Effective Implementation date: Spring 2018, 201830

Required Syllabus Information – all must be included in the course syllabus

PHY112
Course Title: Physics: Algebra-Based II with Lab: GT-SC1
Course Credits: 5
Course Description: Covers the physics of electricity and magnetism and requires application of classical physics to both mathematical and conceptual problems. DC circuits involving resistors, capacitors, and batteries will be covered. Also covered are electromagnetic waves and geometric optics. This course may also include topics relating to simple harmonic motion, traveling and standing waves, and AC circuits. This is a statewide Guaranteed Transfer course in the GT-SC1 category.

Guaranteed Transfer (GT) Pathways Course Statement:
The Colorado Commission on Higher Education has approved PHY112 for inclusion in the Guaranteed Transfer (GT) Pathways program in the GT- SC1 category. For transferring students, successful completion with a minimum C– grade guarantees transfer and application of credit in this GT Pathways category. For more information on the GT Pathways program, go to https://highered.colorado.gov/academics/transfers/gtpathways/curriculum.html.

GT-SC1: NATURAL & PHYSICAL SCIENCES CONTENT CRITERIA
Students should be able to:

1. The lecture content of a GT Pathways science course (GT-SC1):
    a. Develop foundational knowledge in specific field(s) of science.
    b. Develop an understanding of the nature and process of science.
    c. Demonstrate the ability to use scientific methodologies.
    d. Examine quantitative approaches to study natural phenomena.

2. The laboratory (either a combined lecture and laboratory, or a separate laboratory tied to a science lecture course) content of a GT Pathways science course (GT-SC1):
    a. Perform hands-on activities with demonstration and simulation components playing a secondary role.
    b. Engage in inquiry-based activities.
    c. Demonstrate the ability to use the scientific method.
    d. Obtain and interpret data, and communicate the results of inquiry.
    e. Demonstrate proper technique and safe practices.

GT-SC1 COMPETENCIES & STUDENT LEARNING OUTCOMES

Competency: Inquiry & Analysis:
Students should be able to:

4. Select or Develop a Design Process
    a. Select or develop elements of the methodology or theoretical framework to solve problems in a given discipline.

5. **Analyze and Interpret Evidence**
    a. Examine evidence to identify patterns, differences, similarities, limitations, and/or implications related to the focus.
    b. Utilize multiple representations to interpret the data.
6. **Draw Conclusions**
    a. State a conclusion based on findings.

Competency: Quantitative Literacy:
Students should be able to:

1. Interpret Information
    a. Explain information presented in mathematical forms (e.g., equations, graphs, diagrams, tables, words).
2. Represent Information
    a. Convert information into and between various mathematical forms (e.g., equations, graphs, diagrams, tables, words).

REQUIRED COURSE LEARNING OUTCOMES

1. Produce both numerical and symbolic solutions to problems using the techniques of algebra, trigonometry, and the concepts of classical physics.
2. Apply physics concepts and equations to real-world problems and design challenges.
3. Design scientific experiments, collect and analyze data, and draw conclusions.
4. Communicate the ideas of classical physics both in everyday language and in the language of mathematics.
5. Explain and apply the concepts and equations of electrostatics, including Coulomb's Law, Gauss's Law, the electrical properties of matter, and basic concepts relating to charge and charge transfer.
6. Explain and calculate the electric field and potential for discrete and simple continuous charge distributions.
7. Analyze parallel and series circuits involving resistors, capacitors, batteries, and other DC circuit components.
8. Explain and apply the concepts and equations of magnetism, including Faraday's Law, the magnetic properties of matter, and basic concepts relating to currents and induction.
9. Discuss the Lorentz Force Law and the effects of charges and currents on moving particles and on stationary particles.
10. Explain the relationship between the components of electromagnetic waves and calculate the energy carried in an electromagnetic wave.
11. Analyze the use of mirrors and thin lenses to focus or disperse light.

RECOMMENDED COURSE LEARNING OUTCOMES

1. Analyze, conceptually and by the use of phasors and equations, circuits including combinations of inductors, resistors, and capacitors.
2. Demonstrate an understanding, both conceptually and mathematically, of the relationship between a simple mass-spring system and the position, velocity, and acceleration of the mass at any given time.
3. Relate the position and velocity of the mass in a mass-spring system to the energy in the system.

4. Analyze plane waves in one and two dimensions and describe their behavior conceptually and mathematically.
5. Describe, both conceptually and mathematically, the superposition of two waves.
6. Explain how standing waves are formed and relate the concepts and mathematics of standing waves to various situations, including waves on a string and waves in open and closed tubes.

REQUIRED TOPICAL OUTLINE

I. Electrostatics
- a. Electric charge
- b. Coulomb's Law
- c. Insulators and conductors
- d. Charge and field inside/outside a conductor in electrostatic equilibrium
- e. The electric field of discrete and simple continuous charge distributions
- f. Electric flux
- g. Gauss's Law
- h. The electric potential of discrete and simple continuous charge distributions
- i. The Lorentz Force Law for electricity

II. Circuits
- a. Batteries
- b. Resistance
- c. Capacitance
- d. Resistors and capacitors in parallel and series
- e. Resistor circuits
- f. Current, voltage, and power
- g. Ohm's Law
- h. RC circuits

III. Magnetism
- a. Magnetic fields of moving charges and currents
- b. Faraday's Law
- c. Induction
- d. The Lorentz Force Law for magnetism

IV. Electromagnetic Waves
- a. Electromagnetic spectrum
- b. Speed of light
- c. Energy carried in electromagnetic waves
- d. Polarization

V. Optics
- a. Reflection of light
- b. Plane and spherical mirrors
- c. Refraction of light
- d. Lenses

RECOMMENDED TOPICAL OUTLINE

I. Simple Harmonic Motion
   a. The spring-mass sytem
   b. Energy and simple harmonic motion
II. Waves
   a. Nature of waves and the traveling wave equation
   b. Superposition of waves
III. Standing waves
IV. Alternating Current Circuits
   a. Phasor diagrams
   b. LC circuits
   c. LRC circuits
   d. Driven LRC circuits and resonance