Miami Dade College

Course Description

PHY2054 | Physics (without Calculus) 2 | 3.00 credits

An introduction to the basic principles of physics. PHY 2053 covers mechanics, sound and thermodynamics. PHY 2054 includes electricity, magnetism, and optics. Prerequisite: PHY 2053; corequisite: PHY 2054L. Special fee.

Course Competencies:

Competency 1: The student will demonstrate knowledge, comprehension, application, and synthesis of units and dimensions by:

1. Stating or recognizing the units of all the physical quantities discussed in this course
2. Expressing the units of complex physical quantities discussed in this course in terms of simpler units.

Competency 2: The student will demonstrate knowledge, comprehension, application, and evaluation of the concepts of electric charge and electric field in electrostatics by:

1. Stating or recognizing the concept of electric charge.
2. Distinguishing between positive and negative charges and identifying the carriers of positive and negative charges.
3. Stating or recognizing the charge of the proton and the electron.
4. Stating or recognizing the principle of conservation of charge.
5. Solving problems involving conservation of charge.
6. Describing or recognizing the process of charging by contact conduction induction
7. Stating or recognizing the electrical properties of conductors, insulators, and semiconductors.
8. Stating, recognizing, and applying the definition of electric field.
9. Stating or recognizing the properties of electric lines of force.
10. Inferring the magnitude and direction of the electric field given the lines of force.
11. Drawing electric lines of force when given a simple charge distribution.
12. Stating or recognizing Coulombs' law, gauss's law, and the principle of superposition.
13. Solving problems involving electric charges exerting forces on each other electric charges interacting with electric fields
14. Solving problems involving the electric field of discrete charge distributions.
15. Stating or recognizing the properties of electric fields within and around conductors and dielectrics.

Competency 3: The student will demonstrate knowledge, comprehension, application analysis, and evaluation of electric potentials in electrostatics by:

1. Stating or recognizing and applying the definition of the basic physical quantities related to electrical energy, electric potential, energy difference, electric potential, and voltage.
2. Distinguishing between electric field, electric potential energy difference, electric potential difference potential difference, electric potential, and voltage.
3. Stating or recognizing the relationship between electric fields, electric potential energy differences, electric potential differences, electric potentials, and voltage.
4. Solving problems involving the relationship between electric fields, electric potential energy differences, electric potential differences, electric potentials, and voltage.
5. Solving problems involving the acceleration of charges by electric potential differences.
6. Solving problems involving the electric potential of discrete and charge distributions using the electric potential of a point charge and the principle of superposition.
7. Stating or recognizing the definition of equipotential lines and their relationship to electric lines of force.
8. Drawing equipotential lines given the electric lines of force and vice-versa.
9. Drawing the equipotential lines of simple charge distributions.
10. Stating or recognizing the definition of an ideal cell or battery.

11. Describing the construction of a simple cell or battery.

Competency 4: The student will demonstrate knowledge, comprehension, and application of capacitors by:

1. Stating or recognizing the definition of a capacitor and capacitance.
2. Describing different uses for capacitors.
3. Describing the process of charging and discharging capacitors.
4. Describing the design of parallel plate capacitors.
5. Stating or recognizing the relationship between charge, capacitance, and energy stored in a capacitor.
6. Stating or recognizing the relationship between the electric field and the electric potential difference in a single parallel plate capacitor.
7. Stating or recognizing the relationship between the electric field and the energy storage in a parallel plate capacitor.
8. Stating or recognizing the definition of series, parallel, and series-parallel electrical connections for electrical devices in general for capacitors in particular
9. Solving problems involving charge, capacitance, and electric potential difference in single capacitors as well as in capacitors connected in series connected in parallel in series-parallel combinations
10. Stating or recognizing the definition of the dielectric constant.
11. Describing the microscopic dipole theory of the structure of dielectrics.
12. Calculating the effect on the capacitance, charge, electric field, electric potential, and energy storage when a dielectric is introduced in a capacitor.

