Fakultät für Ingenieurwesen
Facoltà di Ingegneria
Faculty of Engineering

COURSE DESCRIPTION – ACADEMIC YEAR 2024/2025

Course title	**Materials science and structural mechanics**
Course code	42175
Scientific sector	ICAR/08 – ING-IND/22
Degree	Bachelor in Industrial and Mechanical Engineering (L-9)
Semester	1
Year	2
Credits	12 (6+6)
Modular	yes

Total lecturing hours	115 (55+60)
Total lab hours	
Attendance	*Recommended*
Prerequisites	none
Course page	Microsoft Teams and https://ole.unibz.it/

Specific educational objectives	The specific educational objectives include the understanding and knowledge of the fundamentals of material science and structural mechanics. The students will learn mechanical properties of engineering materials and structural elements and how they may be analyzed. This includes modelling abstractions, solution methods and the interpretation of results of relevant engineering mechanics problems.

Module 1	**Mechanics of structures**
Lecturer	Dr. techn. Thomas Moosbrugger https://www.unibz.it/en/faculties/engineering/academic-staff/person/42499-thomas-franz-xaver-moosbrugger
Scientific sector of the lecturer	
Teaching language	German
Office hours	18h (by appointment: ThomasFranzXaver.Moosbrugger@unibz.it)
Lecturing Assistant (if any)	No present
Contact LA	---
Office hours LA	----
List of topics	1. Core topics of the course (fundamental for the learning objectives and cultural project) • Equilibrium of forces with a common point of application, and of rigid bodies • Determination of support reactions and internal forces • Centre of forces, mass, and gravity • Elementary theory of tension/compression, bending, and torsion • Stresses, stress resultants, strains, and Hooke's law 2. Complementary topics of the course • Buckling

	• Basic energy methods in statics and elastostatics • Kinematical and statical determinacy • Coulomb theory of friction, and belt friction^ • Thin-walled pressure vessels
Teaching format	Frontal lectures, exercises

Module 2	**Material Science and Technology**
Lecturer	**Prof. Stefano Rossi PhD** stefano.rossi@unibz.it, and stefano.rossi@unitn.it, 0471-017092, https://www.unibz.it/en/faculties/engineering/academic-staff/person/1075-stefano-rossi
Scientific sector of the **lecturer	ING IND22
Teaching language	Italian
Office hours	18 h in conjunction with the lesson timetable (by prior agreement via email)
Lecturing Assistant (if any)	No present
Contact LA	---
Office hours LA	----
Office hours	Before lectures
List of topics covered	• **Introduction**: the materials and their use in the industrial production. • Technological properties of materials: different type of materials and their typical properties; • correlation between microstructure and mechanical properties; • basis of thermodynamics and equilibrium diagrams. • **Metals**: • characteristics and properties of iron alloys (steel and cast iron), • non ferreous metals. • **Ceramics and glasses**: • the production and utilization of ceramic materials; • the characteristics of glass; the production of glass components. • **Polymers:** production and properties of polymeric materials; • production of components in polymeric matter; utilization of polymers. • **The composite materials**: production, properties, utilization of composite materials. **Testing standard about of materials**:

Teaching format	Frontal lectures, exercises

Learning outcomes	**Module I Mechanics of structures:** Knowledge and understanding: • Knowledge and understanding of the fundamentals of structural mechanics. Applying knowledge and understanding: • Applying theoretical methods to analyze engineering structures and structural systems. Making judgments: • Analyzing structural engineering devices/systems requires a deep understanding and the ability to show judgment regarding methods, results and designs. Communication skills: • Communication skills to convey and transfer structural mechanics knowledge. • Communication skills to interpret results of structural mechanics analyses and their consequences with respect to design. Ability to learn: • Learning skills to study independently the large and complex field of structural mechanics for specific applications beyond this lecture. **Module II Material Science and Technology:** Knowledge and understanding: • Knowledge and understanding of the different properties of materials and different technologies and production processes. Applying knowledge and understanding: • Applying knowledge and understanding through the development of skills and the ability to choose the suitable materials and the technology for a particular industrial product. In addition, the students should develop the ability to apply the knowledge on the behavior of materials in the performance of laboratory technological tests. Making judgments

