Miami Dade College

Course Description

PHY2054 | Physics (without Calculus) 2 | 3.00 credits

This course is an introduction to the basic principles of physics. PHY2053 covers mechanics, sound and thermodynamics. PHY2054 includes electricity, magnetism, and optics. Prerequisite: PHY2053; corequisite: PHY2054L, 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 charge
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 and 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 capacitor
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 connected 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, 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: stating or recognizing the definition of an electric circuit

1. Stating or recognizing the concept of electromotive force or EMF
2. Solving problems involving the relationship between the emf and terminal voltages and internal resistance of real batteries
3. Calculating the electric potential of batteries connected in series parallel
4. Calculating the resistance, current and voltage when resistors are connected in series parallel series-parallel combinations
5. Stating or recognizing Kirchoff's Laws
6. Using Kirchhoff's Laws to calculate currents and voltages in circuits involving resistors
7. Describing the charging and discharging process of the capacitor in an RC circuit
8. 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
9. Distinguishing between dc voltmeters and ammeters according to their function their internal resistance 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 a straight wire carrying a current a current loop's a 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 due to a straight current loops solenoids
13. Solving problems about the generation of magnetic field by a straight current loops solenoids
14. Solving problems involving the relationship between energy storage and magnetic fields in a solenoid
15. Distinguishing between diamagnetism paramagnetism and ferromagnetism
16. Stating or recognizing the role played by electron orbits and electron spin in diamagnetism paramagnetism 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 Lenz's law
3. Solving problems involving the emf induced by a constant magnetic field on a moving conductor a rotating loop on a loop whose area is changing
4. Solving problems involving the emf induced a varying magnetic field on a fixed conducting loop
5. Describing the functioning of electric generators
6. Distinguishing between AC and DC generators
7. Stating, recognizing, and applying the definitions of reactance, impedance, phase constant, and power factor as they relate IRC series ac circuits
8. Stating and recognizing the concept of resonance as it relates to lRCs series ac circuits
9. Solving problems involving the emf, current, power and phase in IRC series ac circuits
10. Describing the functioning of transformers
11. 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 maxwells equations
2. Stating or recognizing the role of maxwells equations and the displacement current in the propagation of electromagnetic waves
3. Stating or recognizing the role of accelerated charges in the generation of 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 vacuum
5. Solving problems involving the relationship between the electric field, the magnetic field and the speed of propagation 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 magnitudes of the electric and magnetic field 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 a rectangular slab as 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 spherical mirrors
16. Drawing ray diagrams illustrating the image formation by plane refracting surfaces thin lenses
17. Solving image formation problems by plane refracting surfaces 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 principle
4. Using Huygens 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 illustrating the resulting constructive and destructive interference produced by a double slit apparatus
9. Solving problems involving the constructive and destructive interference of light produced by a double slit apparatus
10. Explaining how to use a double slit apparatus to determine the wavelength of light
11. Drawing ray diagrams illustrating the dispersion of light by a prism
12. Using interference to explain the diffraction of light by a circular aperture
13. Solving problems involving the diffraction of light by a single circular or rectangular aperture
14. Using interference to explain the diffraction pattern produced by a diffraction grating
15. 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 films 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 material strains mission 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 a simple magnifier a compound microscope refracting telescope reflecting telescope
2. Drawing ray diagrams illustrating the image formation of the human eye the camera a simple magnifier a compound microscope refracting telescope a reflecting telescope
3. Describing the characteristics and the causes of common eye defects
4. Describing the process of accommodation in human vision
5. Distinguishing between angular magnification and lateral magnification in magnifiers and telescopes
6. Describing the characteristics and the causes of the common lens aberrations
7. Stating or recognizing the definition of resolution
8. Stating or recognizing the definition of Rayleigh criterion
9. Solving problems involving the relationship between Rayleigh criterion and the limit of resolution of optical instruments

General Education Learning Outcomes:

- Use quantitative analytical skills to evaluate and process numerical data
- Solve problems using critical and creative thinking and scientific reasoning
- Formulate strategies to locate, evaluate, and apply information