UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria
ACADEMIC YEAR	2018/2019
BACHELOR'S DEGREE (BSC)	CIVIL AND BUIDING ENGINEERING
SUBJECT	MECHANICS OF MATERIALS AND THEORY OF STRUCTURES
TYPE OF EDUCATIONAL ACTIVITY	B
AMBIT	50108-Edilizia e ambiente
CODE	06313
SCIENTIFIC SECTOR(S)	ICAR/08
HEAD PROFESSOR(S)	PALIZZOLO LUIGI Professore Associato Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	9
INDIVIDUAL STUDY (Hrs)	144
COURSE ACTIVITY (Hrs)	81
PROPAEDEUTICAL SUBJECTS	04954 - RATIONAL MECHANICS 03675 - GEOMETRY
MUTUALIZATION	MECHANICS OF MATERIALS AND THEORY OF STRUCTURES - Corso: INGEGNERIA AMBIENTALE MECHANICS OF MATERIALS AND THEORY OF STRUCTURES - Corso: ENVIRONMENTAL ENGINEERING
YEAR	2
TERM (SEMESTER)	1° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**PALIZZOLO LUIGI** Thursday 10:00 12:00

DOCENTE: Prof. LUIGI PALIZZOLO

PREREQUISITES	Basics of Rational Mechanics; Geometry and linear algebra concepts; Mathematical analysis.
LEARNING OUTCOMES	Knowledge and understanding skills At the end of the course, the student will have knowledge of the issues involved The mechanics of materials and structures. Ability to apply knowledge and understanding The student must be able to: determine the condition and degree of Hypo-, iso-, hyper-staticity of a structure formed by rods; Determine and To govern the equilibrium, both external and internal, global and local, of a structure, and Describe it numerically, analytically and graphically; Impose the Conditions of compatibility and compatibility of a structure; Know the physical-mechanical properties, resistance and elasticity, main materials, Traditional and modern; Know how to determine the main tensions and directions in the point and describe them appropriately, both analytically and graphically; Know how to determine stress diagrams due to simple stresses composed of the solid of Saint Venant and describing them graphically; Calculate the Displacements and elastic and thermal deformations of elementary structures; Determine hyperstatical unknowns and stress and displacement states hyper-static structures; Determine the critical loads and security condition of straight loaded rectangular stitches. Judgment autonomy The student will be able to evaluate independently: - the validity and approximation limits of the phenomenological models that characterize the elastic-linear behavior of materials and structures. -the conditions for the applicability of the structural models commonly used to describe real structures; -the uses of the technical theory of the beam and its criteria structural safety; - static suitability of structural systems, appropriate bonding conditions and shape and size of the transverse sections of inflected structures. Communication skills The student will acquire the ability to communicate and express problems inherent in the object of the course. She'll be able to support conversations on Topics related to the fundamental aspects of the discipline (state of tension and deformation in solids and structures, structural classification, reactions of the constraints and conditions of maximum solicitude) using one appropriate scientific terminology, and the tools of representation mathematics of the main mechanical phenomena described. Learning ability The student will have learned the fundamental principles of the mechanical analysis of materials and structures. He'll learn the basics of mechanical behavior materials and will include the properties of rigidity and strength. These knowledge will contribute to the formation of its knowledge bag of mechanics applied to materials and structures and represents a training a fundamental engineering base that will allow him to continue his engineering studies
ASSESSMENT METHODS	Written Examination and Oral Examination. There is also an on-going test for the Students who will attend the course. The final evaluation is expressed in thirty Minimum score 18 Maximum score of 30 if the student shows full security of subjects treated with proper language properties
EDUCATIONAL OBJECTIVES	The primary objective of the course is to provide the basic knowledge of the continuous and materials together with elements of structure theory, developed specifically in the field of civil engineering applications. In the formulation of theoretical assumptions (continuous mechanics, theory of beam) is therefore sought to focus the fundamental relationships: balance, Congruence, principle of virtual works, bond equations. In view of the applications, the beam theory is widely developed in a specific Part of the lesson course, while in parallel, the tutorial develops the numerical-application aspects of simple structural systems. The course is from a methodological point of view as an essential joint among the basic lessons (mathematics, geometry, physics and rational mechanics), which uses the same formal rigor, and teachings strictly engineering related to the design and verification of the resistance of the materials and structures. The student must demonstrate that he has learned the basic concepts introduced and that they have achieved an adequate level of knowledge of specific topics. The student must also demonstrate that he / she is able to use the tools provided by trying to solve simple problems but paradigmatic of structural cases. The learning mechanism is based on the direct student involvement in practical

	exercises held in the classroom, where are solved together with the teacher of application exercises on topics treated in theoretical lessons.
TEACHING METHODS	Lectures, Classroom Exercises, Visits to the Engineering Laboratory Structural and Geotechnical
SUGGESTED BIBLIOGRAPHY	C. Polizzotto, Scienza delle Costruzioni, Ed. Cogras, 1985. E. Viola, Esercitazioni di Scienza delle Costruzioni, Pitagora, 1988. Di Paola M., Pirrotta A., Lezioni di Scienza delle Costruzioni, Dispense del corso.

