2008-2009
University School
KAP Physics (Physics 140): Classical Physics
KAP Physics Lab (Physics 141): Classical Physics Lab
Instructor – Gordon Loveland
gloveland@us.edu

Course Description

This course is a theoretical and experimental introduction to calculus-based mechanics. It is taught through daily meetings with a 3-hour weekly laboratory session. Topics covered in the course include the kinematics and dynamics of particles, gravitation, work and energy, momentum, rotation, and special relativity. Participants are expected to also enroll in calculus, but we will develop the necessary mathematical tools in class as well. It is a year course.

The text used is Halliday, Resnick and Walker, *Fundamentals of Physics* 8th Edition Extended. Accompanying ancillary material is also used.

The syllabus of the course is that of Physics 140 at Kenyon College, and is essentially that suggested by the College Board for a C-level AP physics course in mechanics. In addition, coverage is given to one dimensional waves, special relativity, and elementary particle theory. The mathematical level of the course is the same level as the Halliday, Resnick, and Walker text, using calculus whenever appropriate.

Exams and Grading Information

Semester 1 Grades and weights:		Semester 2 Grades and weights:	
Exam 1	20%	Exam 1	20%
Exam 2	20%	Exam 2	20%
Exam 3 (Semester Exam)	20%	Exam 3 (Final Exam)	30%
Formal lab	25%	Formal lab or lab exam	20%
Quizzes/Homework/Labs	15%	Quizzes/Homework/Labs	10%

Lab

Students will keep a laboratory notebook that is inspected and signed off at the end of each lab period, and they undergo a formal laboratory evaluation each semester.

Experiments include:

1. Analysis of Experimental Data
2. Acceleration Due to Gravity
3. Projectile Motion
4. Centripetal Force
5. Young's Modulus
6. Air Resistance
7. The Ballistic Pendulum
8. Collisions in One Dimension
9. Collisions in Two Dimensions
10. Rotational Kinematics
11. Rotational Inertia of a Ring
12. Rotational and Gravitational Energy
13. Equilibrium
14. Rotational Collisions
15. Simple Harmonic Motion
16. Angular Simple Harmonic Motion
17. Speed of Sound in Air
18. Elastic Scattering of Particles

19. Inelastic Scattering of Particles
20. The Mass of the Electron

Outline of Topics

I. Newtonian Mechanics

A. Kinematics (including Vectors)
1. Motion in one dimension
2. Motion in two or three dimensions, including projectile motion.

B. Dynamics
1. Newton's Laws of motion
i. Static equilibrium
ii. Dynamics of a single particle
iii. Systems of two or more objects
2. Elasticity

C. Work, energy, power
1. Work and work-energy theorem
2. Forces and potential energy
3. Conservation of energy
4. Power

D. Systems of particles, impulse and linear momentum
1. Center of mass
2. Impulse and momentum
3. Conservation of linear momentum, collisions

E. Circular motion and rotation
1. Uniform circular motion
2. Torque and rotational statics
3. Rotational kinematics and dynamics
4. Angular momentum and its conservation

F. Oscillations and gravitation
1. Simple harmonic motion
2. Mass on a spring
3. Pendulum and other oscillations
4. Newton's law of gravitation
5. Orbits of planets and satellites

II. Relativity

1. Postulates
2. Relativity of time and length
3. Lorentz Transformations
4. Mass, momentum, and energy