ETY602 - Mechanics of Materials

COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF ENGINEERING			
ACADEMIC UNIT	DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING			
LEVEL OF STUDIES	UNDERGRADUATE			
COURSE CODE	ETY602	**SEMESTER**	6	
COURSE TITLE	Mechanics of materials			
INDEPENDENT TEACHING ACTIVITIES *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*			**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures / Labs / Tutorials			4	4
Add rows if necessary. The organization of teaching and the teaching methods used are described in detail at (d).				
COURSE TYPE *general background, special background, specialized general knowledge, skills development*	General background			
PREREQUISITE COURSES:	NO			
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK			
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO			
COURSE WEBSITE (URL)	http://mss-nde.uoi.gr/greek/302%20-%20ETY%20602/index.html			

(2) LEARNING OUTCOMES

Learning outcomes

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.

Consult Appendix A

- *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*

This is an introductory course to Mechanics of Materials. The purpose of the course is to introduce students to the basic concepts of solid mechanics, as taught civil engineers or mechanical engineers, but in the context of materials processing, structure, properties, and performance, which is the point of view of materials engineers.

Upon successful completion of the course the student will:

- Understand the concepts of stress and strain, so that they can relate the materials' performance with mechanical loading.
- Learn the properties of materials identified by single-axle charge tests.
- Understand the material's response to multiaxial stress and strain and will be able to calculate the principal stresses.
- Learn the failure criteria and be able to use them for evaluating ductile and brittle fractures.

- Understand the concept of stress concentration and will be able to analyze the stress field in real structures.
- Learn the introductory concepts of fracture mechanics for studying the mechanical and failure behavior of structures.
- Understand mechanical behavior of materials under bending, torsion and buckling and be able to calculate the mechanical behavior in structural elements subjected to various mechanical loadings.
- Learn the basic concepts of fatigue so that they can evaluate the remaining life of the material when it is subjected to cyclic mechanical loading.

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…*
	…….

- Autonomous Work
- Teamwork

(3) SYLLABUS

1. Introduction. Concept of stress and strain.
Normal and shear stress. Maximum and permissible stress. Safety factor.
Applications.
2. Uniaxial loading - Tensile response of materials.
Mechanical stress/strain. Stress-strain diagrams. Strength. Ductility. Stiffness. Energy absorption. Real stress/strain. Elastic and plastic behavior of materials. Equation Ramberg - Osgood.
3. Multiaxial stress and strain.
Generalized Hooke's law. Principal stresses. Methods for determining principal stresses. Transformation equations. Direction cosines. Mohr's cyrcle.
4. Material failure theory.
Ductile and brittle fracture. Failure criteria (Tresca, Von Mises, Mohr).
5. Stress concentration.
Stress concentration factor. Neuber's rule.
6. Elements of fracture mechnics.
Linear elastic fracture mechanics. Stress intensity factor. Types of fracture. Fracture toughness.
7. Bending.
8. Torsion.
9. Buckling.
10. Fatigue.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	In class lectures
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	

TEACHING METHODS

The manner and methods of teaching are described in detail.
Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical

Activity	*Semester workload*
Lectures	52
Self-study	28
Final exam preparation	20

practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc. *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*		
	Course total	100
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *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* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	LANGUAGE OF EVALUATION: Greek METHOD OF EVALUATION: (i) Final written examination with multiple choice questions and/or problem solving (ii) Comparative evaluation of elements of the theory (iii) Project	

(5) ATTACHED BIBLIOGRAPHY

-Suggested bibliography:

- T.E. Matikas, Mechanics of Materials (Class Notes), University Printing, 2019.
- Beer-Johnston-DeWolf-Mazurec, ΜΗΧΑΝΙΚΗ ΤΩΝ ΥΛΙΚΩΝ (6th Edition), TZIOLAS Publications, 2011.
- Ap. Polyzakis, Static and Strength of Materials (Theory-Methodology-Solved Problems), 2017

-Related academic journals: