Mechanics 2

1. **Course number and name:** 020MC2CI3 Mechanics 2

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

3. **Name of course coordinator:** Sami Youssef

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

5. **Specific course information**
   a. **Catalog description:**
   The course of Mechanics 2 focuses on the study of specific topics within the field of classical mechanics. Its primary objective is to provide students with a deeper understanding of non-inertial reference frames, friction phenomena, and solid rotation around a fixed axis. In the realm of non-inertial reference frames, students explore the principles and equations necessary to analyze and solve problems involving accelerated systems. They learn to account for the effects of fictitious forces, such as centrifugal and Coriolis forces, which arise in non-inertial frames. The course also delves into the intricate nature of friction, examining its various types and the factors affecting its magnitude. Students acquire the skills to analyze the behavior of objects subject to both static and kinetic friction. Lastly, the study of solid rotation around a fixed axis enables students to comprehend the kinematics and dynamics of rotating bodies, including concepts like angular velocity, angular acceleration, and moments of inertia. Overall, the course of Mechanics 2 equips students with the fundamental knowledge and problem-solving abilities necessary to tackle complex mechanical systems involving non-inertial reference frames, frictional forces, and solid rotation.

   b. **Prerequisites:** 020MC1CI1 Mechanics 1

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

6. **Educational objectives for the course**
   a. **Specific outcomes of instruction:**
   - Autonomously choose a study reference frame, eventually non-Galilean, by evaluating the advantages and disadvantages of this choice.
   - Give meaning to the familiar expression “fictitious force.”
   - Discuss, in a concrete situation, the approximately Galilean nature of the Earth’s reference frame.
   - Conduct the study of a problem involving solid friction.
   - Conduct the study of the motion of a solid rotating around an axis while maintaining a fixed direction in a Galilean reference frame

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

- Non-inertial frame of reference, such as a linearly accelerating or rotating reference frame. Velocity and acceleration transformations. Coriolis acceleration. Coincident point (12 lectures)
- Laws of dynamics in a non-Galilean reference frame in the case where the frame of reference is either undergoing uniform translation or uniform rotation around a fixed axis relative to a Galilean reference frame. Fictitious forces. Approximate Galilean nature of certain reference frames: Copernicus reference frame, geocentric reference frame, and Earth reference frame. Foucault pendulum (13 lectures)
- Coulomb's Law of Friction: static and kinetic frictions (7 lectures)
- Definition of a solid. Fixed-axis rotation. Angular momentum for rotation about a fixed axis: moment of inertia. Force couple. Lower pair. Angular momentum theorem. Compound pendulum. Rotational kinetic energy and work-energy theorem (10 lectures)