PHY 202 - General Physics II

Instructor: Dr. Romulo Ochoa
Science Complex - P132
Phone: 771-3162 e-mail: ochoa@tcnj.edu
Office Hours: Tuesdays 11:00 a.m. – 2:00 p.m.

Course Description

This is a calculus-based introductory physics course, the second of a two-semester sequence. Topics covered include electric fields and forces, circuits, magnetic fields and forces, electromagnetic waves, light, and optics. 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: "Physics for Scientists and Engineers," Serway and Jewett (10^{th} Ed.)
Electronic homework: WebAssign
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 electric and magnetic fields and the interactions between charges and fields.
1.2. Calculate electric fields from stationary charge distributions.
1.3. Calculate magnetic fields from steady current distributions.
1.4. Construct and analyze simple electronic circuits.
1.5. Draw ray diagrams and use them to analyze simple lens and mirror systems.

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. Understand how scientists support or rule out new ideas and add to the body of scientific knowledge.

3. Experimental Skills

Learning Objectives:

3.1. Students will learn to write well-defined research questions, develop testable hypotheses, and identify the measurable parameters.
3.2. Students will design an experiment (including setup and procedure) that will measure relevant parameters within appropriate experimental error and considering time, safety, and available equipment.
3.3. Students will troubleshoot experimental issues by creating orderly tests to isolate the problem.
3.4. Students will be able to identify the appropriate sensors and/or transducers for data collection using PASCO Universal Interfaces with Capstone software.
3.5. Students will be able to measure and interpret waveforms using oscilloscopes.
3.6. Students will be able to construct, measure, and analyze electronic circuits using breadboards and multimeters.
3.7. Students will be able to characterize lenses and mirrors.
3.8. Students will be able to plot data and mathematical functions in Excel. They will effectively display data using appropriate axes, proper labels, legends, and error bars.
3.9. Students will be able to use Excel to perform statistical analyses of experimental data. They will be able to select appropriate fits to data, perform curve fitting, obtain best fit parameters, and explain the significance of the results.

4. 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:

4.1. Identify the important variables in any given physical problem.
4.2. Develop an appropriate strategy for solving physical problems using fundamental principles rather than secondary formulas.
4.3. Successfully apply the appropriate mathematical methods to implement your solution.
4.4. Evaluate your solutions to determine if they are physically reasonable.
4.5. Develop spatial reasoning in three dimensions.

5. To engage in productive communication and collaboration with peers.

Learning Goals:

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

Course Outline/Schedule

A. Topics:

1. Electric Fields (Ch. 22)
   Properties of electric charges. Coulomb's Law. Electric field lines. Electric field due to an electric dipole. Examples of calculations of electric fields. Point charge in a uniform electric field.
   WebAssign homework problem set Chapter 22.

2. Electric Field of a Continuous Charge Distribution (Ch. 23.1)
   Electric field due to a charged rod. Electric field of a uniform ring of charge. Electric field of a uniformly charged disk.
   WebAssign homework problem set Chapter 23.1

3. Electrical potential.- (Ch. 24)
   Electric potential energy, potential difference, examples of calculations. Equipotential surfaces. Electric potential energy of a system of point charges. Electric potential due to continuous charge distributions.
   WebAssign homework problem set Chapter 24.

4. Current, resistance and direct current circuits.- (Ch. 26 - 27)
   Electric current. Current density. Resistivity and resistance. Ohm's Law. Power in circuits. Work energy and electromotive force. Series and parallel circuits. Kirchhoff's rules. Capacitance and capacitors.
   WebAssign homework problem sets Chapter 26 & Chapter 27.

Test 1 (TBA)

5. Magnetic fields.- (Ch. 28)
   Magnetic force on a charge. Magnetic field lines. Discovery of the electron. Motion of charged particles in magnetic fields. Magnetic force on a current-carrying wire.
   WebAssign homework problem set Chapter 28.

6. Sources of Magnetic fields.- (Ch. 29)
   The Biot-Savart Law. Calculations of magnetic fields. Forces between parallel conductors.
   WebAssign homework problem set Chapter 29.

7. Gauss's Law, Ampere's Law, and Faraday's Law.- (Ch. 23, Ch. 29, and Ch. 30)
   Electric flux. Gauss's Law. Applications of Gauss's Law. Ampere's Law. Faraday's law of induction. Demonstrations of induction. Motional emf. Lenz's law.

8. Electromagnetic Waves.- (Ch. 33)
   Maxwell's equations. Traveling electromagnetic waves. Sinusoidal waves. Energy carried by electromagnetic waves. Momentum and radiation pressure. The spectrum of electromagnetic waves.

