Syrian Arab Republic

Higher Institute for Applied Sciences and Technology

Course Specification Document

Title	Mechanics 1

Credits	5 ECTS

Aims	This course aims to provide the student with the basic knowledge necessary to describe the motion of a material point in 1D, 2D and 3D spaces, and to deduce equations of motion based on Newton's laws and energy, in a way that contributes to his study of specialized engineering courses and later to his work practice.

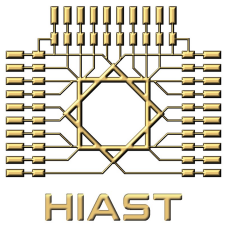
Intended learning outcomes

On successful completion of this course, the student will be able to:

- Determine the physical dimension of any physical quantity based on the seven fundamental dimensions.
- Describe motion in one dimension, in a plane, and in space, and express these motions in different coordinate systems (Cartesian, cylindrical, polar, spherical, and general curvilinear).
- Understand Newton's laws and apply them to deduce the differential equation(s) of motion and solve them in some simple cases.
- Identify conservative forces, deduce potential energy and mechanical energy and apply the theory of kinetic energy.
- Study the effect of electric and magnetic fields on the motion of a charged particle.

Syllabus

- **Units of measurement and dimensions:** The seven basic units in the International System of Units (SI), the seven basic dimensions in SI, the derived units in SI, the dimension of a physical quantity.
- **Motion in one dimension:** Interval, speed and acceleration, uniform motion and its laws, regularly varying motion and its laws, deducing the equations of interval, speed and acceleration as a function of time in the general case.
- **Vectors:** Vector components and their projections, basic operations on vectors (addition, scalar product and vector product), mixed product and its properties.
- **Motion in two dimension and in space:** Position, velocity and acceleration, description of motion in cylindrical frame, polar frame, spherical frame, Frenet frame, circular motion, solving a first-order differential equation.
- **The laws of motion:** The four basic forces in nature, the definition of force, the diagram of mutual interactions, free body diagram, the principle of inertia and the Galilean statement, the second law of motion, the principle of action and reaction, the theory of angular momentum, examples of some forces, equilibrium and its types, and the equation of motion near equilibrium.



- **Work and energy:** Definition of the work of a force in the general case, the work of a constant force with examples, the theory of kinetic energy, the gradient of a scalar function and potential energy, conservative force, mechanical energy, equilibrium study using the concept of potential energy.
- **Motion of a charged particle in an electromagnetic field:** The electric field and the magnetic field, Lorentz's law, the case of a uniform electric field, the case of a uniform magnetic field, the case of a uniform electromagnetic field, applications: Hall Effect, velocity selector, mass spectrometer.