Department of Computer Science and Engineering
School of Engineering
University of Ioannina

Graduate Program of Studies
«Data and Computer Systems Engineering»
Courses Outline

ACADEMIC YEAR 2023/2024

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A0. Introduction to Algorithm and Information Technologies

COURSE OUTLINE

GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING		
LEVEL OF STUDIES	GRADUATE		
COURSE CODE	**A0**	**SEMESTER**	
COURSE TITLE	Introduction to Algorithm and Information Technologies		
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 Exercices		4	7
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).			
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special background		
PREREQUISITE COURSES:	NO		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	http://ecourse.uoi.gr/enrol/index.php?id=1736		

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*

After successfully attending the course students will:

- Gain a deeper understanding of fundamental techniques for the design and analysis of algorithms.
- Know advanced techniques for the design and analysis of algorithms.
- Have knowledge and understanding of basic topics in computational complexity, approximate solutions, and randomization.
- Be able to apply advanced techniques for the design and analysis of algorithms. Be able to use mathematical tools such as probabilistic analysis, amortized analysis, and competitive analysis.
- Be able to provide appropriate mathematical models for various problems.

- Be able to compare the efficiency and suitability of different algorithmic techniques for solving specific problems.
- Be able to recognize in which of the basic complexity classes (e.g. P, NP) a specific problem belongs to.

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…*
	…….

- Production of free, creative and inductive thinking
- Search for, analysis and synthesis of data and information, with the use of the necessary technology.
- Algorithmic thinking.
- Team work.
- Autonomous work.

SYLLABUS

Basic and advanced techniques for algorithms design and analysis. Data structures. Graph algorithms. Computational geometry. Randomized algorithms and tools for probabilistic analysis. Computational complexity and NP-completeness. Approximation algorithms. Elementary number theory and applications in security and cryptography.

TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• Use of projector and interactive board during lectures. • Course website maintenance. Announcements and posting of teaching material (lecture slides and notes, programs). • Announcement of assessment marks via the e-course platform by UOI.
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	13 × 3 = 39 hours
Laboratory practice	13 × 1 = 13 hours
Student's study hours	123 hours

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	***175 hours***
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 Methods of Evaluation: • Final written examination with problem solving questions. • Homework assignments. The evaluation procedure is accessible to students via the course website.	

ATTACHED BIBLIOGRAPHY

- Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, Introduction to Algorithms, MIT press, 3rd edition, 2009.
- Jon Kleinberg and Éva Tardos, Algorithm Design, 1st edition, Pearson, 2006.

A1. Algorithmic Graph Theory

COURSE OUTLINE

GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING		
LEVEL OF STUDIES	GRADUATE		
COURSE CODE	**A1**	**SEMESTER**	**Fall**
COURSE TITLE	**ALGORITHMIC GRAPH THEORY**		

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 Exercices	4	7
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialised general knowledge
PREREQUISITE COURSES:	NO
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	http://www.cs.uoi.gr/~stavros/mypage-teaching-MSc-AGT.html

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 this course is to study the main concepts of graph theory and to recognize graphs as an important modeling technique in several applications. In addition the course introduces the students to algorithmic graph theory which has become one of the major tools for the design and analysis of algorithms. The course focuses on the most interest topics in theoretical computer science.

The course's aim is to develop interest in graph theory and its many applications. In particular, at the end of this course, a student should be able to

- apply the abstract concepts of graph theory in several practical problems;
- develop a number of standard and powerful algorithms, as well as demonstrate methodologies in graph techniques; and
- use the graphs in the solution of complex 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* *Working in an international environment* *Working in an interdisciplinary environment* *Production of new research ideas*	*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* *Production of free, creative and inductive thinking* *……* *Others…* *…….*
• Production of free, creative and inductive thinking • Search for, analysis and synthesis of data and information, with the use of the necessary technology. • Algorithmic thinking • Team work • Autonomous work	

SYLLABUS

- Graph theoretic foundations.
- The design of efficient algorithms (complexity of algorithms, data structures). Perfect graphs. Holes and antiholes in graphs. Triangulated graphs.
- Comparability graphs. Split graphs. Permutation graphs. Interval graphs. Cographs, Quasi-threshold (or, trivially perfect), and threshold graphs.
- Perfectly orderable graphs.

TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Use of projector and interactive board during lectures. •Course website maintenance. Announcements and posting of teaching material (lecture slides and notes, programs). •Announcement of assessment marks via the e-course platform by UOI.
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*	

Activity	***Semester workload***
Lectures	13x3=39 hours
Laboratory practice	13x1=13 hours
Student's study hours	123 hours
Course total	***175 hours***

STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of*	Language of evaluation: Greek Methods of Evaluation: i) Final written examination

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.*	ii) Lab projects examination iii) Evaluation of weekly assignments The evaluation procedure is accessible to students via the course website.

ATTACHED BIBLIOGRAPHY

- M.C. Golumbic, Algorithmic Graph Theory and Perfect Graphs. Academic Press, Inc., New York, 1980. Second edition, Annals of Discrete Mathematics 57, Elsevier, 2004.
- A. Brandstadt, V.B. Le, and J. Spinrad, Graph classes -- A survey, SIAM Monographs in Discrete Mathematics and Applications, SIAM, Philadelphia, 1999.

