

Ceramics

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 503	SEMESTER	5 th Semester
COURSE TITLE	Ceramics		
TEACHING ACTIVITIES		TEACHING HOURS PER WEEK	ECTS CREDITS
Lectures, tutorials/problem sessions, laboratory/computer exercises (where applicable), case studies and guided self-study.		4 (3L + 1T)	6
COURSE TYPE	Background / General knowledge / Scientific area		
PREREQUISITES	Physical Chemistry, Inorganic Materials Chemistry		
TEACHING AND EXAMINATION METHODS	Face-to-face lectures and guided problem-solving sessions; short in-class quizzes; final written examination.		
COURSE OFFERED TO ERASMUS STUDENTS	Yes.		
COURSE URL	https://elearning.auth.gr/course/view.php?id=xxxxx		

2. LEARNING OUTCOMES	
Learning Outcomes	<p>The aim of this course is to introduce students to ceramic materials, glass, glass-ceramic materials and binders, in terms of both science and engineering. The teaching of the science of ceramic materials aims at learning the properties of these materials, such as physical, chemical, electrical, optical, magnetic, as a result of their compositions. The teaching of ceramic engineering aims to learn all the experimental methods of manufacturing and testing ceramic materials as applied around the world. The interest of the course is focused on all categories of ceramic materials, and in terms of composition, e.g. oxides, carbides, nitrides, glass, binders (cement and gypsum), and in their form, e.g. powders, porous and solid materials, from macro- to micro- and nano-dimensions, and in terms of their final application, ie advanced ceramics, such as nano-tech ceramics, nano-composites and nano-dimensions, such as coatings.</p> <p>Competences</p> <p>The above are absolutely necessary (in terms of skills) for the Materials Engineer to design new ceramic material compositions with the desired properties as well as in the quality control of ceramic materials produced by the industry and marketed and applied in a number of applications, on the other hand are a particularly attractive perspective (and acquired skill) for the</p>

	<p>graduates of the Department as they match the particular characteristics of the Greek Economy, such as traditional ceramics, which is a cornerstone of a country's industry but also of Europe and internationally, but also advanced ceramics, which should be the future of the country's development in the near future. Thus, with regard to Understanding, the student must be able (that is, expected to be able) to distinguish, explain, evaluate and conclude the value and importance of the above knowledge as necessary to the Science and Technique of Ceramics as a key component of the Materials Engineering subject, and with regard to Application, the student is (that is, must be) able to use the knowledge both in the strict context of this course and in the context of the challenges he will face in practicing the profession of Materials Engineer, in industry or research.</p>
<p>General Skills</p>	<ul style="list-style-type: none"> • Problem solving with quantitative reasoning • Teamwork in tutorial and lab-style activities • Information literacy (handbooks, databases, standards awareness) • Technical reporting and oral communication • Ethics and sustainability awareness in materials choices

3. COURSE CONTENT

The course Ceramic Materials provides a comprehensive introduction to the science, technology, and applications of ceramics in materials science and industry. It begins with an overview of ceramics in various industrial and technological contexts and a discussion of raw materials and their properties. Students study the classification of ceramics into traditional and advanced categories and learn about processing and shaping techniques, including powder processing, sintering, and forming methods, as well as ceramic coatings. The course covers the atomic and crystalline structures of ceramics, as well as non-crystalline solids such as glasses, and introduces phase diagrams to understand phase equilibria and transformations. Key concepts of nucleation, crystal growth, devitrification, solid-state reactions, and non-equilibrium processing are addressed to explain microstructural development. Students explore the relationship between microstructure and a wide range of properties, including mechanical (strength, toughness), thermal (conductivity, expansion), optical (transparency, refractive index), electrical (dielectric, conductive behavior), and chemical stability (corrosion, oxidation). Emphasis is placed on understanding the interdependence of processing, structure, and properties, and on the critical evaluation of ceramics for engineering and technological applications. Through lectures, case studies, and practical examples, students develop the knowledge and skills necessary to select, design, and optimize ceramic materials for diverse applications.

4. LEARNING & TEACHING METHODS - EVALUATION

<p>Teaching method</p>	<p>Face-to-face. Lectures, guided problem sessions, short demonstrations, and small-group activities/case studies.</p>
<p>Use of ICT</p>	<p>Learning management system (e-learning platform) for notes, quizzes and announcements; spreadsheets for simple property charts; basic use of materials databases for information retrieval.</p>

Teaching organization	The supervised and unsupervised workload per activity is indicated below (total workload complies with ECTS standards).	
	Activity	Workload/semester (hours)
	Lectures	39
	Tutorials / problem sessions	13
	Short assignments / quizzes	10
	Independent study	70
	Exam preparation	16
	Final written exam	2
Total	150	
Student evaluation	Assessment language: English. Methods: written final exam (60%), homework/problem sets and short quizzes (25%), mini-case study/report (15%). Students are informed via the course guide and e-learning announcements.	

5. SUGGESTED BIBLIOGRAPHY

EUDOXUS

To be specified in EUDOXUS.

Additional bibliography for study

- Barsoum M., Fundamentals of Ceramics, 2003 Institute of Physics Publishing, Bristol and Philadelphia