

APPLIED PHYSICS

Home Department: Physics (<https://my.kettering.edu/academics/departments/physics>)

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Program Overview

Physics (<https://www.kettering.edu/programs-and-degrees/applied-physics>) is the most fundamental science and underlies the understanding of nearly all areas of science, technology, and engineering.

Physics is concerned with the study of energy, space, time, matter, the interaction between material objects and the laws that govern these interactions at various scales from sub nano-scale to light-years scale.

Physicists study mechanics, sound, heat, light, electric and magnetic fields, gravitation, relativity, atomic and nuclear physics, solid state physics, wave-like properties of particles and particle-like properties of radiation. Applied physics is not a specific branch of physics but the application of all branches of physics to the broad realm of practical problems in scientific and industrial applications, applied science, and advanced industry. Applied Physics (<https://www.kettering.edu/program-and-degrees/applied-physics>) (AP) is the interface between physics, applied sciences and technology; linking the theory, laboratory, and practice. It involves applications of optics, acoustics, and materials in fields such as nanotechnology, telecommunications, medical physics and devices, or advanced and electronic materials. The Applied Physics degree is a flexible degree designed to interface physics with applied sciences and engineering disciplines.

The degree in Applied Physics at Kettering University provides excellent preparation for work in industry or in government agencies. The program also serves as a solid foundation for students desiring to go on to graduate school in physics or any number of fields in pure and applied science. The curriculum in Applied Physics provides a solid education in mathematics, applied sciences and physics with emphasis on the four areas of Applied Optics, Acoustics, Materials Science and nanotechnology and Medical Physics.

- Applied Physics (AP) students at Kettering University take the same core physics courses as physics students at other universities. Furthermore, our Physics students are required to take a sequence of courses in optics, acoustics, and materials science.
- Applied Physics (AP) students at Kettering University will graduate from the most distinctive physics program in the nation. Due to the Co-op and Experiential Learning (<https://www.kettering.edu/undergraduate-admissions/co-op>) model which provides students with a rich co-op experience while they are undergraduates. This is unique compared to any other Applied Physics program.
- The Applied Physics (AP) program includes a thorough background in mathematics, science, computer programming, social sciences, humanities, and communication.
- Applied Physics (AP) students complete a sequence of courses in an area of applied science, mathematics or advanced technology or even business (<http://catalog.kettering.edu/undergrad/academic-programs/minors/business>), pre-law (<http://catalog.kettering.edu/undergrad/academic-programs/minors/pre-law>), or pre-med ([\[catalog.kettering.edu/undergrad/academic-programs/pre-med-education\]\(http://catalog.kettering.edu/undergrad/academic-programs/pre-med-education\)\).](http://

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- Applied Physics students must write a senior thesis.
- The Applied Physics program at Kettering University is the first and only ABET accredited applied physics program in the world.

For more information about the Applied Physics program, including pictures and descriptions of our laboratory faculty, facilities, concentrations and minors, please visit our Web site (<https://www.kettering.edu/program-and-degrees/applied-physics>), or send an email to physics@kettering.edu.

Program Educational Objectives

Applied Physics graduates will:

- Excel in technical careers and thrive in graduate studies using scientific principles and application of physical sciences.
- Work effectively in bringing multi-disciplinary ideas to diverse professional environments.
- Improve their workplaces and communities, and the society through professional and personal activities.

Dual Options

One of the advantages of being an Applied Physics major is that because physics leads to or has overlaps with nearly every science and engineering discipline, it makes it very easy to pursue a dual option.

Pursuing a dual option will create greater flexibility in terms of future career or graduate studies. When thinking about a dual option as an Applied Physics major please be aware that Kettering University offers two distinct dual options as described below.

Double Major: Students may earn a double major as part of a single bachelor's degree by completing all course requirements for the two majors. If capstone courses are required in both majors, both must be completed. Only one thesis (<http://catalog.kettering.edu/undergrad/culminating-experience-thesis>) is required. To pursue a double major, obtain approval from departments for both majors. Both majors will be shown on one diploma and on the transcript.

Two Degrees: Students may earn two undergraduate degrees simultaneously by completing all course requirements for any two majors that in combination require at least 28 credits beyond 161 credits. If capstone courses are required in both majors, both must be completed. Only one thesis (<http://catalog.kettering.edu/undergrad/culminating-experience-thesis>) is required. To pursue two degrees, obtain approval from departments for both degrees. Two diplomas will be awarded and both degrees will be shown on the transcript.

