COLLEGE OF THE DESERT

Course Code PH-003B

Course Outline of Record

1. Course Code: PH-003B
2. a. Long Course Title: Engineering Physics
   b. Short Course Title: ENGINEER PHYSICS
3. a. Catalog Course Description:
   This is the second semester of the calculus-based physics sequence for scientists and engineers including those entering the computer fields. Topics include electricity, magnetism, and thermodynamics.
   b. Class Schedule Course Description:
   This is the second semester of the calculus-based physics sequence for scientists and engineers including those entering the computer fields. Topics include electricity, magnetism, and thermodynamics.
   c. Semester Cycle (*if applicable*): every semester
   d. Name of Approved Program(s):
   - PHYSICS AS Degree and Transfer Preparation
4. Total Units: 4.00 Total Semester Hrs: 108.00
   Lecture Units: 3 Semester Lecture Hrs: 54.00
   Lab Units: 1 Semester Lab Hrs: 54.00
   Class Size Maximum: 24 Allow Audit: No
   Repeatability No Repeats Allowed
   Justification 0
5. Prerequisite or Corequisite Courses or Advisories:
   Course with requisite(s) and/or advisory is required to complete Content Review Matrix (CCForm1-A)
   Prerequisite: PH 003A or
   Prerequisite: PH 003A and
   Prerequisite: MATH 001B or
   Corequisite: MATH 001B
6. Textbooks, Required Reading or Software: *(List in APA or MLA format.)*
   a. Young,R.,Freedman,G. (2011). *University Physics with Modern Physics* (13/e). Addison-Wesley. ISBN: 0321696867
   College Level: Yes
   Flesch-Kincaid reading level: 12
   b. MacIntire, D.. Lab Manual for Physics 4B. COD , 08-01-2014.
7. Entrance Skills: *Before entering the course students must be able:*
   a. Understand the standards of measurement used in physics, including length mass and time and their units including unit analysis, conversion and order of magnitude calculations.
   - PH 004A - Understand the standards of measurement used in physics, including length mass and time and their units including unit analysis, conversion and order of magnitude calculations.

   b. Define displacement, velocity and speed and relate velocity, acceleration and position for objects moving in one dimension with attention to the topic of freely falling bodies.
   - PH 004A - Define displacement, velocity and speed and relate velocity, acceleration and position for objects moving in one dimension with attention to the topic of freely falling bodies.

   c. Use vectors in different coordinate systems, and understand the properties of vectors and unit vector notation.
   - PH 004A - Use vectors in different coordinate systems, and understand the properties of vectors and unit vector notation.

   d. Understand motion in two dimensions including projectile motion and uniform circular motion and the relationship between tangential and radial acceleration and relative velocity and relative acceleration.

- PH 004A - Understand motion in two dimensions including projectile motion and uniform circular motion and the relationship between tangential and radial acceleration and relative velocity and relative acceleration.

e. Use Newton’s laws and solve problems with both forces in inertial frames and understand effects of friction.

- PH 004A - Use Newton’s laws and solve problems with both forces in inertial frames and understand effects of friction.

f. Apply kinematics and Newton’s laws to circular motion and non-inertial frames, understand the effects of air resistance and be introduced to the uses of numerical methods for non-analytical solutions.

- PH 004A - Apply kinematics and Newton’s laws to circular motion and non-inertial frames, understand the effects of air resistance and be introduced to the uses of numerical methods for non-analytical solutions.

g. Solve problems involving work done by constant and varying forces, define the scalar product in the context of work, use the work energy theorem and power.

- MATH 001B - Apply definite integrals to solve problems in geometry, science, probability, and social science.
- PH 004A - Solve problems involving work done by constant and varying forces, define the scalar product in the context of work, use the work energy theorem and power.

h. Understand the relationship between conservative forces and potential energy and conservation of energy in general.

- PH 004A - Understand the relationship between conservative forces and potential energy and conservation of energy in general.

i. Quantitatively predict the outcome of an elastic or inelastic collision in two dimensions and understand how to calculate the center of mass of a system of particles.

- PH 004A - Quantitatively predict the outcome of an elastic or inelastic collision in two dimensions and understand how to calculate the center of mass of a system of particles.

j. Understand the relationships between angular velocity, acceleration and their linear equivalents in the context of the rotation of a rigid object about a fixed axis including calculations of energy, moments of inertia and torque.

- MATH 001B - Apply definite integrals to solve problems in geometry, science, probability, and social science.
- PH 004A - Understand the relationships between angular velocity, acceleration and their linear equivalents in the context of the rotation of a rigid object about a fixed axis including calculations of energy, moments of inertia and torque.

k. Apply the vector product in calculating torque and understand rotational kinematics and angular momentum including rotational collisions.

