RHINEBECK CENTRAL SCHOOL DISTRICT
PRIORITIZED CURRICULUM
AP PHYSICS C MECHANICS SYLLABUS

COURSE DESCRIPTION

This course is designed to parallel a first semester calculus based engineering physics class with a hands on laboratory component. There is a high expectation of significant time spent by the student outside of the classroom on homework and laboratory reports. Homework is checked daily. Active participation and commitment by the student and the teacher are mandatory.

ENROLLMENT GUIDELINES

Students enrolled in this class have either taken or are concurrently enrolled in AP® Calculus AB (or equivalent). This course requires the use of differential and integral calculus. Students must be recommended for this class by prior science teacher.

TEXTBOOK:

Halliday, Resnick and Walker. Fundamentals of Physics, 6th Ed. John Wiley and Sons, 2001. ISBN 0-471-32000-5
Note: Corresponding HRW supplements also used as time permits

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LABORATORIES

The lab program is integrated with the theory as much as is permissible. Labs will typically be conducted *at least one day out of a five day week.* When possible, students are required to develop their own hypotheses around the topic of focus, collaboratively develop an appropriate procedure, safely collect and document data, collaboratively analyze data, draw conclusions and present the laboratory in a structured lab report. Labs *are conducted to promote students' use of guided scientific inquiry and discovery of information by posing questions and seeking answers*. Students typically work in groups of two or three for laboratories. Students will keep lab reports in a structured lab portfolio that can be used to document laboratory work when applying for college credit

LAB EQUIPMENT

Includes but not limited to:

- graphing calculators and Vernier Labpro's and peripherals
- recording timers
- timers
- video recorders
- balances
- force scales
- carts
- tracks
- calipers
- stopwatches
- safety equipments

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PROBLEM SOLVING

Part of class time is devoted to students' peer coaching each other to become better problem solvers. A major component of AP® Physics is the development and awareness of one's own critical thinking skills needed to solve physics problems that involve several concepts and strategies. Differential and Integral Calculus are routinely used in problem solving. These skills are invaluable in engineering programs and careers.

COURSE EVALUATION

Exams: 55%
Laboratory 15%
Homework 15%
Midterm and Final 15%

CLASSROOM STRATEGIES EMPLOYED:

Lecture, teacher lead examples, homework clinics, demonstrations, predict, observe and discussions, guided peer problem coaching, whiteboard problems, video clips and discussions, test revisions, one on one problem pointers.

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SCHEDULE/ TOPIC/ LAB COVERAGE PLAN

*Use of Calculus involved

WEEK ONE:

- Introduction to Course Policies and Requirements
- Lab and Classroom Safety
- Introduction to Measurement; Precision, Uncertainty Treatment and Accuracy Methods
- Review of Mathematics and Graphical Methods, Position, Velocity and acceleration (Kinematics)
- Review Part one of summer assignment
- Lab: Measurement and Uncertainty Methods Lab

WEEK TWO:

- Review part 2 of Summer Assignment
- Instantaneous Velocity and Acceleration (Kinematics)
- Graphical Relations (Kinematics)
- *Derivatives and using differential Calculus to determine instantaneous velocity and
- acceleration (Kinematics)
- Constant Acceleration and Freefall (Kinematics)
- Lab: Measuring Motion: use of the recording timer and Labpro
- Lab: Factors that affect period of simple pendulum (inquiry and graph techniques)

WEEK THREE:
*Complete Kinematics
Problem coaching
Laboratories: *Accelerated motion and graphical analysis: Demonstrate the relationship between position, velocity and acceleration for an object accelerating in one dimension
Freefall Lab - time permitted (sometimes done as extra credit)

WEEK FOUR:
Vectors and Vector Skills
Laboratory: Dealing with three dimension vectors: applying vector techniques

WEEK 5:
Two dimensional motion and projectiles
Laboratory: Ring of Fire: projectile lab. Use projectile motion skills to setup a hot wheel jump and get the car through the "ring of fire" on the first try!

WEEK 6:
Circular Motion
Newton's Laws: Static Equilibrium, Newton's First Law, Newton's 2nd Law, Newton's 3rd Law
Laboratory: Newton's 2nd law
Laboratory (if time) Equilibrium in two dimensions

WEEK 7:
Newton's Laws (continued)
Atwood's Machine
Friction
Lab: Friction Lab: exploring static and kinetic friction, verifying data on ramps

WEEK 8:
Lab: Uniform Circular Motion: Verify Centripetal force for a whirling stopper moving in a horizontal circle
*Work and Energy: Work Energy Theorem,
*Power

WEEK 9:
Potential Energy; *Potential Energy Curves; *Force energy relationship
Conservation of Energy
Lab: Demonstration of the Conservation of Energy: Choose from a variety of systems; develop a method of tracking energy variables and analyze in terms of conservation of energy

WEEK 10:
Complete Conservation of Energy
Evaluation of Problem solving strengths and Weaknesses
Review
Midterm

WEEK 11:
Center of Mass, *Systems of Particles and Conservation of Momentum, Impulse
Lab: Impulse momentum project: Collision protection
Improvise a package to protect an egg from a variety of impacts, analyze perform in the context of momentum and impulse

WEEK 12:
Collisions: Elastic and Inelastic (one and two dimensions)
Lab: Conservation of Momentum and Energy in a Collision; Setup a one dimensional collision to verify conservation of momentum and include conservation of energy analysis

WEEK 13:
Rotation: *Angular position, velocity and acceleration, Torque, Rotational Inertia and
Newton's 2nd Law for Rotation
Lab: Atwood Machine revisited: Predict acceleration and compare to measured

WEEK 14:
Parallel Axis theorem, Work, Energy and Power in Rotation; Rolling
Lab: Yoyo lab; Build your own and predict its time of descent

WEEK 15:
Complete Rolling; *Angular Momentum; Conservation of Angular Momentum
Lab: Build a device or arrange a unique demonstration that demonstrates Conservation of angular momentum

WEEK 16:
Revisit Static Equilibrium problems using torque
Begin Gravitation
Lab: Verify Kepler's Laws using planetary position data

WEEK 17:
*Gravitation
Begin *Simple Harmonic Motion (Oscillations)
Lab: Hooke' Law and Simple Harmonic Motion (mass spring); set up a method to use SHM to find mass of an unknown object

WEEK 18:
Simple Harmonic Motion, Simple Pendulum, Torsional Pendulum and Physical Pendulum
Lab: Physical Pendulum: Build your pendulum, predict its period

WEEK 19:
*Problems with Objects experiencing force that varies with velocity (1st order diff eq.)
Note: teacher provided handouts/background is provided here
Review

WEEK 20:
Review
Final