- Applied Physics/Applied Mathematics (<http://catalog.kettering.edu/undergrad/academic-programs/applied-mathematics>)
- Applied Physics/Computer Science (<http://catalog.kettering.edu/undergrad/academic-programs/computer-science>)
- Applied Physics/Electrical Engineering (<http://catalog.kettering.edu/undergrad/academic-programs/electrical-engineering>)
- Applied Physics/Mechanical Engineering (<http://catalog.kettering.edu/undergrad/academic-programs/mechanical-engineering>)

For further information please contact the Physics Department Head at physics@kettering.edu.

Physics Program Concentrations

Applied and Engineering Physics (<http://catalog.kettering.edu/undergrad/academic-programs/engineering-physics>) students who wish to obtain a concentration in acoustics, applied optics, medical physics, or materials science, and have it so designated on their transcript should contact one of the following Professors: Ludwigsen (<https://my.kettering.edu/faculty/daniel-ludwigsen>) (Acoustics), Tackett (<https://my.kettering.edu/faculty/ronald-tackett>) (Materials), Kumon (<https://my.kettering.edu/faculty/ronald-kumon>) (Medical) or Rablau (<https://my.kettering.edu/faculty/corneliu-rablau>) (Optics). The basic criteria is that to obtain a concentration students must successfully complete four courses (16 credits) the same as those listed under minor programs (16 credits).

Track of Studies and International Programs

Applied Physics students may utilize the flexibility built in the physics curriculum to use their elective courses toward a collection of courses in a specific area of engineering or a cohesive collection of science and mathematics courses. This in particular could be useful in designing a track of study that may facilitate student participation in an existing study abroad program. This flexibility in the Physics curriculum may also be useful in better planning and preparing for future graduate studies and career. For further information about this please contact the Physics Department Head at physics@kettering.edu.

Applied Physics Program Curriculum Requirements

First Year Experience

FYE-101	First Year Foundations	1
<i>Credit Hours Subtotal:</i>		7

General Education

COMM-101	Written & Oral Communication I	4
COMM-301	Written & Oral Communication II	4
ECON-201	Economic Principles	4
HUMN-201	Introduction to Humanities	4
LS-489	Senior Seminar: Leadership, Ethics, and Contemporary Issues	4
SSCI-201	Introduction to the Social Sciences	4
Advanced Humanities Elective		4
Advanced Social Science Elective		4
<i>Credit Hours Subtotal:</i>		32

Chemistry

Select one of the following:			4
CHEM-137 & CHEM-136	General Chemistry I and Principles of Chemistry Lab		
CHEM-135 & CHEM-136	Principles of Chemistry and Principles of Chemistry Lab		
Select one of the following:			4
CHEM-145 & CHEM-146	Industrial Organic Chemistry and Industrial Organic Chem Lab		
CHEM-237 & CHEM-238	General Chemistry II and General Chemistry II Lab		
<i>Credit Hours Subtotal:</i>			8

Computer Science

CS-101	Computing & Algorithms I	4	
<i>Credit Hours Subtotal:</i>		4	
Engineering			
Select one of the following:			4
EE-210 & EE-211	Circuits I and Circuits I Lab		
EE-212 & MECH-231L	Applied Electrical Circuits and Signals for Mechanical Systems Lab		
EE-240	Electromagnetic Fields and Applications	4	
EP-235	Computers in Physics	4	
EP-342	Materials Science and Nanotechnology	4	
EP-485	Acoustic Testing and Modeling	4	
<i>Credit Hours Subtotal:</i>			20
Mathematics			
MATH-101 or MATH-101X	Calculus I	4	
Select one of the following:			4
MATH-102	Calculus II		
MATH-102X	Calculus II		
MATH-102H	Calculus II - Honors		
MATH-203 or MATH-203H	Multivariate Calculus	4	
MATH-203 or MATH-203H	Multivariate Calculus - Honors		
MATH-204 or MATH-204H	Differential Equations & Laplace Transforms	4	
MATH-204 or MATH-204H	Differential Equations and Laplace Transforms - Honors		
MATH-313	Boundary Value Problems	4	
MATH-327	Mathematical Statistics I	4	
MATH-307	Matrix Algebra	4	
<i>Credit Hours Subtotal:</i>			28
Physics			
PHYS-114 & PHYS-115	Newtonian Mechanics and Newtonian Mechanics Laboratory	4	
PHYS-224 & PHYS-225	Electricity and Magnetism and Electricity and Magnetism Laboratory	4	
PHYS-302	Vibration, Sound and Light	4	
PHYS-362	Modern Physics and Lab	4	
PHYS-412	Theoretical Mechanics	4	
PHYS-452	Thermodynamics and Statistical Physics	4	
PHYS-462	Quantum Mechanics	4	
PHYS-477	Optics and Lab	4	
Advanced Physics Elective (Choose Two) ¹			8
<i>Credit Hours Subtotal:</i>			40
Electives			
Free electives			8
Technical Electives ²			16
<i>Credit Hours Subtotal:</i>			24
Culminating Undergraduate Experience			

