Syrian Arab Republic

Higher Institute for Applied Sciences and Technology

Course Specification Document

Title	Mechanics 2

Credits	5 ECTS

Aims	This course aims to provide with complementary knowledge to what he studied in the Mechanics 1 course, which is the study of relative motion and motion in non-Galilean frame, harmonic, damped, and forced oscillations, coupled oscillations, motion with centripetal acceleration, and special relativity, in a way that contributes to his study of specialized engineering courses and later to his work practice.

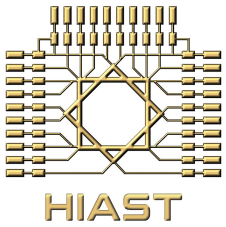
Intended learning outcomes

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

- Understand the velocity composition laws and accelerations in relative motion, and deduce the equations of motion in a non-Galilean frame.
- Identify and study oscillations in all their forms (harmonic, damped, forced and coupled).
- Study of motion with centripetal acceleration and its characteristics.
- Understand the Kepler problem, study the type of path and apply Kepler's laws.
- Understand Einstein's principles of special relativity and Lorentz transformations.

Syllabus

- **Relative motion:** Derivation with respect to time in a reference frame, derivation relationship of vector quantity between two frames, composition of velocities, composition of accelerations, special cases.
- **The laws of motion and equilibrium in a non-Galilean frame:** Inertial forces**,** case of non-rotational frame, case of rotational frame, case of terrestrial Coriolis force.
- **Oscillations:** Definition and examples of a harmonic oscillation, small oscillation near stable equilibrium site, mechanical energy of a harmonic oscillator, a damped oscillation and its phases, period, logarithmic decrease, quality factor, solving a second-order differential equation.
- **Forced oscillations**: Definition of forced oscillation, the case studied: forced oscillation under the influence of a sinusoidal force, differential equation of motion, equations of motion x(t) and v(t), study of capacitance and phase, resonance and bandwidth, comparison with electric circuits.
- **Centripetal motion and Kepler's problem**: Definition of centripetal motion and its properties, Binet relation, definition of Kepler's problem, the concept of effective potential energy and discussion of the type of motion, case study of the elliptic constraint, deduction of the path equation and its properties, Kepler's laws and artificial satellites, study of the types of ellipses and their properties in the polar frame.



- **Coupled oscillations:** Definition, modes, examples.
- **Special relativity:** Einstein's principles, time dilation and length contraction, Lorentz transformations, relativistic shock and energy.