College of San Mateo
Official Course Outline

1. **COURSE ID:** PHYS 260 **TITLE:** Physics with Calculus II **C-ID:** PHYS 210, PHYS 200S (PHYS 250 & 260 & 270)
   Units: 4.0 units **Hours/Semester:** 48.0-54.0 Lecture hours; and 48.0-54.0 Lab hours
   Method of Grading: Letter Grade Only
   Prerequisite: PHYS 250, completion of or concurrent enrollment in MATH 253

2. **COURSE DESIGNATION:**
   Degree Credit
   Transfer credit: CSU; UC
   AA/AS Degree Requirements:
   CSM - GENERAL EDUCATION REQUIREMENTS: E5a. Natural Science
   CSU GE:
   CSU GE Area B: SCIENTIFIC INQUIRY AND QUANTITATIVE REASONING: B1 - Physical Science
   CSU GE Area B: SCIENTIFIC INQUIRY AND QUANTITATIVE REASONING: B3 - Laboratory Activity
   IGETC:
   IGETC Area 5: PHYSICAL AND BIOLOGICAL SCIENCES: A: Physical Science
   IGETC Area 5: PHYSICAL AND BIOLOGICAL SCIENCES: C: Science Laboratory

3. **COURSE DESCRIPTIONS:**
   Catalog Description:
   Second semester in a three-semester sequence for students majoring in the Physical Sciences and Engineering. Topics covered are electricity and magnetism including AC and DC circuits.

4. **STUDENT LEARNING OUTCOME(S) (SLO'S):**
   Upon successful completion of this course, a student will meet the following outcomes:
   1. Identify problems that should be solved using Coulomb's Law for electric forces and electric fields and correctly solve them
   2. Identify problems that should be solved using Gauss's Law for electric fields and correctly solve them.
   3. Identify problems that should be solved using Ampere's Law and correctly solve them.
   4. Identify problems that should be solved using Faraday's Law and correctly solve them.
   5. Analyze DC and AC circuits.
   6. Collect and analyze data to verify physics principles.

5. **SPECIFIC INSTRUCTIONAL OBJECTIVES:**
   Upon successful completion of this course, a student will be able to:
   Content-specific objectives: Upon completion of this course, students will have a working knowledge of the skills and concepts listed in the course outline. For example, they will be able to:
   1. Identify problems that should be solved using Coulomb's Law for electric forces and electric fields and correctly solve them.
   2. Identify problems that should be solved using Gauss's Law for electric fields and correctly solve them.
   3. Identify problems that should be solved using Ampere's Law and correctly solve them.
   4. Identify problems that should be solved using Faraday's Law and correctly solve them.
   5. Analyze DC and AC circuits.
   6. Collect and analyze data to verify physics principles.

   General objectives: Upon completion of this course, the student will be better able to:
   1. Follow scientific arguments, including derivations of formulas, presented either orally or in writing.
   2. Use the language and notation of differential calculus and other mathematics correctly in the solution of physics problems, and use appropriate style and format in written work.
   3. Demonstrate good problem-solving habits, including: 1) estimating solutions and recognizing unreasonable results. 2) considering a variety of approaches to a given problem, and selecting one that is appropriate. 3) rejecting the temptation to rely on mechanical techniques (either pencil-and-paper or electronic) that they do not understand. 4) interpreting results of problems and experiments correctly, and answering the questions that were actually asked.
   4. Read and follow laboratory procedures. Use a variety of instruments to take physical measurements and record them with correct precision and units.

6. **COURSE CONTENT:**

Lecture Content:

Electric Charge and Electric Field 5 to 7 days
Electric charge; conductors, insulators, and induced charges; Coulomb's Law; electric fields and electric forces; electric field lines; electric dipoles

Gauss's Law 5 to 7 days
Charge and electric flux; calculating electric flux; Gauss's Law and applications.

Electric Potential 3 to 5 days
Electric potential energy; electric potential; calculating electric potential; equipotential surfaces; charges on conductors

Capacitance and Dielectrics 3 to 5 days
Capacitors and capacitance; capacitors in series and parallel; energy storage in capacitors and electric field energy; dielectrics; molecular model of induced charges; Gauss's Law in dielectrics

Current, Resistance, and Electromotive Force 3 to 5 days
Current; resistivity; resistance; electromotive force and circuits; energy and power in electric circuits; theory of metallic conduction

Direct-Current Circuits 3 to 5 days
Resistors in series and parallel; Kirchhoff s Rules; electrical measuring instruments; RC circuits; power distribution systems

Magnetic Field and Magnetic Forces 2 to 4 days
Magnetism; magnetic field; magnetic field lines and magnetic flux; motion of charged particles in magnetic field and applications; magnetic force on a current-carrying conductor; force and torque on a current loop; direct current motor; the Hall effect.