A2. Algorithms for Data Science

COURSE OUTLINE

GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING		
LEVEL OF STUDIES	GRADUATE		
COURSE CODE	**A2**	**SEMESTER**	Spring
COURSE TITLE	ALGORITHMS FOR DATA SCIENCE		

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 Exercices	4	7
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special background
PREREQUISITE COURSES:	NO
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	

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 course focuses on algorithmic techniques that are used in practice to solve basic problems in data processing and extraction and can be successfully applied even to large-scale data.

After attending the course students should be able to:

- Apply techniques for the design and analysis of algorithms suitable for the processing of large scale data.
- Provide appropriate mathematical models for data mining problems.
- Compare the efficiency and suitability of different algorithmic techniques to solve a problem.

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…*
	…….

- Production of free, creative and inductive thinking
- Search for, analysis and synthesis of data and information, with the use of the necessary technology.
- Algorithmic thinking.
- Team work.
- Autonomous work.

SYLLABUS

Design, analysis and application of algorithms in areas where there is a direct practical interest in processing large scale data. In particular, the following topics are considered: algorithms and data structures for string processing, data compression, information theory and codes, multi-dimensional data calculations, algorithms in graphs and networks, linear programming, combinatorial optimization.

TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• Use of projector and interactive board during lectures. • Course website maintenance. Announcements and posting of teaching material (lecture slides and notes, programs). • Announcement of assessment marks via the e-course platform by UOI.
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,*	

Activity	*Semester workload*
Lectures	13 × 3 = 39 hours
Laboratory practice	13 × 1 = 13 hours
Student's study hours	123 hours

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*	<table><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td>Course total</td><td>***175 hours***</td></tr></table>
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 Methods of Evaluation: • Final written examination with problem solving questions. • Homework assignments. • Individual presentation of a research topic related to the subject matter of the course. The evaluation procedure is accessible to students via the course website.

ATTACHED BIBLIOGRAPHY

- Jure Leskovec, Anand Rajaraman, Jeff Ullman, Mining of Massive Datasets, Cambridge University press, 2nd edition, 2014.
- Avrim Blum, John Hopcroft, Ravindran Kannan, Foundations of Data Science. Unpublished, available online.
- Steven S. Skiena, The Data Science Design Manual, Springer, 2017.
- Brian Steele, John Chandler, Swarna Reddy: Algorithms for Data Science, Springer, 2016.

D0. Introduction In Data Analysis And Processing

COURSE OUTLINE

GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
ACADEMIC UNIT	DEPT. OF COMPUTER SCIENCE & ENGINEERING		
LEVEL OF STUDIES	GRADUATE		
COURSE CODE	D0	**SEMESTER**	
COURSE TITLE	INTRODUCTION IN DATA ANALYSIS AND PROCESSING		
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	7
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	General background		
PREREQUISITE COURSES:	NO		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK or ENGLISH		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	http://ecourse.uoi.gr/enrol/users.php?id=1720		

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 introductory course exposes the students to the main concepts and methodologies in Data Science. The course comprises a series of lectures that concisely cover the necessary mathematical background as well as essential topics in Data Science, such as data types and representation, clustering techniques, learning and generalization, optimization, data transformations and compression, text processing and information retrieval. Moreover, it offers an overview of popular programming tools used in Data Science. After the successful completion of this course, students will be exposed to: ● The fundamental mathematical background that is necessary for the in-depth study of specialized topics in Data Science. ● The basic fields of study that they can deepen in data analysis and processing.

- Modern programming tools that are highly useful in Data Science.

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* *Working in an international environment* *Working in an interdisciplinary environment* *Production of new research ideas*	*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* *Production of free, creative and inductive thinking* *……* *Others…* *…….*

- Production of free, creative and inductive thinking.
- Decision-making.
- Search for, analysis and synthesis of data and information.
- Development of algorithmic thinking.
- Ability of analyzing and modelling problems.

SYLLABUS

- Elements of Linear Algebra
- Elements of Optimization
- Overview of Probability Theory and Statistics
- Data Types and Representation
- Clustering
- Data Transformations
- Data Compression
- Learning and Generalization
- Text Processing and Information Retrieval
- Programming Tools in Data Science

TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Weekly lectures
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• Course webpage where literature and free material is provided. • Live simulations in the classroom. • Use of email services and social media for communication with the students.
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography,*	

Activity	*Semester workload*
Lectures	13*3 = 39 hours
Labs	13*1 = 13 hours

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*	Self-study	123 hours
	Course total	***175 hours***
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 or English METHODS OF EVALUATION: Written exam	

ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- A. Blum, J. Hopcroft, R. Kannan, **Foundations of Data Science**, Cornell University, 2015, e-book available at: https://www.cs.cornell.edu/jeh/book.pdf
- J. Grus, **Data Science from Scratch: First Principles with Python**, O'Reilly Media, 2015.

- Related academic journals:

D2. Data Mining

COURSE OUTLINE

GENERAL

SCHOOL	SCHOOL OF SCIENCES		
ACADEMIC UNIT	DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING		
LEVEL OF STUDIES	GRADUATE		
COURSE CODE	**D2**	**SEMESTER**	
COURSE TITLE	Data Mining		
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 Exercices		4	8
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialised general knowledge		
PREREQUISITE COURSES:	NO		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	http://www.cse.uoi.gr/~arly/courses/dm/dm.html		

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 objective of this course is to provide a detailed description of data mining problems and solutions. The main problems presented and studied are related to classification, regression, clustering, feature selection/extraction and discovery of association rules. State-of-the-art methods are presented and compared for all the above problems.

