College of San Mateo
Course Outline

☐ New Course
☐ Update/No change
☒ Course Revision (Minor)
☐ Course Revision (Major)

Date: November 2008

Department: Physics **Number:** 220

Course Title: General Physics II **Units:** 4.0

Total Semester Hours: **Lecture:** 48 **Lab:** 48 **Homework:** 96 **By Arrangement:** 16

Length of Course
- ☒ Semester-long
- ☐ Short course (Number of weeks___)
- ☐ Open entry/Open exit

Grading
- ☒ Letter
- ☐ Pass/No Pass
- ☐ Grade Option (letter or Pass/No Pass)

1. **Prerequisite** (Attach Enrollment Limitation Validation Form.)

Physics 210

2. **Corequisite** (Attach Enrollment Limitation Validation Form.)

3. **Recommended Preparation** (Attach Enrollment Validation Form.)

4. **Catalog Description** (Include prerequisites/corequisites/recommended preparation.)

Minimum of forty-eight lecture and forty-eight lab hours
plus sixteen hours by arrangement per term.
Prerequisites: PHYS 210; Electricity and magnetism, light, modern physics. Extra supplies required. (AA: Area E5a, CSU, UC) (PHYS 210 and 220 = CAN PHYS SEQ A)

5. **Class Schedule Description** (Include prerequisites/corequisites/recommended preparation.)

Magnetism, electricity, light, modern physics. Plus 16 hours by arrangement per term.
Extra supplies may be required. Prerequisite: PHYS 210 with a grade of C or higher.
(CSU/UC) (PHYS 210 and 220 = CAN PHYS SEQ A)

6. **Student Learning Outcomes** (Identify 1-6 expected learner outcomes using active verbs.)

Upon successful completion of the course, the student will be able to:

1. Identify problems involving electric and/or magnetic fields and forces and correctly solve them

2. Analyze DC circuits.
3. Identify problems that should be solved using concepts of geometric and physical optics and correctly solve them. This includes but is not limited to image formation and interference problems.
4. Identify problems involving quantization of energy and correctly solve them. This includes but is not limited to the photoelectric effect and energy levels in atoms.
5. Identify problems involving the structure of the atom and the nucleus and correctly solve them. This includes but is not limited to the quantum-mechanical view of atoms and nuclear binding energy and radioactivity.
6. Collect and analyze data to verify physics principles

7. Course Objectives (Identify specific teaching objectives detailing course content and activities. *For some courses, the course objectives will be the same as the student learning outcomes. If this is the case, please simply indicate this in this section).*

see included "Course Outline Attachment"

8. Course Content (Brief but complete topical outline of the course that includes major subject areas [1-2 pages]. Should reflect all course objectives listed above. In addition, you may attach a sample course syllabus with a timeline.)

see included "Course Content"

9. Representative Instructional Methods (Describe instructor-initiated teaching strategies that will assist students in meeting course objectives. Include examples of out-of-class assignments, required reading and writing assignments, and methods for teaching critical thinking skills.) **If hours by arrangement are required by this course, indicate the additional instructional activity which will be provided during this time.**

see included "Course Outline Attachment"
Hours by arrangement: Attendance at office hours; organized study group which may meet in the Integrated Science Center; other activities as announced in class.

10. Representative Methods of Evaluation (Describe measurement of student progress toward course objectives. Courses with required writing component and/or problem-solving emphasis must reflect critical thinking component. If skills class, then applied skills.)

see included "Course Outline Attachment"

11. Representative Text Materials (With few exceptions, texts need to be current. Include publication dates.)

Giancoli, Physics, Principles with Applications, Sixth Edition, Prentice Hall, 2005.
CSM Physics Department, Physics 220 Lab Manual, CSM, revised 2008.

Prepared by: _____
(Signature)

