Miami Dade College

Course description

PHY1005| Physics with Applications 2| 3.00 credits

Emphasizes the basic concepts and principles and their practical applications. Designed specifically for students in technical studies and for others wishing to strengthen their physics background before taking advanced courses. Prerequisite: PHY1004; Corequisite: PHY1005L.

Course competencies:

Competency 1: Describing the method by:

1. Identifying which object can be electrically charged in contact temporally by induction or permanently by induction

Competency 2: The student will demonstrate an application of the coulomb's law by:

1. Describing the factors that determine the magnitude of the electric force between two-point charges
2. Applying Coulomb's law in solving word problems related to the electrostatic forces between charged objects

Competency 3: The student will demonstrate a comprehension of electric field patterns and equipotential line patterns by:

1. Drawing the electric field pattern and equipotential line pattern about:
   a. Single point charges
   b. Two-point charges, which are oppositely charged
   c. Two oppositely charged parallel plates

Competency 4: The student will demonstrate an application of the concepts of electric field, electric force, electrical potential, electrical potential difference, and kinetic energy of a point charged by:

1. Solving word problems related to a point charge placed near one or more other points between two oppositely charged parallel plates of a capacitor

Competency 5: The student will demonstrate an application of electrical resistance by:

1. Solving word problems related to the variation of electrical resistance with the material of the conductor:
   a. Cross-sectional area of the conductor
   b. Length of the conductor
   c. Temperature of the conductor

Competency 6: the student will demonstrate an application of Ohm's law by:

1. Stating the correct relationship between voltage, electrical resistance, and electrical current
2. Solving word problems involving Ohm's law
3. Solving word problems related to electric power, electric energy, and the cost of electric energy

Competency 7: The student will demonstrate an application of Ohm's law and Kirchhoff's laws by:

1. Stating Kirchhoff's laws in the student's own words
2. Solving word problems related to resistors arranged in series and parallel in an electric circuit

Competency 8: The student will demonstrate a comprehension of the RC circuit by:

1. Explaining the method by which a capacitor can be charged when connected in series with a battery and a resistor
2. Describing how this type of circuit can be used in a heart pacemaker

Competency 9: The student will demonstrate a comprehension of the direction of a magnetic field about current carrying wires by:

1. Using the right-hand rule to predict the direction of the magnetic field produced by the current

Competency 10: The student will demonstrate a comprehension of the magnetic field lines between the poles of bar magnets by:

1. Drawing the line patterns:
    a. Around a single bar magnet
    b. Between a magnetic north pole and a magnetic south pole
    c. Between two like poles
    d. Around a horseshoe magnet

Competency 11: The student will demonstrate an application of the right-hand rule by:

1. Using the appropriate right-hand rule to determine the direction of the force on a current-carrying wire in a magnetic field and a charged particle passing perpendicular through a magnetic field

Competency 12: The student will demonstrate an application of the right-hand rule by:

1. Solving word problems related to the magnitude of the force on a current-carrying wire in a magnetic field motion of charged particles traveling through magnetic fields

Competency 13: The student will demonstrate a comprehension of the charge-to-mass ratio for an electron experiment performed by:

1. Describing the apparatus and procedures used in the experiment
2. Explaining how Thomson's conclusions on the experiment's results led to his model of the atom
3. Solving word problems to determine the charge's ratio to an electron's mass

Competency 14: The student will demonstrate a comprehension of Lenz's law by:

1. Determining the direction of induced electric current through wires either moving perpendicular to a stationary magnetic field or in a changing magnetic field

Competency 15: The student will demonstrate an application of Faraday's law by:

1. Solving word problems related to the values of (induced) voltages and currents
2. Producing a wire moving perpendicular to a magnetic field in a coil of wire in a changing magnetic field

Competency 16. The student will demonstrate an application of the production of images by lenses or mirrors by:

1. Drawing a ray diagram and locating the image of an object placed at some distance from a lens or mirror of known focal length
2. Using the Gaussian form of the lens and mirror equations to solve word problems related to the formation of real and virtual images

Competency 17: The student will demonstrate an application of Snell's law by:

1. Solving problems related to the refraction of light as it passes from one substance to another
2. Solving word problems related to total internal reflection and the critical angle of a substance

Competency 18: The student will demonstrate an application of geometrical optics by:

1. Explaining how a converging lens produces an image on the film of a camera
2. Explaining how a converging lens is used in a movie or slide projector to produce an image on a screen
3. Explaining how images are produced by a microscope or refracting telescope
4. Explaining how a reflecting telescope produces images

Competency 19: The student will demonstrate an application of geometrical optics by:

1. Explaining how the lens of the human eye produces an image on the retina:
    a. Converging or diverging lenses can be used to correct the vision of a person who has one of the

following defects:

I. Nearsightedness (myopia)
II. Hyperopia (farsightedness)
III. Astigmatism

Competency 20: The student will demonstrate a comprehension of the wave theory of light by:

1. Describing and explaining in the student's own words how Young's double slit experiment, single slit diffraction experiment and diffraction grating support the wave theory of light

Competency 21: The student will demonstrate a comprehension of electromagnetic waves by:

1. Listing the sections of the electromagnetic spectrum from the longest wavelength to the shortest:
    a. Radio waves
    b. Microwaves
    c. Infrared light
    d. Visible light
    e. Ultraviolet light
    f. X-rays
    g. Cosmic rays
2. Describing in the student's own words the process by which accelerated electric charges produce an electromagnetic wave

Competency 22: The student will demonstrate a comprehension that light is a transverse electromagnetic wave by:

1. Describing how the polarization of light by reflection indicates that light is a transverse wave
2. Solving word problems using Brewster's formula to calculate the angle of maximum polarization of reflected light from various substances

Competency 23: The student will demonstrate a comprehension of x-rays by:

1. Describing the experiments performed by Wilhelm Roentgen that led to their discovery
2. Solving word problems to determine the frequency, wavelength, and energy of an x-ray

Competency 24: The student will demonstrate a comprehension of the Rutherford scattering experiment by:

1. Describing the apparatus and procedures used in the experiment
2. Explaining how the results and conclusions drawn from the experiment led to his model of the atom
3. Solving word problems to determine the size of the nucleus of the atom

Learning Outcomes:

- Communicate effectively using listening, speaking, reading, and writing skills
- Solve problems using critical and creative thinking and scientific reasoning
- Use computer and emerging technologies effectively