Curriculum Guide

Course 541: College Prep Physics **Level:** Grades 11 & 12

1. Course Structure

This full-year course meets daily. There are no supplementary laboratory periods because investigations are incorporated into regular class periods.

2. Intended Audience

College Prep Physics is an elective course intended for junior/senior students who have completed, or in some cases are currently enrolled in, Algebra I.

3. Course Goals

Students in this course will develop a solid understanding of many of the physical principles which govern our world through the study of the workings of common everyday objects and phenomena and the skills necessary to effectively collect and analyze laboratory data to form meaningful conclusions.

4. Course Objectives

Content:

I. Laws of Motion I
II. Laws of Motion II
III. Mechanical Objects
IV. Fluids and Motion
V. Resonance and Mechanical Waves

Skills:

- Students will demonstrate habits of mind characteristic of physicists, including the constant questioning of how and why things happen in the physical world around them.
- Students will demonstrate an ability to effectively answer questions and clearly explain how and why certain physical phenomena occur.
- Students will become proficient in observing, recording, analyzing, and effectively reporting data collected in the laboratory.
- Students will recognize inherent limitations in experimentation, and they will design procedures that minimize sources of error.
- Students will be able to relate everyday experiences to the laws of physics. For example, students will be able to use Newton's laws of motion to explain why seatbelts and airbags are necessary for automobile safety.

5. Essential Questions

I. Laws of Motion I
- How can graphing motion be used to describe motion?
- How do skaters speed up, slow down and coast?
- Why do objects fall? How far can they fall? How fast can they fall?
- Why do ramps make moving objects up easier?

II. Laws of Motion II
- How can you play on a seesaw alone? How do you balance a seesaw?
- Why do wheels make objects easier to move?
- Why are bumper car collisions fun whereas automobile collisions are not?

III. Mechanical Objects
- How do bathroom and supermarket scales find an object's weight?
- Why don't you fall out of a roller-coaster car when at the top of a loop-the-loop?

IV. Fluids and Motion
- What is the difference between keeping a hot-air balloon up and keeping a helium balloon up?
- How do you get water from your well or reservoir to your bathroom?
- How does obesity contribute to high blood pressure?

V. Resonance and Mechanical Waves
- How does a pendulum keep time?
- How does a rock (quartz) keep time?
- Why do violins have strings of different thicknesses?

6. Course Outline/ Curriculum Map

<u>Quarter 1</u>

I. Laws of Motion I
- Newton's First Law of Motion
- One-Dimensional Linear Motion
  - Horizontal
  - Vertical
  - Graphical Model of Motion
- Newton's Law of Gravity
- Vector Analysis
- Projectile Motion
  - Vector verse scalar measurements
  - Projectiles Launched Horizontally
- Projectiles Launched at an Angle (symmetrical only)

- Newton's Second Law of Motion
- Newton's Third Law of Motion
- Work and Energy

Quarter 2

II. Laws of Motion II
- Newton's Laws of Rotational Motion
- Torque and Center of Mass
- Power and Thermal Energy
- Impulse and Momentum
- Conservation of Momentum
- Conservation of Energy
- Friction
  - Static verse kinetic

Quarter 3

III. Mechanical Objects
- Hooke's Law
- Elastic Potential Energy
- Uniform Circular Motion
  - Centripetal Force and Acceleration
- Apparent Weight

Quarter 4

IV. Fluids and Motion
- Pressure, Density and Temperature
- Atmospheric Pressure
- Archimedes' Principle
- Bernoulli's Principle
- Viscosity
- Poiseuille's Law
- Reynolds Number
  - Laminar Flow
  - Turbulent Flow
- Universal Gravitation and Satellite Motion

V. Resonance and Mechanical Waves
- Natural Resonance
- Simple Harmonic Motion
- Pendulums
- Wave Motion
  - Wave Types
  - Wave Characteristics
- Vibrating Strings and Harmonics
- Vibrating Air Columns and Harmonics

7. Course Text and Other Materials

The text for this course is:

- Hewitt, Paul. **Conceptual Physics**. 9th Ed., Addison Wesley (2002).

Support materials include:

- List support materials here

8. Instructional Methods and Course Activities

Content will be conveyed through:

- Class dialogue and discussion
- Interactive lecture demonstrations
- PowerPoint Presentations
- On-line simulation and Tutorial Activities
- Instructor-designed laboratory investigations

9. Learning Strategies

- Class discussion and problem-solving, accompanied by laboratory experiences, are designed to illustrate and reinforce physical principles learned in class.
- Computer-assisted instruction (interactive lecture demonstrations, microcomputer based laboratories) will be used to increase learning and to support a variety of learning styles.
- The development and effective use of a problem solving strategy will also be used.

10. Assessment

The assessment of students will occur through:

- Evaluation of class preparation and participation
- Laboratory performance including observations, analysis, and reporting of data
- Formal testing and quizzing

11. Course Evaluation

The assessment of this course will occur through:

- Feedback from current students and graduates
- A formal student questionnaire