**PSC1515 Energy in the Natural Environment**

**Course Description:**
Investigation of the physical environment using energy as a theme to demonstrate the impact of science and technology on the environment and on the lives of people. Special fee. (3 hr. lecture)

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<tr>
<th>Course Competency</th>
<th>Learning Outcomes</th>
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<tr>
<td><strong>Competency 1:</strong> The student will understand the basic methodology of science by:</td>
<td>3. Critical thinking</td>
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<tr>
<td>1. a. Describing the scientific method by differentiating between hypothesis, theory, law and experiment and by giving examples of each. b. Discussing and describing the scientific measurements including the use and conversion of various units (including SI). c. Differentiating between those areas considered “science” and those considered “non-science” or “pseudo-science.”</td>
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<tr>
<th>Competency 2: The student will demonstrate basic knowledge of physics by:</th>
<th>2. Numbers / Data 3. Critical thinking</th>
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<td>1. a. Defining what vector and scalar quantities are and be able to give examples.b. Describing the relationships between position, distance, velocity, speed, and acceleration and know common units for each.c. Explaining what is meant by gravitational acceleration and free fall.d. Describing Newton's Three Laws of Motion and give examples of each.e. Describing Newton's Universal Law of Gravitation, including knowing what objects feel the force and what direction the forces act.f. Explaining the relationship between force, weight, mass and inertia.g. Describing the concept of momentum.h. Explaining what is meant in physics by “conservation laws” and solving problems related to them.i. Describing the work-energy theorem and solving physical problems related to it.</td>
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<th>Competency 3: The student will demonstrate knowledge of gases, liquids and solids by:</th>
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<td>1. a. Describing how force, pressure and area are related.b. Describing the concept of density by writing the formula and solving physical problems related to it.c. Describing Archimedes Principle and how it relates to buoyancy.d. Describing the properties of solids, liquids, and gases. e. Defining temperature and the three scales of measurement.f. Describing heat and how it relates to concepts such as sensible and latent heat.g. Calculating the heat transfer involved during various phase transitions. h. Describing the different modes of heat transfer.i. Summarizing the three Laws of Thermodynamics. j. Describing what is meant by freezing point and melting point and what factors can change them.</td>
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<th>Competency 4: The student will demonstrate basic knowledge of electricity and magnetism by:</th>
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<td>1. a. Describing the concept of an electric charge, field, current, power, resistance and potential.b. Giving two examples of how magnetic fields are created.c. Describing how electricity and magnetism are related and their use in electric motors and generators.d. Describing the differences between AC and DC electricity.</td>
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**Competency 5:** The student will demonstrate knowledge of energy sources by:

1. **a.** Comparing and contrasting the strengths and weaknesses of energy sources, including but not limited to, fossil fuels, nuclear fission and fusion, hydroelectric, wind, solar, waste conversion, geothermal, hydrogen, ocean technology, tides and biomass.
   
   **b.** Differentiating between and giving examples of renewable and non-renewable energy resources.
   
   **c.** Describing and giving examples of conservation and recycling as a strategy to extend available energy and other natural resources.
   
   **d.** Describing the effects of continued population growth on the world’s energy resources.

**2. Numbers / Data**

**3. Critical thinking**

**10. Environmental Responsibility**

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**Competency 6:** The student will demonstrate basic knowledge of wave dynamics by:

1. **a.** Describing the various properties of a wave including amplitude, wavelength, speed, frequency and period.
   
   **b.** Explaining what is meant by constructive and destructive interference.
   
   **c.** Describing and differentiating transverse and longitudinal waves.
   
   **d.** Describing the Doppler Effect and explaining how it is used to detect motion.
   
   **e.** Describing how various types of waves can interact with material to include reflection, absorption, transmission and refraction.
   
   **f.** Explaining how sound waves are created, transmitted and received.
   
   **g.** Describing the electromagnetic spectrum and the various spectra that are contained within to include what is meant by color.
   
   **h.** Explaining what is meant by polarization.

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**Competency 7:** The student will demonstrate a basic knowledge of chemistry by:

1. **a.** Describing parts of the atom including protons, neutrons and electrons, their relative masses, their charges and their locations in the atom.
   
