University of Connecticut
General Physics 121Q
ECE Equivalent
COURSE SYLLABUS

Instructor: Hans Drenkard
Trumbull High School

Textbook: Serway, Raymond A., and Jerry S. Faughn.2003 College Physics, 6th Edition, Brooks Cole Publishing, Pacific Grove CA

Class Schedule - Classes meet one 47 minute period per day with an additional 47 minute lab period scheduled every fourth day.

Course Grading – Students receive a grade based on the average of their performance on problem solving and conceptual explanation exams, final exam and assessment of their Problem Solving/Lab Journals.

Problem Solving – Class discussions are employed to introduce concepts and develop solution strategies for related problems. Class participation in multiple choice quizzing on the concepts is used by students to evaluate their own conceptual understanding. Problem sets are assigned for each chapter of study. These are completed in the students' Problem Solving/Lab Journals. The assigned problems are listed in the course outline and again summarized at the end.

Lab - Lab activities are all hands on investigations with simple measurement tools to facilitate fundamental understanding. Lab data analyses and conclusions are entered into the Lab/ Problem Solving Journal. Lab activities usually encompass two 47-minute periods. The first of these is an introduction in the context of the material currently under investigation. The second is dedicated to data collection. Lab facilities are made available after school for follow-up investigations and extra help with data analysis. Lab activities are listed within the following outline and are also listed together in a summary at the end of the outline.

Exams – Exams consist of problems similar to those assigned in the textbook. Released AP Test Problems are also used. Typically, the exams are eight questions long. Two of these are conceptual while the remaining six are numerical solutions to proposed problems. Supportive mathematical work and unit agreement must be included for full credit on problem solutions.

Final Exams have three components:

1. Conceptual multiple choice
2. Written problem solving
3. Oral problem solution presentation

COURSE OUTLINE

1) Newtonian Mechanics
   a) Kinematics
      i) Class Discussions –
         (1) Dimension anal Analysis
         (2) Order of Magnitude Estimations
         (3) Displacement, Average and Instantaneous Velocity
         (4) Acceleration
         (5) Graphing motion(x vs. t ,V vs. t)
         (6) Constant Acceleration
         (7) Freely Falling Objects
         (8) Vector Quantities and Components
         (9) Velocity and Acceleration in Two Dimensions (Projectile Motion)
         (10) Relative Motion
      ii) Labs
         (1) Acceleration – How do objects move due to gravity? Students drop several different masses connected to ticker timer tape. Students measure and graphically determine gravitational acceleration and the mass influence.
         (2) Force Vector Table – How do multiple two dimensional forces combine? Students use spring scales oriented at random angles and vector analysis to predict equilibrant force magnitude and direction.
         (3) Projectile Motion – How do projectiles travel? Students predict projectile paths with two-dimensional motion equations and verify using marbles and launch ramps.
      iii) Assignments
         (1) Chapter 1 Problems 3,5,8,13,17,18,23,25,29,31
         (2) Chapter 2 Problems 2,5,6,9,10,13,18,24,26,28,35,40,49.56,62,67,68
         (3) Chapter 3 Problems 3,9,16,18,24,27,29,31,33,39,41,47,49,52,58,61,67
      iv) Exams – Problem Solving and Conceptual Explanations
   b) Dynamics
      i) Class Discussions –
         (1) Forces
            (a) Newton's First and Second Laws, Free Body Diagrams
            (b) Gravity
            (c) Newton's Third Law
            (d) Newton's Law Applications
            (e) Friction
         (2) Energy
            (a) Work and Kinetic Energy
            (b) Potential Energy
            (c) Energy Conservation/ Conservative Processes
         (3) Momentum
            (a) Impulse and Momentum
            (b) Momentum Conservation
            (c) One and two dimensional collisions
         (4) Rotation
            (a) Angular Sped And Acceleration

(b) Angular vs. Linear Quantities
(c) Centripetal Acceleration
(d) Centripetal Forces
(e) Universal Gravitation
(f) Kepler's Laws
(g) Torque and Rotational Equilibrium
(h) Rotational Inertia

ii) Labs
(1) Newton's Second Law – How do net force and object mass affect motion? Students set up lab carts with various masses to be accelerated by various hanging masses. Ticker tape recordings are analyzed to develop the relationships of Newton's Second Law.
(2) Air Track Energy Conservation – Is energy conserved? Students use a sloped frictionless air track and photo gates to determine total energy of a slider. Graphical analysis of results shows constant total energy.
(3) Hot Wheels – How is energy converted and conserved through travel on a Hot Wheels track? Students evaluate the efficiency of a toy car track and predict starting heights to complete track loops and resulting heights from an elastic launcher using energy conservation and efficiency calculations.
(4) Explosion – How is momentum conserved? Students set up lab cart "explosions" and measure exit velocities that demonstrate momentum conservation and Newton's third law.
(5) Centripetal Force –What is the relationship between velocity, path radius and net force acting on a revolving object? Students use hanging masses or spring scales to develop centripetal force relationship for a stopper revolving at the end of a string

iii) Problem Assignments
(1) Chapter 4. Problems 5,9,11,15,19,21,23,29,32,34,38,41,43,47,57,61,69,71
(2) Chapter 5 Problems 3,7,11,13,15,25,32,41,42,43,47,51,57,63,74
(3) Chapter 6 Problems 1,5,8,11,15,17,21,27,31,32,35,41,49,53,59
(4) Chapter 7 Problems 1,2,3,5,7,13,15,17,19,25,28,29,33,39,45,51,53
(5) Chapter 8 Problems 1,3,7,11,17,19,58,62

iv) Exams – Problem Solving and Conceptual Explanations

2) Fluid Mechanics and Thermal Physics
a) Fluids
i) Class Discussions –
(1) Density and Pressure Depth dependence
(2) Archimedes' Principle
(3) Pascal's Principle
(4) Bernoulli's Principle

b) Thermal Physics
i) Class Discussions –
(1) Temperature and Thermal Expansion
(2) Ideal Gas and Avogadro's Number
(3) Kinetic Theory
(4) Specific Heat and Calorimetry
(5) Specific Heat and Work Equivalency
(6) Conduction

(7) Convection Radiation
(8) First Law of Thermodynamics, Work and Energy
(9) Heat Engines and the Second Law of Thermodynamics
(10) Reversible Processes and Entropy

ii) Labs
(1) Brass Specific Heat – How are the specific heats of materials found? Students devise calorimetric method to determine brass specific heat, evaluate results, adjust methods and repeat with revised method

iii) Problem Assignments
(1) Chapter 9 Problems 13,14,15,17,21,25,27,31,35,41,45,51
(2) Chapter 10 Problems 5,11,15,17,21,25,27,29,33,35,39,41,43
(3) Chapter 11 Problems 1,5,7,11,13,15,19,21,25,29,33,43,45
(4) Chapter 12 Problems 3,5,9,11,15,19,21,23,25,27,31,33,37,39

iv) Exams – Problem Solving and Conceptual Explanations

3) Vibrations, Waves and Sound
a) Vibrations
i) Class Discussions –
(1) Hooke's Law Restoring Force
(2) Elastic Potential Energy
(3) Position and Velocity Function of Mass Spring System
(4) Circular Motion as Harmonic Motion
(5) Position, Velocity and Acceleration as Time Functions In Harmonic Motion
(6) Pendulum and Damped oscillations

ii) Lab
(1) Harmonic Motion – How are the different forms of harmonic motion related? Students observe circular motion of a turntable as harmonic oscillations, then create pendulums and mass spring systems that match the period of the turntable

iii) Problem Assignments
(1) Chapter 13 Problems 1,3,11,13,19,25,31,35,39,43,47,55

iv) Exam – Problem Solving and Conceptual Explanations

b) Waves
i) Class Discussions –
(1) Wave Motion, Types and Parameters
(2) String Wave Velocity, Interference and Standing Waves

ii) Class Activity – Students demonstrate the wave parameters of speed, amplitude, reflection, interference and standing waves using phone cords.

c) Sound
i) Class Discussions –
(1) Sound Waves, Characteristics and Speed
(2) Sound Intensity and Intensity Level (dB)
(3) Doppler Effect
(4) Sonic Booms and Shock Waves
(5) Air Column Resonance and Standing Waves

ii) Lab
(1) Sound Speed – How can sound speed be measured? Students measure sound speed by setting up a resonance in an air column and evaluate the sound speed dependence on temperature

iii) Problem Assignments
    (1) Chapter 14 Problems 1,5,7,9,13,,17,19,21,25,29, 33,39,45,47,
iv) Exam – Problem Solving and Conceptual Explanations

PROBLEM ASSIGNMENT SUMMARY

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Chapter 2 Problems 2,5,6,9,10,13,18,24,26,28,35,40,49.56,62,67,68
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LAB ACTIVITY SUMMARY

(1) Acceleration –How do objects move due to gravity? Students drop several different masses connected to ticker timer tape. Students measure and graphically determine gravitational acceleration and the mass influence.
(2) Force Vector Table – How do multiple two dimensional forces combine? Students use spring scales oriented at random angles and vector analysis to predict equilibrant force magnitude and direction.
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(10) Harmonic Motion – How are the different forms of harmonic motion related? Students observe circular motion of a turntable as harmonic oscillations, then create pendulums and mass spring systems that match the period of the turntable.
(11) Sound Speed – How can sound speed be measured? Students measure sound speed by setting up a resonance in an air column and evaluate the sound speed dependence on temperature.
(12) ensions using trigonometry and wave interference principles.