THE GOVERNOR'S SCHOOL for SCIENCE AND TECHNOLOGY

University Physics I

Governor's School for Science and Technology

Fall 2025
Version 1.0

Instructor Information

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- **Place:** GSST A33
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- **Office Hours**: Anytime or Zoom

Course Text:

- Physics for Scientists and Engineers (4th edition) by Randall D. Knight
- Supplemenary text: Schaum's Outline Series: Physics for Scientists and Engineers.

Prerequisite/Co-requisite

- Co-requisite: Enrollment in GSST College Calculus Course.(Calculus I)

1 Course Pages:

- All course information will be relayed via Canvas.

Office Hours:

Anytime you find me in my office (which is almost always), and by appointment. Always feel free to come by: you will be welcome to discuss any topic. In addition, you may post your questions in the forum provided for this purpose on Canvas. I am also available other hours via Zoom and of course email.

However, please do not come to me always expecting *answers*, but rather other questions that will lead *you* to the answers.

Dual Enrollment

This course may be dual enrolled for college credit at Virginia Peninsula Community College (VPCC) as Physics 241 for the Spring semester.

Course Objectives:

- To help students develop analytical, graphical and reasoning skills
- To help students understand the fundamental concepts of physics
- To enable students to apply these concepts qualitatively as well as to quantitatively solve problems in their fields of study

Course Description:

A general introduction to physics in which the principles of classical physics are applied to the solution of physical problems. The reasoning through which solutions are obtained is stressed. Topics include mechanics, fluids, and thermodynamics. This course is designed for students who plan to pursue studies in any of the physical sciences, engineering, mathematics, or computational sciences.

Additional References:

This is a limited list of various interesting and useful books related to this course.

- Young and Freedman *University Physics with Modern Physics any edition*. Also an excellent text.
- Hugh D. Young *Fundamentals of Mechanics and Heat*. First published in 1964, and available used today. I saw it for a mere 12 bucks. An excellent text written by a superb teacher.
- My lecture notes, "Lectures in Physics", posted on Canvas.
- Feynman, Richard, *Lectures on Physics*. Difficult but worth the effort.
- Shankar, R., *Basic Training in Mathematics*. A terrific summary of the requisite mathematics.

Video References:

- Yale Open Source Physics I and II by R. Shankar. Excellent supplement to my lectures. Links are available on Canvas.
- Walter Lewin MIT course 801/802. Dr. Lewin's lectures are *very* entertaining as well as instructive. Links for some lectures are on Canvas.
- Kahn Academy for specific topics.

Course Outline:

In this course, you will be introduced to some core topics in physics. The course will stress fundamental physical principles; the main emphasis of supplementary work will be to illuminate these principles. Each unit is approximately 1 week long. The units covered in this course are as follows:

- Mechanics: Chapters 1-14
  - Measurement, Units, Vectors
  - Motion in One Dimension
  - Motion in Two and Three Dimensions

  - Newton's Laws
  - Applications of Newton's Laws
  - Work and Kinetic Energy
  - Potential Energy and the Conservation of Energy
  - Momentum, Impulse, Collisions
  - Rotational of Rigid Bodies
  - Rotational Dynamics
  - Static Equilibrium and Elasticity
  - Fluid Mechanics
  - Gravity and Orbits
- Oscillations Chapter 15
  - Hooke's Law and Periodic Motion
- Heat and Thermodynamics: Chapters 18-21
  - Heat and the First Law of Thermodynamics
  - Kinetic Theory of Gasses
  - Heat Engines and the Carnot Cycle
  - Entropy and the Second Law of Thermodynamics

Grading Scale

A	≥ 90
B	≥ 80
C	≥ 70
D	≥ 60
F	< 60

Required Materials:

- Notebook (3-ring binder preferred) – Students will be expected to keep a binder or section exclusively for use in this class. The binder should be a comprehensive, well-organized record of your work in physics, particularly homework problems and in-class assignments as well as lecture notes.
- A laboratory notebook will be supplied to each lab group.
- A Scientific Graphing Calculator, CAS preferred (TI-89 titanium, TI-Nspire, or HP Prime) is highly recommended.
- A limited number of laptops are available in the classroom.
- Please download R and RStudio software onto your laptops (Download is free).
- Please download wxMaxima and Maxima onto your laptops (Download is free).
- Please download matlab onto your laptops (Download is free to GSST students).

Effective organization is important in a student's success in physics, and can make a difficult course manageable.

Experimental Procedures:

Each experiment will be performed by a group consisting of at least 2, at most 3 students.

Each group is responsible for setting up the equipment necessary for conducting the experiment.

UNDER NO CIRCUMSTANCES will the equipment be dismantled prior to approval from the instructor. Sufficient analysis must be performed on the data prior to dismantling the experiment. Doing so will result in an immediate 0 grade for the lab.

Laboratory Notebook: *Each lab group* will be required to maintain a laboratory notebook. Instructions for a proper laboratory notebook is covered in a separate document on Canvas. In addition I will give an in-class presentation.

Laboratory Reports:

Each lab group must show a brief summary of the lab results as requested by the instructor.

A brief written report will be submitted one week after the lab by each group. This will include a brief summary of the purpose, relevant equations, and results of the lab, and should be no longer than 1 or 2 typed pages. Also in your lab report include your raw data sheets, as well as any relevant graphs. When possible and appropriate include estimates of resolution and errors. Further guidance on the lab report will be given in class. Submit lab reports one week after the completion of the experiment. Each group will produce a lab report which will be submitted online via Canvas, as well as a paper copy.

