Course Number and Title: PHY 120 Energy Physics

Campus Location:
Georgetown, Dover, Stanton

Effective Date:
2018-51

Prerequisite:
MAT 020, SSC 100 or concurrent

Co-Requisites:
None

Course Credits and Hours:
3.00 credits
3.00 lecture hours/week
1.00 lab hours/week

Course Description:
This course covers the fundamentals of physics concepts with an emphasis on energy principles, including energy conservation, thermodynamics, energy efficiency, and principles of fluid dynamics.

Required Text(s):
Obtain current textbook information by viewing the campus bookstore - https://www.dtcc.edu/bookstores online or visit a campus bookstore. Check your course schedule for the course number and section.

Additional Materials:
None

Schedule Type:
Classroom Course

Disclaimer:
None

Core Course Performance Objectives (CCPOs):

1. Explain the organization and characteristics of science. (CCC 2, 6)
2. Integrate and differentiate the basic energy processes with emphasis on thermodynamics, energy transfer, energy transformation, and efficiency. (CCC 2, 6)
3. Analyze the atomic nature of matter and phase changes. (CCC 2, 6)
4. Integrate and differentiate among the basic principles of waves with emphasis on electromagnetic radiation, sound, and related renewable energy technologies. (CCC 2, 6)
5. Analyze the basic principles of static electricity and current electricity. (CCC 2, 6)
6. Integrate laboratory and didactic principles and experiences with emphasis on work and power, rotational motion, circuits, lighting, and thermodynamics. (CCC 1, 2, 3)

See Core Curriculum Competencies and Program Graduate Competencies at the end of the syllabus. CCPOs are linked to every competency they develop.

Measurable Performance Objectives (MPOs):
Upon completion of this course, the student will:

1. Explain the organization and characteristics of science.
    1. Define *fact*, *hypothesis*, *law*, *theory*, and science methods.
    2. Contrast the traditional scientific method with science methods and the nature of science.
2. Integrate and differentiate between basic energy processes, with emphasis on thermodynamics, energy transfer, energy transformation, and efficiency.
    1. Define *speed*, *velocity*, and *acceleration,* and explain their interrelationship.
    2. List and identify units of measure for force, characteristics of motion, work, energy, power, and temperature.
    3. Explain the law of the conservation of energy.
    4. Derive and calculate characteristics of motion (displacement, velocity, and acceleration) and types of energy from their definitions.
    5. Perform graphical analysis on motion versus time, force versus displacement, and energy versus time graphs.
    6. Define the laws of thermodynamics, and relate these to the principles of energy conservation, transfer, and transformation.
    7. Describe the steps of the Carnot cycle and the refrigeration cycle.
    8. Calculate the heat transfer through a solid surface with air on both sides via conduction and radiation.
    9. Identify examples of forced and spontaneous convection.
    10. Identify examples of fluid dynamics, and relate these to common system components, exfiltration, and infiltration.
    11. Identify examples of heat engines.
    12. Calculate the energy efficiency of complex machines and heat engines.
3. Analyze the atomic nature of matter and phase changes.
    1. Define *atom*, *molecule*, and *particle*.
    2. Describe the microscopic character of liquids, solids, and gases.
    3. Define *the ideal gas law*, and relate gas characteristics and behavior to heat engines and building systems.
    4. Identify and investigate the physics principles of phase changes.
    5. Define *enthalpy*, *latent heat of fusion*, and *latent heat of vaporization*.
    6. Identify opportunities for application of enthalpy, latent heat of fusion, and latent heat of vaporization phenomena in energy technologies.
4. Integrate and differentiate among the basic principles of waves with emphasis on electromagnetic radiation, sound, and related renewable energy technologies.
    1. Define *electromagnetic radiation*, *the electromagnetic spectrum*, *wave-particle duality*, *amplitude*, *frequency*, *period*, *wavelength*, *wave speed*, *interference pattern*, *Doppler effect*, *standing wave*, *node*, and *antinode*.
    2. Differentiate among common light sources based on emission spectra.
    3. List and identify units of measure for frequency, period, amplitude wavelength, and wave speed.
    4. Investigate applications of wave characteristics and electromagnetic radiation in energy technologies.
    5. Define *reflection* and radiation phenomena, including *specular reflection*, *diffuse reflection*, *black and white body radiation theory*, *emissivity*, and *the photovoltaic effect.*
5. Analyze the basic principles of static electricity and current electricity.
    1. Define and identify the units of measure and electronic components or metering devices associated with charge, conductor, insulator, electric field, electric potential energy, voltage, amperage, resistance, inductance, alternating current, direct current, volt-ampere reactive, transformers, and capacitance.
    2. Explain the relationship among electric potential energy, charge, and voltage.
    3. Identify examples of energy storage technologies.
    4. State and apply Ohm's law and Kirchhoff's loop rules.
    5. Distinguish between parallel and series circuits.
    6. Calculate the power consumed by an electrical circuit.
6. Integrate laboratory and didactic principles and experiences with emphasis on work and power, rotational motion, circuits, electromagnetic radiation, and thermodynamics.
    1. Investigate and explain work and power in the laboratory.
    2. Investigate and explain linear and rotational motion in the laboratory.
    3. Investigate and explain properties of circuits in the laboratory.
    4. Investigate and explain properties of electromagnetic radiation in the laboratory.
    5. Investigate and explain thermodynamics in the laboratory.

Evaluation Criteria/Policies:
Students must demonstrate proficiency on all CCPOs at a minimal 75 percent level to successfully complete the course. The grade will be determined using the Delaware Tech grading system:

92	–	100	=	A
83	–	91	=	B
75	–	82	=	C
0	–	74	=	F

Students should refer to the Student Handbook - https://www.dtcc.edu/handbook for information on the Academic Standing Policy, the Academic Integrity Policy, Student Rights and Responsibilities, and other policies relevant to their academic progress.

Core Curriculum Competencies (CCCs are the competencies every graduate will develop):

1. Apply clear and effective communication skills.
2. Use critical thinking to solve problems.
3. Collaborate to achieve a common goal.
4. Demonstrate professional and ethical conduct.
5. Use information literacy for effective vocational and/or academic research.
6. Apply quantitative reasoning and/or scientific inquiry to solve practical problems.

Program Graduate Competencies (PGCs are the competencies every graduate will develop specific to his or her major):
None

Disabilities Support Statement:
The College is committed to providing reasonable accommodations for students with disabilities. Students are encouraged to schedule an appointment with the campus Disabilities Support Counselor to request an accommodation needed due to a disability. A listing of campus Disabilities Support Counselors and contact information can be found at the disabilities services - https://www.dtcc.edu/disabilitysupport web page or visit the campus Advising Center.