Effective Implementation date: SUMMER 2018, 201910

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

PHY 107
Course Title: Energy Science and Technology with Lab: GT-SC1
Course Credits: 5
Course Description: Explores the science of energy and energy technologies with a focus on renewable energy resources and clean technologies. The course provides a background in the physics of energy, energy transfer, and the current state of energy technology. Evaluation of the future utilization of renewable technologies is included. Topics may include conservation of energy; mechanical, electrical, heat, and fluid power systems; energy transfer and loss; energy audits; and testing solar collectors and wind generators.

GT Pathways Requirements:

Guaranteed Transfer (GT) Pathways Course Statement:
The Colorado Commission on Higher Education has approved PHY 107 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. Discuss current global energy use.
2. Describe the difference between non-renewable and renewable resources.
3. Design scientific experiments, collect and analyze data, and draw conclusions.
4. Communicate, conceptually and mathematically, the ideas of classical physics as they relate to energy, work, heat, and electricity.
5. Relate the work done on an object to a change in the object's energy.
6. Analyze, using calculations and arguments, results based on the Work-Energy Theorem.
7. Analyze, using calculations and arguments, results based on the conservation or non-conservation of total energy in a system.
8. Describe the current state of electricity distribution systems and their limitations.
9. Summarize how fossil fuels develop, where they are located, and why extraction is an environmental issue.
10. Discuss the relationship between energy technology emissions and global climate change.
11. Explain, conceptually and mathematically, how various renewable technologies convert energy to electrical output.
12. Describe the difference between passive and active solar technology systems.
13. Summarize the current use of solar, wind, biomass, geothermal, and hydropower systems.
14. Compare the technology, risks, and benefits of nuclear power to other technologies.
15. Compare the feasibility of various renewable energy technologies to replace fossil fuels.

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. Global energy use overview: past, present, and future

a. How societies use energy
b. Environmental concerns: global warming
c. Fossil fuels: distribution and depletion
d. Efficiency and distribution of current systems

II. Physics of energy needed to understand energy and environmental processes
a. SI units
b. Work, energy, and power
c. Thermodynamics
d. Heat transfer and heat engines
e. Electricity and electric generators
f. Nuclear fission and fusion

III. Overview of technological-engineering systems for the extraction, processing, and end-use of energy
a. Energy conservation and storage
b. Engineering limitations of current grid systems
c. Needs for new technology implementation

IV. Overview of non-renewable vs. renewable energy sources
a. What defines renewable?
b. Fossil fuels defined
c. Peak oil debate
d. Economic and environmental issues of extraction (coal, oil, gas, and minerals)
e. Emissions and global warming
f. Carbon sequestration and coal gasification
g. Renewable technology overview

V. Nuclear energy
a. Fission reactors
b. Waste storage and risk assessment
c. Radiation types, monitoring, and effects
d. Fusion reactors

VI. Solar energy
a. Solar energy, light, reflection, and refraction
b. Passive solar methods
c. Active solar methods
d. Photovolatic basics

VII. Wind energy
a. Energy conversion and power output
b. Current systems

VIII. Biomass energy
a. Biomass sources
b. Biomass conversion
c. Solid waste

IX. Algae conversion

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.