PHYS 201: Introductory Physics II (Rev. 5)

Physics 201: Introductory Physics II is an algebra-based course that provides an overview of oscillatory motion, thermodynamics, and electricity.

Prerequisite

PHYS 200 or PHYS 204 or equivalent.

Course Syllabus

PHYS 201

Learning Outcomes

Upon successful completion of this course, you should be able to

- explain thermal expansion and solve problems of linear and volume change, for solids and liquids, resulting from change in temperature.
- describe the ideal gas law and solve problems involving changes in mass, volume, pressure, and temperature of gases.
- define latent heat and specific heat capacity and apply them to solving problems in calorimetry.
- outline and interpret the first and second laws of thermodynamics and use them to solve problems involving heat engines.
- define the electric charge and use Coulomb's law to compute the electric forces between static point charges.
- describe the electric field and the electric potential due to a set of static point charges and use algebra to solve related problems.
- define voltage, current, and resistance and solve problems involving Ohm's law and Kirchhoff's rules to analyze direct current circuits.
- define capacitance and solve problems involving the charging and discharging of capacitors.
- demonstrate skills related to performing simple experiments in thermodynamics and electricity, including experimental setup, data acquisition, data analysis, and communication of scientific results.

Course Outline

Physics 201 consists of the following five units:

- **Unit 1:** Simple Harmonic Motion
  - Simple Harmonic Motion

- The Simple Pendulum
- Damped Harmonic Motion
- Forced Vibrations and Resonance

- **Unit 2: Heat and Kinetic Theory**
  - Heat and Temperature
  - Thermal Expansion
  - Ideal Gas Law
  - Kinetic Theory
  - Phase Change
  - Heat and Thermal Energy
  - Specific Heat and Latent Heat
  - Heat Transfer

- **Unit 3: Thermodynamics**
  - The First Law of Thermodynamics
  - The Second Law of Thermodynamics and Heat Engines
  - Entropy and the Second Law of Thermodynamics

- **Unit 4: Electrostatics**
  - Electrically Charged Bodies
  - Coulomb's Law
  - Electric Field
  - Electric Potential Energy and Potential Difference
  - Electric Dipoles
  - Capacitors

- **Unit 5: Circuit Theory**
  - Electric Current
  - Resistance and Ohm's Law
  - Resistance and Resistivity
  - Electric Power
  - Resistors in Series and Parallel
  - EMF and Terminal Voltage
  - Kirchhoff's Rules
  - Capacitors in Series and Parallel
  - Ammeters and Voltmeters
  - Wheatstone Bridge

Course Materials

- EText: Giancoli, D. C. (2014). Physics: Principles with applications (7th ed.). Boston, MA: Pearson.

- Physics 201 Study Guide
- Physics 201 Home Lab Manual
- Physics 201 lab kit

Laboratory Component

Lab work is an important component of the introductory physics course, as it emphasizes the relation between theoretical and empirical work in physics. The lab component for this course is based on the home lab concept, which involves performing hands-on experiments outside the conventional lab setting. The following six experiments are meant to go with the course material and may be conducted in a place of your choice.

- **Lab 1:** The Simple Pendulum
- **Lab 2:** Thermal Expansion of Water
- **Lab 3:** Charles's Law
- **Lab 4:** Specific Heat and Heat of Fusion
- **Lab 5:** Ohm's Law
- **Lab 6:** Charging and Discharging of a Capacitor

Equipment and Materials

Most of the material and equipment required for the experiments in this course are packaged in a lab kit, which you can request from the AU Science Lab. The lab kit should be mailed to you shortly after you request it. Sometimes there will be a waiting list if the demand for kits is high. Note that you should be able to perform the first experiment without the need for the lab kit. You are expected to provide additional materials in the form of common household items, and you will need a personal computer with a USB port to log your data.

The following is a list of the lab kit contents:

- multimeter (model may vary)
- multimeter cables
- clips
- “Go! Temp” temperature sensor
- circuit board
- circuit board cables
- light bulbs
- large ohm resistors
- protractor
- 10 mL graduated cylinder
- 100 mL graduated cylinder
- stopwatch
- cork & pipette
- plastic dropper

The following is a list of the household items required:

- computer (PC or MAC) with a USB port
- dental floss
- measuring tape or meter stick
- coins (about 30 pieces)
- medium-size glass bottle (250 - 350 mL in volume)
- bag of crushed ice
- cable salt
- clear adhesive tape
- clear large-size plastic cup
- juice straw
- paper (or Styrofoam) cup
- plastic spoon

Lab Software

The home lab experiments of PHYS 201 will require the Logger *Pro* 3 software by Vernier. The software provides interface with sensors, which allows monitoring real-time data on the computer. The software is also used to analyze experimental data and to generate graphs for the lab report.

