

## PHY 201 - GENERAL PHYSICS I

Instructor: Dr. Romulo Ochoa  
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Office Hours: Tuesdays: 1:30 p.m. – 3:00 p.m. and Wednesdays: 1:30 p.m. - 3:00p.m.

### Course Description

This is a calculus-based introductory physics course, the first of a two-semester sequence. Topics covered include kinematics, forces, energy, linear momentum, collisions, torques, and rotational motion. Problem solving is an integral part of the course. Conceptual understanding is reinforced using laboratory experiments, demonstrations, small-group work, homework assignments, and interactive computer-based techniques.

### Course Materials

Text: “University Physics,” Young and Freedman (15<sup>th</sup> Ed.)  
Electronic homework: Mastering Physics  
Laboratory Instructions: posted on Canvas

### Course Requirements

Class attendance, completion of electronic homework associated with each chapter, active class participation via clicker questionnaires and peer instruction, completion of lab activities and a formal lab report, two tests, and a final exam.

### Course Goals

1. To provide a foundation in physics necessary for further study in science, engineering and technology.

#### ***Learning Goals:***

- 1.1. Develop an understanding of forces, energy, and momentum.
  - 1.2. Draw force diagrams and use them to analyze systems of interacting objects.
  - 1.3. Apply understanding of conservation of energy and momentum to study collisions.
  - 1.4. Learn to distinguish when to apply constant forces and when to use conservation of energy.
  - 1.5. Develop an understanding of torques, angular momentum, and rotational motion.
2. To provide an appreciation of the nature of physics, its methods, and its goals.

#### ***Learning Goals:***

- 2.1. Make connections between the atomic nature of matter and the behavior of macroscopic systems.
- 2.2. Construct computational models to predict the time evolution of a particular system.
- 2.3. Generate graphs to illustrate the correlation between different parameters.

- 2.4. Become proficient in using commercial software, such as Excel, MatLab, or Mathematica, to plot data, conduct error and statistical analysis of data, and perform calculations on relatively large data sets.
  - 2.5. Understand how scientists support or rule out new ideas and add to the body of scientific knowledge.
3. To contribute to the development of the student's thinking process through the understanding of the theory and application of this knowledge to the solution of practical problems.

***Learning Goals:***

- 3.1. Identify the important variables in any given physical problem.
  - 3.2. Develop an appropriate strategy for solving physical problems using fundamental principles rather than secondary formulas.
  - 3.3. Successfully apply the appropriate mathematical methods to implement your solution.
  - 3.4. Evaluate your solutions to determine if they are physically reasonable.
  - 3.5. Develop spatial reasoning in three dimensions.
4. To engage in productive communication and collaboration with peers.

***Learning Goals:***

- 4.1. Contribute productively to group discussions about physical phenomena and problems.
- 4.2. Clearly articulate their beliefs about how the natural world behaves.
- 4.3. Use scientific reasoning and argumentation to defend their ideas against competing ideas.
- 4.4. Explain physical phenomena and mechanisms using both formal and informal language, as well as graphical, pictorial, mathematical, or other representations.

**Course Outline**

**A. Topics:**

1. Physics, Measurement, Units, and Vectors.  
Standards of length, mass, and time. Conversion of units. Significant figures.  
Coordinate systems. Vector and scalar quantities. Vector components.  
Homework: Mastering Physics chapter 1.
2. Motion in One Dimension.  
Position, velocity, and acceleration. Constant acceleration. Free fall.  
Homework: Mastering Physics chapter 2
3. Motion in Two Dimensions.  
Position, velocity, and acceleration vectors. Two-dimensional motion with constant acceleration. Projectile motion. Uniform circular motion. Relative velocity.  
Homework: Mastering Physics chapter 3.

### Test 1 (TBA)

4. Newton's Laws of Motion and Applications.  
Concept of force. Newton's three laws. Gravitational force and weight. Friction.  
Homework: Mastering Physics chapters 4 and 5.
5. Work and Conservation of Energy  
Work done by a constant force. Scalar product of two vectors. Work done by a variable force. Potential energy of a system. Conservation of energy. Power.  
Homework: Mastering Physics chapters 6 and 7.

### Test 2 (TBA)

6. Linear Momentum and Collisions  
Linear momentum. Collisions in one and two dimensions. Center of mass.  
Systems of many particles. Rocket propulsion.  
Homework: Mastering Physics chapter 8.
7. Rotation of a Rigid Object about a Fixed Axis  
Angular position, velocity, and acceleration. Constant angular acceleration. Angular and translational quantities. Torque. Rotational inertia. Rotational kinetic energy.  
Homework: Mastering Physics chapter 9.
8. Dynamics of Rotational Motion  
Vector product and torque. Torque and angular acceleration for a rigid body. Angular momentum of a rotating rigid object.  
Homework: Mastering Physics chapter 10.
9. Static Equilibrium  
Rigid object in equilibrium. Center of gravity. Static equilibrium conditions.

### Final Exam (TBA)

### Laboratory

- Lab. 1. Mass Density and Error Analysis.
- Lab. 2. Excel Exercise. Constant Velocity.
- Lab. 3. Motion with constant acceleration & Position Templates.
- Lab. 4. Projectile motion.
- Lab. 5. Test 1 Preparation – peer instruction exercises.
- Lab. 6. Newton's Second Law.
- Lab. 7. Centripetal Force.
- Lab 8. Simple Pendulum.
- Lab. 9. Test 2 Preparation – peer instruction exercises.
- Lab. 10. Hooke's law: Spring - mass system.
- Lab. 11. Ballistic Pendulum.
- Lab. 12. Collisions in One Dimension.

