AP Physics C Course Syllabus

Scoring Components		Page(s)
SC 1	The course covers Newtonian mechanics in depth and provides instruction in kinematics.	3
SC 2	The course covers Newtonian mechanics in depth and provides instruction in Newton's Laws of motion.	3
SC 3	The course covers Newtonian mechanics in depth and provides instruction in work.	3
SC 4	The course covers Newtonian mechanics in depth and provides instruction in energy.	3
SC 5	The course covers Newtonian mechanics in depth and provides instruction in power.	3
SC 6	The course covers Newtonian mechanics in depth and provides instruction in systems of particles.	3
SC 7	The course covers Newtonian mechanics in depth and provides instruction in linear momentum.	3
SC 8	The course covers Newtonian mechanics in depth and provides instruction in circular motion.	3
SC 9	The course covers Newtonian mechanics in depth and provides instruction in rotation.	3
SC 10	The course covers Newtonian mechanics in depth and provides instruction in oscillations.	4
SC 11	The course covers Newtonian mechanics in depth and provides instruction in gravitation.	4
SC 12	Introductory differential and integral calculus are used throughout the course.	2- 4
SC 13	The course utilizes guided inquiry and student-centered learning to foster the development of critical thinking skills.	2, 3
SC 14	Students spend a minimum of 20% of instructional time engaged in laboratory work	2
SC 15	A hands-on laboratory component is required.	2-5
SC 16	Each student should complete a lab notebook or portfolio of lab reports.	2

AP Physics C Course Syllabus

Course Introduction

Textbook:

Giancoli, Douglas C. *Physics for Scientists and Engineers, 4/E*. Upper Saddle River, NJ: Prentice Hall.

Study guide by the teacher (focus & reinforcement of key concepts)

AP® Physics C is a national calculus-based **[SC12]** 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 the concepts and skills and using the concepts and formulae to solve problems. Laboratory work is an integral part of this course.

Course Design, Objectives, and Strategies

The goal in the AP Physics C course is to provide an excellent first-year college-level calculus-based physics education. **[SC12]** Students coming out of this course should have a strong conceptual understanding of physics and well-developed skills in performing and analyzing laboratory experiments. They should also be able to apply their understanding to approach and solve problems that are essentially new to them. **[SC13]**

Organization around Experiments:
The course is organized around experiments rather than physics topics. Each experiment incorporates several aspects of physics, so students don't see them as isolated examples of particular concepts. The course has a hands-on laboratory component covering an array of experiments. **[SC15]** Instead, students learn to look at a physical situation and see how it involves principles of dynamics, kinematics, energy, etc. Although this is not the best way to introduce a new powerful concept, such as energy conservation, our students are already familiar with the basic tools of physics. We don't want to simplify our experiments to highlight a particular concept to make it clear. Instead, we want our students to deepen their understanding and be able to pick out familiar concepts from more complicated (and realistic) situations**. [SC13]** Early in the course, we use experiments to introduce new topics, such as air resistance and rotation. After seeing new phenomena in the lab, there is motivation to explore them in class through demonstrations and theory.

Course Evaluation
Your grade will be based on the following:
Exams 40%
Homework 20%
Laboratory 20%
Final ……..................... 20%

Laboratory
Each week students will work in small groups to perform a 2 hour student-conducted, hands-on laboratory assignments, but each student must write his or her own report. **[SC14 & SC15]** Students are to keep a portfolio of all laboratory investigations and reports. **[SC16]** Laboratories are included in the schedule below. Most labs begin as a problem for which the students must propose and develop their own solution. They then conduct an experiment to test their ideas, make observations, and take

measurements. Finally, they form conclusions based on their collected measurements, observations, and data and error analysis. **[SC13]**

Each lab will require:

- The formation of a hypothesis or hypotheses based on in-class discussion of the presented problem or focus of each experiment;
- Design of an experiment or multiple experiments, 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;
- Class discussion of variance and error analysis; and
- A written report.

<u>Course Planner: Scope and Sequence</u>

Topic 1: Introduction; Units and Measurements, Scalars and Vectors, relative motion.
Students will use trigonometry and geometry to determine inaccessible heights and distances.
Labs: Scientific Method—Students duplicate and "rediscover" Galileo's proof of equal acceleration of all falling bodies. Students will determine volumes and densities of various solids and liquids.

Topic 2: Kinematics in 1D; Kinematics in 2D-Projectiles. **[SC1]**
Students integrate Force–Displacement, velocity and acceleration graphs and equations. **[SC12]**
Labs: A Projectile in Motion—Students study range and "hang time" of projectiles using a launcher. Students will determine the position of a ball falling to the floor from rolling down a ramp off a table. Show derivative/integral relationships between position, velocity, and acceleration. **[SC13]**
Predict and reproduce kinematics graphs with motion detector.

Topic 3: Mechanics and Newton's Laws of Motion- Force and Mass, Friction, Drag Force **[SC2]**
Labs: Students will use Atwood's machine to demonstrate and verify Newton's first/second laws. Students will evaluate friction on an incline. A study of rockets.

Topic 4: Work and Energy-Kinetic, Potential, elastic; Conservation of Energy-conservative vs. non-conservative forces **[SC3 & SC4]**
Labs: Students will prove transfer of potential to kinetic energy using a launch ramp and steel ball. The lab will tie in to projectile motion. Students will demonstrate Hooke's law. Students will perform "student power" lab using stairs. **[SC5]** Students will determine work done by a variable force. **[SC12]**

Topic 5: Momentum (conservation), Impulse and Collisions- 1D and 2D; Systems of Particles **[SC6 & SC7]**
Labs: Students will use Pasco cars to demonstrate conservation of momentum.
Students will use Pasco cars to investigate impulse.

Topic 6: Rotational Kinematics, Rotational Dynamics, and Circular Motion **[SC8 & SC9]**
Students will investigate: Rigid Bodies, Moment of Inertia and Torque, Rotational Variables and Newton's Second Law, Angular Momentum, Conservation of Angular Momentum, Rotational Equilibrium, Mechanical Equilibrium, Rolling Motion.
Labs: Students will use a pulley and weight to investigate moment of inertia.
Students will use a pulley and weight to study conservation of angular momentum.

Topic 7: Simple Harmonic Motion/Oscillations **[SC10]**
Kinematics, Dynamics, Simple Pendulum, Spring Mass System, Physical Pendulum.
Labs: Students will use a spring/systems of springs–mass system to study oscillations.
Students will use a motion detector to model oscillations.

Topic 8: Gravitation and Satellite motion **[SC11]**
Newton's Law of Gravitation, Gravitational Potential Energy, Motion of Planets and Satellites, Kepler's Laws, Critical and Escape Velocities.
Labs: Students will do a pendulum lab to determine *g*.
Students will use software to model elliptical orbits and use calculus to demonstrate that Kepler's second law is equivalent to the law of conservation of angular momentum. **[SC12]**

Review and Final