1st Semester

Introduction to Materials Science and Engineering

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 101**	**SEMESTER**	1st Semester
COURSE TITLE	**Introduction to Materials Science and Engineering**		
TEACHING ACTIVITIES Lectures, tutorials/problem sessions, laboratory/computer exercises (where applicable), case studies and guided self-study.		**TEACHING HOURS PER WEEK**	**ECTS CREDITS**
		4 (3L + 1T)	6
COURSE TYPE	Background / General knowledge / Scientific area		
PREREQUISITES	None. Recommended: high-school Chemistry and Physics; basic Calculus.		
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 (taught in English, subject to minimum enrollment).		
COURSE URL	https://elearning.auth.gr/course/view.php?id=xxxxx		

2. LEARNING OUTCOMES	
Learning Outcomes	• Explain the structure-processing-properties-performance paradigm in Materials Science and Engineering. • Describe bonding, crystal structures, and common defects, and relate them to macroscopic properties. • Interpret basic phase diagrams and use them to rationalize microstructure evolution. • Compare metals, ceramics, polymers, semiconductors, and composites in terms of key properties and applications. • Select simple characterization and testing methods appropriate for a given materials problem. • Communicate materials-related technical information using correct terminology and clear engineering reasoning.
General Skills	• 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

- What is Materials Science and Engineering: the materials paradigm and design trade-offs.
- Materials classes and typical applications; introduction to microstructure.
- Atomic bonding, crystal structures, and amorphous solids.
- Crystal defects: vacancies, dislocations, grain boundaries; diffusion basics.
- Phase diagrams: phases, lever rule, eutectic; intro to phase transformations.
- Mechanical behavior: elastic/plastic deformation, strengthening mechanisms, fracture basics.
- Functional properties overview: electrical, thermal, magnetic, optical; corrosion basics.
- Introduction to processing routes: casting, deformation processing, heat treatment, polymer processing, sintering, additive manufacturing (overview).
- Intro to materials selection concepts and sustainability considerations.

4. LEARNING & TEACHING METHODS - EVALUATION

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

- W.D. Callister & D.G. Rethwisch, Materials Science and Engineering: An Introduction.
- M.F. Ashby & D.R.H. Jones, Engineering Materials 1–2.
- J.F. Shackelford, Introduction to Materials Science for Engineers.
- Selected open courseware notes (indicative): MIT OCW / UC Berkeley MSE course materials.