Test 2 (TBA)

9. The Nature of Light and the Principles of Ray Optics.- (Ch. 34)
   Ray approximation if ray optics. Reflection and refraction. Index of refraction. Dispersion. Total internal reflection.
   WebAssign homework problem set Chapter 34.

10. Image Formation.- (Ch.35)
    Types of images. Reflection by plane and spherical surfaces. Refraction by thin lenses. Graphical methods. Optical instruments.
    WebAssignhomework problem set Chapter 35.

11. Wave optics.- (Ch. 36-37)
    Young's double slit (interference) experiment. Coherence. Interference from thin films. Michelson's interferometer. Diffraction from a single slit. Diffraction by a circular aperture. Diffraction gratings. X-ray diffraction. Polarization.
    WebAssign homework problem sets Chapter 36 & Chapter 37.

Final Exam (TBA)

B. Laboratory:

Lab 1. Coefficient of linear expansion. Review of Excel.
Lab 2. Coulomb's Law.
Lab 3. Simulation on electric fields & forces. Equipotential lines.
Lab 4. Capacitance and Capacitors.
Lab 5. Peer instruction. Pre-test practice.
Lab 6. Resistivity and Resistance: Ohmic and non-ohmic devices
Lab 7. Series and parallel circuits.
Lab 8. Magnetic Force on a Current-Carrying Wire.
Lab 9. Peer instruction. Pre-test practice.
Lab 10. Magnetic Fields due to Coils.
Lab 11. Faraday's Law.
Lab 12. Standing Waves.
Lab 13. Reflection and Thin lenses.
Lab 14. Interference and Diffraction of light

Grading

1. Electronic homework (10% of course grade)
2. Tests (35% of course grade)
3. Final exam (30% of course grade)
4. Active class participation such as clicker questions and peer instruction (3% of course grade).
5. Lab. grade (22% of course grade)

For lab grade student must complete in a satisfactory manner the laboratory exercises (20% of course grade); and prepare 1 (one) formal report (2% of lab grade). 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, 4th Ed., J. Wiley & Sons, 2015.
Feynman, R., The Feynman Lectures on Physics, Vols. 1, 2, & 3, CA, Addison-Wesley, 1989.
Walker, J. "Halliday and Resnick Fundamentals of Physics," 10th Ed., J. Wiley & Sons, 2013.
Wolfson, R. Essential University Physics, 3rd Ed., Pearson, 2016.
Young and Freedman, University Physics 14th Ed., New York, Pearson, 2016.

SELECTED TCNJ POLICIES

Final Examinations

The final exam is not scheduled until the middle of the semester. Therefore do not plan on any travel until after the last day of the exam period. TCNJ's final examination policy is available on the web:

http://policies.tcnj.edu/policies/digest.php?docId=9396

Attendance

Every student is expected to participate in each of his/her courses through regular attendance at all class sessions. It is further expected that every student will be present, on time, and prepared to participate when scheduled class sessions begin. While attendance itself is not used as a criterion for academic evaluations, grading in this course is based on participation in quizzes to be given at the beginning of several classes. No make-ups or extensions will be given unless a student has a genuine emergency. If a student misses an exam or assignment deadline they must contact the instructor within 36 hours to explain the situation; otherwise the student will earn a zero for that exam or assignment.
Students who must miss classes due to participation in a field trip, athletic event, or other official college function or for a religious holiday should arrange with their instructors for such class absences well in advance. In every instance, however, the student has the responsibility to initiate arrangements for make-up work.

TCNJ's full attendance policy is available at: **http://policies.tcnj.edu/policies/digest.php?docId=9134**

Academic Integrity Policy

Academic dishonesty is any attempt by the student to gain academic advantage through dishonest means, to submit, as his or her own, work which has not been done by him/her or to give improper aid to another student in the completion of an assignment. Such dishonesty would include, but is not limited to: submitting as his/her own a project, paper, problem set, report, test, or speech copied from, partially copied, or paraphrased from the work of another (whether the source is printed, under copyright, or in manuscript form). Credit must be given for words quoted or paraphrased. The rules apply to any academic

dishonesty, whether the work is graded or ungraded, group or individual, written or oral. TCNJ's academic integrity policy is available at: **http://policies.tcnj.edu/policies/digest.php?docId=9394**

Americans with Disabilities Act (ADA) Policy

Any student who has a documented disability and is in need of academic accommodations should notify the professor of this course and contact the Office of Differing Abilities Services (609-771-2571). Accommodations are individualized and in accordance with Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1992.TCNJ's Americans with Disabilities Act (ADA) policy is available at: **http://affirm.pages.tcnj.edu/files/2011/08/Americans-with-Disabilities-Act-4.7.10.docx**