- PH 004A - Apply the vector product in calculating torque and understand rotational kinematics and angular momentum including rotational collisions.

l. Understand the limitations of gravity as constant acceleration and determine Kepler's laws and the motion of planets, and calculate satellite motion.

- PH 004A - Understand the limitations of gravity as constant acceleration and determine keepers law and the motion of planets, and calculate satellite motion.

m. Describe and solve many types of harmonic motion problems including springs and pendulums, look at damped and driven oscillation problems numerically.

- MATH 001B - Solve first order separable differential equations.
- PH 004A - Describe and solve many types of harmonic motion problems including springs and pendulums, look at damped and driven oscillation problems numerically.

n. Relate mechanical waves and sound waves to harmonic oscillators and understand interference and diffraction problems.

- PH 004A - Relate mechanical waves and sound waves to harmonic oscillators and understand interference and diffraction problems.

o. Describe sinusoidal waves in air, strings and plates and discuss resonance and beats.

- PH 004A - Describe sinusoidal waves in air, strings and plates and discuss resonance and beats.

8. Course Content and Scope:

Lecture:

1. Electricity and Magnetism
    1. Charge, Electric Forces and Coulomb's Law
    2. Gauss' Law and Electric Fields
    3. Electric Potential
    4. Capacitors
    5. Current, Resistance and Resistivity
    6. Circuits, Ohms Law, Kirchoffs Laws
    7. Magnetic Forces and Fields
    8. Motion of Charged Particles in E&B Fields
    9. Faradays Law and Motors and Generators
    10. Inductance
    11. AC Circuits
    12. Electromagnetic Waves and Maxwell's Equations
2. Introduction to Thermodynamics
    1. Heats and Temperature, Phase Changes, Thermal Expansion
    2. Heat Transfer, Kinetic Theory and Ideal Gas Law
    3. Thermodynamics and Heat Engines

Lab: *(if the "Lab Hours" is greater than zero this is required)*

1. Electricity and Magnetism
    1. Charge, Electric Forces and Coulomb's Law
    2. Gauss' Law and Electric Fields
    3. Electric Potential
    4. Capacitors
    5. Current, Resistance and Resistivity
    6. Circuits, Ohms Law, Kirchoffs Laws
    7. Magnetic Forces and Fields
    8. Motion of Charged Particles in E&B Fields
    9. Faradays Law and Motors and Generators
    10. Inductance
    11. AC Circuits
    12. Electromagnetic Waves and Maxwell's Equations
2. Introduction to Thermodynamics
    1. Heats and Temperature, Phase Changes, Thermal Expansion
    2. Heat Transfer, Kinetic Theory and Ideal Gas Law
    3. Thermodynamics and Heat Engines

9. Course Student Learning Outcomes:

   1. State the fundamental laws and describe the fundamental concepts of electricity and magnetism, and discuss the interrelation between electricity and magnetism.
   2. Analyze simple charge and current configurations using the laws of electricity and magnetism; determine the motion of charged particles in the presence of electric and magnetic fields.
   3. Analyze the characteristics and behavior of simple circuits.
   4. Apply equations and laws of physics to determine the behavior of solids, liquids, and gases.
   5. Using the scientific method of inquiry and appropriate experimental techniques in a laboratory setting, set up basic physics experiments, acquire, record, and analyze data, and draw conclusions from the data.

10. Course Objectives: *Upon completion of this course, students will be able to:*

    a. Understand the relationships between Charge, Electric Forces and Coulomb's Law.
    b. Use Gauss' Law to determine Electric Fields of continuous charge distributions.
    c. Determine the Electric Potential of a continuous charge distribution and relate Electric potential to energy.
    d. Understand energy in Capacitors and combinations of capacitors in series and parallel, including parallel plate capacitors.
    e. Solve DC Circuit problems using Ohms Law and Kirchoffs Laws.

f. Understand Magnetic forces and Fields.
g. Determine the motion of a charged particle in a time independent electric and magnetic field. Understand modern particle accelerator technology including projects based on Fermilab and LHC design parameters.
h. Use Faraday's law in the context of Induction.
i. Solve AC Circuit problems.
j. Understand Electromagnetic Waves and how they relate to mechanical waves and Maxwell's equations.
k. Understand the concepts of Heats & Temperature, Phase Changes, Thermal Expansion, Heat Transfer, Kinetic Theory and the Ideal Gas Law.
l. Use the concepts of Thermodynamics, with emphasis on Heat Engines.

