Course Syllabus

1. Course number and name: 020RDMES4 Mechanics of materials
2. Credits and contact hours: 4 credits ; 48,5 h = 35 h Courses + (4 Lab experiments * 2h30 * 2 groups)*2/3

3. Instructor's or course coordinator's name: Toufic WEHBE

4. Text book :
    a. other supplemental materials: Written course / Exercises Handout
    [1] Techniques de l'ingénieur
    [2] Engineering Mechanics of solids, 1990, (Egor. P. Popov)
    [3] Mechanics of materials, 9th edition, (R.C. HIBBELER)

5. Specific course information
    a. brief description of the content of the course (catalog description)

In mechanical engineering, the Strength of Materials (SOM) uses the dimensions of the part (beam), the external applied loadings (torque and efforts), and the mechanical properties of the material to predict its behavior when loaded and evaluate the risk of breakage. Depending on the specifications and the objective, the SOM distinguishes different approaches: the calculation of the part dimensions with known material and external loading; the determination of the material for a beam with fixed dimensions and submitted to a well-known external loading; the calculation of the maximal reachable efforts and/or torque on a part before its breakage; solving statically indeterminate beam problems.

    b. prerequisites or co-requisites:

Co-requisites: statics, equilibrium of rigid bodies

    c. Required/Elective/Selected Elective: Required

6. Specific goals for the course
    a. specific outcomes of instruction

Distinguish and use of the main mechanical properties of materials
Determine the rigid body equations of equilibrium and identify the main loadings
Recognize and differentiate the main types of stresses acting over a cross section of a beam
Identify the impact of each loading on the part in terms of displacements and stress
Calculate the stresses, the displacements and rotations of the cross sections of the beam.
Calculate and modify the dimensions of a part in a way to validate its security
Calculate the maximal loading to be supported by the part

b. KPIs addressed by the course.

KPI	a1	a2	b1		
Covered	x	x	x		
Assessed	x	x	x		
Give Feedback					

7. Brief list of topics to be covered and approximate lecture hours :

1-2

Reminders of statics and introduction to SOM. Rigid body equilibrium under external loading, standardized mechanical connections and supports reaction calculations. Objectives of the SOM, the hypothesis of the SOM and key definitions

3-8

Geometrical properties of areas. Centroid of an area, composite area centroid, moments of inertia for an area, polar moment of inertia, product of inertia for an area, parallel axis theorem / moments of inertia for a composite area. Exercises.

9 – 11

Stresses. Method of sections, internal resultant normal force, average normal stress, internal resultant shear force, average shear stress, shear stress in pins and bolts design, factor of safety. Exercises.

12 – 16

Axially loaded beams. Stress-strain diagram, Hooke's law and Young's Modulus, elastic deformation of an axially loaded members (basic cases), deformation of a member with non-constant section area and a non-constant axial loading, Poisson's ratio, generalized form of Hooke's law. Thermal expansion and associated developed stresses. Principle of superposition for statically indeterminate axially loaded members. Exercises.

17 – 23

Bending of beams. Internal moment diagram (convention, calculus and graphs), the flexure formula (bending normal stress). Boundary and continuity conditions, rotation and displacement by integration, principle of superposition for statically indeterminate beams. Exercises.

24 – 28

Torsion

Resultant internal torque acting at the cross section, the torsion formula (shear stress), angle of twist, principle of superposition for statically indeterminate torque loaded members. Exercises.