San Bernardino Valley College
Curriculum Approved: FA01

I. CATALOG DESCRIPTION

A. Division: Science
Department: Physics
Course ID: PHYSIC 201
Course Title: Physics II
Units: 6
Lecture: 4 hours per week
Laboratory: 5 hours per week
Prerequisite: PHYSIC 200
Prerequisite/Corequisite: MATH 251

B. Catalog and Schedule Description:
A calculus based physics course covering electricity, magnetism, optics, and modern physics. This course is designed to satisfy the lower division physics requirement for majors in physics, engineering, astronomy, chemistry, geology, computer science and mathematics.

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:

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. Define and use the concepts of electric field and electric potential
E. Analyze a variety of charge distributions using Gauss's law
F. Recognize the basic components of a d.c. electrical circuit
G. Solve problems involving d.c. electrical circuits
H. Apply conservation of energy and conservation of charge (Kirchoff's laws) in the solution of d.c. circuits
I. Understand and use the fundamental concepts of magnetism
J. Use Ampere's law to calculate the magnetic field
K. Study the effects of changing magnetic fields using Faraday's and Lenz's laws
L. Recognize the basic components of an a.c. electrical circuit
M. Solve problems involving a.c. electrical circuits
N. Codify electromagnetism in Maxwell's equations and the Lorentz force
O. Use the concepts of electricity and magnetism in the understanding of electromagnetic waves
P. Understand the connection between electromagnetic waves and light
Q. Describe and solve basic problems involving light - both geometrical and physical optics
R. Explore the transition from classical theory to the theory of relativity
S. Understand and apply the principles of the special theory of relativity
T. Recognize the limitations of classical physics which necessitated the intro of quantum theory
U. Explain the fundamental structure of atoms and nucleii
V. Utilize calculus techniques of differentiation and integration to analyze a variety of problems such as field of a line charge, RC circuits, the magnetic field of a current carrying wire
W. Support the above learning objectives through directed laboratory work

IV. CONTENT:

(Laboratories listed are representative.)

A. Electricity
1. charge
2. Coulomb's law
3. electric field
4. Gauss' law
5. electric potential

- *lab - static electricity*
- *lab - equipotentials*
- *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
   - *lab - Ohm's law*
   - *lab - electric power and heating*
   - *lab - electrical meters*
   - *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
   8. LR circuits
   - *lab - the magnetic field*
   - *lab - force between parallel conductors*
   - *lab -LR circuits*
   - *e/m*

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

E. Electromagnetic waves: *microwaves*

F. Light and Optics
   1. speed
   2. reflection and refraction
   3. mirrors
   4. lenses
   5. interference
   6. diffraction
   7. polarization
   8. color
   - *lab - speed of light*
   - *lab - reflection and refraction*
   - *lab - interference*
   - *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
- *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
- *lab -energy transfer by radiation*
- *lab - photoelectric effect*
- *lab - random events*
- *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:

Instructors will include some or all of the following instructional components:

A. Classroom lecture. May be accompanied by activities such as demonstrations, video, film, and computer simulations.
1. Specific reading assignments to reinforce and extend classroom presentations.
2. Demonstration experiments evoking discussion and problem solving.
3. Computer aided instruction.
4. Written assignments involving the solution of problems illustrative of various physical situations requiring critical thinking skills.

B. Laboratory experimentation. Students work toward specific goals of observation and analysis.
1. Students write and summarize their laboratory observations.
2. Writing includes background, data analysis, and documentation of principles and apparatus.

C. Other written assignments such as library research including analysis of current popular scientific literature.

VI. TYPICAL ASSIGNMENTS:

A. LECTURE ASSIGNMENT

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.

Read: Chapter 23 – Electrostatics

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.

B. LAB ASSIGNMENT
Resistance
As the voltage across a load is increased the current will also increase. The resistance of the load is defined by Ohm's Law as $R = V/I$. For two devices, a lamp bulb and a carbon resistor, connect a circuit which will measure both the voltage and current supplied to the device. Measure at least ten pairs of values of voltage and current throughout the range from 0 V to 6.5 V.

