Deformation and failure of engineering 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 802**	**SEMESTER**	8th Semester
COURSE TITLE	**Deformation and failure of engineering 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 / Skills development		
PREREQUISITES	Introduction to Solid Mechanics, Design and Analysis of Materials Experiments, Mechanical Behavior of Engineering Materials		
TEACHING AND EXAMINATION METHODS	Face-to-face		
COURSE OFFERED TO ERASMUS STUDENTS	Yes		
COURSE URL	https://elearning.auth.gr/course/view.php?id=xxxxx		

2. LEARNING OUTCOMES	
Learning Outcomes	By the end of this course, students will be able to: • Differentiate between the fundamental mechanisms of material deformation • Analyze the physics of fatigue crack nucleation and propagation, identifying microstructural features that influence fatigue life • Predict the fatigue life of engineering components • Evaluate the impact of variable amplitude loading and mean stress effects on component durability
General Skills	• Search for, analysis and synthesis of data and information, with the use of the necessary technology • Work in an international context • Advance free, creative and causative thinking • Work in teams • Decision-making • Modeling and solving real-world problems • Working in a multidisciplinary environment • Generate new research ideas

3. COURSE CONTENT

This course provides an insight into the mechanical response of engineering materials, with a primary focus on cyclic loading and fatigue failure, while foundational topics in plastic deformation and static fracture are covered. The course bridges theory and application, equipping students with the analytical tools to predict component life. Emphasis is placed on modern approaches to fatigue design, including fracture mechanics and strain-based methods used in the automotive and aerospace industries.

Key topics:

- Plastic Deformation & Static Failure
- High-Cycle Fatigue.
- Low-Cycle Fatigue
- Fracture Mechanics & Crack Growth
- Variable Loading & Failure Analysis

4. LEARNING & TEACHING METHODS - EVALUATION

Teaching method	Face-to-face.
Use of ICT	Use of ICT in Course Teaching, Use of ICT in Communication with Students Description: Use of Information and Communication Technologies (ICT) in teaching the course with tools of modern distance learning (MS-Teams) and asynchronous education (e-learning). Use of learning aids based on ICT: Excel, Matlab, CAE software Use of ICT in student assessment: Electronic grading (e-learning). Use of ICT in communication with students: e-leaning, email, MS-Teams.
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	Report Oral exams Written Exams with Problem Solving (Summative)

5. SUGGESTED BIBLIOGRAPHY

EUDOXUS

To be specified in EUDOXUS.

Additional bibliography for study

1.Lee, Y-L., Pan, J., Hathaway, R. B., Barkey, M. E. (2005). Fatigue Testing and Analysis: Theory and Practice (1st Edition). Butterworth-Heinemann.
2. Schijve, J. (2009). Fatigue of Structures and Materials (2nd Edition). Springer Dordrecht