SAGRADO
Universidad del Sagrado Corazón

SYLLABUS

TITLE: General Physics II

CODE: FIS 204

PREREQUISITE: FIS 203

CREDITS: 4 credits | 45 hours contact | 45 hours of laboratory | 1 term

DESCRIPTION

This course is the continuation of General Physics 1, this course is also developed in a theoretical and experimental way where the active learning methodology is used for science students to acquire knowledge about oscillations and waves, geometrical optics, as well as electromagnetic nature which are described as follows: oscillations and waves, principles of electricity and magnetism, electric force and potential, Gauss' Law, capacitance and dielectric materials, current and resistance, direct current circuits, magnetic forces and fields, Ampere's and Faraday's Laws, inductance and alternating current circuits, electromagnetic waves and geometric optics.

JUSTIFICATION

The basic training of every science student requires knowledge of the basic laws that regulate the behavior of the universe. Knowledge of motion and dynamics are essential to all processes in nature. Knowledge of nature also requires an understanding of wave phenomena which are discussed in this course. Likewise, electromagnetic interactions are essential for chemistry, biology and engineering. This course allows the science student to apply this knowledge in their professional development either in the natural sciences or in health areas.

COMPETENCES

The course develops in the student the following competences:

- **Critical thinking**
- **Research and exploration**
- **Communication**

OBJECTIVES

At the end of the course, students will be trained to:

1. Describe oscillatory and wave phenomena that occur in nature.
2. Solve problems with situations involving electric fields or magnetic fields.
3. Solve problems of DC circuits with capacitors or with resistors in series, parallel or combined.
4. Predict the electromotive force induced in a circuit using Faraday's law.
5. Predict the current as a function of time for direct current and alternating current circuits.
6. Describe phenomena related to geometrical optics.

CONTENT

I. Oscillatory movements

   A. Simple harmonic motion
      1. Hooke's Law
      2. Characteristics of oscillatory motion
      3. Mathematical model for the position equation as a function of time
      4. Relationship between period, frequency and amplitude
   B. Waves
      1. General description of waves
         a. General characteristics
         b. Relationship between frequency and wavelength with propagation velocity
         c. Reflection and refraction
         d. Wave interference
      2. Waves in strings
         a. Standing waves
      3. Sound waves
         a. Sound intensity and measurement scale
         b. Interference and beats
      4. Electromagnetic waves
         a. Refraction of light and Snell's law
         b. Geometrical optics and lenses

II. Electrical interactions

   A. Introduction

1. Electric charges
2. Coulomb's law
3. Electric field

B. Gauss's Law
1. Electric flux
2. Gauss's law
3. Applications in insulators
4. Applications in conductors

C. Electric potential
1. Difference in potential
2. Uniform fields
3. Point charges and dipoles
4. Continuous distributions

D. Capacitance
1. Capacitance calculations
2. Combination of capacitors
3. Capacitor energy
4. Capacitors with dielectrics

E. Resistance and current
1. Current and current density
2. Resistance and Ohm's law
3. Energy and power

F. Direct current circuits
1. Electromotive force
2. Resistors in series and in parallel
3. Kirchhoff's rules
4. RC circuits

III. Magnetism

A. Introduction
1. Definition and properties
2. Magnetic forces in current-carrying conductors
3. Torques in windings
4. Motion of charged particles in magnetic fields

B. Sources of magnetic fields
1. Biot-Savart law
2. Long and straight wires
3. Ampere's Law
4. Solenoids and windings

C. Faraday's Law

1. Induction
2. Induced electric fields

D. Inductance
1. Self-inductance
2. RL circuits
3. Energy in magnetic fields

E. Alternating current
1. Alternating current circuits
2. Series RLC circuits
3. Power in RLC circuits

LABORATORY EXPERIENCES

A. Mass-spring system and simple pendulum
B. Wave motion
C. Electric field
D. Identification of electrical and electronic components
E. Ohm's Law
F. Resistor association
G. RC circuit in direct current
H. Geometric optics

METHODOLOGY

The following strategies of the active learning methodology are recommended:

- Lecture
- Flipped classroom
- Discussion and problem analysis
- Collaborative learning
- Procedure-oriented coaching and problem solving.
- Demonstration and hands-on exercises
- Problem-based learning

EVALUATION

Participation	10%
Partial Assignment	40%
Compositions	10%
Immersive Experience	20%
Project or final exam	20%
Total	100%

LEARNING ASSESSMENT

The institutional assessment rubric is applied to the core activity of the course.

BIBLIOGRAPHY

TEXT

Young, H. & Freedman, R. (2020). *Sears and Zemansky's University Physics with modern physics* (15th). Pearson.

REFERENCES

Giancoli, D. (2016). *Physics: Principles with Applications* (7th ed.). Pearson

Knight, R. (2017). *Physics for Scientists and Engineers: A Strategic Approach with Modern Physic*s (4th ed.). Pearson

Serway, R. and Jewett, J. (2015). *Physics for Scientists and Engineers* (9th ed.). Cengage.

ELECTRONIC RESOURCES

Coronado, G y Fernández, J.L.(2020). Fisicalab. https://www.fisicalab.com

University of Colorado Boulder (2020). PhET Interactive Simulations. https://phet.colorado.edu/es/simulations/category/physics

Find more information resources related to the course topics on the library page http://biblioteca.sagrado.edu/

REASONABLE ACCOMMODATION

To obtain detailed information on the process and the required documentation, you must visit the corresponding office. To guarantee equal conditions, in compliance with the ADA (1990) and the Rehabilitation Act (1973), as amended, all students who need reasonable accommodation services or special assistance must complete the process established by the Vice Presidency for Academic Affairs.

ACADEMIC HONESTY, FRAUD AND PLAGIARISM

Any student who misses the policy of honesty, fraud and plagiarism is exposed to the following sanctions: received a grade of zero in the evaluation and/ or repetition of the work in the course, grade of F (*) in the seminar: suspension or expulsion as established in the Academic Honesty Policy document (DAEE 205-001) effective August 2005.