University of Connecticut
General Physics 122Q
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) Electricity and Magnetism
   a) Electrostatics
      i) Class Discussions –
         (1) Charges, Conductors and Insulators
         (2) Coulomb's Law
         (3) Electric Fields
         (4) Electric potential
         (5) Potential due to point charges
         (6) Equipotential Surfaces
         (7) Charged Capacitors
         (8) Capacitor Combinations
         (9) Energy Stored on Capacitors
      ii) Lab
         (1) Electric Field – How does an electric field form around a charged object? Students measure and map electric field lines and equipotential surfaces using voltmeters on a graphite surface
      iii) Problem Assignments
         (1) Chapter 15 Problems 5,9,13,17,19,27,35,39,43,51,57
         (2) Chapter 16 Problems 1,5,9,15,19,21,23,25,29,31,35,41,43,47,53
      iv) Exam – Problem Solving and Conceptual Explanations
   b) Current Electricity
      i) Class Discussions –
         (1) Current, Drift Speed and Ohm's Law
         (2) Resistivity and Temperature Variations of Resistance
         (3) EMF Sources, Energy and Power Cost
         (4) Resistance in Series
         (5) Resistance in Parallel
         (6) Combined circuits and Kirchhoff's Laws.
         (7) RC Circuits
      ii) Labs
         (1) Series Circuits – How do devices connected in series affect circuit current and device voltage? Students create and analyze multiple series circuits.
         (2) Parallel Circuits – How do devices connected in parallel affect circuit current and device voltage? Students create and analyze multiple parallel circuits
      iii) Problem Assignments
         (1) Chapter 17 Problems 5,9,13,17,23,1,39,41,45,49,51,57
         (2) Chapter 18 Problems 1,5,9,13,19,21,27,31,35,37,45,53
      iv) Exams – Problem Solving and Conceptual Explanations
   c) Magnetism
      i) Class Discussions –
         (1) Magnetism, Magnetic field lines
         (2) Magnetic Force on Conductors and Loops
         (3) Charges moving in Magnetic Fields
         (4) Magnetic Fields around Wires, Loops and Solenoids
         (5) Magnetic Flux, Faraday's and Lenz's Laws
         (6) Generators, Motors and Back EMF

(7) AC Power Equivalent and Transformers
(8) Electromagnetic Waves

ii) Lab
(1) Magnetic Field Mapping –How are field lines formed around a magnet? Students use a directional compass and a variety of permanent magnets to map magnetic fields.

iii) Problem Assignments
(1) Chapter 19 Problems 1,7,9,13,19,25,33, 37,41,51 57
(2) Chapter 20 Problems 3,7,11,15,17,21,25,27,29,35, 51
(3) Chapter 21 Problems 1,3,5,39,41,43,45,47,49,51,53,55

iv) Exams – Problem Solving and Conceptual Explanations

2) Light
a) Nature of light
i) Class Discussions –
(1) Wave Nature of light
(2) Reflection and Refraction
(3) Refraction Index
(4) Dispersion and the Rainbow
(5) Total Internal Refraction

ii) Labs
(1) Images, Images, Images – How are virtual images formed behind a flat mirror? Students set up patterns of objects and observe images in multiple mirrors. Reflection law is used to diagram light path to virtual image in mirror
(2) Bending of Light – How does light path change direction due to medium change? Students use semicircular dish of water to observe refraction from a variety of incidence angles including normal. Refractive index is calculated

iii) Problem Assignments
(1) Chapter 22 Problems 3,7,11,15,17,21,27,29,33,39,43,49

iv) Exams – Problem Solving and Conceptual Explanations

b) Optics
i) Class Discussions –
(1) Flat Mirrors and Spherical Concave Mirrors
(2) Spherical Convex Mirrors
(3) Thin Lenses
(4) Lens Systems

ii) Labs
(1) Lens Systems – How are lens systems used to create images of various size? Students determine lens' focal lengths and predict and verify image locations and magnifications using optics bench.

iii) Problem Assignments
(1) Chapter 23 Problems 3,5,9,13,17,21,27,31,35,43,45

iv) Exam - Problem Solving and Conceptual Explanations

c) Light Wave Phenomena
i) Class Discussions –
(1) Double Slit Interference
(2) Thin Film Interference
(3) Diffraction (CDs/DVDs)
(4) Single Slit Interference – Diffraction

(5) Diffraction Grating
(6) Polarization

ii) Lab
(1) Diffraction Grating – How are light patterns from a diffraction grating related to grating spacing and light wavelength? Students use optics bench to determine the grating dimensions using trigonometry and wave interference principles.

iii) Problem Assignments
(1) Chapter 24 Problems 3,9,11,15,17,23,27,33,39,45,47,57

iv) Exam - Problem Solving and Conceptual Explanations

3) Atomic and Nuclear Physics
a) Quantum Physics
i) Class Discussions –
(1) Black Body Radiation and Planck's Constant
(2) Photoelectric effect
(3) X-Rays and Diffraction
(4) Compton Effect
(5) Bohr Atom
(6) de Broglie wavelength
(7) Pauli Exclusion

ii) Problem Assignments
(1) Chapter 27 Problems 3,5,9,13,17,23,27,29,33,37,43,45,47,53
(2) Chapter 28 Problems 1.5.9,11,17,19,25,29,35

iii) Exam - Problem Solving and Conceptual Explanations

b) Nuclear Physics
i) Class Discussions –
(1) Nuclear Size and Properties
(2) Binding Energy and Radioactivity
(3) Decay Processes
(4) Fission and Fusion

ii) Problem Assignments
(1) Chapter 29 Problems 1,5,7,11,15,21,25,35,37,
(2) Chapter 30 Problems 3,11

iii) Exam - Problem Solving and Conceptual Explanations

4) Review and Practice Exams (Approximate Schedule Apr 24- May 10)

PROBLEM ASSIGNMENT SUMMARY

Chapter 15 Problems 5,9,13,17,19,27,35,39,43,51,57
Chapter 16 Problems 1,5,9,15,19,21,23,25,29,31,35,41,43,47,53
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Chapter 29 Problems 1,5,7,11,15,21,25,35,37,
Chapter 30 Problems 3,11

LAB ACTIVITY SUMMARY

(1) Electric Field – How does an electric field form around a charged object? Students measure and map electric field lines and equipotential surfaces using voltmeters on a graphite surface

(2) Series Circuits – How do devices connected in series affect circuit current and device voltage? Students create and analyze multiple series circuits.

(3) Parallel Circuits – How do devices connected in parallel affect circuit current and device voltage? Students create and analyze multiple parallel circuits.

(4) Magnetic Field Mapping –How are field lines formed around a magnet? Students use a directional compass and a variety of permanent magnets to map magnetic fields.

(5) Images, Images, Images – How are virtual images formed behind a flat mirror? Students set up patterns of objects and observe images in multiple mirrors. Reflection law is used to diagram light path to virtual image in mirror

(6) Bending of Light – How does light path change direction due to medium change? Students use semicircular dish of water to observe refraction from a variety of incidence angles including normal. Refractive index is calculated.

(7) Lens Systems – How are lens systems used to create images of various size? Students determine lens' focal lengths and predict and verify image locations and magnifications using optics bench.

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