Email address: uchida@smccd.edu

Submission Date: _____

Course Outline Attachment Physics 220

Course Objectives	Methods of Instruction	Assignments	Methods of Evaluation
Objectives fall into two broad categories: mastery of skills and concepts specific to this course, and continued development of good mathematical habits and thought processes. I. . 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: Course Objectives (Student Learning Outcomes): 1. Identify problems involving electric and/or magnetic fields and forces and correctly solve them 2. Analyze DC circuits. 3. Identify problems that should be solved using concepts of geometric and physical optics and correctly solve them. This includes but is not limited to image formation and interference problems. 4. Identify problems involving quantization of energy and correctly solve them. This includes but is not limited to the photoelectric effect and energy levels in atoms. 5. Identify problems involving the structure of the atom and the nucleus and correctly solve them. This includes but is not limited to the quantum-mechanical view of atoms and nuclear binding energy and radioactivity. 6. Collect and analyze data to verify physics principles II. General objectives: Upon completion of this course, the student will be better able to: A. Recognize some of the fundamental laws of nature and express them in mathematical form. B. Apply the laws of nature to the solution of problems. State the range of validity of each law, express the relevant law(s) in mathematical form appropriate to the specific problem, and solve the resultant equation(s) for the unknown quantity or quantities. C. Use the language and notation of physics correctly. Communicate explanations of physical phenomena in writing. D. Demonstrate good problem-solving habits, including: 1) organizing given information and determining which physical principles apply to the problem. 2) considering a variety of approaches to a given problem, and selecting one that is appropriate. 3) estimating solutions and recognizing unreasonable results. 4) interpreting solutions correctly, and answering the questions that were actually asked. E. Develop skill in laboratory procedure. Explain the purpose of each experiment, correctly use laboratory equipment, record data with proper attention to units and significant figures. Analyze data a draw conclusions. Write clear and concise lab reports.	The following methodologies are appropriate. Individual faculty will use whatever mix of these they find most effective. Method of Instruction: **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 the understanding of the physical concepts **3. Collaborative learning:** Guided discussions and in class exercises, which lead to clarification of the concepts and sharpen the problem solving skills. **4. Homework assignments:** Outside of classroom problem solving which helps further students understanding of concepts, including the range of validity, and develops their ability to apply the concepts. **5. 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 during in lecture..	The following types of assignments are appropriate. Individual faculty will use whatever mix of these they find most effective. Assignments: 1. Reading the textbook to restate lecture and clarify the key points and concepts. 2. Solve problems. 3. Write laboratory reports for the experiments performed during the lab reporting the result of the observation and analysis of the experiments.	Method of Evaluation: Instructors have considerable discretion in determining course grades. However, the department expects that in class tests and quizzes account for at least 40% of the final grade, a comprehensive final exam accounts for at least 20%, laboratory reports account for about 20%, and out of class homework assignments account for 10 to 20 %. 1. Tests are designed to assess students' conceptual understanding of the material as well as their problem solving skills, logical reasoning, and analytical thinking. 2. Lab reports assess students' methods, careful recording of observations and data measurements, correctness of calculations, and critical thinking to clearly evaluate conclusions. Furthermore, these reports evaluate students' ability to communicate their results in clear writing. 3. Out-of-class homework assignments are an important tool in student learning. 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.

COLLEGE OF SAN MATEO COURSE CONTENT

November 2008

PHYSICS 220 GENERAL PHYSICS II

Course outline based on Giancoli, Physics, Principles with Applications, Sixth Edition, Prentice Hall, 2005. *Italicized* topics are optional.

Electric Charge and Electric Field 3 to 5 days

Electric charge and its conservation; insulators and conductors; induced charge; Coulomb's Law; electric field; field lines; electric fields and conductors, Gauss's Law.

Electric Potential and Electric Energy; Capacitance 3 to 5 days

Electric potential and potential difference; relation between electric potential and electric field; equipotential lines; the electron volt, a unit of energy; electric potential due to point charges; *electric dipoles;* capacitance; dielectrics; storage of electric energy; *cathode ray tube; the electrocardiogram.*

Electric Currents 3 to 5 days

The electric battery; electric current; Ohm's law; resistance and resistors; resistivity; *superconductivity;* electric power; power in household circuits; alternating current; *microscopic view of electric current; the nervous system and nerve conduction.*

DC Circuits 3 to 5 days

Resistors in series and parallel; EMF and terminal voltage; Kirchhoff's rules; EMFs in series and parallel; capacitors in series and parallel; *heart pacemakers;* electric hazards; *DC ammeters and voltmeters; effects of meter resistance.*

Magnetism 3 to 5 days

Magnets and magnetic fields; electric currents produce magnetism; force on an electric current in a magnetic field; force on an electric charge moving in a magnetic field; magnetic field due to a straights wire; force between two parallel wires; *definition of the ampere and the coulomb;* Ampere's Law*; torque on a current loop; magnetic moment; applications; galvanometers, motors, loudspeakers; the Hall effect; mass spectrometer; ferromagnetism; electromagnets and solenoids; magnetic fields in magnetic materials.*