11. Methods of Instruction: *(Integration: Elements should validate parallel course outline elements)*
    a. Collaborative/Team
    b. Demonstration, Repetition/Practice
    c. Laboratory
    d. Lecture
    e. Technology-based instruction

12. Assignments: *(List samples of specific activities/assignments students are expected to complete both in and outside of class.)*
    In Class Hours: 108.00
    Outside Class Hours: 108.00
    a. In-class Assignments
        1. Students develop critical thinking skills through class participation and discussion of course topics.
    b. Out-of-class Assignments
        1. Do all reading assignments (text, study guides)
        2. Complete assigned homework assignments.
        3. Submit completed weekly supervised laboratory assignments in thesis format.
        4. Maintain a comprehensive laboratory manual documenting all lab course work.

13. Methods of Evaluating Student Progress: *The student will demonstrate proficiency by:*
    - Written homework
    - Laboratory projects
    - Computational/problem solving evaluations
    - Group activity participation/observation
    - Mid-term and final evaluations
    - Student participation/contribution

14. Methods of Evaluating: Additional Assessment Information:
    a. Periodic examinations: essay; practical parts and short answer. b. A comprehensive final. c. Laboratory examinations. d. Weekly laboratory assignments.

15. Need/Purpose/Rationale -- *All courses must meet one or more CCC missions.*
    IGETC Area 5: Physical and Biological Sciences (mark all that apply)
    A: Physical Science with Lab
    A: Physical Science without Lab
    A: Physical Science, Lab only
    CSU GE Area B: Physical and its Life Forms(mark all that apply)
    B1 - Physical Science
    B3 - Laboratory Sciences
    PO-GE C1-Natural Sciences
    Explain concepts and theories related to physical, chemical, and biological natural phenomena.

Apply the scientific process and its use and limitations in the solution of problems.
Draw a connection between natural sciences and their own lives.
Make critical judgments about the validity of scientific evidence and the applicability of scientific theories.
Demonstrate knowledge of the use of technology in scientific investigation and human endeavors, and the advantages and disadvantage of that technology.
Use college-level mathematical concepts and methods to understand, analyze, and explain issues in quantitative terms.

IO - Scientific Inquiry

Identify components of the scientific method.
Collect and analyze data. Skills of data collection include an understanding of the notion of hypothesis testing and specific methods of inquiry such as experimentation and systematic observation.
Predict outcomes utilizing scientific inquiry: using evidence and assertions determine which conclusions logically follow from a body of quantitative and qualitative data.
Analyze quantitative and qualitative information to make decisions, judgments, and pose questions.
Recognize the utility of the scientific method and its application to real life situations and natural phenomena.

16. Comparable Transfer Course

University System	Campus	Course Number	Course Title	Catalog Year
UC	UC Riverside	PHYS-40C	General Physics	2008-2009
CSU	CSU San Bernardino	PHYS 222	General Physics II	2008-2009

17. Special Materials and/or Equipment Required of Students:

18. Materials Fees: ☐ Required Material?

Material or Item	Cost Per Unit	Total Cost

19. Provide Reasons for the Substantial Modifications or New Course:

TMC

20. a. Cross-Listed Course *(Enter Course Code)*: *N/A*
    b. Replacement Course *(Enter original Course Code)*: PH-004B

21. Grading Method *(choose one)*: Letter Grade Only

22. MIS Course Data Elements
    a. Course Control Number [CB00]: CCC000559804
    b. T.O.P. Code [CB03]: 190200.00 - Physics, General
    c. Credit Status [CB04]: D - Credit - Degree Applicable
    d. Course Transfer Status [CB05]: A = Transfer to UC, CSU
    e. Basic Skills Status [CB08]: 2N = Not basic skills course
    f. Vocational Status [CB09]: Not Occupational
    g. Course Classification [CB11]: Y - Credit Course
    h. Special Class Status [CB13]: N - Not Special
    i. Course CAN Code [CB14]: *N/A*
    j. Course Prior to College Level [CB21]: Y = Not Applicable
    k. Course Noncredit Category [CB22]: Y - Not Applicable
    l. Funding Agency Category [CB23]: Y = Not Applicable
    m. Program Status [CB24]: 1 = Program Applicable

Name of Approved Program *(if program-applicable)*: *N/A*

Attach listings of Degree and/or Certificate Programs showing this course as a required or a restricted elective.)

23. Enrollment - Estimate Enrollment
    First Year: 60
    Third Year: 70

24. Resources - Faculty - Discipline and Other Qualifications:
    a. Sufficient Faculty Resources: Yes
    b. If No, list number of FTE needed to offer this course: *N/A*
25. Additional Equipment and/or Supplies Needed and Source of Funding.
    N/A
26. Additional Construction or Modification of Existing Classroom Space Needed. *(Explain:)*
    N/A
27. FOR NEW OR SUBSTANTIALLY MODIFIED COURSES
    Library and/or Learning Resources Present in the Collection are Sufficient to Meet the Need of the Students Enrolled in the Course: Yes
28. Originator Doug MacIntire Origination Date 10/15/14