Materials Characterization Laboratory

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 602**	**SEMESTER**	6th Semester
COURSE TITLE	**Materials Characterization Laboratory**		
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, students will be able to: • Understand the principles and applications of modern materials characterization techniques. • Explain structure–property relationships at the atomic, crystallographic, and microstructural levels. • Select appropriate characterization methods (XRD, microscopy, spectroscopy, thermal and mechanical analysis) for different classes of materials. • Prepare samples and safely operate basic materials characterization equipment. • Acquire, analyze, and interpret experimental data, identifying sources of error and limitations. • Relate experimental results to material composition, structure, and properties. • Communicate experimental findings effectively through written laboratory reports and oral presentations.
General Skills	1. Applying knowledge in practice

	2. Searching, analyzing and synthesizing data and information, using the necessary spectroscopic technologies 3. Decision-making 4. Independent work 5. Teamwork 6. Generate new research ideas 7. Promoting free, creative and inductive thinking

3. COURSE CONTENT

This course provides a comprehensive introduction to the experimental techniques used for the characterization of materials and the interpretation of structure–property relationships. Through a combination of lectures and hands-on laboratory sessions, students gain practical experience with modern characterization tools commonly used in materials science and engineering. Topics covered include crystallographic analysis using X-ray diffraction (XRD), microstructural characterization with optical microscopy and scanning electron microscopy (SEM), elemental analysis through energy-dispersive X-ray spectroscopy (EDS) and spectroscopy techniques (FT-IR and Raman). Additional experiments introduce thermal analysis techniques such as differential scanning calorimetry (DSC), as well as mechanical characterization methods including hardness testing and basic tensile testing. Emphasis is placed on proper sample preparation, experimental design, data acquisition, and quantitative data analysis. Students learn how to critically evaluate experimental results, identify sources of error, and relate observed material behavior to underlying atomic and microstructural features. By the end of the course, students will be able to select appropriate characterization techniques for different classes of materials, operate laboratory instrumentation safely and effectively, and communicate experimental findings clearly through written laboratory reports and oral presentations.

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