"*We choose to go to the moon in this decade and do the other things, not because they are easy, but because they are hard, because that goal will serve to organize and measure the best of our energies and skills, because that challenge is one that we are willing to accept, one we are unwilling to postpone, and one which we intend to win."*

---John Fitzgerald Kennedy

Instructor: Dr. Vincent M. Stumpo Year: 2008-09

AP Physics C Mechanics Syllabus

Course Philosophy: The study of the physical laws that govern our universe is a wonderfully exciting endeavor. I hope that you will come to realize this in the coming year. Many of you may believe that science is simply about memorizing facts and equations, and pushing calculator buttons. Although Physics does express itself through the language of mathematics, it is a language that can be quite elegant. However, in order to enjoy science and to master the desired skills, one must come to an understanding of some basic principles. This requires more than blind memorization and calculator manipulation. In other words, while it is essential to arrive at the correct response to a homework problem, it is equally important to understand the physical situation well enough that you can *verbally* explain it to another individual. Using formulas whose origins, meanings, and application limitations are unknown to you will significantly limit your deeper understanding.

Physics requires an interesting blend of critical thinking and imagination. The reward is that, with hard work, talents are nurtured that will prove invaluable to whatever career you pursue. Throughout the year, I will act as your guide on this exciting journey. You must supply the effort, but please seek my assistance whenever it is needed.

Course Requirements: 1) Text: *Physics for Scientists & Engineers with Modern Physics*, Raymond A. Serway, Saunders College Publishing, 0-03-031353-8

2) Large Classroom Notebook (Bound)
3) Large 3-ring Binder (Homework)
4) Scientific calculator
5) Consistent Work

Grading Procedure: Your First semester grade will be determined by the usual combination of assessment methods. Their first semester weighting factors are given below.

Major Tests 50%
Quizzes 20%
Laboratory 20%
Homework 10%

AP Exam: All students are required to take the AP Physics C Exam (Mechanics) in May.

Homework Policies: Homework is the most critical component of the learning process. The following policies are necessary to remain in good standing in this class.

1. Assignments have due dates at approximately one to two week intervals. It is the student's responsibility to check homework responses in appropriate solution keys.

2. Despite the extended nature of the assignments it is imperative that students perform their homework, whether reading and/or writing, on a daily basis.

3. Since class time is limited, all material on the syllabus cannot be covered during lectures. Students are responsible for **all** material assigned as textbook readings.

4. Effort estimates for assignments are a minimum of 45 per night. Written assignments must be neat, complete, and timely. Tardy assignments will not be accepted for full credit. Completeness implies full sentence responses and showing all work used to generate an answer. I suggest using a pencil. Missing assignments receive a zero grade.

5. Lab reports must be computer generated and follow the standard laboratory format as outlined in a separate handout. Labs may be done with partners, but each student is responsible to write his/her own, individual lab report.

6. All submitted assignments must begin with the student's name, the date, the class title, and the period.

7. When returned, homework (and all submitted items: tests, quizzes, labs etc.) is to be stored in your 3-ring binder.

8. Study groups can be effective. However, when a student submits an assignment, he/she is stating that the material submitted has been fully comprehended. Therefore, joint submissions and plagiarism are unacceptable.

Classroom Policies:

1. Daily *prepared* attendance is mandatory. Students who miss class time place themselves at a learning disadvantage.

2. The student is solely responsible for any material covered or announcements made during their absence.

3. Inappropriate, disrespectful, or dishonest behavior is unacceptable.

4. Cheating or plagiarism will result in zero credit for the assessment. Such incidents will be referred to the Honor Council.

AP Physics C Mechanics Outline

I. **Motion**

A. Units and Measurements

1. Metric Units: Fundamental and Derived
2. Metric Prefixes
3. Significant Digits: Data and Arithmetic
4. Mass, Weight, and Density

B. Mathematical Review: Vectors, Graphing, Differentiation, Integration

1. Vectors vs. Scalars
2. Vector Addition: Perpendicular Component Method
3. Vector Multiplication: Scalar and Vector Product
4. Unit Vector Notation: i, j, k
5. Basic Graphing: Scales, Slopes, Direct & Indirect Proportions
6. Review of basic Calculus: Differentiation and Integration

C. Kinematics

1. Kinematic Vectors: Displacement, Velocity, and Acceleration
2. Average vs. Instantaneous Quantities
3. Equations of Motion and their Application: Constant Acceleration
4. Graphical Analysis of Motion: kinematic vector vs. time graphs
5. Two-dimensional kinematics: Projectiles

Lab: Introduction to Pasco Explorer GLX

Lab: P-06 Acceleration due to Gravity

Lab: Displacent, Velocity, and Acceleration via a Motion Sensor

II. Force

A. The Laws of Newton

1. Inertia: The Law of Galileo in contrast to Aristotle
2. Force and Acceleration
3. Newtonian Couples and the Overlooked Clause

B. Friction and Normal Forces:

C. Mechanical Equilibrium: Force Diagrams or Free-Body Diagrams

1. Force Summation on point masses
2. Torque Summation on extended bodies
3. The Inclined Plane
4. Static vs. Dynamic Equilibrium

Lab: P-04 Constant Acceleration Down an Incline

Lab: P-11 Newton's Second Law

Lab: P-13 Atwood's Machine

D. Definitions: Work, Kinetic Energy, Potential Energy (gravitational and elastic), Mechanical Energy and Power

E. Conservation of Mechanical Energy

1. Energy Interconversions
a. Landing Speed of Falling Objects
b. Speed of Object on Inclined Plane w&w/o Friction
2. Escape Velocity

F. Linear Momentum

1. Classical and Newtonian Definitions of Linear Momentum
2. Linear Momentum Conservation & Collisions
3. Impulse

Lab: P-17 Conservation of Momentum

G. Gravitation

1. Universal Gravitation: The Inverse-Square Law
2. The Constant Acceleration of Earth's Surface Gravity (g)
3. Orbiting Objects as Falling
4. Planetary Motion: The Laws of Kepler

H. Circular Motion

1. Uniform Circular Motion and Acceleration
2. Centripetal Acceleration via Similar Triangles and Centripetal Force
3. Debunking Centrifugal "Force"
4. Calculating the value of g by relating universal gravitation and weight
5. Calculating the period of the moon's orbit via centripetal force
6. Units for rotational speed: rot/s, rev/s, rad/s
7. Rotational Kinematics: Simple Analogy to Linear Kinematics
8. Angular Momentum and its Conservation

III Oscillations

A. Simple Harmonic Motion
1. Hooke's Law
2. Comparison of SHM and UCM: The Period of oscillation
3. Time-dependent position, velocity, and acceleration of an oscillator
4. Elastic Potential Energy and Energy Conservation
5. The Simple Pendulum
6. Resonance: The Swing

Lab: P-19 Simple Harmonic Motion
B. Waves
1. Longitudinal and Transverse Waves
2. Wave Parameters and Relationships: wavelength, frequency, velocity,...
3. EMR: Basic Description and The Spectrum