Electromagnetic Induction and Faraday's Law; AC Circuits

3 to 5 days

Induced EMF; Faraday's Law of induction; Lenz's law; EMF induced in a moving conductor; changing magnetic flux produces and electric field; electric generators; *counter EMF and torque; eddy currents;* transformers; *applications of induction; inductance; energy stored in a magnetic field; LR cirsuit; LRC series AC circuit; resonance in AC circuits; impedance matching.*

Electromagnetic Waves **1 to 3 days**

Changing electric fields produce magnetic fields; Maxwell's equations; *displacement current;* production of electromagnetic waves; light as an electromagnetic wave and the electromagnetic spectrum; *measuring the speed of light; calculation of the speed of electromagnetic waves ;energy in EM waves.*

Light: Geometric Optics **4 to 6 days**

The ray model of light; reflection: image formation by a plane mirror; formation of images by spherical mirrors; index of refraction; Snell's Law; total internal reflection; thin lenses; ray tracing; the lens equation; problem solving for lenses; problem solving for combinations of lenses; the lensmakers; equation.

The Wave Nature of Light **3 to 5 days**

Waves versus particles; Huygens' principle; interference: Young's double-slit experiment; the visible spectrum and dispersion; diffraction by a single slit or disk; diffraction grating; the spectrometer and spectroscopy; interference by thin films; *Michelson interferometer;* polarization; *scattering of light by the atmosphere.*

Optical Instruments **1 to 3 days**

The camera; the human eye and corrective lenses; the magnifying glass; telescopes; aberrations of lenses and mirrors; *limits of resolution: the Rayleigh criterion; resolution of telescopes and microscopes; resolution of the human eye; specialty microscopes and contrast;* X-rays and X-ray diffraction; *X-ray imaging and computerized axial tomography (CAT scan).*

Special Theory of Relativity **1 to 3 days**

Postulates of the special theory of relativity; *simultaneity; time dilation and the twin paradox; length contraction; four-dimensional space-time;* momentum and mass; the ultimate speed; mass and energy; *relativistic addition of velocities; the impact of special relativity.*

Early Quantum Theory and Models of the Atom **3 to 5 days**

Discovery and properties of the electron; Planck's quantum hypothesis; photon theory of light and the photoelectric effect; photon interactions: Compton effect and pair production; wave-particle duality: the principle of complementarity; wave nature of matter; *electron microscopes;* early models of the atom; atomic spectra; the Bohr model; de Broglie's hypothesis applied to atoms.

Quantum Mechanics of Atoms
2 to 4 days

Quantum mechanics-a new theory; the wave function and its interpretation: the double-slit experiment; the Heisenberg uncertainty principle; philosophical implications: probability versus determinism; quantum mechanical view of atoms; quantum mechanics of the hydrogen atom; complex atoms and the exclusion principle; the periodic table of the elements; X-ray spectra and atomic number; *fluorescence and phosphorescence; lasers; holography.*

Nuclear Physics and Radioactivity **2 to 3 days**

Structure and properties of the nucleus; binding energy and nuclear forces; radioactivity; alpha decay; beta decay; gamma decay; conservation of nucleon number and other conservation laws; half-life and rate of decay; decay series; radioactive dating; *stability and tunneling; detection of radiation.*

Nuclear Energy: Effects and Uses of Radiation **2 to 3 days**

Nuclear reactions and the transmutation of elements; nuclear fission; fusion; *passage of radiation through matter; radiation damage; measurement of radiation; radiation therapy; tracers and imaging in research and medicine; emission topography; nuclear magnetic resonance and magnetic resonance imaging.*

COURSE CONTENT – LABORATORY

The following is a list of the experiments in the current Physics 220 Laboratory Manual, CSM Physics Department, . Students typically complete between 10 and 14 experiments per semester.

1. Coulomb's Law
2. Electric Field Plotting
3. Capacitance
4. Ohm's Law and Circuits
5. The Joule Constant
6. Kirchhoff's Rules
7. The Wheatstone Bridge
8. The Potentiometer
9. The RC Series Circuit
10. Magnetic Field Plotting
11. The Ratio of Charge to Mass for the Electron
12. The Current Balance
13. A Qualitative Study of Induced EMF
14. Ray Tracing
15. Thin Lenses
16. Newton's Rings
17. Interference Using Microwaves
18. The Photoelectric Effect
19. The Balmer Series of Hydrogen