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 while 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
4. Finding the current at various points of a multi-loop circuit
5. 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 ofcurrents

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:

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

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

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

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

1. Explaining the propagation of light in a homogeneous medium
2. Using the laws of reflection and refraction of light at the boundary between two media
3. Explaining total internal reflection
4. Describing the images formed by plane and spherical mirrors
5. 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:

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

Learning Outcomes:

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