ETY906 – Mechanical behavior of Composite Materials

COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	ETY906	**SEMESTER**	9
COURSE TITLE	Mechanical behavior of Composite 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 / Case Studies	3	3
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*	Specialized general knowledge
PREREQUISITE COURSES:	Mechanics of Materials, Composite Materials, Laboratory of Materials VII
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO
COURSE WEBSITE (URL)	http://users.uoi.gr/csmlab/

(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*

The scope of the course is the study of the response of composite materials in loading environments. The course provides in depth knowledge in intrinsic properties of advanced composite materials and are related to the interaction of the distinct phases, the response of anisotropic materials in relation to the loading axis and the methodologies/ standards for the design requirements due to this anisotropy. By successfully completing the course, the student should know:

- The meaning of anisotropy and its relation to the mechanical behavior of materials;
- The basic notions related to the laminate design of composite materials;
- The relations that govern the phase interaction; the basic models for simple symmetries, e.g. unidirectional composite materials;
- The response of the materials in different loading conditions in relation to the material symmetry;

- The fundamental mechanical tests and standardisation of composite materials in relation to the international standards.

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, analysis and synthesis of information and data with the application of the required technologies
- Adapt to novel enviroments
- Production of novel research ideas and themes
- Instigation of free, productive and creative thinking
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(3) SYLLABUS

The course presents the necessary principles that govern the study of mulri phase materials and their response to loading environments. The course focuses in advanced composite naterials with specific reinforcement geometry. The content of the lesson is as following:

- Introduction, general principles, definitions and categorisation, composite properties and phase properties;
- Matrix, reinforcing phase and interface, geometry of reinforcing phase , design;
- Role of the interface, composites with metal/ organic/ ceramic matrix;
- Structure-property relation, stiffness-strength, stress-strain relation, isotropic materials, principle stresses and axes
- Failure criteria, anisotropic materials/ unidirectional composites: stress-strain relations, out of axis loading, stiffness of laminates
- Micromechanics and micromechanics of unidirectional composites, micromechanical models for stiffness-strength, long vs. short fibre composites, critical length of reinforcement, relation to macroscopic properties
- fracture and energy absorption mechanisms, crack initiation and propagation, slow crack propagation, crack types (I, II, mixed), toughness enhancement mechanisms
- Mechanical testing of anisotropic laminates: tension, compression, flexure, shear, toughness, environmental testing

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	In class General theory and tutoring classes
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	No
TEACHING METHODS *The manner and methods of teaching are described in detail.*	

Activity	***Semester workload***
Lectures	39

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. *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*	Non supervised student study: 36 Course total: ***75***
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: Individual written assignments and /or written exams in the end of the semester based on theory and exercises that are presented in the course lectures

(5) ATTACHED BIBLIOGRAPHY

Suggested bibliography:

- Σύνθετα υλικά, Γ. Παπανικολάου, Δ. Μουζάκης
- Σύνθετα Υλικά, Κ. Μπέλτσιος
- Materials Science and Engineering: An Introduction (5th edition), chapter 17, William D. Callister
- Composite materials: Engineering and Science, F. L. Matthews and R. D. Rawlings