Lecture Contact Hours: 64-72; Homework Hours: 128-144; Total Student Learning Hours: 192-216
Laboratory Contact Hours: 48-54; Homework Hours: 0; Total Student Learning Hours: 48-54

CUYAMACA COLLEGE
COURSE OUTLINE OF RECORD

PHYSICS 200 – ELECTRICITY AND MAGNETISM

4 hours lecture, 3 hours laboratory, 5 units

Catalog Description
Course focus is on the electric and magnetic behavior of matter. The primary emphasis is on Maxwell's Equations and their applications. This course is part of a three semester sequence intended for students majoring in physical sciences and engineering.

Prerequisite
"C" grade or higher or "Pass" in PHYC 190 or equivalent**;** "C" grade or higher or "Pass" in MATH 280 or equivalent

Recommended Preparation
Concurrent enrollment in MATH 281

Entrance Skills
Without the following skills, competencies and/or knowledge, students entering this course will be highly unlikely to succeed:
1) Solve algebraic word problems by using substitution or simultaneous equations.
2) Knowledge of trigonometric functions and their identities.
3) Solve linear, quadratic and trigonometric equations.
4) Knowledge of related rates and derivatives.
5) Integrate polynomial, exponential and trigonometric functions.
6) Apply Taylor and Fourier series as approximations of functions using simpler functions.
7) Convert between polar and rectangular coordinates.
8) Use the relationship between force, mass and acceleration to solve dynamics problems.
9) Use conservation of energy and conservation of momentum concepts.
10) Understand simple harmonic motion and apply its concepts to analyze oscillating systems.
11) Understand definition of vectors and how to use them.

Course Content
1) Lecture:
    a. Electrostatics and Coulomb's Law
    b. Electric field
    c. Gauss's Law
    d. Electric potential
    e. Capacitors
    f. Current and resistance
    g. Resistivity
    h. Direct current circuits
    i. Magnetic field
    j. Ampere's Law
    k. Faraday's and Lenz's Laws
    l. Inductance
    m. Magnetic properties of matter
    n. Electromagnetic oscillations
    o. Alternating current circuits
    p. Maxwell's Equations
    q. Electromagnetic waves

r. Historical development of physics
s. Application of physics principles to engineering, chemistry, etc.

2) Laboratory Content:
   a. Electric force on a moving charge
   b. Electric field (one point charge)
   c. Electric field (two point charge)
   d. Electric potential (parallel plate capacitor)
   e. Ohm's Law and series and parallel circuits
   f. Resistivity
   g. RC time constants
   h. Current balance
   i. Induction (Gilley coils)
   j. AC resonance (phase constant)

Course Objectives

Students will be able to:

1) Recognize the basic concepts concerning electric fields, electric potential, capacitance, resistance, current, DC circuits, magnetic fields, inductance, AC circuits, Maxwell's Equations, and use algebraic, trigonometric and advanced calculus expressions to represent physical situations involving these subjects.
2) Investigate and delineate the relationship between the theoretical principles of physics and their practical applications, and explain how this relationship affects real world problem solving.
3) Investigate, interpret and analyze the fundamental principles of physics based on reading assignments and in-class discussions.
4) Calculate solutions to physics problems using the fundamental principles of physics and symbolic logic skills:
   a. Analyze simple static charge distributions and calculate the resulting electric field and electric potential.
   b. Analyze simple current distributions and calculate the resulting magnetic field.
   c. Predict the trajectory of charged particles in uniform and magnetic fields.
   d. Analyze DC and AC circuits in terms of current, potential different and power dissipation for each element.

During the lab students will:

1) Design experiments using the scientific method.
2) Collect and analyze data using both traditional and computer data acquisition methods; interpret and analyze numerical data, including appropriate use of error propagation, units and significant figures, and generate a visual representation of the data.
3) Using concepts covered in class, evaluate and interpret the experimental results.

Method of Evaluation

A grading system will be established by the instructor and implemented uniformly. Grades will be based on demonstrated proficiency in the subject matter determined by multiple measurements for evaluation, one of which must be essay exams, skills demonstration or, where appropriate, the symbol system.

1) Quizzes, exams that measure students' ability to recognize physical situations and the concepts associated with them, and use mathematical expressions to formulate solutions while under a time pressure.
2) Homework that measures students' ability to use the fundamental principles of physics and symbolic logic skills to calculate solutions to physics problems.
3) Lab technique as demonstrated by students' ability to design an experiment, set up the equipment, make the appropriate measurements, and maintain a safe work environment.
4) Lab reports will demonstrate students' ability to use the English language; record, interpret and analyze data; and draw conclusions from the results.

5) Physics research paper(s) in which students are required to analyze, interpret and draw conclusions from scientific sources.
6) Participation based on in-class responses to questions, contribution to discussions, and attendance.

Special Materials Required of Student
Scientific calculator

Minimum Instructional Facilities
1) Laboratory with blackboard, Smart Cart, appropriate lab/demonstration equipment
2) Computers with data acquisition probes

Method of Instruction
1) Integrated lecture, demonstration, discussion
2) Small/large group discussion
3) In-class activities and independent homework, research projects
4) Group work in a laboratory situation
5) Auxiliary use of study groups, peer tutoring and/or instructional office hours

Out-of-Class Assignments
1) Reading assignments
2) Homework assignments solving practice problems
3) Completion of lab reports

Texts and References
1) Required (representative examples):
   a. Serway and Jewett, *Physics for Scientists and Engineers*. 9th edition. Cengage, 2014.
   b. Young and Freedman. *University Physics*. 14th edition. Pearson, 2015.
   c. Laboratory Manual for Physics 200, Cuyamaca College.
2) Supplemental: None

Exit Skills
Students having successfully completed this course exit with the following skills, competencies and/or knowledge:
1) Calculate electric and magnetic forces and fields.
2) Understand the basic concepts of voltage, current and power.
3) Understand the basic concepts of resistance, capacitance and inductance.
4) Solve for current, voltage, power and time constants in DC circuits consisting of resistors, capacitors, inductors and batteries.
5) Solve for current, voltage, phase angle and power in AC circuits consisting of resistors, capacitors, inductors and generators.
6) Use Maxwell's Equations to solve problems in electricity and magnetism.

Student Learning Outcomes
Upon successful completion of this course, students will be able to:
1) Integrate simple charge or current distributions to calculate electric or magnetic fields.
2) Analyze symmetric charge or current distributions to calculate electric or magnetic fields.
3) Analyze DC and AC circuits in terms of current, potential different or power dissipation for each element.
4) Use the relevant Maxwell’s equations to analyze and calculate electromagnetic induction.
5) LAB: Collect and analyze experimental data using graphical representation, including appropriate use of units and significant figures.
6) LAB: Relate the results of experimental data to the physical concepts discussed in the lecture portion of the class.