NEW JERSEY CENTER
FOR TEACHING & LEARNING

Progressive Science Initiative® (PSI®)

PHYS6683: Physics Capstone & Praxis Preparation

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Course Credit: 3.0 NJCTL credits

Dates & Times:
This is a 3-credit, self-paced course, covering 6 modules of content. The exact number of hours that you can expect to spend on each module will vary based upon the module coursework, as well as your study style and preferences.You should plan to spend approximately 15 hours per credit working online, and up to 30 hours per credit working offline.

Graduate Student Handbook: www.njctl.org/graduate-handbook/

COURSE DESCRIPTION:
This course is for teachers to review and extend their prior study of physics and also serves as a review for the Praxis Physics Content Knowledge Test (5265).

Teachers will learn core foundational concepts in modern physics topics as well as the pedagogical content knowledge needed to successfully teach introductory physics to students.

STUDENT LEARNING OUTCOMES:
Upon completion of the course, the student will be able to:

1. Demonstrate knowledge of safe laboratory practices including appropriate use, maintenance, and calibration of lab equipment, as well as safe usage, storage and disposal of lab materials.
2. Apply basic mathematical principles commonly used in chemistry/physics, including algebra, dimensional analysis, and graphical analysis.
3. Demonstrate mastery of a broad range of physics topics indicated in the module outcomes below.

TEXTS, READINGS, INSTRUCTIONAL RESOURCES:
Required Texts:
https://njctl.org/courses/science/algebra-based-physics/

https://njctl.org/courses/science/ap-physics-1/

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https://njctl.org/courses/science/ap-physics-2/

These materials include:

- SMART Notebook presentations with direct instruction and formative assessment questions linked to polling devices
- Classwork and homework documents with extra practice problems and answers
- Labs - guided or inquiry versions with embedded videos to show teachers how to set up the lab
- Multiple Choice Review Guides

COURSE REQUIREMENTS:
In order to receive a Passing grade, the participant must complete the following course requirements:

1. Activities: A number of different learning activities will ensure participant engagement and learning in the course. These include:
   - Engage in video module lessons which demonstrate minimized direct instruction followed by frequent formative assessment
   - Completion of formative assessments aligned to learning objectives which include detailed analysis when answered incorrectly.
   - Interaction with module discussion boards that allow conversation with peers and course instructors about the module's content, delivering that content to students. Discussion boards also serve as a place to ask and answer questions related to the module's content.
2. Mastery Exercises: For each module, these multiple-choice question quizzes assess the content knowledge gained in a module. Participants have the opportunity to retake; random questions are pulled from a larger question bank on each attempt ensuring varied questions.
3. Module Exam: One is completed at the end of each module. It is a culminating exam consisting of praxis-like multiple-choice questions aligned to the exam objectives.
4. Reflection Paper: At the end of the course, participants are required to reflect on the knowledge taught in the course, make connections, and compare/contrast their current pedagogy with new strategies gained in this assignment.
5. Final Exam: At the end of the course, a comprehensive exam consisting of multiple-choice questions assesses the content knowledge learned throughout the course in preparation for the praxis exam. There is also an ungraded practice final exam.

GRADE DISTRIBUTION AND SCALE:
Grade Distribution:

Module Exams	70%
Final Exam	15%
Mastery Exercises	11%
Reflection Paper	4%

Grade Scale:

A	93 – 100
A-	90 – 92
B+	86 – 89
B	83 – 86
B-	80 – 82

C+	77 – 79
C	73 – 76
C-	70 – 72
D	60.0 – 69.9
F	59.9 or below

ACADEMIC STANDING:
NJCTL has established standards for academic good standing within a student's academic program. Students enrolled in any NJCTL online course must receive an 80 or higher to successfully complete a course and receive credit for that course. An 80 is equivalent to a GPA of 2.7 or B-. Additionally, students in an endorsement program must receive a cumulative GPA of 3.0 for all courses combined in order to successfully complete the program.

ACADEMIC INTEGRITY:
Students must assume responsibility for maintaining honesty in all work submitted for credit and in any other work designated by the instructor of the course. Academic dishonesty includes cheating, fabrication, facilitating academic dishonesty, plagiarism, reusing /repurposing your own work, unauthorized possession of academic materials, and unauthorized collaboration.

CITING SOURCES WITH APA STYLE:
All students are expected to follow proper writing and APA requirements when citing in APA (based on the APA Style Manual, 6th edition) for all assignments.

DISABILITY SERVICES STATEMENT:
We are committed to providing reasonable accommodations for all persons with disabilities. Any student with a documented disability requesting academic accommodations should contact the Dean of Students, Melissa Axelsson, for additional information to coordinate reasonable accommodations for students with documented disabilities (melissa@njctl.org).

