

Programme of "Scienza delle Costruzioni" "Solid and Structural Mechanics"		
<ul style="list-style-type: none"> • Code: I0537 • Type of course: Compulsory • Level of course unit: 1st Cycle in Industrial Engineering • Year of study: 2nd year , 1st semester 		
Number of ECTS credits: 6 (work-load 150-180 hours)		
Teacher: BENEDETTINI Francesco		
1	Course objectives	The course provides the fundamental theory of solids and structural mechanics. At first, the static problem for rigid bodies is introduced, then, the course continues with the analysis of deformable bodies introducing the main principles of theory of elasticity and strength of materials. Eventually the course deals with the problem of the <i>Saint Venant</i> beam. On successful completion of this module, the student should understand the fundamental concepts of structural mechanics and should be able to tackle with simple design problems.
2	Dublin descriptors	<p>Topics of the module include:</p> <p>1) Statics of rigid bodies: Statics of rigid bodies systems: the equilibrium problem for rigid bodies with constraints; the continuity constraint, the stress measure along the beam.</p> <p>2) Strain and stress in 3D bodies: Kinematics: simple principles. Statics: the Cauchy stress tensor, the equilibrium conditions; principal strains and principal stresses.</p> <p>3) Elements of theory of elastic bodies: Mechanical characterization of materials, constitutive laws, the linear elastic case and the generalized Hooke laws.</p> <p>4) Strength of materials: Ductile and brittle materials, crisis surface and safety domain.</p> <p>5) Elastic theory of the rod: The de Saint Venant problem: Simple traction/compression, simple bending, traction/compression and bending, torsion (elementary cases), shear stress (Jourawsky theory).</p> <p>6) Classical solution methods: The Principle of Virtual Work for truss structures, the displacement method for truss structures, the differential equation of the beam in bending</p> <p>7) The theory of elastic stability: The Euler beam, the Omega method.</p> <p>On successful completion of this module, the student should</p> <ul style="list-style-type: none"> - have knowledge of basic theory of Solid and Structural Mechanics, - have knowledge of basic techniques finalized to the design of simple beam elements in different stress cases.
3	Prerequisites and learning activities	The student must know Previous learnings: Calculus I and II with particular attention to differential equations; Physics: Force, Moments, Work, strength and stiffness, equilibrium and Free-Body Diagrams.
4	Teaching methods and language	Lectures and exercises. Language: Italian Ref. Text books <ol style="list-style-type: none"> 1. Claudia Comi, Leone Corradi Dall'Acqua, Introduzione alla meccanica delle strutture, II edizione, McGraw-Hill, Milano. 2. Russel C. Hibbeler, Meccanica dei Solidi e delle Strutture, Pearson Prentice Hall. 3. Beer, Johnston, DeWolf, Mazurek, Mechanics of Mterials, McGraw Hill (English). 4. Carlo Gavarini, Lezioni di Scienza delle Costruzioni, editoriale ESA, Milano. 5. Giulio Ceradini, Lezioni di Scienza delle Costruzioni, ESA, Milano. 6. Erasmo Viola, Lezioni di Scienza delle Costruzioni, Pitagora editrice, Bologna. 7. Erasmo Viola, Esercitazioni di Scienza delle Costruzioni, Pitagora editrice, Bologna. 8. - Castiglioni, Petrini, Urbano, Esercizi di Scienza delle Costruzioni, Tamburini, Milano.
5	Assessment methods and criteria	Written and oral exam.