

COURSE OUTLINE

1. GENERAL

SCHOOL	Engineering		
ACADEMIC UNIT	Mechanical Engineering		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	EP0701	SEMESTER	6 th
COURSE TITLE	Introduction to Scientific Computations		
INDEPENDENT TEACHING ACTIVITIES <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>	WEEKLY TEACHING HOURS	CREDITS	
Lectures, Practical Exercises	5	6	
<i>Add rows if necessary. The organization of teaching and the teaching methods used are described in detail at (d).</i>			
COURSE TYPE <i>general background, special background, specialized general knowledge, skills development</i>	Specialized knowledge		
PREREQUISITE COURSES:			
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No		
ΗΛΕΚΤΡΟΝΙΚΗ ΣΕΛΙΔΑ ΜΑΘΗΜΑΤΟΣ (URL)	https://mie.uth.gr/?page_id=18354&lang=en		

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 course aims to introduce Scientific Computing through Matlab.

Emphasis is placed on the capabilities offered by the Matlab environment for easily addressing problems of numerical methods, such as solving systems of equations, numerical interpolation, integration and differentiation, solving differential equations, etc.

Upon successful completion of the course, the student will be able to:

- Analyze the data of a problem and create appropriate algorithms for processing them
- Confidently perform scientific computations
- Effectively use Matlab to solve practical engineering problems

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
Adapting to new situations

Decision-making
Working independently
Team work

Project planning and management

Respect for difference and multiculturalism

Respect for the natural environment

Showing social, professional and ethical responsibility and
sensitivity to gender issues

Criticism and self-criticism

<i>Working in an international environment thinking</i>	<i>Production of free, creative and inductive Others...</i>
<i>Working in an interdisciplinary environment Production of new research ideas</i>	

- Retrieve, analyze and synthesize data and information
- Autonomous work
- Decision making
- Development of innovative and inductive thinking
- Critical Thinking

3. SYLLABUS

<p>Unit 1: Introduction to MATLAB</p> <ol style="list-style-type: none"> 1. Basic Concepts – Getting Help – Numeric and Logical Expressions 2. Vectors and Matrices – Random Numbers 3. Procedural Programming – Scripts – Input – Output – Selection – Looping 4. Basic Plotting Commands 5. User-Defined Functions 6. Handling Character Strings 7. Complex Data Structures – Structures – Cell Arrays – Tables 8. Files 9. Advanced Topics in User-Defined Functions 10. More Plotting Functions 11. Live Scripts – Symbolic Variables – Expressions – Functions <p>Unit 2: Solving Mathematical Problems in MATLAB – Applications</p> <ol style="list-style-type: none"> 12. Set Functions – Polynomials 13. Calculus, Series – Limits – Differentiation – Integration (Symbolic and Numeric) 14. Solving Equations and Systems Symbolically and Numerically 15. Linear Algebra, Sparse Matrices, Solving Linear Systems 16. Ordinary Differential Equations and ODE Systems, Initial and Boundary Value Problems, Partial Differential Equations 17. Interpolation – Extrapolation – Approximation (Fitting) 18. Optimization – Linear and Integer Programming 19. Digital Signal Processing 20. Statistical Functions – Probabilities 21. Data Compression – SVD

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY <i>Face to face, Distance learning, etc.</i>	Face to face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY <i>Use of ICT in teaching, laboratory education, communication with students</i>	Use of ICT	
TEACHING METHODS <i>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</i>	Activity	Semester workload
	Lectures	70 hours
	Self-evaluating exercises	40 hours
	Autonomous work	40 hours
	Total	150 hours

<i>according to the principles of the ECTS</i>	
<p align="center">STUDENT PERFORMANCE EVALUATION</p> <p><i>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.</i></p>	<p>I. Homework (30%) II. Midterm (30%) III. Final exam (40%)</p>

5. ATTACHED BIBLIOGRAPHY

1. MATLAB, Εισαγωγή και Εφαρμογές για Μηχανικούς, Κ. Παπαοδυσσεύς, Κ. Καλοβρέκτης, Ν. Μυλωνάς, Θεσσαλονίκη, 2017.
2. Εισαγωγή στα Σήματα & Συστήματα συνεχούς χρόνου με MATLAB, Παρασκευάς Μιχάλης, Εκδ. Τζιόλα, 2015.
3. Αριθμητικές μέθοδοι & εφαρμογές για μηχανικούς με παραδείγματα στο MATLAB, Ι. Σαρρής, Θ. Καρακασίδης, Εκδ. Τζιόλα, 2017.
4. MATLAB για Επιστήμονες και Μηχανικούς, Ε. Χατζίκος, Εκδ. Τζιόλα, 2016.
5. What every Engineer should know about MATLAB and Simulink, Adrian B. Biran, CRC Press Taylor & Francis Group LLC, 2010.
6. MATLAB Programming for Engineers, S. J. Chapman, Thomson, 2004.
7. Numerical Computing with MATLAB, C. B. Moler, Siam, 2004.
8. A MATLAB Companion for Multivariable Calculus, J. Cooper, Academic Press, 2001.
9. MATLAB Guide, D. J. Higham and N. J. Higham, Siam, 2005.
10. The MathWorks, <http://www.mathworks.com>