at least four of the following:		
EN.525.613	Fourier Techniques in Optics	3
EN.525.625	Laser Fundamentals	3
EN.525.636	Optics & Photonics Lab	3
EN.525.691	Fundamentals of Photonics	3
EN.525.753	Laser Systems and Applications	3
EN.525.756	Optical Propagation, Sensing, and Backgrounds	3
EN.525.772	Fiber-Optic Communication Systems	3
EN.525.796	Introduction to High-Speed Optoelectronics	3
EN.525.797	Advanced Fiber Optic Laboratory	3

EN.585.734	Biophotonics	3
EN.615.751	Modern Optics	3
EN.615.778	Optical System Design and Modelling	3
EN.615.780	Optical Detectors & Applications	3
EN.615.781	Quantum Information Processing	3
EN.615.782	Optics and Matlab	3
EN.615.800	Applied Physics Project <sup>1</sup>	3
EN.615.802	Directed Studies in Applied Physics <sup>1</sup>	3

<sup>1</sup> EN.615.800 Applied Physics Project and EN.615.802 Directed Studies in Applied Physics can also be used to allow the student to pursue specialized interests in optics.

Please refer to the course schedule (<https://ep.jhu.edu/courses/>) published each term for exact dates, times, locations, fees, and instructors.