

COURSE OUTLINE

(1) GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF MINERAL RESOURCES ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	MRE707	SEMESTER	7
COURSE TITLE	MATERIALS SCIENCE		
INDEPENDENT TEACHING ACTIVITIES		WEEKLY TEACHING HOURS	CREDITS
<i>if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits</i>			
Lectures		3	4
Labs		1	1
Total		4	5
<i>Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).</i>			
COURSE TYPE <i>general background, special background, specialised general knowledge, skills development</i>	Required, special background		
PREREQUISITE COURSES:	MRE202, MRE303, MRE405		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No		
COURSE WEBSITE (URL)	https://eclass.uowm.gr/courses/MRE158/		

(2) LEARNING OUTCOMES

<p>Learning outcomes</p> <p><i>The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.</i></p> <p><i>Consult Appendix A</i></p> <ul style="list-style-type: none"> • Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area • Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B • Guidelines for writing Learning Outcomes
<p>Students should be able to:</p> <ul style="list-style-type: none"> ❖ Understand structure- properties relationships of materials ❖ Understand the relation between process method-structure-properties of materials with their final usage ❖ Comprehend the quantum-mechanical principle in relation to allowed electron energy states ❖ Design the unit cell of the several crystal systems ❖ To calculate hole concentrations in a solid at certain temperature ❖ To calculate the diffusion coefficients of a material at certain temperature in solids ❖ To sketch simple and eutectic phase diagrams and indicate the phases ❖ To sketch the unit cell geometries of crystalline solids such as NaCl, CsCl, ZrO₂, CeO₂ and perovskites and calculate theoretical densities ❖ Calculate the rate of oxidation of a metal given the current density ❖ To understand concepts related to computational materials science

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology	Project planning and management
Adapting to new situations	Respect for difference and multiculturalism
Decision-making	Respect for the natural environment
Working independently	Showing social, professional and ethical responsibility and sensitivity to gender issues
Team work	Criticism and self-criticism
Working in an international environment	Production of free, creative and inductive thinking
Working in an interdisciplinary environment
Production of new research ideas	Others...

Search for, analysis and synthesis of data and information, with the use of the necessary technology

Working independently

Team work

Working in an interdisciplinary environment

Criticism and self-criticism

Production of new Research ideas

Production of free, creative and inductive thinking

Showing social, professional and ethical responsibility

(3) SYLLABUS

- Classification of materials
- Structure of materials
- bonding and thermodynamics of materials
- crystalline solids
- Diffusion and defects in crystalline solids
- Phase diagrams of metals and alloys
- Microstructure evolution in metals and properties
- Structure and properties of ceramics
- Advanced ceramic materials
- Solid electrolytes
- Glasses
- Ceramic-metal composites
- Principles of corrosion
- Characterization of materials by optical and electron microscopy
- X-Ray diffraction technique
- Introduction to computational materials science

(4) TEACHING and LEARNING METHODS - EVALUATION

<p>DELIVERY <i>Face-to-face, Distance learning, etc.</i></p>	<p>Face-to-face, Distance learning, Lectures, Computational EXCEL-Mathematica or MatLab Lab, Tutorials</p>	
<p>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY <i>Use of ICT in teaching, laboratory education, communication with students</i></p>	<p>E-Class, electronic communication, video demonstrations, intermediate exams via e-Class tools</p>	
<p>TEACHING METHODS <i>The manner and methods of teaching are described in detail.</i> <i>Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</i></p> <p><i>The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</i></p>	<p>Activity</p>	<p>Semester workload</p>
	<p>Lectures</p>	<p>36</p>
	<p>Computational Lab</p>	<p>24</p>
	<p>Tutorials</p>	<p>24</p>
	<p>Self-study</p>	<p>16</p>
	<p></p>	<p></p>
	<p></p>	<p></p>
<p></p>	<p></p>	
<p></p>	<p></p>	
<p>Course total</p>	<p>100</p>	
<p>STUDENT PERFORMANCE EVALUATION <i>Description of the evaluation procedure</i></p> <p><i>Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other</i></p> <p><i>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i></p>	<p>Final exam (40%, minimum required grade =4/10), Multiple choice intermediate exam (20%), Homework (20%), Computational Lab (20%)</p>	