It is expected that after taking the course the student will have:

- knowledge of the data mining problems
- a clear understanding of the notions of learning and generalization
- the ability to solve classification, regression and clustering problems using state-of-the-art approaches
- the ability to discover association rules from data
- the ability to handle large scale datasets
- the skill to apply all the algorithmic steps required for extracting useful knowledge

from a given dataset.

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 for, analysis and synthesis of data and information, with the use of the necessary technology.
- Decision making
- Production of free, creative and inductive thinking
- Team work
- Autonomous work
- Production of new research ideas

SYLLABUS

Introduction to data mining problems, learning and generalization, data preprocessing, linear models, decision trees, rule-based classifiers, naïve Bayes, SVM, classifier ensembles, model selection and evaluation, prototype-based clustering (eg. k-means), agglomerative clustering, spectral clustering, association rule mining, feature selection and extraction, scaling issues.

TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Lecture slides, multimedia (video demonstrations), e-mail communication, course Web page maintenance.
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*	
STUDENT PERFORMANCE EVALUATION	Language of evaluation: Greek

Activity	***Semester workload***
Lectures	13x3=39 hours
Laboratory practice	13x1=13 hours
Student's study hours	148 hours
Course total	***200 hours***

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.*	Methods of Evaluation: i) Final written examination ii) Lab projects examination iii) Evaluation of weekly assignments The evaluation procedure is accessible to students via the course website.

ATTACHED BIBLIOGRAPHY

Book: P. Tan, M. Steinbach and V. Kumar, "Introduction to Data Mining", Addison-Wesley 2006.
Book: D. Hand, H. Mannila, P. Smyth, "Principles of Data Mining", MIT Press, 2001.
Book: I. Kononenko and M. Kukar, "Machine Learning and Data Mining: Introduction to Principles and Algorithms", Horwood Publishing, 2007.

D3. Optimization

COURSE OUTLINE

GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
ACADEMIC UNIT	DEPT. OF COMPUTER SCIENCE & ENGINEERING		
LEVEL OF STUDIES	GRADUATE		
COURSE CODE	**D3**	**SEMESTER**	**Fall**
COURSE TITLE	**OPTIMIZATION**		
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	7
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special background		
PREREQUISITE COURSES:	NO		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK or ENGLISH		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	http://ecourse.uoi.gr/enrol/index.php?id=553		

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*
Optimization is the branch of Mathematics that deals with the detection of optimal solutions. Typically, a solution to a given problem is modeled via a parametric “objective” function (model), the minima of which may correspond to desired solutions. Also, the problem may contain a set of constraints, typically defined through equality and / or inequality relations. The Optimization course aims at equipping the students with essential knowledge in local and global Optimization algorithms of various types. Among other, these include: • Gradient-based algorithms that use first- and second-order derivatives information, such as Gradient Descent, Newton, Quasi-Newton, Conjugate Gradients, in combination with Line Search and Trust Region techniques.

- Derivative-free algorithms such as Nelder-Mead, Hooke-Jeeves, and Pattern Search.
- Stochastic and evolutionary algorithms such as Genetic Algorithms and Particle Swarm Optimization.

Moreover, different techniques for solving problems with constraints are given, along with techniques for the detection of multiple minimizers.

After the successful completion of this course, students are expected to be able to:

- Implement and apply local and global Optimization algorithms.
- Determine the most appropriate algorithm for a given problem.
- Design variants of the algorithms for serial and parallel computing environments, as well as for challenging applications.

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* *Working in an international environment* *Working in an interdisciplinary environment* *Production of new research ideas*	*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* *Production of free, creative and inductive thinking* *……* *Others…* *…….*

- Production of free, creative and inductive thinking.
- Decision-making.
- Search for, analysis and synthesis of data and information.
- Development of algorithmic thinking.
- Ability of analyzing and modelling problems.

SYLLABUS

- Introduction to Optimization
- Optimality conditions
- One-dimensional optimization
- Derivative-free methods: Steepest Descent, Nelder-Mead, Hook-Jeeves, Pattern Search.
- Gradient-based methods: Newton, Quasi-Newton, Conjugate Gradients.
- Line Search and Trust Region techniques.
- Stochastic and evolutionary algorithms: Multistart, Simulated Annealing, Genetic Algorithms, Particle Swarm Optimization.
- Solution techniques for constrained problems.
- Techniques for the detection of multiple minimizers. Parallel coordinates.

TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Weekly lectures
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• Course webpage where literature and free material is provided. • Live simulations in the classroom. • Use of email services and social media for communication with the 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 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*	

Activity	***Semester workload***
Lectures	13*3 = 39 hours
Labs	13*1 = 13 hours
Self-study	123 hours
Course total	***175 hours***

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 or English METHODS OF EVALUATION: Projects and written report.

ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- W. Sun, Y. Yuan: **Optimization Theory and Methods**, Springer, 2006.
- R. Fletcher: **Practical Methods of Optimization**, 2nd edition, Wiley, 2000.
- D. Bertsekas: **Nonlinear Programming**, 2nd edition, Athena Scientific, 2004.
- M.S. Bazaraa, H.D. Sherali, C.M. Shetty, **Nonlinear Programming, Theory and Algorithms**, 3rd edition, Wiley, 2006.
- I. Griva, S.G. Nash, A. Sofer, **Linear and Nonlinear Optimization**, 2nd edition, SIAM, 2008.

