Miami Dade College

Course Description

PHY2049 | Physics With Calculus 2 | 4.00 credits

Foundation course for physical science and engineering majors. PHY2048 covers classical mechanics and thermodynamics. PHY2049 includes electricity, magnetism, waves, and optics

Course Competencies:

Competency 1: The student will demonstrate an understanding of electric charges by charges by:

1. Explaining electrostatic interactions between charges
2. Calculating the resultant force exerted on a charge by other charges.

Competency 2: The student will demonstrate an understanding of electric fields by:

1. Calculating the resultant electric field at a point that results from one or more-point charges.
2. Calculating the resultant electric field at a point that results from a distribution of charges leads to a simple analytical expression.
3. Calculating the acceleration of a charged particle in a uniform electric field.
4. Finding the net force and torque acting on a dipole in an electric field.
5. Using Gauss's law to find the electric field near a symmetrical distribution of charge

Competency 3: The student will demonstrate an understanding of electric potential by:

1. Calculating the electric potential at a point in the vicinity of one or more point charges.
2. Calculating the electric potential at a point in the vicinity of a continuous distribution of charges.
3. Finding the electric field in a region where the electric potential is known as a function of position.
4. Finding the change in potential energy occurs when a charge is moved from one point to another in an electric field.

Competency 4: The student will demonstrate an understanding of capacitance by:

1. Calculating the equivalent capacitance for two or more capacitors connected in series or parallel.
2. Calculating the energy and energy density within a capacitor.
3. Explaining the effects produced by a dielectric material between the plates of a capacitor.

Competency 5: The student will demonstrate an understanding of the concepts of electric current and resistance by:

1. Calculating the quantity of charge transferred by a given current.
2. Finding the resistance of a conductor of known material and dimensions.
3. Finding the current and power in various elements of a network of resistors connected in series and/or parallel. Finding the current at various points of a multi-loop circuit.
4. Finding the charge, current, power, and energy as a function of time in a circuit with resistance and capacitance.

Competency 6: The student will demonstrate an understanding of the magnetic field by:

1. Finding the magnetic force on a charged particle in motion.
2. Finding the magnetic force on a current-carrying wire.
3. Calculating the torque on a current loop in a uniform magnetic field.
4. Using biot-savarts law for a current element to calculate magnetic fields with a simple analytical expression.
5. Using amperes law to find the magnetic field near a symmetrical distribution of currents.

Competency 7: The student will demonstrate an understanding of electromagnetic induction by:

1. Finding the magnetic flux across a surface.

2. Using Faraday's law to find the induced electromotive force in a loop.
3. Determining the direction of the induced current by utilizing Lenz's law.
4. Explaining the operating principle of an AC generator.
5. Calculating the induced electric field associated with a changing magnetic flux.
6. Finding the self- and mutual inductance of symmetric configurations of conductors.
7. Finding the current and power as a function of time in a circuit with resistance and inductance.
8. Describing the oscillations of current and voltage in a circuit with capacitance and inductance.

Competency 8: The student will demonstrate an understanding of alternating current(ac) by:

- Using the concept of root-mean-square averages in AC circuits.
- Finding the resistance, reactance, and impedance of simple AC combinations of resistors, capacitors, and inductors. Explaining the wave nature of light using Maxwell's equations.
- Calculating the voltage, current, and power in basic AC circuits.
- Explaining resonance in an lRC series circuit.
- Using the basic equations describing an ideal transformer.

Competency 9: the student will demonstrate an understanding of Maxwell equations by:

- Noticing the equations' symmetry and the displacement current's presence.
- Calculating the speed of light in vacuum from the electric and magnetic constants.
- Using the Poynting vector to calculate the radiation flux.
- Finding the radiation momentum and pressure.

Competency 10: The student will demonstrate an understanding of ray optics by:

- Explaining the propagation of light in a homogeneous medium.
- Using the laws of reflection and refraction of light at the boundary between two media.
- Explaining total internal reflection.
- Describing the images formed by plane and spherical mirrors.
- Using the thin-lens equation to find the images formed by simple combinations of lenses.

Competency 11: The student will demonstrate an understanding of wave optics by:

- Explaining the wave interference patterns generated by thin films and narrow slits.
- Finding the maxima and minima of interference created by two slits and finding the minima of diffraction created by a single slit.
- Finding the maxima created by a diffraction grating.
- Using the Rayleigh criterion to find the resolution limit.
- Explaining polarization of light and the effects of polarizers.

Learning Outcomes:

- Use quantitative analytical skills to evaluate and process numerical data
- Solve problems using critical and creative thinking and scientific reasoning
- Communicate effectively using listening, speaking, reading, and writing skills