Strength of Materials

1. **Course number and name:** 020RDMGS2 Strength of Materials

2. **Credits and contact hours:** 6 ECTS credits, 3x1.25 hours

3. **Name(s) of instructor(s) or course coordinator(s):** Professor Fadi GEARA

4. **Instructional Materials:**

    a. Professor textbook and class notes

5. **Specific course information**
    a. **Catalog description:** Understand the behavior law of the materials. Calculate and analyze the characteristics of the cross sections, as well as the distribution of the internal efforts and stresses in the different elements of 2D structures and the deformations of these elements.

    The course covers the following topics: Theory of beams – Characteristics of the cross section - Center of Gravity - Moment of inertia – Normal effort - Bending - Torsion - Shear – Combined loadings - Calculation of the critical load of a structure: Theory of Euler - Energy theorems: Clapeyron, Maxwell-Betti, Bertrand de Fonviolant, virtual works, Castigliano, Menabrea - Force method - Three moments method.

    Lab work: Compression test on concrete cylinder + ultrasound, stresses in a 2D frame related to deformations measured on strain gauges, torsion of metallic bars, traction on steel bar.

    b. **Prerequisites or co-requisites:** 020MMDGS1 Continuum Mechanics

    c. **Required:** Required for all Civil Engineering students.

6. **Educational objectives for the course**
    a. **Specific outcomes of instruction:**
        - Provide the basic concepts and principles of strength of materials.
        - Calculate and analyze stresses and deformations of elements under external loadings.
        - Ability to apply the knowledge of strength of materials on engineering applications and design problems.
        - Conduct experiments and analyze data for different load case, on different 2D structures.

    b. **PI addressed by the course:**

PI	1.1	6.1	6.2	6.3	6.4
Covered	yes	yes	yes	yes	yes
Assessed	yes	yes	yes	yes	yes

7. **Brief list of topics to be covered:**
    - Introduction to the theory of beams (Equilibrium - Characteristics of the cross section - Center of Gravity - Moment of inertia – Huygens theorem): (6 Lectures)
    - Normal effort, axial load, cables, (1 Lecture)
    - Bending, bi-axial bending, axial load and bi-axial bending, (5 Lectures)
    - Torsion, open sections, tubular sections, (2 Lectures)
    - Shear, Torsion center (2 Lectures)
    - Examples on combined loadings, calculus of stress and deformations (6 Lectures)
    - Calculation of the critical load of a structure: Theory of Euler, (1 Lecture)
    - Energy theorems: Clapeyron, Maxwell-Betti, virtual works, Bertrand de Fontviolant, Castigliano, Menabrea, (6 Lectures)
    - Force method - Bresse formulas - Three moments method, applications (9 Lectures)
    - Lab work: Compression test on concrete cylinder + ultrasound, stresses in a 2D frame related to deformations measured on strain gauges, torsion, traction on metal bar, (4 x 1:15 hours)