AP® Physics C–Electricity and Magnetism

Syllabus 2

Lecture–Discussion: Monday, Wednesday, Friday. 50 minutes each. Two-hour labs: Tuesdays.

Text

Physics, Resnick, Halliday, and Krane; 4th Ed. New York: John Wiley Vols. I and 2

AP® Physics C is a national calculus-based [C6] course in physics. The syllabus for this course is designed by the College Board. This course is equivalent to the pre-engineering introductory Physics course for the university students. The emphasis is on understanding of the concepts and skills and using concepts and formulae to solve problems. Laboratory work is an integral part of this course. Students engage in inquiry-based activities to develop their understanding of the material of the course. Students work together in small groups to solve problems. Students present solutions to the class.

C6—Evidence of Curricular Requirement: Introductory differential and integral calculus is used throughout the course.

Final Grade

Final grade will be determined from the combination of the following scores.

Quizzes	40%
Homework	20%
Lab	20%
Final Exam	20%

Labs: There is a two-hour lab every week. The lab report is graded on the student's participation in the actual experiment and the written report.

Students must save all the graded lab reports. They will need to present the saved lab reports as a proof of having done these labs when they seek credit for this course in college. [C8]

C8—Evidence of Curricular Requirement: The course includes a laboratory component comparable to a semester long, college-level physics laboratory. Students spend a minimum of 20% of instructional time engaged in laboratory work. A hands-on laboratory component is required. Each student should complete a lab notebook or portfolio of lab reports. Note: Online course providers utilizing virtual labs (simulations rather than hands-on) should submit their laboratory materials for the audit. If these lab materials are determined to develop the skills and learning objectives of hands-on labs, then courses which use these labs may receive authorization to use the "AP" designation. Online science courses authorized to use the "AP" designation will be posted on the AP Central Web site.*

All ten of the following lab experiments will be performed.

1. Electrostatics—Ordering the given materials in the order of their electronegativity
2. Mapping Electric Fields: Plotting equipotential and field lines; 3D landscape
4. Ohm's Law and Internal Resistance of a Battery
5. Properties of Series and Parallel Resistive Circuits
6. RC Circuit—Build the circuit and find the time-constant by curve-fitting techniques

7. Magnetic Field Lines—prediction and plotting for various magnetic configurations
8. Ampere's Law—Straight wire and circular current loop
9. Magnetic Field Due to a Slinky—Use Hall probe
10. Determination of BH for the Earth's Magnetic Field

Each lab will require:

- The formation of an hypothesis or hypotheses, based on in-class discussion of the presented problem or focus of each experiment
- Design of an experiment, also based on in-class discussion, to test the hypothesis or hypotheses
- Collection of data and observations
- Calculations using the collected data
- Conclusions about how well the hypothesis or hypotheses held up based on the experiment(s)
- Class discussion of variance and error analysis
- Written report **[C7]**

C7—Evidence of Curricular Requirement: The course utilizes guided inquiry and student-centered learning to foster the development of critical thinking skills.

Jan. 8–15

Electric Charge

- Coulomb's Law
- Conductors and Insulators
- Conservation of Charge

Jan. 16–24

Electric Field (E)

- Due to a Point Charge
- Due to Charge Distribution
  - Discrete
  - Continuous
- Electric Field Lines
- Electric Dipole **[C1]**

C1— The course covers electricity and magnetism in depth and provides instruction in each of the five content areas outlined in the Course Description: Evidence of Curricular Requirement: Electrostatics

Jan. 25–31

Gauss' Law

- Area Vector
- Electric Flux
- Gauss' Law Applications **[C1]**

C1— The course covers electricity and magnetism in depth and provides instruction in each of the five content areas outlined in the Course Description: Evidence of Curricular Requirement: Electrostatics

Feb. 1–16

Electric Potential Energy (UE) and Potential (V) **[C2]**

- Electric Potential Energy
  - Two-Point System
  - Many-Particle System
- Electric Potential (V)
  - Point Charge
  - Charge Distribution
    - Discrete
    - Continuous
- Relationship Between V and E
- Electrical Properties of a Charged Conductor

C2— The course covers electricity and magnetism in depth and provides instruction in each of the five content areas outlined in the Course Description: Evidence of Curricular Requirement: Conductors, capacitors, and dielectrics

Feb. 19–28

Capacitance **[C2]**

- Capacitor
- Capacitance of
  - Parallel Plate Capacitor
  - Cylindrical Capacitor
  - Spherical Capacitor
- Capacitors in Series and Parallel
- Energy Stored in Capacitor
- Energy Stored in Electric Field
- Capacitors with Dielectric

March 1–9

DC Circuits [C3]

- Electric Current
- Ohm's Law
- Resistors in Series and Parallel
- Energy Transfer
- Kirchoff's Rules
- RC Circuits

C3— The course covers electricity and magnetism in depth and provides instruction in each of the five content areas outlined in the Course Description: Evidence of Curricular Requirement: Electric circuits

March 19–26

Magnetic Fields [C4]

- Magnetic Interactions
- Magnetic Poles or Lack Thereof
- Magnetic Force on a Moving Charge
- Circulating Charge
- Magnetic Force on Electric Current
- Electric Motor

C4— The course covers electricity and magnetism in depth and provides instruction in each of the five content areas outlined in the Course Description: Evidence of Curricular Requirement: Magnetic fields

March 27–Apr 3

Magnetic Field due to Electric Current [C5]

- Long Straight Wire
- Circular Loop
- Solenoid
- Parallel Wires
- Biot-Savart Law and Applications
- Ampere's Law and Applications

C5— The course covers electricity and magnetism in depth and provides instruction in each of the five content areas outlined in the Course Description: Evidence of Curricular Requirement: Electromagnetism

Apr 4–Apr 18

Faraday's Law of Induction [C5]

- Electromagnetic Induction

- Lenz's Law Applications
- Electric Generator
- Transformer

Apr 19–Apr 30

Inductance [C5]

- Self-inductance
- LR-Circuits
- Energy Stored in a Magnetic Field
- LC-Circuit and Electromagnetic Oscillations

C5— The course covers electricity and magnetism in depth and provides instruction in each of the five content areas outlined in the Course Description: Evidence of Curricular Requirement: Electromagnetism

May 1–4

Maxwell's Equations [C5]

- The Basic Equations of Electromagnetism
- Displacement Current and Ampere's Law
- Maxwell's Equations

Review

May 7–11 Final Exams