CUE-495	Culminating Undergraduate Experience Introductory Course (No Credit, Pass/Fail)	
Select one of the following:		4
CUE-495C	Co-op Thesis	
CUE-495E	Intra/Entre/Social E-ship Thesis	
CUE-495P	Professional Practice Thesis	
CUE-495R	Research Thesis	
<i>Credit Hours Subtotal:</i>		4
Total Credit Hours		161

(Minimum) Total Credits Required for Program: 161

- ¹ Any PHYS or EP course that is not a core physics requirement listed above
- ² Any 300 or 400 level Science, Math, Engineering, or Business courses approved by the academic advisor to form a sequence of courses in a specific technical field of study. Some Computer Science courses that are 100 or 200 level could be approved as a technical elective by the Physics Department Head

Representative Program

Course	Title	Credit Hours
Freshman I		
FYE-101	First Year Foundations	1
CHEM-137 or CHEM-135	General Chemistry I or Principles of Chemistry	3
CHEM-136	Principles of Chemistry Lab	1
COMM-101	Written & Oral Communication I	4
CS-101	Computing & Algorithms I	4
MATH-101	Calculus I	4
Credit Hours		17
Freshman II		
CHEM-237 or CHEM-145	General Chemistry II or Industrial Organic Chemistry	3
CHEM-238 or CHEM-146	General Chemistry II Lab or Industrial Organic Chem Lab	1
ECON-201	Economic Principles	4
MATH-102	Calculus II	4
PHYS-114	Newtonian Mechanics	3
PHYS-115	Newtonian Mechanics Laboratory	1
Credit Hours		16
Sophomore I		
MATH-203	Multivariate Calculus	4
MATH-307	Matrix Algebra	4
PHYS-224	Electricity and Magnetism	3
PHYS-225	Electricity and Magnetism Laboratory	1
HUMN-201 or SSCI-201	Introduction to Humanities or Introduction to the Social Sciences	4
Credit Hours		16
Sophomore II		
EP-235	Computers in Physics	4

MATH-204	Differential Equations & Laplace Transforms	4
PHYS-362	Modern Physics and Lab	4
HUMN-201 or SSCI-201	Introduction to Humanities or Introduction to the Social Sciences	4
Credit Hours		16

Junior I

Select one of the following:		4
EE-210 & EE-211	Circuits I and Circuits I Lab	
EE-212 & MECH-231L	Applied Electrical Circuits and Signals for Mechanical Systems Lab	
COMM-301	Written & Oral Communication II	4
MATH-313	Boundary Value Problems	4
PHYS-302	Vibration, Sound and Light	4
CUE-495	Culminating Undergraduate Experience Introductory Course (No Credit, Pass/Fail)	0
Credit Hours		16

Junior II

EE-240	Electromagnetic Fields and Applications	4
MATH-327	Mathematical Statistics I	4
EP-342	Materials Science and Nanotechnology	4
PHYS-412	Theoretical Mechanics	4
Technical Elective ¹		4
Credit Hours		20

Senior I

PHYS-462	Quantum Mechanics	4
PHYS-477	Optics and Lab	4
Advanced Humanities or Advanced Social Science Elective		4
Free Elective		4
Technical Elective ¹		4
Credit Hours		20

Senior II

EP-485	Acoustic Testing and Modeling	4
Advanced Physics Elective ²		4
Advanced Humanities or Advanced Social Science Elective		4
Free Elective		4
Technical Elective ¹		4
Credit Hours		20

Senior III

LS-489	Senior Seminar: Leadership, Ethics, and Contemporary Issues	4
Advanced Physics Elective ²		4
PHYS-452	Thermodynamics and Statistical Physics	4
Technical Elective ¹		4
Credit Hours		16

Any Term

CUE -495C/E/P/R Culminating Undergraduate Experience	4
Credit Hours	4
Total Credit Hours	161

(Minimum) Total Credits Required for Program: 161

- ¹ Technical Electives are any 300 or 400 level Science, Math, Engineering, or Business courses approved by the academic advisor to form a sequence of courses in a specific technical field of study. Some Computer Science courses that are 100 or 200 level could be approved as a technical elective by the Physics Department Head.
- ² Advanced Physics Electives includes any PHYS or EP course, which is not a core physics requirement as listed above.