   **b.** Describing the information obtained from a Periodic Table to include periods, groups, atomic weight, and atomic number.
   
   **c.** Differentiating metals, non-metals and semi-metals.
   
   **d.** Describing the relationships between atomic mass, mole, and molar mass.
   
   **e.** Defining an isotope and how it relates to mass number and the calculation of atomic weight.
   
   **f.** Listing the properties of hydrogen, ionic, covalent and polar covalent bonding as they relate to the formation of molecules and compounds.
   
   **g.** Describing how chemical equations are used to represent chemical reactions.
   
   **h.** Describing the Law of Mass Conservation and how it used to balance chemical reactions.
   
   **i.** Describing the differences between acids, bases and salts.
   
   **j.** Explaining how the pH scale is used to measure relative strength between acids and bases.
   
   **k.** Identifying the components in a solution, how concentrations are measured and what is meant by solubility.

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**Competency 8:** The student will demonstrate a basic knowledge of radioactivity by:

1. **a.** Describing the strong nuclear force.
   
   **b.** Describing the three types of radioactivity and relative penetrative ability of each.
   
   **c.** Describing how radiation is measured, common units and biological effects.
   
   **d.** Defining half-life and how it is used to radiometrically date certain objects.
   
   **e.** Describing the process of nuclear fission and fusion.

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**Competency 9:** The student will demonstrate a basic knowledge of geology by:

1. **a.** Explaining the difference between minerals and rocks and describing the three rock types including igneous, sedimentary and metamorphic.
   
   **b.** Explaining the theory of plate tectonics, describing the various types of plate boundaries and identifying who came up with the theory.
   
   **c.** Explaining how earthquakes occur and how the Richter scale is used to measure relative strength.
   
   **d.** Describing how seismic waves are used to map the Earth’s interior.
   
   **e.** Describing the movement
of energy within and upon the Earth including the structure of the lithosphere and asthenosphere and the movement of heat therein.f. Describing how various types of volcanoes are formed to include differentiating between magma and lava.g. Describing how geological time is divided into different time scales to include eon, era, period and epoch.

Competency 10: The student will demonstrate a basic knowledge of atmospheric and oceanic science by:

1. a. Listing the structure and composition of the Earth’s atmosphere and describing how the Earth’s atmosphere has changed in time.b. Comparing the Earth’s atmosphere with that of other planets in our solar system and describing how the atmosphere of each has evolved over time.c. Explaining the causes of air movement within the Earth’s troposphere and how it influences global pressure systems, climatic zones, and local weather.d. Differentiating the major zones of the atmosphere in terms of chemistry and physics to include the troposphere, stratosphere, mesosphere and thermosphere.e. Explaining the causes of air movement within the troposphere and their influences on global pressure systems, climatic zones and local weather.f. Relating the surface and subsurface oceanic circulation patterns to atmospheric patterns, the Earth’s rotational forces and climatic events.g. Describing the Earth’s hydrological cycle and its influence on the atmosphere, hydrosphere, lithosphere, and biosphere.h. Describing the motion of the Earth’s oceans to include surface and thermohaline circulation and how each is affected by the Earth’s atmospheric patterns, rotational forces and climatic events.i. Listing the major greenhouse gases and describing how they contribute to the warming of a planet. j. Describing how and why greenhouse gases have evolved over time and the effects it has had on Earth’s temperature and compare that to the atmospheres of Mars and Venus.

Competency 11: The student will demonstrate a basic knowledge of astronomy by:

1. a. Discussing current theories and evidence on the origin and evolution of the universe, stars, and solar systems.b. Discussing current theories on how each of the atoms of the Periodic Table were created.c. Describing the planets and major moons of our solar system with an emphasis on the exploration and possible human inhabitation of each.d. Describing a lunar and solar eclipse.e. Using a map or globe to locate and define the North and South Poles, the equator, the Tropics of Cancer and Capricorn, the Arctic and Antarctic Circles, lines of latitude and longitude, the Prime Meridian and the International Dateline, and the Tropic, Temperate and Arctic Zones.f. Describing how ocean tides are created and how a Moon phase may influence the size of the tides.