SYLLABUS

Hrs	Frontal teaching
1	A. THEORY OF THE STRUCTURES 1A. Introduction Thematic of materials mechanics and structures
3	2A. Rigid systems Eligible configurations, Euler theorem; Constraints, kinematics and classification; Reaction of constraints; Static cardinal equations; Principle of Virtual Works
2	3A. Beam systems Kinematic classification of structures; Static classification (isostaticity, hyperstaticity and lability), Stress for Beams Structures , Work and Energy, Principle of Virtual Works
1	4A. Geometry of Areas First order moments, transport theorem, center of gravity, second order moments, simple and complex sections
6	5A. Isostatic structure resolution Reactions of internal and external constraints, stress characteristics diagrams, Normal stress, Shear and Bending Moment.
3	6A. Resolution of hyperstatic structures Force Method and hyperstatical unknowns, Internal Work, Principles of Virtual Works, Energy Theorems: Clapeyron, Betti and Maxwell. Applications and resolution of hyperstatic structures
7	B. MECHANICS OF DEFORMABLE SOLIDS 1B. Static, continuous Solid . Global equilibrium, stress vector definition; Decomposition of the stress vector, Normal and tangential component; Cartesian components of the stress and stress matrix; Symmetry Of the stress matrix; Cauchy's relationships; Main directions, plans and stress; Invariants of the matrix stress; Classification of the stress (cubic cylindrical and hydrostatic), plan stress, Normal stress and maximum tangential stress, Mohr representation, undefined equilibrium equations and equilibrium equations on the free boundary
2	2B. kinematics Strains and continuity constraints; Analysis of deformation around a point (linearization); Decomposition of the displacement gradient vector; Strain matrix; Longitudinal and angular strain and rigid motion; Volumetric and deviating strain; Main directions and major strains; Triaxial, plane and mono-axial strain
3	3B. Elastic-linear constitutive relationships Homogeneous and isotropic solid; Strain energy; Single-axial and linear elasticity test; Longitudinal modulus, shear modulus and Poisson coefficient; Constitutive equations in direct and reverse form; linear elastic problem and Navier equations;
2	4B. Resistance Criteria Fragile and ductile materials; Criterion of maximum main stress; Criterion of maximum strain; Criterion of Tresca and Von Mises.
1	C. PROBLEM OF DE SAINT VENANT FOR BEAMS C1. Generality De Saint Venant's problem; Spacer beams and straight axis beams; Cross Section and Stress Characteristics; congruence and equilibrium Equations
7	C2. Axial stress Uniform strain and stress distribution, Uniform temperature variations, Deformability and axial rigidity. Stiffness and flexural deformability; Differential equations of equilibrium and boundary conditions; Differential equation of the elastic line; Pressoflection; stress distribution and neutral axis; Theory of Bernoulli-Navier; State of strain and Flexible curvature, Applications for simple beams isostatically and hyperstatically constrained and Sections with one or two symmetry axes; Central core of inertia, Truss beams
2	C3. Shear and Tangential stress; Equilibrium and strain of the sections; Jourawsky's equation; Shear stiffness and shear deformability; Testing of simple and double symmetry axis sections
3	C.4 Torsion Kinematics of beam strain with polar symmetry section; Distributions of the Tangential stresses; Torsional rigidity and deformability; Thin section beams and Bredt's relationship;

Hrs	Practice
2	2A. Exercises and Applications on Rigid Systems Cinematics, Euler theorem; Constraints, Reaction of constraints; Static cardinal equations; Principle of virtual works for the equilibrium conditions

Hrs	Practice
6	3A. Exercises and Applications on Beam Systems Kinematic classification of structures; Static classification (isostaticity, hyperstaticity and lability), Stretches for beams Structures, Work and Energy, Principle of Virtual Works
2	4A. Exercises and Applications on Geometry of Areas First order moments, transport theorem, center of gravity, second order moments, central inertia ellipse, study of simple and complex sections
6	5A. Isostatic structure resolution Reactions of internal and external constraints, stress characteristics diagrams, Normal stress, Shear and Bending Moment. Applying the principle of virtual works for reactions and stresses
3	6A. Exercises and Applications on Beam Technical Theory Unlimited equations for inflexible beams and boundary conditions. Congruence equations
6	7A. Resolution of hyperstatic structures Forces Method and hyperstatical unknowns, Internal work, Principle of virtual works, Energy theorems: Clapeyron, Betti and Maxwell. Applications and resolution of hyperstatic structures
2	B. MECHANICS OF SOLIDS 1B. exercises and applications on Continuous static, stress vector; Decomposition of the stress vector, normal component and tangential; Cartesian components of stress and stress matrix; Main directions, plans and tensions; invariants of the stress matrix; stress configuration, normal and tangential maximum stress, Representation of Mohr.
2	C. PROBLEM OF DE SAINT VENANT FOR BEAMS C2 Exercises and Applications for Beams subject to Normal stress Uniform strain and stress distribution. Uniform temperature variations, Axial deformability and axial rigidity, equilibrium differential equation and boundary conditions, Examples of isostatic, hyperstatic beams. Truss beams
2	C3. Applications for Beams subject to Simple Bending Theory of Bernoulli-Navier; Strain and bending curvature, stress distribution and neutral axis; Stiffness and bending deformability; equilibrium equations and boundary conditions; Differential equation of the elastic line; Applications with simple beams isostatically and hyperstatically constrained;
1	C4. Exercises and Applications of Navier equation, stress distribution and neutral axis; Sections with one or two symmetry axes
2	C5. Exercises and Applications of Navier equation, normal eccentric stress and plane stress; Stress distribution and neutral axis; Core inertia of a section, Sections.
2	C6. Exercises and Applications for Beams Subject to shear Tangential stresses and shear stress; equilibrium and strain configuration of the sections; Jourawsky's equation; Shear Stiffness and shear strain; Testing of simple and double symmetry axis sections
2	C.7 Exercises and Applications for Beams Subject to Torsion Beams with polar symmetry section; Distribution of the tangential stresses; Isostatic and hyperstatic applications; Thin section section beams and Bredt's relationship;