- J. Nocedal, S.J. Wright, **Numerical Optimization**, 2nd edition, Springer, 2006.
- Z. Michalewicz: **Genetic Algorithms + Data Structures = Evolution Programs**, 3rd edition, Springer, 1999.
- K.E. Parsopoulos, M.N. Vrahatis: **Particle Swarm Optimization and Intelligence: Advances and Applications**, IGI Global, 2010.
- A. Inselberg, **Parallel Coordinates**, Springer, 2009.

- Related academic journals:

- Optimization Letters, SPRINGER.
- Optimization Methods and Software, TAYLOR & FRANCIS.
- Journal of Global Optimization, SPRINGER.
- Journal of Optimization Theory and Applications, SPRINGER.
- Mathematical Programming, SPRINGER.
- SIAM Journal on Optimization, SIAM.
- IEEE Transactions on Evolutionary Computation, IEEE.
- Applied Soft Computing, SPRINGER.
- Soft Computing, ELSEVIER.
- European Journal on Operational Research, ELSEVIER.
- Computers & Operations Research, ELSEVIER.
- Computers & Industrial Engineering, ELSEVIER.
- Annals of Operations Research, SPRINGER.

D4. Video Processing and Compression

COURSE OUTLINE

GENERAL

SCHOOL	SCHOOL OF ENGINEERING			
ACADEMIC UNIT	DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING			
LEVEL OF STUDIES	GRADUATE			
COURSE CODE	**D4**	**SEMESTER**	**Fall**	
COURSE TITLE	Video Processing and Compression			
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**	**7**
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special background			
PREREQUISITE COURSES:	-			
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK			
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES			
COURSE WEBSITE (URL)	http://ecourse.uoi.gr/enrol/index.php?id=1629			

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 goal of the course is the learning of the basic theory of video processing and compression.

After successfully passing this course the students will be able to:

- Understand the basic principles of video capture and display.
- Apply tools of multidimensional signal processing to video applications.
- Understand and use video sampling theory.
- Implement various motion estimation algorithms.
- Understand the fundamentals of compression and their application to video coding.

- Be familiar with current video compression 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 *Adapting to new situations* *Decision-making* *Working independently* *Team work* *Working in an international environment* *Working in an interdisciplinary environment* *Production of new research ideas*	*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* *Production of free, creative and inductive thinking* *……* *Others…* *…….*

- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Decision-making
- Production of free, creative and inductive thinking
- Evaluation of different solutions and selection of the most appropriate one
- Use of structured mathematical thinking for the development and reinforcement of arguments

SYLLABUS

Video Capture: Color coordinate systems. Video camera. Video display. Progressive and Interlaced scan.

Multidimensional signal processing: Multidimensional signals and systems. Multidimensional continuous and discrete Fourier Transform. Frequency response of the human visual system.

Video sampling theory: Generalized Nyquist sampling theorem. Sampling rate conversion.

Motion estimation: Motion modeling. Optical flow equation. Block matching.

Fundamentals of compression: Information theory basics. Quantization. Transform theory. DCT, KLT, DWT transforms. Motion compensated prediction.

Video compression standards: H.264, H.265, VP9, AV1.

TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Lectures, lab sessions
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• Use of projector during lectures. • Use of Matlab in the lab. • Use of the ecourse electronic platform for course announcements, uploading of class notes, homework assignment, and grade announcement.

<table>
<tr><td></td><td>

- Use of email and social media for more effective communication with the students

</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>

Activity	***Semester workload***
Lectures	13*3 = 39 hours
Labs	13*1 = 13 hours
Self-study	123 hours
Course total	**175 hours**

</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

METHODS OF EVALUATION

(i) Final examination. The students are tested in theory and exercises of video processing and compression.

(ii) Homework assignments. The students are asked to solve video processing and compression exercises.

(iii) Lab reports. The students turn in their code and answer questions regarding their results.

The evaluation procedure is accessible to students via the course website.

</td></tr>
</table>

ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- Video Processing and Communications, Y. Wang, J. Ostermann, Y.-Q. Zhang, Prentice-Hall, 2002.
- Multidimensional Signal, Image and Video Processing and Coding, J.W. Woods, Academic Press, 2nd edition, 2012.

- Related academic journals:

- IEEE Transactions on Image Processing
- IEEE Transactions on Circuits and Systems for Video Technology
- IEEE Transactions on Multimedia

D6. Online Social Networks and Media

COURSE OUTLINE

GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING		
LEVEL OF STUDIES	GRADUATE		
COURSE CODE	**D6**	**SEMESTER**	
COURSE TITLE	**ONLINE SOCIAL NETWORKS AND 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 / Exercises/ Project		3	7
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialised general knowledge		
PREREQUISITE COURSES:	NO		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	http://www.cs.uoi.gr/~tsap/teaching/cs-l14/		

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*

It is expected that after taking the course the student will have:

- knowledge of basic metrics and measurements for real networks, such as power-law degree distributions and clustering coefficient
- knowledge of models for real networks
- the knowledge and ability to find communities in graphs, or dense subgraphs.
- understanding of dynamic processes on networks, such as influence spread, or opinion formation, and algorithms for affecting them
- knowledge of metrics and algorithms for identifying central and influential nodes in a graph.