	• Connect the properties of different materials with their microstructure; capacity to evaluate the experimental data obtained in laboratory tests. Communication skills • Communication skills to present the acquired knowledge with their own lexicon of the discipline and to be able to prepare a technical report about materials tests. Ability to learn • Acquire skills to deepen the topics covered during the course in order to apply them to simple practical cases. • Acquire the ability to interpret experimental test data obtained in material characterization tests.

Assessment	**Module I Mechanics of structures:** **Formative assessment:** Oral exam in groups (2-4 Students, 1 hour): clarity of answers, mastery of language (also with respect to teaching language), ability to summarize, evaluate, and establish relationships between topics; **Module 2 Material Science and Technology:** Written exam with open questions and exercises (5/6 in number) aimed at verifying the acquisition of the concepts and topics illustrated during the course and the ability to put them into practice. Exam duration: 2 hours.
Assessment language	Module I Structural Mechanics: German Module II Material Science and Technology: Italian
Assessment Typology	Collegial
Evaluation criteria and criteria for awarding marks	Module I Structural Mechanics: Written examination (in German) will include derivations and numerical examples to evaluate the ability to solve structural-mechanics problems as well as comprehension questions. Theoretical knowledge (30%) Appropriate use of methods (30%) Ability to solve problems (30%) Appropriate use of units (10%) Module II Material Science and Technology: Written exam Theoretical knowledge of the subject (40%).

	Ability to link different topics highlighting the similar peculiarities and characteristics (30%). Ability to apply the concepts relating to materials and production technologies, for examples of objects and products (20%). Mastery of technical language (10%). Final mark: 50% Module I Structural Mechanics 50% Module II Material Science and Technology Note: Students must pass both Modules in order to pass this course The exam methods are the same for non-attending students.

Required readings	Module I Mechanics of structures: Teaching materials in the form of the students' own notes on the lecturer's notes on the blackboard German: • Gross, D., W. Hauger, J. Schröder, and W. A. Wall (2013). Technische Mechanik 1: Statik (12 ed.). Springer • Gross, D., W. Hauger, J. Schröder, and W. A. Wall (2014). Technische Mechanik 2: Elastostatik (12 ed.). Springer. English: • Gross, D., W. Hauger, J. Schröder, W. A. Wall, and J. Bonet (2011). Engineering mechanics 2: Mechanics of materials (1 ed.). Springer. • Gross, D., W. Hauger, J. Schröder, W. A. Wall, and N. Rajapakse (2013). Engineering mechanics 1: Statics (2 ed.). Springer. Italian: • Curti, G. and F. Curà (2006). Fondamenti di meccanica strutturale. Clut. Further literature will be discussed during the lectures and exercises. Module II Material Science and Technology: Lectures notes. The slides, supplied during class, are a useful to follow the lectures and for the individual study. However, they are NOT sufficient for the successful exam preparation.
Supplementary readings	Module I Mechanics of structures:

	Module II Material Science and Technology: • William F. Smith "Scienza e Tecnologia dei Materiali" Mc Graw-Hill 2021 • A. Bugini, C. Giardini, R. Pacagnella, G. Restelli "Tecnologia Meccanica vol I, Lavorazioni per fusione e deformazione plastica" Città Studi Edizioni 1995 A. Bugini, C. Giardini, R. Pacagnella, G. Restelli "Tecnologia Meccanica vol II, Lavorazioni per asportazione di truciolo" Città Studi Edizioni 1995 Subject Librarian: David Gebhardi, David.Gebhardi@unibz.it and Ilaria Miceli, Ilaria.Miceli@unibz.it
Software used	Module I none Module II Material Science and Technology: none