Course Syllabus

020RDMGS2 Strength of Materials

1. **Course number and name:** 020RDMGS2 Strength of Materials
2. **Credits and contact hours:** 6 credits, 3x1:15 contact hours including Lab work
3. **Instructor's or course coordinator's name:** Professor Fadi GEARA
4. **Textbook and other supplemental material:**
   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.
   Prerequisites: 020MDGS1 Continuum Mechanics; 020STANI4 Statics
   b. **Prerequisites:** Required
   c. **Required/Elective/Selected Elective:** Required

6. **Specific goals 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. **KPIs addressed by the course:**

KPI	a1	b1	b2	b3	e3
Covered	x	x	x	x	x
Assessed		x	x	x	
Give Feedback					

7. **Brief list of topics to be covered and approximate number of lectures:**
   - 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)