Competency 5: The student will demonstrate knowledge, comprehension, and application of electric currents by:

1. Stating, recognizing, and applying the definition of electric current.
2. Distinguishing between direct and alternating current.
3. Stating or recognizing which are the charge carriers involved in different types of charge flow.
4. Solving problems involving the relationship between electric current and the number and speed of charges involved in the current.
5. Stating or recognizing Ohm's law.
6. Stating or recognizing the definition of resistance and resistivity.
7. Solving problems involving the dependence of the resistance of a wire on the resistivity, length, and cross-sectional area.
8. Solving problems involving the variation of the resistance of a metallic conductor with temperature.
9. Solving problems involving the relationships between the potential difference across a resistor, the current flowing through that resistor, and the power dissipated by that resistor.
10. Solving problems involving electrical power consumption.

Competency 6: The student will demonstrate knowledge, comprehension, and application of electric DC circuits by:

1. Stating or recognizing the definition of an electric circuit.
2. Stating or recognizing the concept of electromotive force or emf.
3. Solving problems involving the relationship between the EMF and terminal voltages and internal resistance of real batteries.
4. Calculating the electric potential of batteries connected in series-parallel
5. Calculating the resistance, current, and voltage when resistors are connected in series-parallel series-parallel combinations.
6. Stating or recognizing Kirchhoff laws.
7. Using Kirchhoff laws to calculate currents and voltages in circuits involving resistors.
8. Describing the charging and discharging process of the capacitor in an RC circuit.
9. Solving problems involving the values of the resistor and capacitor in an RC circuit and the time it takes the charge to build up or disappear from the capacitor.
10. Distinguishing between DC voltmeters and ammeters according to their function, their internal resistance, and the way they are connected when used to make measurements.

Competency 7: The student will demonstrate knowledge, comprehension, application, and evaluation of magnetic fields by:

1. Stating or recognizing the definition of the magnetic field.
2. Stating or recognizing the relationship between moving charges and magnetic fields.
3. Stating or recognizing that magnetic charges do not exist.
4. Stating and recognizing the definition of magnetic moment and its relationship to magnetic fields.
5. Stating or recognizing the spin magnetic moment of electrons, protons, and neutrons.
6. Describing the interaction of magnets and magnetic fields.
7. Stating or recognizing the relationship between magnetic poles and the direction of the magnetic field.
8. Relating the pole and magnetic line concepts to bar magnets, horseshoe magnets, compass needles, and the magnetic field of the earth.
9. Solving problems involving the force or torque between a magnetic field and a bar magnet, a moving charge, and a Straight wire carrying a current loop magnetic moment.
10. Solving problems involving the force between electric currents.
11. Describing the operation of a DC motor.
12. Drawing the magnetic field lines from a straight current loop's solenoid.
13. Solving problems about generating the magnetic field using straight current loop solenoids.
14. Solving problems involving the relationship between energy storage and magnetic fields in a solenoid.
15. Distinguishing between diamagnetism paramagnetic and ferromagnetism)
16. Stating or recognizing the role played by electron orbits and electron spin in diamagnetism paramagnetic and ferromagnetism.

Competency 8: The student will demonstrate knowledge, comprehension, application, and evaluation of electromagnetic induction by

1. Stating or recognizing the definition of induced emf, inductance, and magnetic flux.
2. Stating or recognizing faradays and lens law.
3. Solving problems involving the emf induced by a constant magnetic field on a moving conductor rotating loop) on a loop whose area is changing) solving problems involving the EMF induced by a varying magnetic field on a fixed conducting loop.
4. Describing the functioning of electric generators.
5. Distinguishing between AC and DC generators.
6. Stating, recognizing, and applying the definitions of reactance, impedance, phase constant, and power factor as they relate to LRCS series AC circuits.
7. Stating and recognizing the concept of resonance related to lRC series AC circuits.
8. Solving problems involving the emf, current, power, and phase in lRC series AC circuits.
9. Describing the functioning of transformers.
10. Solving problems involving the power, current, and voltage in transformers.

Competency 9: The student will demonstrate knowledge, comprehension, application, and evaluation of electromagnetic waves by:

1. Stating or recognizing Maxwell equations.
2. Stating or recognizing the role of Maxwell equations and the displacement current in the propagation of electromagnetic waves
3. Stating or recognizing the role of accelerated charges in generating electromagnetic waves.
4. Stating or recognizing the relative direction of the electric field, the magnetic field, and the direction of propagation for plane electromagnetic waves in a vacuum.
5. Solving problems involving the relationship between the electric field, the magnetic field, and the propagation speed of electromagnetic waves.
6. Stating or recognizing the definition of frequency and wavelength of electromagnetic waves.
7. Solving problems involving the relationship between frequency, wavelength, and speed of propagation for electromagnetic waves.

