PEP 201-A Physics III for Engineering Students
Spring 2023

Meeting Times:	Tuesday and Thursday 2:00 PM - 2:50 PM
Classroom Location:	Howe 303
Instructor:	Debing Zeng, Ph.D.
Contact Info:	dzeng@stevens.edu
Office Hours:	TBD

COURSE DESCRIPTION

This course refers to physics developed in the 20th century including wave optics, quantum mechanics, atomic and nuclear physics. While classical physics is generally concerned with matter and energy on the normal scale of observation, much of modern physics is concerned with the behavior of matter and energy under extreme conditions or on the very large (the universe) or very small (sub-atomic level) scale.
This course offers a comprehensive review of modern physics. It is the third semester of the introductory physics sequence designed for undergraduate students majoring in science or engineering. In this course we will begin with a review of wave optics before moving on to modern physics. A wide variety of subjects in modern physics is to be introduced in order to familiarize students with the basic concepts of modern physics. This course also aims to become the first course to prepare students to launch a career in industries utilizing quantum information science and quantum technology.

LEARNING OBJECTIVES

Upon successful completion, students will be able to

- understand the concept of wave interference and patterns of single slit and double slit experiment.
- make the connection between the wave view of light and photon view of light, i.e. the correlation between wave amplitude and probability of detecting the photons.
- understand the photoelectric effect experiment and how its characteristics cannot be explained by classical physics and thus requires new physics.
- know how to determine the de Broglie wavelength of a matter particle and explain why we don't notice the wave behavior of ordinary macroscopic objects such as a baseball in our daily lives.
- understand the concept of quantum mechanics wave function and solve the Schrodinger equation for simple systems.
- gain the foundation for research and development tasks in traditional and emergent industries within the quantum information science and quantum technology areas.
- understand the structures of atoms, and the origin of emission and absorption lines.
- understand the structure and properties of nucleus and radioactivity.
- calculate the energy required/released in nuclear reactions.

COURSE MATERIALS

Textbooks:

> ***Physics for Scientists and Engineers: A Strategic Approach with Modern Physics (4th Edition)*** by **Randall Knight (**ISBN-13: 978-0133942651)

OR:

> ***University Physics*** free by **OpenStax**
> ***Volume 1*** https://openstax.org/details/books/university-physics-volume-1
> ***Volume 3*** https://openstax.org/details/books/university-physics-volume-3

Homework

Homework usually will be assigned weekly and will be due in a week. Late homework is accepted within two days after the due date at 75% of its original value unless reasonable excuses are approved by the professor.

Quizzes

Two quizzes will be managed throughout the semester. No make-up quizze will be given unless you can document a legitimate reason for missing it, such as a doctor's note to verify your illness, or a proof of family emergency. Make-up quizzes will be allowed only if prior notification to the professor is given, and the absence is excused. Any make-up quiz should a different version of the original one.

Final Exam

Final Exam is accumulative and covers all topics discussed in the semester.

Laboratory

The course is accompanied by a lab section that introduces 6 key experiments related to wave diffraction, e/m ratio, Plank's constant, etc. In the lab section students will gain hands-on experience that allows to make deeper connections between the quantum physical concepts and equations introduced in class and the realization of experimental measurable quantities that are relevant for device technologies in modern Quantum Engineering.

Extra Accommodations

Any extra accommodation will have to be approved by the appropriate offices at Stevens before it can be considered by the instructor.

GRADING PROCEDURES

Lecture (PEP 201-A) component (75%) + Lab (PEP 201-LA) component (25%).

Breakdown of lecture component:

Homework ....………………………………… 40%

Quizzes (2) ………….…………..………....... 30%
Final Exam …………..…………..………....... 30%

Overall weight breakdown:

Lab.. 25%
Homework …......……………………………… (40 x 0.75)%
Quizzes (2) ………….…………..……….......... (30 x 0.75)%
Final Exam ……….....………………….…….. (30 x 0.75)%

The final course grade will be based on the following grading scheme:

Percent	Grade	Percent	Grade
94-100	A	74-77	C
90-94	A-	70-74	C-
87-90	B+	65-70	D+
84-87	B	60-65	D
80-84	B-	Below 60	F
77-80	C+		

PRELIMINARY SCHEDULE

Week	**Topics**	**Note**
Week One	Chapter 15 Oscillation	
Week Two	Chapter 16 Traveling Waves	
Week Three	Chapter 17 Superposition	
Week Four	Chapter 33 Wave Optics	
Week Five	Chapter 33 Wave Optics & Chapter 37 The Foundations of Modern Physics	
Week Six	Chapter 37 The Foundations of Modern Physics	***Quiz 1 - Chapters 15,16, 17, 33***
Week Seven	Chapter 38 Quantization	
Week Eight	Chapter 38 Quantization & Chapter 39 Wave Functions and Uncertainty	
Week Nine	Chapter 39 Wave Functions and Uncertainty	
Week Ten	Chapter 40 One-Dimensional Quantum Mechanics	
Week Eleven	Chapter 40 One-Dimensional Quantum Mechanics	***Quiz 2 - Chapters 37, 38, 39***

Week Twelve	Chapter 41 Atomic Physics	
Week Thirteen	Chapter 41 Atomic Physics & Chapter 42 Nuclear Physics	
Week Fourteen	Chapter 42 Nuclear Physics	
FINAL	TBD	