

Composite materials

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 605	SEMESTER	6th Semester
COURSE TITLE	Composite materials		
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	Scientific area / Skill development		
PREREQUISITES	Introduction to Materials Science and Engineering; Introduction to Solid Mechanics (or equivalent).		
TEACHING AND EXAMINATION METHODS	Lectures and problem sessions; case studies on structural composites; final written exam and a design-oriented assignment.		
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	<ul style="list-style-type: none"> • Differentiate polymer-, metal- and ceramic-matrix composites and identify suitable applications. • Analyze the role of reinforcement geometry and orientation on composite stiffness and strength. • Explain processing routes for particulate, whisker, and fiber composites and link processing to defects. • Assess interface phenomena (wetting, adhesion, interphase) and their impact on performance and durability. • Apply simplified micromechanics models (rule of mixtures, load transfer) for preliminary design. • Recognize key failure modes (matrix cracking, delamination, fiber breakage) and propose mitigation strategies.
General Skills	<ul style="list-style-type: none"> • Engineering analysis with simplified models • Design thinking and trade-off evaluation • Use of technical literature and datasheets • Teamwork and presentation of a design case

3. COURSE CONTENT

- Introduction and classification of composites; property advantages and limitations.
- Reinforcements: particles, whiskers, continuous fibers; textiles and architectures.
- Polymer matrix composites: processing (hand lay-up, RTM, prepreg/autoclave), defects and QA.
- Metal matrix and ceramic matrix composites: processing routes and high-temperature behavior.
- Micromechanics: stiffness predictions; strength and load transfer; laminate concepts (intro).
- Interfaces and interphases: bonding, residual stresses, environmental degradation.
- Failure and damage: matrix cracking, delamination, impact, fatigue; NDT overview.
- Composite design case studies (aerospace, automotive, energy, civil).
- Recycling and sustainability challenges for composites (overview).

4. LEARNING & TEACHING METHODS - EVALUATION

Teaching method	Face-to-face. Lectures, problem-solving tutorials, and case-study discussions; optional lab/demo sessions.	
Use of ICT	E-learning for notes; spreadsheets or simple scripts for micromechanics calculations; optional use of CAE tools for laminate basics (demo level).	
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
	Design assignment / case study	18
	Independent study	62
	Exam preparation	16
	Final written exam	2
Total	150	
Student evaluation	Assessment language: English. Methods: written final exam (60%), design assignment/report (25%), quizzes/problem sets (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

- R.M. Jones, Mechanics of Composite Materials.
- D. Hull & T.W. Clyne, An Introduction to Composite Materials.
- A. Kelly & C. Zweben (eds.), Comprehensive Composite Materials (selected chapters).
- M.F. Ashby, Materials Selection in Mechanical Design (composites selection sections).