UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria
ACADEMIC YEAR	2023/2024
BACHELOR'S DEGREE (BSC)	BUILDING ENGINEERING, INNOVATION AND RETROFITTING
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)	GIAMBANCO GIUSEPPE Professore Ordinario Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	9
INDIVIDUAL STUDY (Hrs)	134
COURSE ACTIVITY (Hrs)	91
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	2
TERM (SEMESTER)	2° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**GIAMBANCO GIUSEPPE** Monday 8:30 11:30 Laboratorio NDE - Edificio 8 Viale delle Scienze

DOCENTE: Prof. GIUSEPPE GIAMBANCO

PREREQUISITES	- Basic concepts of mathematical analysis; - Basic concepts of Newtonian mechanics; - Basic concepts of geometry; - Matrix algebra; - Vectorial calculus; - Use of excel type calculus sheet.
LEARNING OUTCOMES	Knowledge and understanding: Acquisition of the knowledge to study the mechanical behavior of structures made by ductile and brittle materials. Skill in using the technical-scientific language proper to the structural engineering. Applying knowledge and understanding: Skill in modeling real structures in terms of geometry, kinematics, external loads, costitutive behavior of the materials. Making judgements: Skill to asses the structural response and its general strength of elements constituting a construction. Communication: Ability to discuss with other professional figures involved in the design and construction of civil infrastructures and buildings. Lifelong learning skills: Skill to study independently issues related to the mechanical behavior of materials and traditional and modern structures by means of scientific publications in the field of solid mechanics and beam theory.
ASSESSMENT METHODS	The exam can be sustained according two different ways. First evaluation method The students take two in-itinere tests, the first one at the end of the first modulus and the second one at the end of the course. The first test regards the arguments developed in the first modulus of the semester and it comprises theoretical questions of solid mechanics and applications of the same arguments on simple structures making use of the practical tools used in Statics. The second test contains the mechanical study of a statically indeterminate framed structure and the evaluation of the stress state induced in the Saint Venant solid due to a combination of internal forces. Each test receives an evaluation out of 30. The student is admitted to the oral colloquium if the arithmetic average of the two marks is at least equal to 18/30. The oral colloquium aims to verify the level of the student knowledge and the capabilities to solve simple practical problems of Structural Mechanics. The questions, therefore, regard the theoretical arguments studied during the whole course and simple exercises. The student evaluation takes also into account the capabilities to connect different arguments, the adoption of a rigorous exposition and a proper technical language. The final mark is the arithmetic average of the three tests, the two written tests and the oral colloquium. Second evaluation method At the end of the course the students take the written test and the oral test. The written test contains three exercises regarding the mechanical study of a statically indeterminate framed structure, the evaluation of the stress state induced in the Saint Venant solid due to a combination of internal forces and the stress or strain state study in a material point of a solid body. The student is admitted to the oral colloquium if the mark assigned to the written test is at least equal to 18/30. The oral test regards the theoretical arguments developed along the course and their application to simple problems of Structural Mechanics. The student evaluation takes also into account the capabilities to connect different arguments, the adoption of a rigorous exposition and a proper technical language. The final mark is the arithmetic average of the two tests, the written test and the oral colloquium. The criteria for evaluation are as follows: Grade: Excellent. Rating: 30-30 with distinction. Excellent knowledge of the topics and very good language skills. Good analytical skills. The student is able to use the knowledge he/she has acquired to solve problems. Grade: Very good. Rating: 26-29. Good grasp of the topics. Sound language skills. The student is able to use the knowledge he/she has acquired to solve problems. Grade: Good. Rating: 24-25. Basic knowledge of the main topics. Fair language skills with limited ability to independently use the knowledge acquired to solve problems. Grade: Satisfactory 21-23. The student lacks a firm grasp but has some knowledge of the main topics. Satisfactory language skills. Low ability to independently use the knowledge acquired.. Grade: Sufficient 18-20.Minimum basic knowledge of the main topics and technical language. Very low ability to independently use the knowledge

	acquired. Fail: The student does not have an acceptable knowledge of the topics.
EDUCATIONAL OBJECTIVES	The principal aim of the course is to provide basic and advanced knowledges in the framework of tridimensional solid mechanics and to analyze structures constituted by one dimensional elements made up of linear elastic material. The principal arguments are the following: Linear elastic constitutive equations; Strength criteria for ductile and brittle materials; Physical-mathematical modeling of solids and structures; Basic concepts of 3D solid mechanics; Stress state; Strain displacements compatibility equations; Methods of structural analysis with applications; Buckling of one dimensional elastic systems.
TEACHING METHODS	Frontal lessons and practice in classroom.
SUGGESTED BIBLIOGRAPHY	C. Polizzotto, Scienza delle Costruzioni, ed. Cogras C. Comi, L. Corradi Dell'Acqua, Introduzione alla meccanica strutturale, McGraw-Hill, ISBN-10 8838615411 E. Viola, Esercitazioni di Scienza delle Costruzioni, vol. 1 e 2, Pitagora editrice Bologna, ISBN-10 8837106653, ISBN-10 8837103565. P. Casini, M. Vasta, Scienza delle Costruzioni (3° edizione), Citta' Studi Edizioni. ISBN-10 8825174055 F. P. Beer, E. R. Johnston Jr, J. T. DeWolf, D. F. Mazurek, Statics and Mechanics of Materials (2nd edition), McGraw-Hill. ISBN-10 8838668574

SYLLABUS

Hrs	Frontal teaching
1	Cauchy stress state in 3D solids;
4	Kinematics of 3D solids and strain state;
4	Stress state and Mohr representation;
2	Constitutive modeling of the linear elastic material;
4	Variational principles in elastostatics;
4	Strength criteria for ductile and brittle materials;
1	Saint Venant solid;
1	Axial load;
2	Bending moment;
2	Axial load and bending moment;
3	Torsion;
2	Shear theory according to Jourawski;
2	Constitutive equations of beam elements;
1	Introduction to the structural analysis methods;
1	The forces and displacements method;
1	Buckling of one dimensional structures (Euler theory).

Hrs	Practice
3	Stress states: calculation of principles stresses and directions. Circles of Mohr.
3	Circular and rectangular beam sections in presence of bending moment;
1	Circular and rectangular beam sections in presence of axial load and bending moment;
1	Rectangular beam section of NT material in presence of axial load and bending moments;
3	Torsion of thin walled beams;
3	Shear of thin walled beams;
4	The unit force method and the elastic line differential equation
2	The Mohr analogy
6	Solving structures by means of forces method;
2	Continous beams and the three moment equation
6	Solving structures by means of displacements method;
2	Evaluation of the critical load: omega method.

Hrs	Workshops
2	Brittle and ductile materials - Experimental characterization;
1	Design and strength evaluation of beam sections subjected to axial force
3	Design and strength evaluation of beam sections subjected to bending moment;
2	Design and strength evaluation of beam sections subjected to axial load and bending moments
3	Design and strength evaluation of beam section subjected to torsion;
3	Design and strength evaluation of beam section subjected to shear;
3	Solution of continuous beams

Hrs	Workshops
3	Solution of hyperstatic structures