SAGRADO
Universidad del Sagrado Corazón

SYLLABUS

TITLE: General Physics I

CODE: FIS 203

PREREQUISITE: MAT 201

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

DESCRIPTION

Physics course developed in a theoretical and experimental way using the active learning methodology for science students to acquire knowledge about kinematics in one and two dimensions, dynamics, circular motion and gravitation, work and energy, particle systems and conservation of linear momentum, rotational kinematics and dynamics, angular momentum and torque, equilibrium of rigid bodies and fluid mechanics.

JUSTIFICATION

The basic formation of every science student requires knowledge of the laws and principles that govern the universe, as well as the experimental corroboration of the laws and principles of physics related to Newtonian mechanics and fluids, and the development of computational models related to physics. This course allows the science student to apply this knowledge in their professional development either in the area of natural sciences or in health areas.

COMPETENCES

The course develops in the student the following competences:

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

OBJECTIVES

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

1. Represent vectors in polar and Cartesian form to perform operations with vectors.
2. Solve problems of bodies in motion under known conditions.
3. Analyze the forces acting on an object to predict its motion, both translational and rotational.
4. Solve motion problems using energy considerations.
5. Solve motion problems using conservation of linear momentum and angular momentum.
6. Solve problems related to fluid mechanics.

CONTENT

I. Introduction

- A. Measurement standards
- B. Dimensional analysis
- C. Vectors
  1. Vectors and scalars
  2. Properties of vectors
  3. Addition of vectors
  4. Components and unit vectors

II. Kinematics

- A. Motion in one dimension
  1. Velocity and acceleration
  2. Constant acceleration
  3. Free fall
- B. Motion in two dimensions
  1. Displacement, velocity and acceleration.
  2. Constant acceleration
  3. Projectiles
  4. Relative motion

III. Dynamics

- A. Newton's laws of motion

1. Force
2. Weight
3. Friction

B. Applications of Newton's laws
   1. Circular motion
      a. Uniform circular motion
      b. Radial and tangential acceleration
      c. Centripetal force
      d. Non-uniform circular motion
   2. Gravitation
      a. Kepler's Laws
      b. Newton's law of universal gravitation
      c. Motion of planets and satellites

C. Collisions
   1. Linear momentum and impulse
   2. Collision in one dimension
   3. Collisions in two dimensions
   4. Center of mass

IV. Work and energy

A. Introduction
   1. Scalar product of vectors
   2. Work of constant force
   3. Variable force work
   4. Kinetic energy
   5. Power

B. Conservation of energy
   1. Conservative and non-conservative forces
   2. Potential energy
   3. Conservation of mechanical energy
   4. Energy-work theorem

V. Rotational motion

A. Rotational kinematics
   1. Relationship between angular and linear quantities
   2. Rotational motion of solid bodies

B. Rotational dynamics
   1. Vector product
   2. Torque

3. Equilibrium conditions in rigid bodies
4. Center of gravity

C. Angular momentum and its conservation

VI. Fluid Mechanics

A. Hydrostatics
   1. Pressure and density
   2. Archimedes' principle

B. Hydrodynamics
   1. Continuity equation
   2. Bernoulli's equation

LABORATORY EXPERIENCES

A. Measurements and uncertainty
B. Construction of graphs
C. Uniformly accelerated rectilinear motion
D. Projectile motion in the plane
E. Equilibrium of concurrent forces
F. Newton's Second Law
G. Static friction
H. Energy diagram
I. Linear momentum
J. Density of bodies
K. Archimedes principle

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.