Physics laboratory classes include hands-on, inquiry-based laboratory investigations. Some lab activities involve the use of equipment that may pose a health or safety danger to both students and teachers if not handled properly. To ensure a safe and healthy environment in our classrooms and laboratories, please observe the following guidelines:

- **GENERAL GUIDELINES:**
  - Students should behave in a mature and responsible manner at all times in the laboratory.
  - Students must follow all verbal and written instructions carefully. If you are unsure of the procedure, ask your instructor for help before proceeding.
  - Students should not touch any equipment unless specifically instructed to do so.
  - Students must not eat, drink, apply cosmetics or chew gum in the laboratory. Wash hands thoroughly after participating in any laboratory activities.
  - Students must perform only those experiments authorized by the teacher.
  - Students will receive training related to the locations and operating procedures for all applicable laboratory safety equipment and personal protective equipment.
- **HANDLING EQUIPMENT**
  - Do not enter the science storage rooms or preparation areas unless accompanied by me.
  - Wear appropriate personal apparel at all times in the laboratory and also avoid wearing loose or flammable clothing; long hair should be tied back. Do not wear open-toed shoes or sandals.
  - Wear safety goggles when directed by your instructor.
  - Report any incident to the instructor immediately, no matter how insignificant it may appear. This should include all injuries such as cuts, burns or other signs of physical harm.
  - Never remove equipment or supplies from the laboratory area.
  - Examine all equipment before each use and report any broken or defective equipment to the instructor immediately.
- **HEATING SUBSTANCES**
  - Students must never reach over an exposed flame or hot plate, or leave a flame or hot plate unattended.

At the conclusion of the laboratory session make sure that all equipment is returned properly to the proper place, and in the condition you received it.

Course Policies:

- Attendance in class is required and will be considered in your grade. Please attend class and laboratory sessions regularly, and be on time. If you are absent, you are responsible for any information or material covered during your absence. Any disruptive behavior that interferes with the learning process will not be tolerated.
- No cellphones are permitted in class- no exceptions. Laptops are to be used only on course material presently being discussed, not for web-surfing or doing homework. *Under no circumstances have headphones or earbuds on during the lecture*. Smoking, eating and drinking are not permitted in the classroom or laboratory. If anyone is distracted by such behavior and feels that I am not properly addressing it, please let me know.
- You are encouraged to pay attention and ask questions since that is the best way to learn. You are strongly encouraged to partake in classroom discussions: I do not expect you to know everything or you would be teaching this course, but I do expect you to actively participate.

Problem Sets:

- Physics is best learned by attempting to solve problems. This will allow you to become familiar with the fundamental physical concepts, as well as to gain experience with the mathematical methods required. These assignments of a few sample problems will be assigned each week and reviewed in class; a *significant* portion of in-class time will be spent reviewing problems. The problem sets will be submitted on-line. You must make a sincere effort to do the these problems, and generally you will be allowed multiple attempts. I will try to address any questions about specific problems in class. This process is necessary for content assessment which will impact your grade, so use this opportunity wisely.

Assessments:

The teaching paradigm employed in this course profoundly integrates demonstration work (experiments and demonstrations) with traditional lectures and problem-solving sessions. Collaboration is encouraged and in fact integral to the class structure. We all do better when we work together. Generally laboratory exercises will require a report whose content for each exercise will be specified. Each lab group, consisting of between two and four students will submit a single report, and share a common grade. Lab reports will generally be due the week after the lab is complete, but in some cases will be more extensive. In addition, each lab exercise may have a few associated problems included in the laboratory report. All reports will be submitted on-line via Canvas. The accumulation of these submissions will be evaluated with equal weight.

There will be a exam on the material covered in each unit at the conclusion of the unit. Exams will generally have two components, an individual section (stage 1) and a collaborative part (stage 2). Small groups will be permitted to collaborate on solving the problems in the second stage. You will be assigned to a group for collaborative work. Your group assignment will be announced near the beginning of the school year. Your notes will be allowed during the exams.

Grading Rubric: Laboratory Reports/Activities (40%), Exams(40%), Unit Problem Sets (20%)

Grade Change Appeal Process:

The New Horizon Governor's School Grade Change Appeal Process guidelines may be found here: Grade Appeal Process

Academic Honesty: It is imperative that students maintain a high degree of individual honor in their scholastic endeavors. Scholastic dishonesty will not be condoned under any circumstances. Generally, scholastic dishonesty is interpreted as cheating on an examination or quiz, which includes giving or receiving information; copying, using unauthorized materials in tests; unauthorized collaboration during examinations; plagiarizing or submitting work other than one's own; and colluding with another person or persons in submitting work for credit unless such collaboration is approved in advance by the instructor. Webster's Third International Dictionary defines plagiarism as follows: "Plagiarism–to steal and pass off, as one's own the ideas or words of another; to use without crediting the source; to present as new and original an idea or product derived from an existing source; to commit literary theft."

You are expected to conform to the guidelines above in all aspects of your conduct in this course. You may work with others on the homework assignments, however, what you submit must represent your own understanding of the problem. Submitting answers online for problems that you have not worked out is cheating. Misconduct of any form will not be tolerated. If you are ever unsure of what is permissible, please consult with Dr. Weygand for clarification.