NETIQUETTE:
Respect the diversity of opinions among the instructor and classmates and engage with them in a courteous, respectful, and professional manner. All posts and classroom communication must be conducted in accordance with the student code of conduct. Think before you push the Send button. Did you say just what you meant? How will the person on the other end read the words?

Maintain an environment free of harassment, stalking, threats, abuse, insults or humiliation toward the instructor and classmates. This includes, but is not limited to, demeaning written or oral comments of an ethnic, religious, age, disability, sexist (or sexual orientation), or racist nature; and the unwanted sexual advances or intimidations by email, or on discussion boards and other postings within or connected to the online classroom.

If you have concerns about something that has been said, please let your instructor know.

CLASS SCHEDULE:

Module	Module Learning Outcomes	Assignments
1 – Special Theory of Relativity	• Compare/contrast Galilean Newtonian relativity with Special Relativity. • Understand the two postulates of Special Relativity. • Understand simultaneity, proper time and proper length. • Calculate time dilation, length contraction, relativistic total energy and momentum.	• Mastery Exercises • Test
2 – Alternating Current Circuits	• Understand how AC current is produced. • Understand the operation of transformers and calculate voltage, current and frequency behavior. • Calculate voltage, current and frequency in series RLC circuits. • Calculate impedance and reactance values in series RLC circuits.	• Mastery Exercises • Test
3 – Mechanics	• Understand vector and scalar quantities in describing motion and force. • Understand motion in terms of displacement, velocity and acceleration. • Document frames of reference and their applications. • Apply Newton's 3 Laws of Motion. • Understand static equilibrium. • Explore friction, including forces and coefficients. • Differentiate circular and simple harmonic motion. • Understand work, mechanical energy, and power, and how they're related to one another. • Evaluate linear momentum and impulse and how they are related to one another. • Understand rotational motion. • Explain the difference between elastic and inelastic collisions. • Investigate laws of conservation of energy and conservation of linear motion. • Understand Newton's law of universal gravitation. • Demonstrate the difference between weight and mass. • Apply Kepler's three laws of orbital motion. • Understand fluid mechanics.	• Mastery Exercises • Test
4 – Electricity & Magnetism	• Describe electrostatics. • Differentiate electrical properties of conductors, insulators and semiconductors. • Evaluate electrical current, resistance, potential difference, energy, power, and the relationships between them. • Understand capacitance and inductance. • Explore magnetic fields, magnetic forces and properties of magnetic materials. • Justify how a changing electric field produces a magnetic field and how a changing magnetic field produces an electric field.	• Mastery Exercises • Test
5 – Optics & Waves	• Apply mathematical routines to describe the relationship between mass and energy and apply this concept across domains of scale. • Analyze electric charge conservation for nuclear and elementary particle reactions and make predictions related to such reactions based upon conservation of charge. • Apply conservation of nucleon number and conservation of electric charge to make predictions about nuclear	• Mastery Exercises • Test

	reactions and decays such as fission, fusion, alpha decay, beta decay, or gamma decay. • Predict the number of radioactive nuclei remaining in a sample after a certain period of time, and also predict the missing species (alpha, beta, gamma) in a radioactive decay.	
6 – Thermal Physics	• Correlate temperature, temperature scales, heat and heat capacity. • Characterize mechanisms of heat transfer. • Compare different forms of energy and transformations between them. • Determine the energy involved in phase transitions between the various states of matter. • Explain kinetic molecular theory and the ideal gas laws. • Understand the laws of thermodynamics.	• Mastery Exercises • Test
7 – Modern Physics	• Relate the organization, structure and states of matter. • Evaluate the nature of atomic and subatomic structure, including various models of the atom. • Depict the relationship of atomic spectra to electron energy levels. • Relate the characteristics, processes and effects of radioactivity. • Understand topics in modern physics.	• Mastery Exercises • Test
8 – Scientific Inquiry, Processes, & Social Perspectives	• Understand and illustrate the processes involved in scientific inquiry. • Apply experimental design. • Teach about the nature of scientific knowledge. • Relate how major principles in physics developed historically and the contributions of major historical figures. • Demonstrate how to collect, process, analyze and report data, including sources of error. • Appropriately use of materials, equipment and technology in in the high school physics laboratory and classroom. • Convey the impact of physics and technology on society and the environment. • Illustrate major issues associated with energy use and production. • Understand applications of physics in daily life.	• Mastery Exercises • Test
9 – Final Reflection	• Review presentations as desired • Zoom meeting with course instructor and discussion board, as needed	• Reflection Paper • Final Exam