

## 5<sup>th</sup> Semester

### Inorganic Materials Chemistry Laboratory

1. GENERAL			
<b>SCHOOL</b>	Faculty of Sciences in collaboration with Faculty of Engineering, Aristotle University of Thessaloniki		
<b>DEPARTMENT</b>	Materials Science and Engineering		
<b>LEVEL OF STUDIES</b>	ISCED level 7 (5-year Integrated Master's programme) ISCED level 6 (4-year BSc programme)		
<b>COURSE CODE</b>	<b>MSEN 501</b>	<b>SEMESTER</b>	5 <sup>th</sup> Semester
<b>COURSE TITLE</b>	<b>Inorganic Materials Chemistry Laboratory</b>		
<b>TEACHING ACTIVITIES</b>	Lectures, tutorials/problem sessions, laboratory/computer exercises (where applicable), case studies and guided self-study.	<b>TEACHING HOURS PER WEEK</b>	<b>ECTS CREDITS</b>
		Lectures: 1 Lab work: 3 Total: 4	6
<b>COURSE TYPE</b>	Background, General Knowledge		
<b>PREREQUISITES</b>	No prerequisites		
<b>TEACHING AND EXAMINATION METHODS</b>	English		
<b>COURSE OFFERED TO ERASMUS STUDENTS</b>	Yes		
<b>COURSE URL</b>	<a href="https://elearning.auth.gr/course/view.php?id=xxxx">https://elearning.auth.gr/course/view.php?id=xxxx</a>		

2. LEARNING OUTCOMES	
<b>Learning Outcomes</b>	By the end of this course, students will be able to: <ul style="list-style-type: none"> <li>• Perform solid-state reactions involving inorganic precursors and explain the role of diffusion, temperature, and stoichiometry.</li> <li>• Carry out sol-gel and coprecipitation syntheses and describe how reaction conditions influence particle size and morphology.</li> <li>• Synthesize metal-organic frameworks (MOFs) via solution or solvothermal methods and explain self-assembly in coordination solids.</li> <li>• Incorporate dopants into inorganic host lattices and predict their effects on material properties.</li> <li>• Apply post-synthetic treatments such as calcination, activation, or solvent exchange.</li> </ul>
<b>General Skills</b>	By the end of this course, students will be able to:

	<ul style="list-style-type: none"> <li>• Explain the fundamental principles governing the synthesis, structure, and properties of inorganic materials.</li> <li>• Compare solid-state, solution-based, and solvothermal synthesis routes and justify the selection of a method for a given material.</li> <li>• Correlate composition, crystal structure, defects, and microstructure with physical properties of inorganic solids.</li> <li>• Safely conduct high-temperature, solution-phase, and materials-processing experiments following best laboratory practices.</li> <li>• Analyze experimental data using appropriate chemical, physical, and crystallographic models.</li> <li>• Communicate scientific results clearly in written reports and oral or poster-style presentations.</li> </ul>
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### 3. COURSE CONTENT

Laboratory experiments covering the following areas:

- Solid state synthesis and characterization of materials such as spinel oxides
- Sol-gel synthesis and characterization of metal oxide nanoparticles
- Preparation and photophysical characterization of doped phosphor materials
- Solvothermal synthesis and characterization of metal-organic frameworks (MOFs)
- Fabrication and testing of a conducting oxide material
- Fabrication and testing of a dye-sensitized solar cell (DSSC)

### 4. LEARNING & TEACHING METHODS - EVALUATION

<b>Teaching method</b>	Face-to-face.	
<b>Use of ICT</b>	ICT will be used in teaching the course, and in communication with students: <ul style="list-style-type: none"> <li>• teaching of the course with modern distance learning (ZOOM) and asynchronous education tools via elearning platform of AUTH,</li> <li>• communication with students via email, ZOOM, and elearning platform of AUTH.</li> </ul>	
<b>Teaching organization</b>	The supervised and unsupervised workload per activity is indicated below (total workload complies with ECTS standards).	
	<b>Activity</b>	<b>Workload/semester (hours)</b>
	Lectures	13
	Bibliographic written, research and problem solving	40
	Laboratory exercises	39
	Writing of Assignments	56
	Exams	2
<b>Total</b>	<b>150</b>	
<b>Student evaluation</b>	<b>Assessment language</b>	

	<p>The assessment language is English.</p> <p><b>Assessment methods</b></p> <p>The course uses the following methods:</p> <ul style="list-style-type: none"> <li>• <b>Multiple choice tests:</b> two midterm exams to check recall of definitions, concepts, and terminology on core concepts on inorganic materials.</li> <li>• <b>Problem solving assignments:</b> two written assignments in which students review course material, analyze literature data, and solve problems on inorganic materials.</li> <li>• <b>Final written exam:</b> it combines short answers, problem solving, and data interpretation questions to evaluate cumulative understanding on core concepts of inorganic materials.</li> </ul> <p>Weighting</p> <ul style="list-style-type: none"> <li>• Multiple choice tests): 20%</li> <li>• Problem solving assignments: 20%</li> <li>• Final written exam: 60%</li> </ul> <p><b>Student information</b></p> <p>Students are informed about the assessment process through:</p> <ul style="list-style-type: none"> <li>• The course outline distributed in the first lecture.</li> <li>• Detailed instructions for the written assignment and presentation posted on the course website.</li> <li>• A dedicated assessment briefing during tutoring time where expectations and criteria are explained.</li> <li>•</li> </ul>
<b>5. SUGGESTED BIBLIOGRAPHY</b>	
<b>EUDOXUS</b>	
<p>M.T. Weller, J. Rourke, F.A. Armstrong, S. Lancaster, T. Overton, Inorganic chemistry. 8th edn. Oxford University Press (2025)</p> <p>E.A. Moore and L.E. Smart, Solid state chemistry: an introduction. 5th ed. CRC Press (2020).</p> <p>A.R. West, Solid state chemistry and its applications, 2nd edn. John Wiley &amp; Sons (2014).</p> <p>M.T. Weller, Inorganic materials chemistry. Oxford Chemistry Primers 23. Oxford University Press (1994).</p>	
<b>Additional bibliography for study</b>	
<ul style="list-style-type: none"> <li>• Teaching material slides</li> </ul>	