1. Draw graphs of the data for the lamp bulb and for the resistor.
2. If the graph is a straight line, determine the resistance by finding the slope of the graph.
3. If the graph is a curve, determine the high, mid, and low values of the resistance by finding the quotient V/I at each point.

VII. EVALUATION:

A. Methods of Evaluation:

Grading may be comparative (scaling, curve) or based on an absolute standard. 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.

Methods of evaluation will vary with the instructor, and may include some or all of the following components.

1. Objective tests which may include true-false, multiple choice, and matching items.
2. Subjective tests which may include completion items and essay questions.
3. Laboratory performance
4. Problem solutions
5. Projects
6. Written assignments as described in V 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):

A. Giancoli, Physics for Engineers and Scientists, 2000, Prentice-Hall
B. Serway, Principles of Physics, 1997, Harcourt
C. Serway and Belchner, Physics for Scientists and Engineers, 5th ed., 2000, Harcourt
D. Tipler, Physics for Engineers and Scientists, 4th ed.,1999, Worth

IX. OTHER SUPPLIES REQUIRED OF STUDENTS:

Graphing Calculator
Blank quadrille notebook

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Content Review Form
PREREQUISITE COURSE

Target Course: **Physics 201**

Prerequisite Course: Physics 200

Instructions:
1. List entrance competencies (skills) for the Target Course.
2. Indicate which prerequisite course provides the entrance skills for the Target Course. Exit skills are listed in the 'Student Outcomes" section of the Course Outline.
3. Indicate the degree of importance of each needed entry skill for course success, using the following rating scale:
1 =Critical 2=Very Helpful 3=Desirable

Skills Analysis

Entry Skills in Target Course	*Exit Skills Provided by prerequisite Course*	*Degree of Importance (Rate 1 - 3)*
Read and critically evaluate scientific literature involving basic concepts	X	1
Apply basic scientific principles to new situations	X	1
Identify and use the fundamental concepts of kinematics	X	1
Recognize and use Newton's Laws of Motion and Gravitation	X	1
Explain the connections between dynamics, energy, and momentum	X	2
Apply the basic laws of conservation of energy and momentum	X	1
Understand and use the concepts of rotational kinematics	X	2
Understand and use the concepts of rotational dynamics	X	2
Use the concepts of kinematics, dynamics, and energy to understand simple harmonic motion	X	2
Identify the fundamental properties of fluids and the laws governing their behavior	X	3
Describe and solve basic problems involving wave motion	X	1
Explore thermodynamics, including the concepts of temperature, heat, and thermal energy	X	3
Support the above learning objectives through directed laboratory work.	X	1

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Last updated 10/2000 **Step 3, Form B**

Content Review Form
PREREQUISITE/COREQUISITE COURSE

Target Course: **Physics 200**

Prerequisite/Corequisite Course: Math 251

Instructions:
1. List exit competencies (skills) from the Corequisite Course. These skills are listed in the 'Student Outcomes" section of the Course Outline.
2. Indicate which of the listed exit competencies (skills) are necessary concurrent enrollment skills that should be developed in conjunction with completion of the target course. Mark with an "X" each needed skill.
3. Indicate the degree of importance of each needed entry skill for course success, using the following rating scale:
1 =Critical 2=Very Helpful 3=Desirable

Skills Analysis

Entry Skills in Target Course	*Exit Skills Provided by Corequisite Course*	*Degree of Importance (Rate 1 - 3)*
A. Apply integration to some practical concepts, including work, fluid pressure, rectilinear motion and arc length.	X	1
B. Differentiate and integrate exponential functions, logarithmic functions and inverse trigonometric functions.	X	1
C. Integrate any single variable situation using the following various techniques:		
1) Integration by parts	X	2
2) Trigonometric substitution	X	2
3) Partial Fractions	X	2
4) Reducing Formulas	X	2
5) Some trigonometric manipulations	X	2
6) Tables of integration	X	1
D. Recognize and evaluate improper integrals	X	2
E. Recognize Indeterminate Forms of Limits and apply the appropriate procedure including L'Hopitals rule	X	3
H. Construct and use Maclaurin and Taylor Polynomial and Series.	X	3