8. Describing different methods for determining the speed of light.
9. Solving problems involving the relationship between the electric and magnetic field magnitudes and the energy and momentum transported by electromagnetic waves.
10. Stating or recognizing the different kinds of waves that make up the electromagnetic spectrum.
11. Distinguishing between the different components of the electromagnetic spectrum in terms of wavelength and frequency.

Competency 10: The student will demonstrate knowledge, comprehension, application, and evaluation of geometrical optics by:

1. Stating and describing the ray model of light.
2. Drawing light rays from point sources and extended sources.
3. Distinguishing between diffuse and specular reflection.
4. Distinguishing between reflection, refraction, and scattering.
5. Stating and recognizing the law of reflection.
6. Drawing ray diagrams showing the refraction of rays at the plane interface between two media as they pass through rectangular slabs they pass through a triangular prism
7. Stating and recognizing the definition of refractive index.
8. Stating or recognizing the law of refraction.
9. Solving problems involving the law of refraction and the direction of the incident and refracted rays.
10. Stating or recognizing the definition of total internal reflection.
11. Drawing ray diagrams showing the total internal reflection of a ray incident at the interface between two media.
12. Using total internal reflection to explain how fiber optics is used to bend light around corners.
13. Stating, recognizing, and applying the definition of focal point and focal length for lenses and mirrors.
14. Drawing ray diagrams illustrating the image formation by plane mirrors spherical mirrors.
15. Solving problems involving image formation by plane mirrors and spherical mirrors.
16. Drawing ray diagrams illustrating the image formation by plane refracting surfaces and thin lenses.
17. Solving image formation problems by plane refracting surface thin lenses.

Competency 11: The student will demonstrate knowledge, comprehension, application, and evaluation of physical optics by:

1. Distinguishing between the wave theory of light and the particle theory of light.
2. Stating or recognizing the definition of interference, diffraction, scattering, dispersion, and polarization.
3. Stating or recognizing Huygens's principle.
4. Using Huygens's principle to explain diffraction.
5. Solving problems involving the relationship between the index of refraction and the speed, frequency, and wavelength of light
6. Distinguishing between coherent and incoherent sources.
7. Distinguishing between constructive and destructive interference.
8. Drawing ray and wave diagrams
9. Illustrating the resulting constructive and destructive interference produced by a double slit apparatus.
10. Solving problems involving the constructive and destructive interference of light produced by a double slit apparatus.
11. Explaining how to use a double slit apparatus to determine the wavelength of light.
12. Drawing ray diagrams illustrating the dispersion of light by a prism.
13. Using interference to explain the diffraction of light by a circular aperture.
14. Solving problems involving the diffraction of light by a single circular or rectangular aperture.
15. Use interference to explain the diffraction pattern produced by a diffraction grating. O)solving problems using the diffraction of light by a diffraction grating.
16. Describing the use of diffraction gratings in spectroscopy.
17. Distinguishing between a continuous and discrete spectrum
18. Explaining, using interference, the interaction of light with thin film the function of non reflective coatings.

19. Distinguishing between plane polarized light and unpolarized light.
20. Distinguishing between polarization by scattering reflection transmission through birefringent materials transmission through polaroid sheets.
21. Solving problems involving polarization and intensity of light transmitted through polaroid sheets.
22. Solving problems involving the polarizing angle.

Competency 12: The student will demonstrate knowledge, comprehension, analysis, application, and evaluation of optical instruments by:

1. Describing the arrangement of lenses or mirrors in the human eye, the camera is a simple magnifier, a compound microscope refracting telescope, reflecting telescope
2. Drawing ray diagrams illustrating the image formation of the human eye (camera, simple magnifier, compound microscope, refracting telescope, reflecting telescopes) describes the characteristics and causes of common eye defects.
3. Describing the process of accommodation in human vision.
4. Distinguishing between angular magnification and lateral magnification in magnifiers and telescopes.
5. Describing the characteristics and the causes of the common lens aberrations.
6. Stating or recognizing the definition of resolution.
7. Stating or recognizing the definition of Rayleigh's criterion.
8. Solving problems involving the relationship between the Rayleigh criterion and the limit of resolution of optical instruments.

Learning Outcomes:

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