

## ETE809 – Introduction to Finite Element Method

### COURSE OUTLINE

#### (1) GENERAL

<b>SCHOOL</b>	SCHOOL OF ENGINEERING		
<b>ACADEMIC UNIT</b>	DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING		
<b>LEVEL OF STUDIES</b>	UNDERGRADUATE		
<b>COURSE CODE</b>	ETE809	<b>SEMESTER</b>	10
<b>COURSE TITLE</b>	Introduction to Finite Element Method		
<b>INDEPENDENT TEACHING ACTIVITIES</b> <i>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</i>	<b>WEEKLY TEACHING HOURS</b>	<b>CREDITS</b>	
Lectures	2	3	
Computational Approaches	1		
<i>Add rows if necessary. The organization of teaching and the teaching methods used are described in detail at (d).</i>			
<b>COURSE TYPE</b> <i>general background, special background, specialized general knowledge, skills development</i>	Specialized general knowledge		
<b>PREREQUISITE COURSES:</b>	NO		
<b>LANGUAGE OF INSTRUCTION and EXAMINATIONS:</b>	LECTURES IN GREEK, PRESENTATION IN ENGLISH/GREEK		
<b>IS THE COURSE OFFERED TO ERASMUS STUDENTS</b>	NO		
<b>COURSE WEBSITE (URL)</b>	<a href="http://ecourse.uoi.gr/enrol/index.php?id=2281">http://ecourse.uoi.gr/enrol/index.php?id=2281</a>		

#### (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*

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

##### **Knowledge:**

- The fundamental concepts of the Finite Element Method and applications to engineering problem
- the ability to recognize and analyze a simple finite element code, that is, they will know and understand all the sub-components that make up a typical Finite element program.
- The skill to compose a complete finite element code for a one-dimensional engineering problem

##### **Abilities:**

- To collect, organize and evaluate interdisciplinary information obtained from various sources

<ul style="list-style-type: none"> <li>○ To organize scientific information and present it effectively</li> <li>○ To solve problems in an organized way using brainstorming meetings</li> <li>○ To work in groups, manage meetings, write agenda and minutes</li> </ul> <p><b>Skills:</b></p> <ul style="list-style-type: none"> <li>○ Around organizing interdisciplinary meetings</li> <li>○ Around teamwork, capturing key information, selecting appropriate actions for optimal scientific and technological results</li> </ul>																		
<p><b>General Competences</b></p> <p><i>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?</i></p> <table border="0"> <tr> <td><i>Search for, analysis and synthesis of data and information, with the use of the necessary technology</i></td> <td><i>Project planning and management</i></td> </tr> <tr> <td><i>Adapting to new situations</i></td> <td><i>Respect for difference and multiculturalism</i></td> </tr> <tr> <td><i>Decision-making</i></td> <td><i>Respect for the natural environment</i></td> </tr> <tr> <td><i>Working independently</i></td> <td><i>Showing social, professional and ethical responsibility and sensitivity to gender issues</i></td> </tr> <tr> <td><i>Team work</i></td> <td><i>Criticism and self-criticism</i></td> </tr> <tr> <td><i>Working in an international environment</i></td> <td><i>Production of free, creative and inductive thinking</i></td> </tr> <tr> <td><i>Working in an interdisciplinary environment</i></td> <td><i>.....</i></td> </tr> <tr> <td><i>Production of new research ideas</i></td> <td><i>Others...</i></td> </tr> <tr> <td></td> <td><i>.....</i></td> </tr> </table>	<i>Search for, analysis and synthesis of data and information, with the use of the necessary technology</i>	<i>Project planning and management</i>	<i>Adapting to new situations</i>	<i>Respect for difference and multiculturalism</i>	<i>Decision-making</i>	<i>Respect for the natural environment</i>	<i>Working independently</i>	<i>Showing social, professional and ethical responsibility and sensitivity to gender issues</i>	<i>Team work</i>	<i>Criticism and self-criticism</i>	<i>Working in an international environment</i>	<i>Production of free, creative and inductive thinking</i>	<i>Working in an interdisciplinary environment</i>	<i>.....</i>	<i>Production of new research ideas</i>	<i>Others...</i>		<i>.....</i>
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<ul style="list-style-type: none"> <li>○ Good understanding and treatment of physical problems</li> <li>○ Improving skills in scientific calculations</li> <li>○ Search for, analysis and synthesis of data and information, with the use of the necessary technology</li> <li>○ Production of free, creative and inductive thinking</li> <li>○ Team work</li> <li>○ Decision-making</li> <li>○ Adapting to new situations</li> <li>○ Project planning and management</li> <li>○ Criticism and self-criticism</li> </ul>																		

**(3) SYLLABUS**

<ul style="list-style-type: none"> <li>- Introduction to theory of elasticity (Hooke’s law and motion equations)</li> <li>- The principle of virtual displacements. Strong and weak forms</li> <li>- The principle on minimum total potential energy</li> <li>- The Ritz and Galerkin methods</li> <li>- Finite element mesh, elements, nodes and degrees of freedom,.</li> <li>- Shape functions and the stiffness matrix of element</li> <li>- Finite element assembly and the stiffness matrix of the structure</li> <li>- The Dirichlet boundary conditions</li> <li>- The static equilibrium problem of one-dimensional elastic bar under axial loads</li> <li>- Numerical implementation of Finite Element Analysis using the computer program MATLAB</li> </ul>
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**(4) TEACHING and LEARNING METHODS - EVALUATION**

<b>DELIVERY</b> <i>Face-to-face, Distance learning, etc.</i>	Face-to-face in the class Practice in Computer Lab
<b>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY</b> <i>Use of ICT in teaching, laboratory</i>	Use of PC for data and information, preparation of deliverables, communication of the team using email/social media/ecourse platform

<i>education, communication with students</i>													
<b>TEACHING METHODS</b> <i>The manner and methods of teaching are described in detail.</i> <i>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.</i> <i>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</i>	<table border="1"> <thead> <tr> <th><i>Activity</i></th> <th><i>Semester workload</i></th> </tr> </thead> <tbody> <tr> <td>Lectures and Laboratory Practice</td> <td>26</td> </tr> <tr> <td>Project and Self-study</td> <td>18</td> </tr> <tr> <td></td> <td></td> </tr> <tr> <td>Course total</td> <td>75</td> </tr> <tr> <td></td> <td></td> </tr> </tbody> </table>	<i>Activity</i>	<i>Semester workload</i>	Lectures and Laboratory Practice	26	Project and Self-study	18			Course total	75		
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<b>STUDENT PERFORMANCE EVALUATION</b> <i>Description of the evaluation procedure</i> <i>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</i> <i>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i>	LANGUAGE OF EVALUATION: Greek  METHOD OF EVALUATION:  ○ Written work and public presentation												

### (5) ATTACHED BIBLIOGRAPHY

Suggested bibliography:

- Παπαδρακάκης, Μ., Ανάλυση φορέων με τη μέθοδο των πεπερασμένων στοιχείων, Εκδόσεις Παπασωτηρίου, Αθήνα 2001
- Τσαμασφύρος, Θεοτόκογλου, Μέθοδος Πεπερασμένων Στοιχείων, Εκδόσεις Συμμετρία, Αθήνα 2005
- Chandrupatla, R., Tipurathi, R., Belegundu, D., Ashok, D, Εκδόσεις ΚΛΕΙΔΑΡΙΘΜΟΣ, Αθήνα 2006