



### **Course Description**

#### **PSC1515 | Energy in the Natural Environment | 3.00 credits**

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.

### **Course Competencies:**

**Competency 1:** The student will understand the basic methodology of science by:

1. Describe the scientific method by differentiating between hypothesis, theory, law, and experiment and giving examples
2. Discussing and describing the scientific measurements, including using and converting various units (including SI)
3. Differentiating between those areas considered “science” and those considered “non-science” or “pseudo-science”

**Competency 2:** The student will demonstrate basic knowledge of physics by:

1. Defining what vector and scalar quantities are and be able to give examples
2. Describe the relationships between position, distance, velocity, speed, and acceleration and know each standard unit
3. Explaining what is meant by gravitational acceleration and free fall
4. Describe Newton's Three Laws of Motion and give examples of each
5. Describing Newton's Universal Law of Gravitation, including knowing what objects feel the force and what direction the forces act
6. Explaining the relationship between force, weight, mass, and inertia
7. Describing the concept of momentum
8. Explaining what physics means by “conservation laws” and solving related problems
9. Describe the work-energy theorem and solve physical problems related to it

**Competency 3:** The student will demonstrate knowledge of gases, liquids, and solids by:

1. Describe how force, pressure, and area are related
2. Describe the concept of density by writing the formula and solving physical problems related to it.
3. Describing Archimedes Principle and how it relates to buoyancy
4. Describe the properties of solids, liquids, and gases
5. Defining temperature and the three scales of measurement
6. Describing heat and how it relates to sensible and latent heat concepts
7. Calculating the heat transfer involved during various phase transitions
8. Describing the different modes of heat transfer
9. Summarizing the three Laws of Thermodynamics
10. Describing what is meant by freezing point and melting point and what factors can change them

**Competency 4:** The student will demonstrate basic knowledge of electricity and magnetism by:

1. Describe the concept of an electric charge, including field, current, power, resistance, and potential.
2. Giving two examples of how magnetic fields are created
3. Describing how electricity and magnetism are related and their use in electric motors and generators.
4. Describing the differences between AC and DC electricity

**Competency 5:** The student will demonstrate knowledge of energy sources by:

1. 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

2. Differentiating between and giving examples of renewable and non-renewable energy resources
3. Describe and give examples of conservation and recycling to extend available energy and other natural resources
4. Describing the effects of continued population growth on the world's energy resources

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

1. Describing the various properties of a wave, including amplitude, wavelength, speed, frequency, and period
2. Explaining what is meant by constructive and destructive interference
3. Describing and differentiating transverse and longitudinal waves
4. Describe the Doppler Effect and explain how it detects motion
5. Describe how various types of waves can interact with the material, including reflection, absorption, transmission, and refraction
6. Explaining how sound waves are created, transmitted, and received
7. Describe the electromagnetic spectrum and the various spectra within, including what color means
8. Explaining what is meant by polarization

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

1. Describing parts of the atom, including protons, neutrons, and electrons, their relative masses, their charges, and their locations in the atom
2. Describe the information obtained from a Periodic Table, including periods, groups, atomic weight, and atomic number
3. Differentiating metals, non-metals, and semi-metals
4. Describe the relationships between atomic, mole, and molar mass
5. Defining an isotope and its relation to mass numbers and calculating atomic weight
6. List the properties of hydrogen, ionic, covalent, and polar bonding as they relate to forming molecules and compounds
7. Describe how chemical equations are used to represent chemical reactions
8. Describing the Law of Mass Conservation and how it balances chemical reactions
9. Describing the differences between acids, bases, and salts
10. Explain how the pH scale measures the relative strength between acids and bases
11. Identify the components in a solution, how concentrations are measured, and what solubility means

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

1. Describing the strong nuclear force
2. Describe the three types of radioactivity and the relative penetrative ability of each
3. Describe how radiation is measured, including common units and biological effects
4. Defining half-life and how it is used to date certain objects radiometrically
5. Describing the process of nuclear fission and fusion

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

1. Explaining the difference between minerals and rocks and describing the three rock types including igneous, sedimentary and metamorphic
2. Explain the theory of plate tectonics, describe the various types of plate boundaries, and identify who came up with the theory
3. Explain how earthquakes occur and how the Richter scale is used to measure relative strength
4. Describe how seismic waves are used to map the Earth's interior
5. Describe the movement of energy within and upon the Earth, including the structure of the lithosphere and asthenosphere, and the movement of heat therein
6. Describe how various types of volcanoes are formed, including differentiating between magma and lava
7. 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. List the structure and composition of the Earth's atmosphere and describe how the Earth's atmosphere has changed in time
2. Comparing the Earth's atmosphere with that of other planets in our solar system and describing how the atmosphere of each has evolved
3. Explain the causes of air movement within the Earth's troposphere and how it influences global pressure systems, climatic zones, and local weather
4. Differentiating the significant zones of the atmosphere in terms of chemistry and physics to include the troposphere, stratosphere, mesosphere, and thermosphere
5. Explaining the causes of air movement within the troposphere and their influences on global pressure systems, climatic zones, and local weather
6. Relating the surface and subsurface oceanic circulation patterns to atmospheric patterns, the Earth's rotational forces, and climatic events
7. Describing the Earth's hydrological cycle and its influence on the atmosphere, hydrosphere, lithosphere, and biosphere
8. 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
9. List the significant greenhouse gases and describe how they contribute to the warming of a planet
10. Describe how and why greenhouse gases have evolved 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. Discuss current theories and evidence on the origin and evolution of the universe, stars, and solar systems
2. Discuss current theories on how each of the atoms of the Periodic Table was created
3. Describing the planets and major moons of our solar system, emphasizing the exploration and possible human inhabitation of each
4. Describing a lunar and solar eclipse
5. 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
6. Describe how ocean tides are created and how a moon phase may influence the size of the tides

**Learning Outcomes:**

- Use quantitative analytical skills to evaluate and process numerical data
- Solve problems using critical and creative thinking and scientific reasoning
- Describe how natural systems function and recognize the impact of humans on the environment