Lab Report

The lab report is an effective way to communicate important experimental results and conclusions. There is little point in doing a wonderful experiment with great results if you cannot effectively

communicate your method and findings to others. Although you have some freedom in preparing your lab report, make sure to include the following sections:

- **Cover Page** – Create a cover page for your lab report that includes the title of the experiment, your name, student ID, and date.
- **Introduction** – Provide a concise theoretical background.
- **Procedure** – Describe your procedure in your own words.
- **Pictures** – Include clear pictures (and/or videos) of your setup.
- **Data** – Organize and present the data you collect in the experiment. Also provide a description of the behaviour and apparent trend of the collected data.
- **Analysis and Discussion** – Give clear and detailed analysis of your data. Make sure to include sample calculations, especially for calculated columns in data tables. You may also need to produce graphs and perform appropriate fits. Do not forget to provide reasonable error analysis of your results and a discussion of measurement uncertainties.
- **Conclusion** – Present a summary of your findings and results.
- **Questions** – Provide detailed answers to the questions at the end of the lab.

Lab Safety

Appropriate care should be taken with moving objects, hot and cold liquids, and other potentially hazardous situations and materials. No materials used are to be connected to electrical power outlets. The level of risk involved in doing these labs is comparable to that of day-to-day activities, and care has been taken to avoid suggesting activities that produce hazards. It is your decision to proceed with any experiment, and in making that decision, you control your situation and assume any risks involved.

You are expected to complete the Workplace Hazardous Materials Information System (WHMIS) training and acknowledge completion of WHMIS by checking the box on the course home page and uploading your certificate of completion prior to starting the labs.

Evaluation

Your final grade in PHYS 201 is based on the marks you achieve on two assignments, six lab reports, and two invigilated exams. You must achieve at least fifty percent (50%) on the final examination and on the laboratory component, and an overall course grade of at least fifty percent (50%), to pass the course. Students who do not achieve a minimum passing grade on the final examination are allowed to write one supplemental examination. There is a fee for this service.

The following chart summarizes the evaluation activities and their credit.

Activity	Credit Weight
Assignment 1	10%
Assignment 2	10%
Lab 1	3.33%

Lab 2	3.33%
Lab 3	3.33%
Lab 4	3.33%
Lab 5	3.34%
Lab 6	3.34%
Midterm Exam	20%
Final Exam	40%
Total	**20%**

Assignments

The two assignments are each worth 10% of your final grade. Assignment 1 covers Units 1–3 and Assignment 2 covers Units 4–5. Although you may find it convenient to answer the assignment problems in the briefest way possible, you should get into the habit of showing all your work. This strategy enables the marker to identify where you are having trouble with concepts or mathematical skills. Once you have answered all the questions in a particular assignment, submit it for marking by uploading it to the appropriate drop box on the course home page. Scanned copies of your handwritten solutions are acceptable.

Examinations

You are required to write two online-invigilated exams (midterm and final). Please request your exams well in advance of the dates you intend to complete them.

The midterm and final exams are both closed-book examinations to be completed online without any printed material or electronic devices outside of the invigilation system (e.g., cell phone, smartwatch, camera, tablet, etc.). A standard scientific calculator is permitted. Key formulas will be provided in the online exam. Any scrap paper you use during the exam must be destroyed at the end of the exam. Make sure you have your student ID number and picture ID with you at your exam.

The midterm exam is worth 20% of your grade and covers Units 1–3 of the Study Guide. It consists of sixteen (16) multiple-choice questions. A maximum of two (2) hours is allowed to write the midterm exam. The final exam is worth 40% of your grade and covers all units (1–5) of the Study Guide, with more emphasis on the second half of the course. The exam consists of twenty-five (25) multiple-choice questions. A maximum of three (3) hours is allowed to write the final exam. Sample exams (with formula sheets and solutions) are available under “Resources” on the course home page.

Course Coordinator

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