San Bernardino Valley College
Curriculum Approved: 09/12/02 (Preview)
Last Updated: January 2000

I. CATALOG DESCRIPTION:

A. Division: Math and Science
Department: Physics
Course ID: PHYSIC 150B
Course Title: General Physics for the Life Sciences II
Units: 5
Lecture: 3 Hours
Laboratory: 6 Hours
Prerequisites: PHYSIC 150A

B. Catalog and Schedule Description:
The second course in a two-semester physics sequence designed primarily for students in biology, pharmacology, pre-medicine, physical therapy, allied health services, and physical education. Topics include electricity, magnetism, optics, and modern physics. The needed concepts of calculus will be developed and used where appropriate.

II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT: One

III. EXPECTED OUTCOMES FOR STUDENTS:

Upon successful completion of the course, the student should be able to do the following.

A. Read and critically evaluate scientific literature involving basic concepts
B. Apply basic scientific principles to new situations
C. Identify and use the fundamental concepts of static electricity
D. Recognize the basic components of a d.c. electrical circuit
E. Solve problems involving d.c. electrical circuits
F. Understand and use the fundamental concepts of magnetism
G. Recognize the basic components of an a.c. electrical circuit
H. Solve problems involving a.c. electrical circuits
I. Use the concepts of electricity and magnetism in the understanding of electromagnetic waves
J. Understand the connection between electromagnetic waves and light
K. Describe and solve basic problems involving light - both geometrical and physical optics
L. Explore the transition from classical theory to the theory of relativity
M. Understand and apply the principles of the special theory of relativity
N. Recognize the limitations of classical physics which necessitated the intro of quantum theory
O. Understand the fundamental structure of atoms and nucleii
P. Develop and utilize calculus techniques for topics such as field of a line charge and RC circuits
Q. Support the above learning objectives through directed laboratory work

IV. CONTENT:

(Laboratories listed are representative, not all of the experiments listed will be performed, and other experiments may be added to those listed.)

A. Electricity
1. charge
2. Coulomb's law
3. electric field
4. Gauss' law (optional)
5. electric potential
6. *lab - static electricity*
7. *lab - equipotentials*
8. *lab - equipotentials - computer simulation*

B. D.C. Circuits
   1. potential difference
   2. current
   3. resistance
   4. resistors
   5. capacitors
   6. meters
   7. d.c. circuits
   8. exponential function
   9. calculus of exponential functions
   10. RC circuits
   11. lab - Ohm's law
   12. lab - electric power and heating
   13. lab - electrical meters
   14. lab - the RC circuit

C. Magnetism
   1. magnetic field
   2. Ampere's law
   3. magnetic force
   4. Faraday's law
   5. Lenz's law
   6. generators, motors (optional)
   7. LC circuits (optional)
   8. LR circuits (optional)
   9. lab - the magnetic field
   10. lab -force between parallel conductors
   11. lab -LR circuits
   12. e/m

D. A.C. Circuits
   1. inductors
   2. reactance
   3. impedance
   4. LRC series circuits
   5. resonance
   6. lab - LRC circuits

E. Electromagnetic waves: *lab – microwaves*

F. Light and Optics
   1. speed
   2. reflection and refraction
   3. mirrors (optional)
   4. lenses
   5. interference
   6. diffraction
   7. polarization
   8. color
   9. lab - speed of light
   10. lab - reflection and refraction
   11. lab - interference
   12. lab - color and spectra

G. Special Relativity (selected topics)
   1. experiments
   2. postulates
   3. simultaneity
   4. time dilation
   5. length contraction
   6. mass, energy, and momentum
   7. lab - analysis of time dilation experiment

H. Quantum theory (selected topics)
1. blackbody radiation
2. photoelectric effect
3. quantization of energy]
4. photon
5. Compton effect
6. matter waves (deBroglie)
7. the wave equation
8. *lab -energy transfer by radiation*
9. *lab - photoelectric effect*
10. *lab - random events*
11. *atomic spectra*

I. Atoms (selected topics)
1. atomic spectra
2. Rutherford scattering
3. the electron
4. the proton
5. energy levels and transitions
6. particle in a box

J. Nucleii (selected topics)
1. the neutron
2. isotopes
3. nuclear force/energy
4. radioactive decay
5. half-life
6. fission and fusion
7. elementary particles

V. METHODS OF INSTRUCTION:

A. Instructors will include some or all of the following instructional components:
B. Classroom lecture. May be accompanied by activities such as demonstrations, video, film, and computer simulations. Specific reading assignments to reinforce and extend classroom presentations.
C. Demonstration experiments evoking discussion and problem solving.
D. Computer aided instruction.
E. Written assignments involving the solution of problems illustrative of various physical situations.
F. Students will utilize critical thinking in performance of specific problem solving strategies.
G. Laboratory experimentation. Students work toward specific goals of observation and analysis.
H. Students write and summarize their laboratory observations. Writing includes background, data analysis, and documentation of principles and apparatus.
I. Other written assignments such as library research including analysis of current popular scientific literature.

VI. TYPICAL ASSIGNMENTS:

A. Electrostatics: We introduce electric charge and study the interaction of charges. The concept of electric field is introduced, and the field of various charge distributions is calculated.
B. Read: Chapter 23 – Electrostatics
C. End of Chap. Exercises: (Examples of 10 – 15 assigned exercises)
1. Calculate the force between two electrons at a separation of (a) 1 m, (b) 2 m, (c) 3 m.
2. A long straight wire 1 m long carries 20 μC of charge. Find the electric field (a) 0.10 m above the center of the wire, and (b) 0.01 m from one end of the wire.

VII. EVALUATION(S):

A. Methods of Evaluation:
   1. Grading may be comparative (scaling, curve) or based on an absolute standard.
   2. Questions are designed to evaluate student comprehension of the learning goals enumerated in item IV above. Students will be asked to identify basic principles, recognize and apply common terminology, and apply fundamental knowledge to real world situations.
   3. Methods of evaluation will vary with the instructor, and may include some or all of the following components.
      a) Objective tests which may include true-false, multiple choice, and matching items.
      b) Subjective tests which may include completion items and essay questions.
      c) Laboratory performance
      d) Problem solutions
      e) Projects
      f) Home experiments
      g) Written assignments as details in I above

B. Frequency of evaluation:
   1. There are typically three to five exams during the semester.
   2. Other, more frequent evaluation techniques, such as quizzes, may be utilized.

C. Typical exam questions:
   1. Given a 2 μC charge at the origin and a – 5 μC charge at (3 m, 0) locate a point at which the electric field is zero.
   2. Two long parallel wires separated by 0.5 m carry currents of 5 A in opposite directions. What is the magnitude of the magnetic field (a) midway between the wires, and (b) in the plane of, and 0.5 m beyond one of the wires.
   3. Given a 100 V, 60 Hz source, L= 3 mH, R = 100 Ω and C = 50 μF, find (a) the impedence and (b) the phase angle. What is the maximum current in the circuit? Does the current lead or lag the voltage?

VIII. TYPICAL TEXT(S):

Physics for Engineers and Scientists, Giancoli, 2000, Prentice-Hall
Principles of Physics, Serway, 1997, Harcourt
Physics for Scientists and Engineers, 5th ed., 2000, Harcourt
Physics for Engineers and Scientists, 4th ed.,1999, Worth

IX. OTHER SUPPLIES REQUIRED OF STUDENTS: Graphing Calculator and blank quadrille notebook