## Lab. 13. Torques and Conservation of Angular Momentum.

### Grading

1. Electronic homework (10% of course grade)
2. Tests (35% of course grade)
3. Final exam (32% of course grade)
4. Class attendance, active class participation and peer instruction (3% of course grade)
5. Lab. grade (20% of course grade)

For lab grade student must complete in a satisfactory manner the laboratory exercises and maintain an electronic lab notebook. Students are expected to be in the lab on time, **points will be deducted for tardiness** (if a student is more than 20 minutes late, he/she will receive an automatic zero grade for that lab).

| Grading Scale |              |
|---------------|--------------|
| Final Score   | Letter Grade |
| 92.5 - 100    | A            |
| 89.5 – 92.4   | A-           |
| 86.5 – 89.4   | B+           |
| 82.5 – 86.4   | B            |
| 79.5 – 82.4   | B-           |
| 76.5 – 79.4   | C+           |
| 72.5 – 76.4   | C            |
| 69.5 – 72.4   | C-           |
| 66.5 – 69.4   | D+           |
| 59.5 – 66.4   | D            |
| 0 – 59.4      | F            |

### Exam or Test Absences Policy

- I. Final Exam:** The final exam schedule is known well in advance. Serious personal illness and death in immediate family will be the only acceptable excuses. All students must follow the general guidelines stated below. All excused students must take their make-up final exam before 2:00 PM on the last day of the final exams, or they will receive an incomplete (I) or an F. It is the student's responsibility to request the make-up and provide a timely and acceptable proof.
- II. Tests:** You should make every effort to take the test at its scheduled date. If you cannot:  
You must **inform** the instructor about the nature of your absence before the missed test (for non-emergency absences) or within 24 hours after the missed test (for emergency absences);  
By the following class period you must show the instructor (or arrange to be shown) a **proof** that the absence is excusable; it is the student's responsibility to contact the

instructor in a timely manner and provide an acceptable excuse.

### III. Excuses:

**Non-acceptable:** Travel plans, weddings, lack of preparation, busy schedules; too many other obligations, assignments, or tests; job interviews, doctor's appointments or any other engagements or appointments that can be scheduled at different times, and alike, **will not be accepted** and the student will receive zero points for the test - **no exceptions**. The test dates are known ahead of time, so please plan accordingly.  
**Acceptable:** Personal illness, death in one's family, and alike.

### IV. Taking the Make-Up:

A student will be allowed to take a make-up only for an excused absence;  
Unless otherwise stated in writing by her/his physician, s/he must take the make-up **within seven days** of the missed examination.  
If the student fails to inform the instructor, does not provide an acceptable proof, or does not take the make-up in a timely manner, s/he will be given zero.  
The make-ups will be **different** from regular examination, so **timely notification** of the instructor is essential.

### Fourth Hour:

In this class, the deep learning outcomes associated with TCNJ's 4th hour are accomplished by a series of rigorous educational assignments that extend beyond the typical scheduled class time. These include activities conducted in the scheduled laboratory section, out-of-class problem sets, and out-of-class online learning activities such as video lectures and reading assignments.

### Additional Resources

Chabay, R. and Sherwood, B., Matter and Interactions, 4<sup>th</sup> Ed., J. Wiley & Sons, 2015.  
Feynman, R., The Feynman Lectures on Physics, Vols. 1, 2, & 3, CA, Addison-Wesley, 1989.  
Wolfson, R. Essential University Physics, 3<sup>rd</sup> Ed., Pearson, 2016.  
Young and Freedman, University Physics 14<sup>th</sup> Ed., New York, Pearson, 2016.

### SELECTED TCNJ POLICIES

#### COMMITMENT TO DIVERSITY, EQUITY, INCLUSION, ACCESS AND BELONGING

Include a statement that references the college's commitment to diversity, equity, inclusion, access, and belonging, along with the link to the TCNJ Campus Diversity Statement. Instructors are encouraged to include the following statement in their syllabus: "The TCNJ community is composed of people with diverse backgrounds, perspectives, and experiences, and the college is committed to diversity, equity, inclusion, access and belonging. The college's Campus Diversity Statement can be viewed here: <https://diversity.tcnj.edu/campus-diversity-statement/>."

#### CLASSROOM ENVIRONMENT AND COMMITMENT TO STUDENT SUCCESS, SAFETY AND WELL-BEING

Include a statement that refers the student to the "TCNJ Student Support Resources and Classroom Policies" webpage. Instructors are encouraged to include the following statement in their syllabus: "The TCNJ community is dedicated to the success, safety and well-being of each student. TCNJ strictly follows key policies that govern all TCNJ community members rights and responsibilities in and out of the classroom. In addition, TCNJ has established several student support offices that can provide the support and resources to help

students achieve their personal and professional goals and to promote health and well-being. You can find more information about these policies and resources at the “TCNJ Student Support Resources and Classroom Policies” webpage here: <https://academicaffairs.tcnj.edu/tcnj-syllabus-resources/>.

Students who anticipate and/or experience barriers in this course are encouraged to contact the instructor as early in the semester as possible. The Accessibility Resource Center (ARC) is available to facilitate the removal of barriers and to ensure reasonable accommodations. For more information about ARC, please visit: <https://arc.tcnj.edu/>.”