(5) SUGGESTED BIBLIOGRAPHY

- Suggested bibliography:

1. Επιστήμη και Τεχνολογία Υλικών, 9η Έκδοση, by Callister William D., Κωδικό στον Εύδοξο: 50655973, ISBN: 978-960-418-556-6, Εκδότης: ΕΚΔΟΣΕΙΣ Α. ΤΖΙΟΛΑ & ΥΙΟΙ Α.Ε.
2. Επιστήμη και Τεχνολογία των Υλικών, 2η Έκδοση, by Ζασπάλης Βασίλης, Κωδικό στον Εύδοξο: 94689171, ISBN: 978-960-418-888-8, Εκδότης: ΕΚΔΟΣΕΙΣ Α. ΤΖΙΟΛΑ & ΥΙΟΙ Α.Ε.
3. Επιστήμη και τεχνολογία των σύνθετων υλικών, by Μπέλτσιος Κ., Κωδικό στον Εύδοξο: 18548803, ISBN: 978-960-418-308-1, Εκδότης: ΕΚΔΟΣΕΙΣ Α. ΤΖΙΟΛΑ & ΥΙΟΙ Α.Ε.
4. ΥΛΙΚΑ: ΜΗΧΑΝΙΚΗ, ΕΠΙΣΤΗΜΗ, ΕΠΕΞΕΡΓΑΣΙΑ ΚΑΙ ΣΧΕΔΙΑΣΜΟΣ, by MICHAEL ASHBY, HUGH SHERCLIFF, DAVID CEBON, Κωδικό στον Εύδοξο: 12534905, ISBN: 978-960-461-449-3, Εκδότης: ΕΚΔΟΣΕΙΣ ΚΛΕΙΔΑΡΙΘΜΟΣ ΕΠΕ
5. Επιστήμη και τεχνολογία υλικών, by Βατάλης Αργύρης Σ., Κωδικό στον Εύδοξο: 10996, ISBN: 978-960-456-137-7, Εκδότης: Ζήτη Πελαγία & Σια Ι.Κ.Ε.

6. *Επιστήμη και Τεχνολογία των Μεταλλικών Υλικών*, Έκδοση: 2η έκδ./2007, by Χρυσουλάκης Γιάννης Δ., Παντελής Δημήτρης Ι., Κωδικός Βιβλίου στον Εύδοξο: 9643, ISBN: 978-960-7510-39-6, Εκδότης: Α. ΠΑΠΑΣΩΤΗΡΙΟΥ & ΣΙΑ Ι.Κ.Ε..

7. *Foundations of material science and engineering*, by Smith W., Hashemi J., Κωδικό στον Εύδοξο: 59395096, ISBN: 9780071311144, Εκδότης: Εκδόσεις ΕΠΙΚΕΝΤΡΟ Α.Ε.

8. *Introduction to Computational Materials Science*, by Richard LeSar, ISBN: 9781139033398, Εκδότης: Cambridge University Press, Print publication year:2013 (<https://doi.org/10.1017/CBO9781139033398>)

9. *An Introduction to Scientific Computing*, by Ionut Danaila, Pascal Joly, Sidi Mahmoud Kaber, Marie Postel, ISBN: 978-0-387-49159-2, Εκδότης: 2007 Springer Science+Business Media, LLC (<https://doi.org/10.1017/CBO9781139033398>)

- Related academic journals::

1. *Computational Materials Science*
2. *Materials Science and Engineering: A*
3. *Advances in Materials Science and Engineering*
4. *Materials Today*
5. *Acta Materialia*
6. *Journal of Sustainable Metallurgy*
7. *JOM*
8. *Journal of Electronic Materials*
9. *ADVANCED ENERGY MATERIALS*
10. *Journal of European Ceramic Society*
11. *Energy, The International Journal*
12. *Journal of Materials Research and Technology*