NATIONAL UNIVERSITY OF ENGINEERING
COLLEGE OF GEOLOGICAL, MINING AND METALLURGICAL ENGINEERING
METALLURGICAL ENGINEERING PROGRAM

FI203 – PHYSICS I

I. GENERAL INFORMATION

CODE	**:**	FI203 Physics I
SEMESTER	**:**	1
CREDITS	**:**	5
HOURS PER WEEK	**:**	7 (Theory – Practice - Laboratory)
CONDITION	**:**	Compulsory

II. COURSE DESCRIPTION

The course prepares students in the understanding and application of the fundamentals laws of classis mechanics that models the surrounding physical world. Students apply Newton Laws for analyzing the motion of a particle and a system of particles, as well as the related work and energy and their mechanical transformations. Linear and rotational motions are analyzed and diverse problems related to engineering are solved. Laboratories experiences are carried out to verify the validity and applicability of physics laws.

III. COURSE OUTCOMES

1. Analyze the concepts of vector algebra applied to mechanics.
2. Design static equilibrium and apply to specific cases.
3. Specify the equations of motion to specific cases of particles using the differential and integral calculus.
4. Model the motion of particles relating it to the laws of dynamics.
5. Analyze the concepts of work – energy and energy conservation into conservative and non conservative areas to specific cases.
6. Select the concepts of kinematics and dynamics applied to a particle system related to the conservation of the linear momentum and kinetic energy.
7. Specify Newton's laws and conservation laws of energy applied to rotation and translation of rigid bodies.

IV. COURSE CONTENTS

1. VECTOR ANALYSIS

Course general description / Scalar and vector magnitudes / Coordinate System and unit vectors, addition and vector difference / Graphic and analytical methods / Scalar and vector product / Examples.

2. STATIC EQUILIBRIUM

Concepts of force / Concurrent force systems / Equilibrium of a particle / Non-concurrent force systems / Torque or moment of force: applications / Center of gravity / Equilibrium of a rigid body / Concepts of static friction: applications.

3. PARTICLE KINEMATICS

Differentiation and integrals / Rectilinear and curvilinear motion of a particle: average and instantaneous velocity / Average and instantaneous acceleration / Rectilinear uniform motion / Uniformly varied motion / Varied motion: applications / Projectile motion / Free fall and parabolic motion / Trajectory equation: applications / Circular motion: angular velocity and angular acceleration / Uniform circular motion / Uniformly varied circular motion / Tangential and normal components of acceleration: applications.

4. PARTICLE DYNAMICS

Concepts of force / Friction force / Coefficient of friction: static and dynamic / Applications / Newton's laws / Internal and external forces / Inertial mass / Force and linear momentum: applications.

5. WORK AND ENERGY

Concept of work / Work of constant and variables forces / Kinetic energy / Theorem of work and kinetic energy / Potential energy: applications / Conservative forces / Elastic and gravitational force / Gravitational and elastic potential energy / Mechanical energy / Power: applications / Principle of energy conservation / Conservative and non-conservative systems / Particle system and its relation to the case of a particle: applications.

6. PARTICLE SYSTEMS

Dynamics of a particle system / Center of mass (CM) / CM movement / Velocity and acceleration / Linear momentum of a particle system: applications / Conservation of the linear momentum / Kinetic and potential energy of a particle system / Elastic and inelastic collisions / One-dimensional and two-dimensional collision: applications.

7. ROTATIONAL DYNAMICS OF SOLID

Rotational motion of a particle system / Conservation of angular momentum / Moment of inertia of a particle system and a rigid body / Torque and angular momentum / Torque and moment of inertia: applications / Kinetic energy of a rigid body / Kinetic energy of rotation and translation / Energy conservation / Kinetic energy and moment of inertia / Mechanical energy of a rigid body: applications.

V. PRACTICE AND LABORATORY EXPERIENCES

Laboratory 1: Measurements and curve fitting
Laboratory 2: Instantaneous velocity and acceleration
Laboratory 3: Relative motion
Laboratory 4: Two dimensional motion and collision
Laboratory 5: Work and energy
Laboratory 6: Gravitational and elastic potential energy

VI. METHODOLOGY

The course consists of theory, practice and laboratory sessions. The instructor presents the concepts and physical laws using applets, videos and formulating equations using differential and integral expressions. Problems related to engineering are solved with active student participation. Laboratory experiences are carried out using specialized equipment and software simulation. For every experience, students work in group and present a report summarizing main results, analysis and conclusions.

VII. GRADING SYSTEM

The Final Grade (FG) is calculated with the following formula:

FG = (EP + EF + PP) / 3

EP: Mid-term exam EF: Final exam PP: Average of quizzes and laboratories

VIII. BIBLIOGRAPHY

1. Sears-Zemansky-Young-Freedman
   University Physics Vol. 1, 2010, 12th Ed. Pearson Education.
2. Resnick-Halliday-Krane
   Physics, Vol. 1. 2011, 5th Ed. CECSA.