ETY309 – Mechanics of Continuous Media

COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	ETY309	**SEMESTER**	3
COURSE TITLE	Mechanics of Continuous Media		

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 / Laboratory Exercises	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:	LECTURES IN GREEK, PRESENTATION IN ENGLISH/GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO
COURSE WEBSITE (URL)	http://ecourse.uoi.gr/enrol/index.php?id=873

(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 main objective of the course is to familiarize the students with the fundamental concepts of Mechanics of Continuous Media and their applications to engineering problems.

The course provides a background mathematical knowledge for the understanding of specialized courses in the field of Materials Science and Engineering that follow.

By completing the course, the students are expected to have acquired the following:

Knowledge:

- Have a good **understanding** of the fundamental principles that govern the motion of all bodies, solids and fluids, at the macroscopic level.

Abilities:

- To analyze the various practical problems in applied engineering based on the theoretical principles acquired in the course.
- To solve some typical 1-d problems in elastostatics and fluid statics
- To collect, organize and evaluate interdisciplinary information obtained from various sources
- To organize scientific information and present it effectively
- To solve problems in an organized way using brainstorming meetings
- To work in groups, manage meetings, write agenda and minutes

Skills:

- To model a simple equilibrium problem. That is to say analyzes a real problem, to choose the appropriate PDE and boundary conditions so as to construct a simple mathematical model corresponding to it.
- Use MATLAB to model and solves a simple 2-d equilibrium problem using ready-made programs in the graphic environment.
- Around organizing interdisciplinary meetings
- Around teamwork, capturing key information, selecting appropriate actions for optimal scientific and technological results

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…*
	…….

- Good understanding and treatment of physical problems
- Transformation of an Engineering problem into a mathematical and computational problem and solve it with the help of computer.
- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Production of free, creative and inductive thinking
- Team work
- Decision-making
- Adapting to new situations
- Project planning and management
- Criticism and self-criticism

(3) SYLLABUS

- The Continuous Medium
- Vector and Tensor Calculus
- Kinematics of a Continuous Medium, Material Derivatives
- Finite Strain and Deformation
- Balance Laws, Energy Balance, Transpose Theorem
- Forces in a continuum and Cauchy Stress Tensor
- Balance of Linear Momentum and Euler Equation
- Balance of Angular Momentum and the symmetry of Cauchy tensor
- Constitutive Relations
- Elasticity and Hooke's Law
- Plasticity and Viscoelasticity
- Fluid Motion
- Boundary Value Problems of Elasticity
- MATLAB PDE tool

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY Face-to-face, Distance learning, etc.</td><td>Face-to-face in the class</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students</td><td>Use of PC for data and information, preparation of deliverables, communication of the team using email/social media/ecourse platform</td></tr>
<tr><td>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 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</td><td>
<table>
<tr><th>Activity</th><th>Semester workload</th></tr>
<tr><td>Lectures
Laboratory Practice</td><td>39
13</td></tr>
<tr><td>Project</td><td>25</td></tr>
<tr><td>Self-study</td><td>13</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td>100</td></tr>
</table>
</td></tr>
<tr><td>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.</td><td>LANGUAGE OF EVALUATION: Greek

METHOD OF EVALUATION:
o Written exam (solving problems) at the end of the semester. (80%)
o Project (20%)</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

Suggested bibliography:

- Αυφαντής, Η.Χ., Μηχανική Ρευστών και Στερεών, Εκδόσεις Grapholine, 2008
- Βαρδουλάκης, Ι., Εισαγωγή στη Μηχανική του Συνεχούς, Εκδόσεις Συμμετρία, 2002
- Καλπακίδης, Β., Σημειώσεις στη Μηχανική του Συνεχούς, Πανεπιστήμιο Ιωαννίνων, 2006 (http://users.uoi.gr/vkalpak)