<u>**Curriculum at a Glance**</u>

AP Physics C: Electricity & Magnetism

Level: 400
Grade 12

This Advanced Placement Physics course at Darien is a demanding curriculum, designed specifically to prepare students for the AP Physics C: Electricity & Magnetism exam. In this course, students will receive a strong college-level foundation in physics. Emphasis will be placed on solving a variety of high-level problems, requiring calculus. In order to fully understand the intricacies of physics, the students must be guided by the principals of Scientific Thought and Inquiry to solve not only their homework and in-class problems, but also with their experimental investigations in laboratories. Students will often be required to develop their own experimental procedures to answer questions and solve problems posed to them. This course is designed to provide the student with a college-level, calculus-based, introduction to the study of physics. At the completion of the course, all students will be well prepared to take the College Board's Advanced Placement Physics C Electricity & Magnetism examination. Throughout all class activities students will present questions for open discussion (among students and with the instructor). These discussions foster an environment of student-centered learning and guided inquiry, as those questions will often times lead to more experimentation on the student's part.

While the main goal of the course is to prepare students to take the A.P. exam, it is further intended that upon the completion of the course the students will also be able to:

- Read, understand and interpret both mathematical and graphical information.
- Develop problem-solving skills, which are reflected by the formulation of questions and hypotheses, and the analysis the results of those experiments.
- Describe and explain the steps needed to fully analyze a given physics problem or situation and explain those steps in both a mathematical, experimental and verbal manner.
- Use calculus to fully analyze and solve complex mathematical application problems
- Design and perform experiments that analyze a given problem or situation, taking into account experimental uncertainties and the limitations of the theoretical models in use.

Unit Name & Description	Content and/or Skills
Unit 1 Charge and Capacitors	● Electric charge ● Conservation of charge ● Capacitors ● Dielectrics ● Energy stored in capacitors ● Capacitor circuits: series, parallel, & complex
Unit 2 Current and Resistance	● Electric current ● Current density ● Drift speed ● Resistance & Resistors ● Electric Power ● Resistor Circuits: series, parallel, & complex ● Voltmeters & Ammeters ● Using Kirchhoff's Laws to solve complex circuit problems
Unit 3 RC Circuits	● Discharging RC circuits ● Charging RC circuits ● Solving differential equations to derive equations for RC analysis ● Graphical Analysis of RC circuits ● T = 0, transient state, & steady state analysis of RC circuits
Unit 4 Electric Force and Field	● Electric Force ● Electric Field ● Particles in uniform E-fields ● Force & Field superposition ● Equilibrium problems
Unit 5 Magnetic Force and Field	● Magnetic Force ● Single charges ● Current carrying wires ● Trajectories of charged particles in magnetic fields ● Parallel wire analysis

Unit 6 Electric Potential	● Electric Potential ● Work done by the Electric Field ● Particles accelerated by E-fields
Unit 7 Charge Distributions: Fields and Potentials with Calculus	● Using calculus to derive E-fields from charge distributions: rings, arcs of charge, lines, disks ● Using calculus to derive Potentials from charge distributions: rings, arcs of charge, lines, disks ● Finding potential from E-fields with calculus ● Finding E-fields from potential with calculus
Unit 8 Gauss' Law	● Electric Flux ● Using Gauss' Law to derive expressions for E-fields: ○ Point charges ○ Sheets / plates of charge ○ Cylinders of charge ○ Spheres of charge
Unit 9 Capacitors, Magnetic Fields from wires, and Ampere's Law	● Using calculus to derive capacitance equations for: ○ Parallel-plate capacitors ○ Cylindrical capacitors ○ Spherical capacitors ● Torque on loops of wires ● Biot-Savart Law ● Ampere's Law: straight wires, solenoids, & toroids
Unit 10 Electromagnetic Induction	● Magnetic Flux ● Faraday's Law of Induction ● Lenz' Law ● Wires on rails ● Induced E-fields ● Applications of Faraday's Law to solve problems
Unit 11 Inductors in Circuits	● Inductors ● Energy in B-fields ● Energy density ● RL Circuits

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