Mechanics 2

1. **Course number and name:** 020MC2NI3 Mechanics 2

2. **Credits and contact hours:** 4 ECTS credits, 2x1:15 contact hours

3. **Name(s) of instructor(s) or course coordinator(s):** Joseph Kesserwani, Abbas Mgharbel, Adnan Naja, Antoine Choueiry, Elie Moussaed.

4. **Instructional materials:** Course handouts; slides; in-class problems

5. **Specific course information**
   a. **Catalog description:**
   Solid mechanics is a branch of mechanics that studies the motion and equilibrium of objects considered as rigid bodies. A rigid body is an object in which different parts do not deform relative to each other when subjected to external forces. This course covers the laws of mechanics for systems, focusing specifically on solids. It enables students to apply various methods to determine the center of mass of a solid and study its translational and/or rotational motion around a fixed axis. Once the definition of the force system in mechanics is provided, along with all the derived laws, students gain proficiency in applying static, dynamic, and energetic laws to solve complex mechanical problems.

   a. **Prerequisites:** 020MC1NI1 Mechanics 1

   b. **Required/Selected Elective/Open Elective:** Required

6. **Educational objectives for the course**
   a. **Specific outcomes of instruction:**
   - Define a rigid system, frame, and reference frame.
   - Apply the time derivative to a vector in different reference frames.
   - Define the center of mass of a continuous and discrete system.
   - Determine the center of mass of a system using different methods.
   - Define the barycentric reference frame and its importance in mechanical applications.
   - Apply the center of mass theorem.
   - Apply the theorem of angular momentum at a fixed or moving point.
   - Determine the energetic quantities of a system, particularly for a solid.
   - Use the two König theorems to calculate angular momentum and kinetic energy.
   - Determine the work and power of forces applied to a system.
   - Apply the work-energy theorem and kinetic energy theorem.
   - Introduce the concept of a torque vector and its properties in solid mechanics.
   - Study the kinematics and dynamics of solids.
   - Address the models of one-point contact between two solids.
   - Represent contact forces.

- Use Coulomb's laws for static and kinetic friction in advanced mechanical problems.

b. PI addressed by the course:

PI	1.2	1.3
Covered	x	x
Assessed	x	x

7. Brief list of topics to be covered

- Introduction to system mechanics (1 lecture)
- Definition of the center of mass (1 lecture)
- Practical determination of the center of mass (2 lectures)
- Applications on center of mass determination (2 lectures)
- Determination of the center of mass theorem (1 lecture)
- Determination of the angular momentum theorem (2 lectures)
- Energetics of systems (1 lecture)
- Applications on kinetic quantities determination (3 lectures)
- Mechanical Torsor (2 lectures)
- Kinematics of solids (2 lectures)
- Torsorial formulation and center of mass theorem for a solid (1 lecture)
- Angular momentum theorem and energetics of a solid (2 lectures)
- Contact actions between two solids (1 lecture)
- Applications on solid mechanics (3 lectures)