El Camino College

COURSE OUTLINE OF RECORD - Official

I. GENERAL COURSE INFORMATION

Subject and Number: Physics 1C
Descriptive Title: Electricity and Magnetism

Course Disciplines: Physics/Astronomy

Division: Natural Sciences

Catalog Description: This course details the mathematical and physical description of Coulomb's Law, electric field and potential, Gauss's Law, DC circuit analysis with Ohm's Law and Kirchhoff's Law, AC circuit analysis with phase diagrams, elementary electronics, capacitance, magnetic fields and their effect on moving charges and currents, magnetic fields produced by various current configurations, induced emf, mutual and self-inductance, basic theory of dielectrics, magnetic properties of materials and Maxwell's Equations in integral and differential form.

Conditions of Enrollment: **Prerequisite**

Physics 1A
with a minimum grade of C

AND

Mathematics 191
with a minimum grade of C

Course Length: [X] **Full Term** [ ] **Other (Specify number of weeks):**
Hours Lecture: **4.00 hours per week** [ ] **TBA**
Hours Laboratory: **2.00 hours per week** [ ] **TBA**
Course Units: **4.00**

Grading Method: **Letter**
Credit Status **Associate Degree Credit**

Transfer CSU: [X] **Effective Date: Prior to July 1992**
Transfer UC: [X] **Effective Date: Prior to July 1992**

General Education:

El Camino College: **1 – Natural Sciences**
Term: Other:

CSU GE: **B1 - Physical Science**

Term: Fall 1991 Other:

B3 - Laboratory Sciences

Term: Fall 1991 Other:

IGETC:

5A - Physical Science with Lab

Term: Fall 1991 Other:

II. OUTCOMES AND OBJECTIVES

A. COURSE STUDENT LEARNING OUTCOMES (The course student learning outcomes are listed below, along with a representative assessment method for each. Student learning outcomes are not subject to review, revision or approval by the College Curriculum Committee)

1. ***SLO #1*** Students can recognize the basic physical principles which are relevant in a given physical situation involving electricity, magnetism or electromagnetism in order to correctly answer conceptual questions.

2. ***SLO #2*** Students can identify and apply the relevant laws of physics along with the necessary mathematics to successfully solve a problem dealing with electricity, magnetism or electromagnetism in order to answer a conceptual question.

3. ***SLO #3*** Students can read and record, with appropriate units and uncertainties, measurements taken from a multimeter . Students can interpret and analyze that data, including error analysis.

The above SLOs were the most recent available SLOs at the time of course review. For the most current SLO statements, visit the El Camino College SLO webpage at http://www.elcamino.edu/academics/slo/.

B. Course Student Learning Objectives (The major learning objective for students enrolled in this course are listed below, along with a representative assessment method for each)

1. Solve problems using differential and/or integral calculus as well as elementary aspects of vector calculus, to include the “del” operator as applied to divergence, gradient, and curl calculation.

   Homework Problems

2. Solve multiple-loop circuit problems using Kirchhoff's rules.

Quizzes

3. Demonstrate the ability to explain physical phenomena involving electricity, magnetism, and electronics conceptually and/or qualitatively.

   Quizzes

4. Demonstrate the ability to make meaningful measurements using basic mechanical and electrical measuring devices, manipulate the collected data using basic error theories, report on the outcome of the experiment, and explain the result physically.

   Laboratory reports

III. OUTLINE OF SUBJECT MATTER (Topics are detailed enough to enable a qualified instructor to determine the major areas that should be covered as well as ensure consistency from instructor to instructor and semester to semester.)

Lecture or Lab	Approximate Hours	Topic Number	Major Topic
Lecture	13	I	Direct Current (DC) CIRCUITS A. Current and current density B. Resistance and Resistivity C. Electromotive Force (EMF) D. Ohm's and Kirchhoff's laws E. Power F. Capacitors as circuit elements G. Resistor Capactor (RC) and Resistor Inductor (RL) circuits
Lecture	7	II	Alternating Current (AC) CIRCUITS A. Reactance B. Impedance C. Complex numbers and phase diagrams D. Ohm's and Kirchhoff's Laws with phasors E. Power and power factor
Lecture	3	III	ELECTRONICS A. Positive Negative (PN) junction B. Junction diode and transistors
Lecture	19	IV	ELECTRIC FIELD A. Coulomb's Law B. Electric field C. Calculation of E for various charge distributions D. Gauss's Law E. Electrical potential and potential energy F. Capacitance and properties of dielectrics G. Displacement current
Lecture	23	V	MAGNETIC FIELD A. Forces on moving charges B. Current carrying conductors C. Torque on a current loop D. Magnetic Moment E. Hall effect F. Biot's Law G. Ampere's Law H. Displacement currents and magnetic fields I. Induced EMF J. Lenz's Law K. Eddy currents

			L. Motors/generators M. Self and mutual inductance N. RLC circuits O. Magnetic properties of matter
Lecture	7	VI	MAXWELL'S EQUATIONS A. Gradient B. Divergence C. Curl D. Maxwell's equations E. Wave equation F. Poynting vector
Lab	36	VII	LABORATORY EXERCISES A. D.C. Circuits B. Wheatstone Bridge C. Oscilloscope and RLC Circuits D. Vacuum Tubes E. Transistors F. Measurements of Capacitance G. Electric Fields H. Measurements of e/m for an Electron I. Measurements of Earth's Magnetic Field
Total Lecture Hours		72	
Total Laboratory Hours		36	
Total Hours		108	

IV. PRIMARY METHOD OF EVALUATION AND SAMPLE ASSIGNMENTS

A. **PRIMARY METHOD OF EVALUATION:**

Problem solving demonstrations (computational or non-computational)

B. **TYPICAL ASSIGNMENT USING PRIMARY METHOD OF EVALUATION:**

A circuit draws 330 W from a 110 V rms, 60 Hz line. A power factor is 0.60, and the current lags voltage. a) Find the value of C, the series capacitor, that will cause the power factor to be 1. b) What power will then be drawn from the power supply?

