Effective Implementation date: SUMMER 2018, 201910

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

PHY 212
Course Title: Physics: Calculus-Based II with Lab: GT-SC1
Course Credits: 5
Course Description: Covers the physics of electricity and magnetism using conceptual and mathematical reasoning, including calculus. Maxwell's equations, waves, and time-varying circuits will be covered. Optional topics include wave and geometric optics and AC circuits.

GT Pathways Requirements:

Guaranteed Transfer (GT) Pathways Course Statement:
The Colorado Commission on Higher Education has approved PHY 212 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 CCHE GT Pathways Program Information.

NATURAL & PHYSICAL SCIENCES (N&PS) CONTENT CRITERIA – GT-SC1

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.

COMPETENCIES & STUDENT LEARNING OUTCOMES FOR GT-SC1

Inquiry & Analysis:

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.

Quantitative Literacy:

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).

SYSTEM REQUIREMENTS:

REQUIRED COURSE LEARNING OUTCOMES

1. Produce both numerical and symbolic solutions to problems using the techniques of calculus 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 the concepts and equations of electrostatics, including Coulomb's Law, Gauss' Law, the electrical properties of matter, and basic concepts relating to charge and charge transfer.
6. Apply the concepts and equations of electrostatics, including Coulomb's Law, Gauss' Law, the electrical properties of matter, and basic concepts relating to charge and charge transfer.
7. Explain and calculate the electric field and potential for discrete and continuous charge distributions.
8. Analyze parallel and series circuits involving resistors, capacitors, batteries, and other circuit components.
9. Explain and apply the concepts and equations of magnetism, including Faraday's Law, the Ampere-Maxwell Law, the magnetic properties of matter, and basic concepts relating to currents and induction.
10. Discuss the Lorentz Force Law and the effects of charges and currents on moving or stationary particles.
11. Write Maxwell's equations in their integral form.
12. Explain Maxwell's equations and what they describe in the physical world.
13. Describe the wave nature of light as indicated by Maxwell's equations.
14. Analyze plane and spherical waves in one, two, and three dimensions, and describe their behavior conceptually and mathematically.
15. Describe, conceptually and mathematically, the superposition of two or more waves.
16. 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.

RECOMMENDED COURSE LEARNING OUTCOMES:

1. Apply the concept of wave superposition to the phenomena of interference and diffraction.

2. Analyze the use of mirrors and thin lenses to focus or disperse light.
3. Analyze, conceptually and by the use of phasors and equations, circuits including combinations of inductors, resistors, and capacitors.

REQUIRED TOPICAL OUTLINE

The required topical outline information MUST be included in the syllabi. It may be incorporated using one of the following variations: copying the topical outline as written below, integrating the topics within the assignment schedule, or listing the topics to be covered.

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 continuous charge distributions
   f. Electric flux
   g. Gauss' Law
   h. The electric potential of discrete and 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. The Biot-Savart Law
   c. Faraday's Law
   d. Induction
   e. The Ampere-Maxwell Law
   f. The displacement current
   g. The Lorentz Force Law for magnetism

IV. Maxwell's equations
   a. Maxwell's equations in their integral form
   b. The meaning of Maxwell's equations, individually and as a group

V. Waves
   a. Nature of waves and the traveling wave equation
   b. Superposition of waves
   c. Standing waves

RECOMMENDED TOPICAL OUTLINE:

I. Optics

a. Interference and diffraction of light
b. Geometric optics

II. Alternating current circuits
a. Phasor diagrams
b. LC circuits
c. LRC circuits
d. Driven LRC circuits and resonance

Syllabi requirements, including legal compliance information must be included. Individual College syllabi guidelines may include additional information. Please contact your VPI/CAO for specific College requirements.