Engineering Laboratory (mechanical testing, non destructive testing)

1. GENERAL			
SCHOOL	Faculty of Sciences in collaboration with Faculty of Engineering, Aristotle University of Thessaloniki		
DEPARTMENT	Materials Science and Engineering		
LEVEL OF STUDIES	ISCED level 7 (5-year Integrated Master's programme) ISCED level 6 (4-year BSc programme)		
COURSE CODE	**MSEN 604**	**SEMESTER**	6th Semester
COURSE TITLE	**Engineering Laboratory (mechanical testing, non destructive testing)**		
TEACHING ACTIVITIES Lectures, tutorials/problem sessions, laboratory/computer exercises (where applicable), case studies and guided self-study.		**TEACHING HOURS PER WEEK**	**ECTS CREDITS**
		Lectures: 1 Lab work: 3 Total: 4	6
COURSE TYPE	Background, General Knowledge		
PREREQUISITES	No prerequisities		
TEACHING AND EXAMINATION METHODS	English		
COURSE OFFERED TO ERASMUS STUDENTS	Yes.		
COURSE URL	https://elearning.auth.gr/course/view.php?id=xxxxx		

2. LEARNING OUTCOMES	
Learning Outcomes	Upon successful completion of the course, undergraduate students will be able to: • Describe the basic mechanical behavior of engineering materials under common loading conditions. • Conduct standard mechanical tests (tensile, bending, impact, hardness, fatigue) following established testing procedures. • Identify elastic and plastic deformation, fracture behavior, and typical failure modes in metals, polymers, ceramics, and composites. • Understand the basic principles and practical applications of common non-destructive testing (NDT) methods. • Select appropriate mechanical or non-destructive testing techniques for simple engineering problems. • Record, analyze, and interpret experimental data, recognizing basic sources of error. • Follow safe laboratory practices and clearly report

	experimental results in written and oral form.
General Skills	• Applying knowledge in practice • Searching, analyzing and synthesizing data and information, using the necessary spectroscopic technologies • Decision-making • Independent work • Teamwork • Generate new research ideas • Promoting free, creative and inductive thinking

3. COURSE CONTENT

This course provides a comprehensive introduction to experimental methods used for the mechanical characterization and non-destructive evaluation of engineering materials and components. The course integrates theoretical background with hands-on laboratory practice, enabling students to understand material behavior under different loading and service conditions. Laboratory experiments focus on mechanical testing techniques such as tensile, compression, bending, impact, fatigue, and hardness testing. Students investigate elastic and plastic deformation, fracture mechanisms, and failure modes in metals, polymers, ceramics, and composite materials. Data acquisition systems and standardized testing procedures (ASTM/ISO) are emphasized. In parallel, the course introduces fundamental non-destructive testing (NDT) methods used in industrial quality control and structural integrity assessment. Techniques include ultrasonic testing, radiographic inspection, magnetic particle testing, dye penetrant testing, and basic eddy current methods. Students learn the principles, capabilities, and limitations of each technique. Emphasis is placed on experimental planning, safe laboratory practice, data analysis, uncertainty evaluation, and technical reporting. Upon completion, students will be able to select appropriate mechanical and non-destructive testing methods, interpret experimental results, and assess material performance and structural reliability in engineering applications.

4. LEARNING & TEACHING METHODS - EVALUATION

Teaching method	Face-to-face.
Use of ICT	ICT will be used in teaching the course, and in communication with students: • teaching of the course with modern distance learning (ZOOM) and asynchronous education tools via elearning platform of AUTH, • communication with students via email, ZOOM, and elearning platform of AUTH.
Teaching organization	The supervised and unsupervised workload per activity is indicated below (total workload complies with ECTS standards).

Activity	Workload/semester (hours)
Lectures	13
Bibliographic research and analysis	40
Laboratory exercises	39

	Writing of assignments	56
	Final written exam	2
	Total	**150**
Student evaluation	**Assessment language** The assessment language is English. **Assessment methods** The course uses the following methods: • **Multiple choice tests**: two midterm exams to check recall of definitions, concepts, and terminology on core concepts on inorganic materials. • **Problem solving assignments**: two written assignments in which students review a class of inorganic materials, analyze literature data, and solve problems on inorganic materials. • **Final written exam**: it combines short answers, problem solving, and data interpretation questions to evaluate cumulative understanding on core concepts of inorganic materials. Weighting • Multiple choice tests): 20% • Problem solving assignments: 20% • Final written exam: 60% **Student information** Students are informed about the assessment process through: • The course outline distributed in the first lecture. • Detailed instructions for the written assignment and presentation posted on the course website. • A dedicated assessment briefing during tutoring time where expectations and criteria are explained.	

5. SUGGESTED BIBLIOGRAPHY
Course Bibliography
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Additional bibliography for study
Teaching material slides