C. **COLLEGE-LEVEL CRITICAL THINKING ASSIGNMENTS:**

1. Three identical small Styrofoam balls (m = 2.00) are suspended from a fixed point by three non-conducting threads, each with a length of 50.0 cm and negligible mass. At equilibrium the three balls form an equilateral triangle with sides of 30.0 cm. What is the common charge "q" carried by each ball? Show all calculations.
2. A disk of radius R meters has a total charge Q coulombs uniformly distributed over its surface. Find the electric field on the axis of the disk at point P, a distance

y meters above the disk. (Hint: Divide the disk into rings of infinitesimal width, dr, and find dq on a ring). Show all calculations.

D. **OTHER TYPICAL ASSESSMENT AND EVALUATION METHODS:**

Objective Exams

Quizzes

Written homework

Laboratory reports

Class Performance

Homework Problems

Multiple Choice

V. INSTRUCTIONAL METHODS

Demonstration
Discussion
Laboratory
Lecture

Note: In compliance with Board Policies 1600 and 3410, Title 5 California Code of Regulations, the Rehabilitation Act of 1973, and Sections 504 and 508 of the Americans with Disabilities Act, instruction delivery shall provide access, full inclusion, and effective communication for students with disabilities.

VI. WORK OUTSIDE OF CLASS

Study
Answer questions
Required reading
Problem solving activities
Other (specify)
Reduced the study hours from 8 to 7 with the understanding that the 2 hours of lab was instrumental in supporting the lecture material. This will be concurrent with Physics 1A.

Estimated Independent Study Hours per Week: 7

VII. TEXTS AND MATERIALS

A. **UP-TO-DATE REPRESENTATIVE TEXTBOOKS**
Young and Freedman. University Physics. 13th Edition ed. Addison-Wesley, 2012.
Wilson. PHYSICS 1C Electricity Lab Manual. El Camino College Bookstore, 2008.
Qualifier Text: Discipline Standard,

B. **ALTERNATIVE TEXTBOOKS**

C. **REQUIRED SUPPLEMENTARY READINGS**

D. **OTHER REQUIRED MATERIALS**
Scientific calculator
Ruler, protractor, and compass
Graph paper (linear, log-log)
Bound lab book

VIII. CONDITIONS OF ENROLLMENT

A. Requisites (Course and Non-Course Prerequisites and Corequisites)

Requisites	Category and Justification
Course Prerequisite Physics-1A AND	Sequential
Course Prerequisite Mathematics-191	Computational/Communication Skills

B. Requisite Skills

Requisite Skills
Ability to identify forces on an object (free body diagram), and to determine their effect on the motion of the object. PHYS 1A - Analyze physical problems in order to draw a free-body-diagram.PHYS 1A - Recognize all the physical principles required to solve the problem.
Ability to determine errors introduced with any measurement, and their effect on the results. PHYS 1A - Define and use the basic concepts and equations in error theory. Recognize when to use the different equations.
Ability to use graphical techniques to analyze data - experimental and theoretical. PHYS 1A - Analyze data graphically using linear, semi log, and log-log scales.
Be practiced in identifying what is and is not important in a problem, drawing meaningful diagrams to aid in problem solving, and constructing mathematical models of physics problems. PHYS 1A - Isolate and model the physical principle underlying each part of the problem.
Ability to set up and solve differential and integral equations. PHYS 1A - Derive formulas describing physical phenomena using differential or integral calculus.
Ability to manipulate equations symbolically. MATH 191 - Evaluate integrals using integration techniques including: integration by parts; trigonometric substitutions; partial fraction decomposition and tables of integrals. PHYS 1A - Combine and solve the system of equations for the problem.
Ability to take partial derivatives in vector form to determine the gradient, divergence and curl of a function. MATH 191 - Evaluate integrals using integration techniques including: integration by parts; trigonometric substitutions; partial fraction decomposition and tables of integrals. PHYS 1A - Solve mechanics problems utilizing differential or integral calculus for a variety of physical situations.

C. Recommended Preparations (Course and Non-Course)

Recommended Preparation	Category and Justification

D. Recommended Skills

Recommended Skills

E. Enrollment Limitations

Enrollment Limitations and Category	Enrollment Limitations Impact

Course created by T. Wilson, G. Karpel, M. Lehman, J. Platts on 02/01/1965.

BOARD APPROVAL DATE:

LAST BOARD APPROVAL DATE: 02/17/2015

Last Reviewed and/or Revised by Susana Prieto on 08/01/2014

18750