Tompkins Cortland Community College

Master Course Syllabus

Course Discipline and Number: PHSC 213 **Year: 2023-2024**
Course Title: Physics III (Waves, Optics & Modern Physics) **Credit Hours: 4**

Attendance Policy: *To maintain good grades, regular attendance in class is necessary. Absence from class is considered a serious matter and absence never excuses a student from class work. It is the responsibility of all instructors to distribute reasonable attendance policies in writing during the first week of class. Students are required to comply with the attendance policy set by each of their instructors. Students are not penalized if they are unable to attend classes or participate in exams on particular days because of religious beliefs, in accordance with Chapter 161, Section 224-a of the Education Law of the State of New York. Students who plan to be absent from classroom activity for religious reasons should discuss the absence in advance with their instructors. See college catalog for more information.*

Services for Students with Disabilities: *It is the College's policy to provide, on an individual basis, appropriate academic adjustments for students with disabilities, which may affect their ability to fully participate in program or course activities or to meet course requirements. Students with disabilities should contact the Coordinator of Access and Equity Services, to discuss their particular need for accommodations. All course materials are available in alternate formats upon request.*

Course Description

This is the third semester of a three-semester calculus-based physics course. Topics include wave motion, sound, electromagnetic waves, relativity, geometrical and wave optics, polarization, duality of waves and particles, atomic theory, quantum mechanics, and nuclear and particle physics. A calculator capable of solving systems of linear equations is required. PHSC 213 fulfills the SUNY General Education Natural Sciences requirement. Prerequisites: PHSC 212; MATH 203; RDNG 099 if required by placement testing; prior completion or concurrent enrollment in ENGL 100. 4 Cr. (3 Lec., 2 Lab.) Spring semester.

Course Context/Audience

This is a core course for a student planning to pursue a four-year degree in physics or engineering. Some computer science majors will choose this course, also. The topics and techniques in this course build extensively on those presented in PHSC 211 and PHSC 212, and on the mathematical methods taught in the calculus sequence. There is a strong emphasis on performing lab experiments, along with interpreting data from those experiments using graphical analysis and error analysis.

Basic Skills/Entry Level Expectations

Writing:	WC	College level writing skills are required. See course co-requisites or pre-requisites.
Math:	MC	College level math skills – Course requires college level math skills. See course description for co-requisite and/or prerequisite requirement(s).
Reading:	R2	Before taking this course, students must have a C or better in RDNG 099 or assessment indicating that RDNG 099 was not required.

Course Goals

By successfully completing this course, the student will

1. Become familiar with the laws of physics in the areas of wave motion, sound, electromagnetic waves, relativity, geometrical and wave optics, polarization, duality of waves and particles, atomic theory, quantum mechanics, and nuclear and particle physics.

2. Know how to employ the laws mentioned above, along with mathematical methods, to solve problems in those content areas.

3. Know how to perform experiments that test the validity of the laws mentioned above. They will build apparatuses and make appropriate measurements, and use error and graphical analysis to interpret their results.

Course Objectives/Topics

Objective/Topic	% Course
Students will understand the theories that apply to waves, sound, and electromagnetic radiation, and will recognize how these topics are connected with concepts from Physics I and Physics II. Students will employ these theories, along with mathematical methods, to solve problems of moderate difficulty.	20%
Students will gain a basic understanding of light and make predictions about its behavior, using wave optics or geometric optics as appropriate.	22%
Students will understand the theories of special and general relativity, and solve problems of moderate difficulty in these areas.	7%
Students will gain a basic understanding of quantum mechanics, atomic physics, nuclear physics, and particle physics, and will be able to solve problems of moderate difficulty in these areas.	38%
Students will perform experiments in the laboratory that will test the validity of the theories studied, will measure quantities accurately, and successfully apply error analysis or graphical analysis to interpret the results.	13%

General Education Goals - Critical Thinking & Social/Global Awareness

CRITICAL THINKING OUTCOMES	**HOW DOES THE COURSE ADDRESS THE OUTCOMES** (Include required or recommended instructional resources, strategies, learning activities, assignments, etc., that must or could be used to address the goal/outcomes)
Students will be able to ➢ develop meaningful questions to address problems or issues. ➢ gather, interpret, and evaluate relevant sources of information. ➢ reach informed conclusions and solutions. ➢ consider analytically the viewpoints of self and others.	Because of the mathematical nature of the course, students need to develop meaningful questions to design algorithms that solve the problems based on data they gather from laboratory work, textbooks and the internet. Laboratory analysis and homework problems involve complex algorithms that are a slight variation on those presented in class. Cooperation amongst students is imperative to succeed in science. This course encourages students to work in teams during labs. Encourage students to share solutions and strategies during homework preparation and lab circuit design and implementation.
SOCIAL/GLOBAL AWARENESS OUTCOMES	**HOW DOES THE COURSE ADDRESS THE OUTCOMES** (Include required or recommended instructional resources, strategies, learning activities, assignments, etc., that must or could be used to address the goal/outcomes)

➢ Students will begin to understand how their lives are shaped by the complex world in which they live. ➢ Students will understand that their actions have social, economic and environmental consequences.	As topics in physics are presented, historical context is usually included. This allows students to realize that science is an ongoing process, and contributors to this process come from all over the world. The economic and social stimuli that brought about various scientific breakthroughs are also considered in a global context.

Instructional Methods
Traditional lecture works very well in presenting the concepts and techniques of the course. Discussion of homework problems in each class, with some time set aside for students to try new problems, is also effective.

In the lab sessions, it helps to spend five to twenty minutes at the beginning to explain how the experiment to be performed that day will demonstrate some theory that was already presented in lecture. If students work with partners in lab, they seem to learn quite a bit from each other.

The most effective sequence of topics is that given by the chapter order in the textbook listed below.

Computer software, such Excel, and calculators allow students to learn more from doing analysis and interpretation of lab results, and spend less time on busy work.

Methods of Assessment/Evaluation

Method	% Course Grade
Frequent Quizzes	25-45%
Final Exam	20-35%
Lab Reports and Assignments	15-30%

Text(s)
Physics for Scientists & Engineers, Serway and Jewett, 8th Edition, © 2010 Brooks/Cole.

Bibliography
Conceptual Physics, 7th ed., by Paul Hewitt (Harper Collins College Publishers, © 1993).

The Cartoon Guide to Physics, by Larry Gonick and Art Huffman (Harper Perennial, © 1990).

Encyclopedia of Physics, 3rd ed., edited by Lerner and Trigg, (Wiley, © 2005)

(All three of these books are in the collection of the TC3 library.)

Other Learning Resources

Audiovisual Physics Timeline, mural outside the physics lab (Room 260) Mechanical Universe and Beyond, video series
Electronic graphing calculators
Other: No resources specified