Sources of Magnetic Field 4 to 6 days
Magnetic field of a moving charge; magnetic field of a current element; magnetic field of a straight current-carrying conductor; force between parallel conductors; magnetic field of a circular current loop; Ampere's Law and applications; magnetic materials

Electromagnetic Induction 3 to 5 days
Induction experiments; Faraday's Law; Lenz's Law; motional electromotive force; induced electric fields; eddy currents; displacement current and Maxwell's Equations; superconductivity

Inductance 2 to 4 days
Mutual inductance; self-inductance and inductors; inductors and magnetic-field energy; the RL circuit; the LC circuit; the LRC series circuit

Alternating Current 2 to 3 days
Phasors and alternating currents; resistance and reactance; the LRC series circuit; power in alternating-current circuits; transformers

Electromagnetic Waves 2 to 3 days
Maxwell's Equations and electromagnetic waves; plane electromagnetic waves and the speed of light; sinusoidal electromagnetic waves; energy and momentum in electromagnetic waves; standing electromagnetic waves

Lab Content:

The following is a list of the experiments in the current Physics 260 Laboratory Manual, College of San Mateo Physics Department. Students typically complete between 11 and 14 experiments per semester.

1. Coulomb's Law
2. Magnetic Field Plotting
3. Magnetic Force Law
4. Electric Field Plotting
5. Measurement of Capacitance

6. Charge Sharing by Capacitors
7. Ohm's Law and Resistors in Series and Parallel
8. The Joule Constant
9. Kirchhoffs Rules
10. The Wheatstone Bridge
11. The Potentiometer
12. The RC Series Circuit
13. The Ratio of Charge to Mass of the Electron
14. The Current Balance
15. The Tangent Galvanometer
16. Magnetic Moment and the Earth's Horizontal Magnetic Field
17. Qualitative Study of Induced EMF
18. AC Circuits

7. **REPRESENTATIVE METHODS OF INSTRUCTION:**

Typical methods of instruction may include:

A. Lecture
B. Lab
C. Discussion
D. Experiments
E. Other (Specify): 1. Lecture: Introduce and explain the concepts, define the appropriate terms, provide examples and solve problems to illustrate the application of the concepts. 2. Demonstrations: Use physical demonstrations to reinforce understanding of the physical concepts 3. Collaborative learning: Guided discussions and in-class exercises, which lead to clarification of concepts and development of problem solving skills. 4. Laboratory work: Group and individual work to investigate physical principles; observe, record, and analyze the results of experiments, which deepens the understanding of concepts introduced in lecture.

8. **REPRESENTATIVE ASSIGNMENTS**

Representative assignments in this course may include, but are not limited to the following:

Writing Assignments:

Students complete written laboratory reports in which they analyze the results of experiments performed in the lab. This analysis requires critical thinking and requires students to connect lecture topics to the experiments performed. These assignments also require students to effectively communicate their ideas in writing.

Reading Assignments:

Reading the textbook prior to lectures to become familiar with the topics to be presented. Reading the textbook after lectures to review the key points and concepts.

Other Outside Assignments:

Solving textbook (or similar) problems after each lecture. Problems are of varying difficulty and are completed by students to help further their understanding of the concepts and to learn how physics formulas and mathematics are used to apply the concepts to specific situations.

9. **REPRESENTATIVE METHODS OF EVALUATION**

Representative methods of evaluation may include:

A. Class Participation
B. Exams/Tests
C. Homework
D. Lab Activities
E. Quizzes
F. 1. Lab activities require students to participate in performing measurements and observations during the lab period. Lab reports assess students' careful recording of observations and measurements, correctness of calculations, and critical thinking ability. Furthermore, these reports evaluate students' ability to communicate their results in clear writing. Department policy is that students must pass the lab portion of the course to receive a grade of "C" higher. 3. Homework assignments allow students to receive feedback from instructors on their understanding of the material before they are required to demonstrate their understanding on the exams. Homework problems require and develop critical thinking and other problem solving skills. 4. Exams are designed to assess both students' conceptual understanding of the material and their problem solving skills, logical reasoning, and analytic thinking. Department policy is for a comprehensive final exam to be required which accounts for at least 20% of a student's grade.

10. **REPRESENTATIVE TEXT(S):**
Possible textbooks include:
A. Young and Freedman. *University Physics with Modern Physics*, 13th ed. Pearson Education/Addison-Wesley, 2012
Other:
A. CSM Physics Department, Physics 260 Lab Manual, CSM, revised 2008.

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Course Originator: David Locke