- Knowledge of different models algorithms for predicting links or understanding their strength and sign
- Knowledge on specialized topics related to networks such as privacy, team formation, small world effects, fairness, content-based analysis
- The ability to process and manipulate large graphs using programming tools

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 for, analysis and synthesis of data and information, with the use of the necessary technology.
- Decision making
- Production of free, creative and inductive thinking
- Team work
- Autonomous work
- Production of new research ideas

SYLLABUS

- Theoretical problems and applications around the analysis and mining of (online) social networks and media such as Facebook and Twitter.
- Indicative subjects: models for networks, techniques for obtaining, storing and processing networked data, models for information diffusion, algorithms for ranking and selecting of influencers, dynamic processes such as influence spread and opinion formation, team formation and community finding, games over networks, privacy, fairness and diversity.

TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Lecture slides, multimedia (video demonstrations), e-mail communication, course Web page maintenance.

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

Activity	*Semester workload*
Lectures	13x3=39 hours
Student's study hours	123 hours
Final Project	13 hours

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*	<table><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td>Course total</td><td>***175 hours***</td></tr></table>
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 or English Methods of Evaluation: iv) Assignments v) Presentation vi) Final project The evaluation procedure is accessible to students via the course website.

ATTACHED BIBLIOGRAPHY

D8. Biomedical data analysis

COURSE OUTLINE

GENERAL

SCHOOL	POLYTECHNIC		
ACADEMIC UNIT	DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING		
LEVEL OF STUDIES	GRADUATE		
COURSE CODE	D8	**SEMESTER**	
COURSE TITLE	Analysis and Processing of Biomedical Data		
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/ Exercices		3 / 1 /10	7
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialised general knowledge		
PREREQUISITE COURSES:	NO		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://ecourse.uoi.gr/course/view.php?id=2091		

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*

Biomedical data analysis and processing is a wide engineering area, which combines knowledge from almost every field in computer science and engineering. It includes biomedical signal processing and analysis, tele-medicine, storage, retrieval and management of biomedical data, medical systems and medical support systems. Many more applications can be added in this short, representative, list. The wide range of subjects signifies that a course on biomedical data analysis and processing, even in a post-graduate level, should illuminate the state of the art and research trends of the area, before focusing on specific subjects. This course focuses on biomedical signal and image analysis and includes subjects from health data management, personal/patient support systems (e-health, m-health and p-health technologies) and medical support systems.

After taking the course, the students are expected to:

- have acquired a general image of the field
- understand the basic terms and ideas
- be able to deepen their knowledge
- have taken their first steps in research activity

- have acquired theoretical background
- have studied several applications
- have worked in depth with a specific problem

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…*
	…….

- production new research ideas
- search of research challenges and solutions
- presentation of ideas and results
- bibliography search, organization and presentation of information
- data analysis and interpretation
- enhancement of free and productive way of thinking
- exercise of evaluation skills and self-criticism
- reinforcement of decision taking
- improve of algorithm development
- work autonomously
- work in a team

SYLLABUS

Biomedical data analysis:

e-health: medical records, electronic prescription, medical support systems, tele-medicine

m-health: emergency alert systems, medical support systems, medical security systems, pharmaceutical treatment monitoring, patient socialization.

p-health: sensors, personal diagnosis and treatment, personal support systems, use of genetic information in diagnosis and treatment.

Analysis and processing of biomedical signals:

Electrocardiogram: The functionality of the heart, ECG for prognosis and diagnosis, ECG waveforms and points, QRS detection, P and T wave recognition, heart rate extraction

Heart rate signal: Heart rate variability, autonomous nervous system, ectopic beats, arrhythmia detection

CTG fetal monitoring: Fetal heart rate variability, uterus contractions, heart rate deceleration, recordings during labor

Other biomedical signals: respiration, blood pressure, electroencephalography, electromyography, polysomnography

Analysis and processing of biomedical images: ultrasounds, MRI, fMRI

Biomedical signal and image analysis methods:

Heart rate analysis: time-domain, geometrical domain, frequency domain, time-frequency domain, non linear

Deceleration capacity of heart rate: phase-rectified signal averaging, method of the sign, beat to beat method, other methods

Non-linear methods: Poincare plot, detrended fluctuation analysis, correlation dimension estimation, symbolic analysis

Entropy: uncertainty, Shannon Entropy, conditional entropy, approximate entropy, sample entropy, multi-scale entropy, fast computation of entropy, other entropy definitions/estimations, entropy as a complexity estimator, application to the complexity of the heart

Analysis in frequency domain: Fourier analysis, power spectrum

Analysis in time-frequency domain: wavelets

Machine learning classification: application of machine learning techniques for classification of recordings, based on diseases or different population groups.

TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
Face-to-face, Distance learning, etc.</td><td>Face-to-face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students</td><td>• Lecture slides
• Webpage
  • Announcements
  • Slides
  • Programming projects
  • Bibliography
• E-mail</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</td><td>13x3=39 hours</td></tr><tr><td>Laboratory practice</td><td>13x1=13 hours</td></tr><tr><td>Student’s study hours</td><td>123 hours</td></tr><tr><td>Course total</td><td>175 hours</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</td><td>Language of evaluation: Greek

Methods of Evaluation:
i.Programming projects
i.Presentation
i.Exams

Evaluation procedure is defined to the students during the first lecture, as well as the weight of each criterion in the final mark. The evaluation procedure is also accessible to students via the course website.</td></tr>
</table>

students.	

ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- Advances in Cardiac Signal Processing, Editors: Dr. U. Rajendra Acharya, Prof. Jasjit S. Suri, Prof. Jos A. E. Spaan, Mr. Shankar M. Krishnan, ISBN: 978-3-540-36674-4 (Print) 978-3-540-36675-1 (Online)
- Biomedical Signal and Image Processing, Second Edition Kayvan Najarian, Robert Splinter, ISBN 9781439870334

- Related academic journals:

- Transactions on Biomedical Engineering (IEEE)
- Journal of Biomedical and Health Informatics (IEEE)
- Biomedical Signal Processing and Control (Elsevier)
- Journal of Biomedical Informatics (Elsevier)
- Computers in Biology and Medicine (Elsevier)
- Computers Methods and Programs in Biomedicine (Elsevier)
- Medical and Biological Engineering and Computing (Springer)
- Physiological Measurements (IOP)

H0. Introduction to Computer Hardware Systems

COURSE OUTLINE

GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING		
LEVEL OF STUDIES	GRADUATE		
COURSE CODE	**H0**	**SEMESTER**	**-**
COURSE TITLE	Introduction to Computer Hardware Systems		

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 / Tutorials	**3+1**	**7**
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized general Knowledge
PREREQUISITE COURSES:	-
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK & ENGLISH
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	http://ecourse.uoi.gr/course/view.php?id=1727

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 primary aim of the course is to convey an in-depth understanding of modern computer systems hardware. After successfully passing this course the students will be able to:

- Describe the structure and operational characteristics of the core and memory hierarchy of a microprocessor.
- Demonstrate an understanding of
  - VLSI Design (full custom, standard cells, gate arrays), CMOS technology, manufacturing technologies and ASICs
  - Basic theory of MOS transistors, elementary & complex gates
  - low-power design techniques at device, module and system levels
- Understand testing requirements in modern VLSI systems, explain testing procedures and describe basic design for testability structures and testing standards.

- Demonstrate an understanding of
  - the basic components of a robotic system and their functions
  - the basic concepts of the kinematics of robotic systems

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…*
	…….

- Production of free, creative and inductive thinking
- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Analysis of requirements for problem solving
- Working independently
- Use abstraction to understand and analyze complex systems/problems

SYLLABUS

Processor core and cache organization: Instruction set architecture, Instruction-level parallelism, Organization and operation of cache memories, Performance evaluation of a computer

VLSI: VLSI design technologies, ASICs, packaging technologies, DRC, economics, MOS transistors, inverter, basic gates, complex gates, standard cells, gate arrays, basic transistor theory.

Testing and Design for Testability: VLSI testing, scan testing, built-in self test (BIST), testing standards (JTAG, IEEE1500).

Low-power design: Power consumption in CMOS circuits, modelling and evaluation of power, low-power design techniques

Robotics: Basic components of a robotic system and their functions, sensors and actuators, position and orientation of a robot, kinematics of a robot.

TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Lectures and tutorials
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• Use of projector and interactive board during lectures. • Use of special electronic equipment and software for delivering the project. • Course website maintenance. Announcements and posting of teaching material (lecture slides and notes, programs). • Announcement of assessment marks via the ecourse platform by UOI. • Use of email for information exchange and improved 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 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

Activity	*Semester workload*
Lectures	13x3 = 39 hours
Tutorials	13x1 = 13 hours
Quizzes	5x1=5 hours
Self-study	118 hours
Course total	**175 hours**

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

METHODS OF EVALUATION

Quiz-style written exam at the end of each sub-module. Overall course mark is the average of the module quiz scores. The Quiz may include problem solving, multiple-choice, and short-answer questions. The quizzes are evaluated based on the correctness and completeness of answers.

ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- SYSTEM ON CHIP TEST ARCHITECTURES, L-T. Wang, C. Stroud, N. Touba, Εκδ.: Morgan-Kaufmann, 2008.
- CMOS VLSI DESIGN: A CIRCUITS AND SYSTEMS PERSPECTIVE, N. Weste and D. Harris, Addison-Wesley, 2011.
- Modern Processor Design, J.P. Shen, M. H. Lipasti, Waveland Press, 2013
- Robotics: Modeling, Planning and Control, Siciliano B., Sciavicco L., Oriolo G., Springer, 2009

-Συναφή επιστημονικά περιοδικά:

- IEEE Transactions on Computers,
- IEEE Transactions on Computer Aided Design of Integrated Circuits and Systems,
- IEEE Transactions on VLSI Systems,
- IEEE Design & Test of Computers
- IEEE Transactions on Robotics
- IEEE/ASME Transactions on Mechatronics

H1. Modern Computer Architecture

COURSE OUTLINE

GENERAL

SCHOOL	SCHOOL OF ENGINEERING			
ACADEMIC UNIT	DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING			
LEVEL OF STUDIES	GRADUATE			
COURSE CODE	**H1**	**SEMESTER**	**Spring**	
COURSE TITLE	**MODERN COMPUTER ARCHITECTURE**			
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 / Project			**3**	**7**
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized general Knowledge			
PREREQUISITE COURSES:	-			
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK & ENGLISH			
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES			
COURSE WEBSITE (URL)	http://ecourse.uoi.gr/enrol/index.php?id=1850			

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 primary aim of the course is to convey an in-depth understanding of modern, high-performance processor micro-architecture and the memory hierarchy. After successfully passing this course the students will be able to:

- Describe the structure and operational characteristics of a pipelined microprocessor.
- Demonstrate an understanding of pipeline hazards and interlocks, out-of-order execution, scoreboards and reservation tables, branch prediction
- Evaluate the performance of a processor and memory system.
- Describe the memory coherency issues involved when designing a multiprocessor system, and explain the behaviour of a typical cache coherency protocol.
- Adapt existing simulators, run simulations and present a critical evaluation of the

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…*
	…….

- Production of free, creative and inductive thinking
- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Analysis of requirements for problem solving
- Team work
- Use abstraction to understand and analyze complex systems/problems
- Adapting to new situations

SYLLABUS

Introduction: Performance measurement. Energy consumption metrics. Reliability metrics. Benchmark programs. Simulators.
Pipelined processor organization: Instruction dependencies, pipeline hazards, data forwarding, pipeline stall, delayed branches. Code scheduling.
Instruction-level parallelism: Dynamic/static superscalar processors. Dynamic scheduling. .Out of order execution. Speculative execution. Branch prediction.
Memory subsystem: memory technology. Organization and operation of cache memories. Performance evaluation of cache memory. Virtual memory, fast memory address translation, virtually/physically addressed caches.
Parallel systems: Shared-memory multicore systems. Memory coherence, memory consistency.

TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Lectures, Project
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• Use of projector and interactive board during lectures. • Use of special electronic equipment and software for delivering the project. • Course website maintenance. Announcements and posting of teaching material (lecture slides and notes, programs). • Announcement of assessment marks via the ecourse platform by UOI. • Use of email for information exchange and improved 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 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

Activity	*Semester workload*
Lectures	13*3 = 39 hours
Tutorials	
Project	10*2 = 20 hours
Self-study	116 hours
Course total	**175 hours**

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

METHODS OF EVALUATION
(i) Final examination, which includes problem solving. The exam papers are evaluated based on the correctness and completeness of answers.
(ii) Laboratory & Project Examination

ATTACHED BIBLIOGRAPHY

- Suggested bibliography:
J.P. Shen, M. Lipasti: Modern Processor Design: Fundamentals of Superscalar Processors

-Συναφή επιστημονικά περιοδικά:

- IEEE Micro, IEEE Computer Architecture Letters, IEEE Transactions on Computers
- Transactions on Architecture and Code Optimization, Transactions on Computer Systems, ACM.
- Microprocessors and Microsystems, Journal of Systems Architecture, Elsevier.

H2. Reliable Integrated Systems

COURSE OUTLINE

GENERAL

SCHOOL	SCHOOL OF ENGINEERING			
ACADEMIC UNIT	DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING			
LEVEL OF STUDIES	POSTGRADUATE - MASTER LEVEL			
COURSE CODE	**Y2**	**SEMESTER**	**Fall**	
COURSE TITLE	Reliable Integrated Systems			
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**	**7**
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).				
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized General knowledge, Skills development			
PREREQUISITE COURSES:	Digital Design I and II, Computer Architecture, VLSI Circuits			
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK - ENGLISH			
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES			
COURSE WEBSITE (URL)	http://www.cs.uoi.gr/~tsiatouhas/Y2-RIS.htm			

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 at introducing to students the fundamentals of integrated circuits and systems testing and design for testability and reliability.

At the end of the course students should be able to perform the following:

- Understand the importance of integrated circuits and systems testing as well as design for testability and reliability, its impact on the total cost and the quality of the designed product.
- State the trends and challenges in the field of VLSI testing and reliable design.
- Understand defect as well as wear out and aging generation mechanisms in

nanometer technologies.

- Analyze testing requirements and examine different test and reliability methodologies.
- Develop design for testability (DfT) techniques.
- Develop design for reliability (DfR) techniques.
- Become a better VLSI designer and test engineer.
- Do research in the field of VLSI test technology.

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…*
	…….

- Production of free, creative and inductive thinking
- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Adapting to new situations
- Analysis of requirements for problem solving
- Abstraction ability for problem modeling
- Combination of existing methods for the synthesis of high quality solutions
- Working independently
- Team work

SYLLABUS

With the continuous scaling of transistor feature size, the chip complexity is dramatically increased since billions of transistors are integrated in a single chip (see the case of Systems-on-Chip – SoCs). Aiming to provide high quality integrated circuits and systems, these must be reliable and fully tested after production. In addition, during their whole operational life time in the field, we must ensure their reliable and uninterruptable operation. Consequently, design for reliability is an integral part of integrated circuits and systems design and manufacturing.

This course covers the fields of integrated circuits and systems testing, design for testability and design for reliability. The topics discussed are: Importance of testing, Defects and fault models, Wear out and aging mechanisms, PVT variations, Test process, Advanced design for testability techniques, Advanced design for reliability techniques, Self-healing systems.

TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
Face-to-face, Distance learning, etc.</td><td>Face-to-face, lectures, lab courses, home-works</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students</td><td>• Use of e-slides and interactive board during lectures.
• Use of computer-aided design tools at the laboratory (circuit design and simulation).
• Course website maintenance. Announcements and posting of teaching material (lecture slides and notes).
• Use of the ecourse facility.
• Use of email for information exchange and improved communication with students.</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</td><td>13*3 = 39 hours</td></tr>
<tr><td>Project</td><td>11*1 = 11 hours</td></tr>
<tr><td>Problems solving</td><td>75 hours</td></tr>
<tr><td>Study & bibliography analysis</td><td>75 hours</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td>200 hours</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 - English

METHODS OF EVALUATION

(i) Final examination, which includes problem solving. The exam papers are evaluated based on the correctness and completeness of answers.

(ii) Project which includes bibliography study, design techniques analysis and their application for the development of high reliability VLSI circuits.

The evaluation procedure is accessible to students via the course website.</td></tr>
</table>

ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

Βιβλίο VLSI TEST PRINCIPLES AND ARCHITECTURES, L-T. Wang, C-W Wu, X. We, Εκδ.: MORGAN-KAUFMANN, 2006.
Βιβλίο SYSTEM ON CHIP TEST ARCHITECTURES, L-T. Wang, C. Stroud, N. Touba, Εκδ.: MORGAN-KAUFMANN, 2008.
Book [41963448]: CMOS VLSI DESIGN: A CIRCUITS AND SYSTEMS PERSPECTIVE, N. Weste and D. Harris, Addison-Wesley, 2011.

Book [13944]: DIGITAL INTEGRATED CIRCUITS, Jan M. Rabaey, A. Chandrakasan, B. Nikolic, Prentice Hall, 2003.
Βιβλίο DESIGN OF HIGH-PERFORMANCE MICROPROCESSOR CIRCUITS, A. Chandrakasan, W. Bowhill, F. Fox, Εκδ.: IEEE PRESS, 2001.

- Related academic journals:

- Design and Test Magazine, IEEE.
- IEEE Transactions on VLSI Circuits and Systems (TVLSI).
- Integration the VLSI Journal, Elsevier
- IEEE Transactions on Circuits and Systems I & II (TCAS).
- IEEE Journal of Solid-State Circuits (JSSC).

H5. Robotic Systems

COURSE OUTLINE

GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING		
LEVEL OF STUDIES	GRADUATE		
COURSE CODE	**H5**	**SEMESTER**	Spring
COURSE TITLE	**ROBOTIC SYSTEMS**		

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**	**7**
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized general knowledge
PREREQUISITE COURSES:	-
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	http://ecourse.uoi.gr/course/view.php?id=1037

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 course objective is to introduce students with more advanced aspects in selected areas of robotics, such as non-linear control, and motion planning of a robotic platform. A student that successfully attends this course should be able to: • Understand, design, and implement advanced control methodologies for robotic manipulators and mobile platforms. • Demonstrate advanced knowledge in motion planning of a robotic platform or a robotic fleet. • Study and solve real life complex problems in the control of robotic systems. • Understand research papers in the field of robotics and try out some innovative ideas.

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* *Working in an international environment* *Working in an interdisciplinary environment* *Production of new research ideas*	*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* *Production of free, creative and inductive thinking* *……* *Others…*

- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Adapting to new situations
- Decision-making
- Team work
- Working in an interdisciplinary environment
- Production of new research ideas
- Production of free, creative and inductive thinking
- Abstraction ability for problem modeling

SYLLABUS

Kinematics: Direct kinematics, inverse kinematics, differential kinematics, Jacobian matrices, singularities, kinematics of mobile robots.

Sensors and actuators: Actuators in Robotics, electronic subsystem, sensors, amplifiers, control system, PID control of a joint, control architecture of a mobile robot.

Robotic motion planning: Robot planning and control architecture, path planning, the configuration space, obstacles in work-space, roadmap, artificial potential fields, non-holonomic constraints, motion planning of a robotic fleet.

Advanced control of robotic systems: Compliance control, impedance control, non-linear control, visual servoing.

TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Lectures, lab courses
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• Use of projector and computer during lectures. • Course website maintenance. Announcements and posting of teaching material (lecture slides and notes, exercises, example programs). • Use of robots in laboratories. • Announcement of assessment marks via the ecourse platform by UOI. • Use of email for information exchange and improved 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 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*	***Activity***	***Semester workload***
	Lectures	13*3 = 39 hours
	Labs	13*1 = 13 hours
	Self-study	123 hours
	Course total	**175 hours**
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 METHODS OF EVALUATION (i) Final written examination. (ii) Project. The evaluation procedure is accessible to students via the course website.	

ATTACHED BIBLIOGRAPHY

-Suggested bibliography in Greek:

- Siciliano, B., Sciavicco, L., Villani, L., Oriolo, G., Ρομποτική: Μοντελοποίηση, Σχεδιασμός και Έλεγχος, Εκδόσεις Φούντας, 2013.
- Craig, J.J., Εισαγωγή στη Ρομποτική, Εκδόσεις Τζιόλα, 2009.
- Δουλγέρη, Ζ., Ρομποτική: Κινηματική, Δυναμική και Έλεγχος Αρθρωτών Βραχιόνων, Εκδόσεις Κριτική, 2007.
- Εμίρης, Δ., Κουλουριώτης, Δ.Ε., Ρομποτική, Εκδόσεις ΣΕΛΚΑ - 4Μ ΕΠΕ, 2006.

-Suggested bibliography in English:

- Siciliano, B., Sciavicco, L., Villani, L., Oriolo, G., Robotics: Modelling, Planning and Control, Springer, 2009.
- Craig, J.J., Introduction to Robotics: Mechanics and Control, Prentice Hall, 2004.
- Corke, P., Robotics, Vision and Control: Fundamental Algorithms in MATLAB, Springer Tracts in Advanced Robotics, Springer, 2011.
- Angeles, J., Fundamentals of Robotic Mechanical Systems: Theory, Methods, and Algorithms, Springer, 2014.
- Choset, H., et al., Principles of Robot Motion: Theory, Algorithms, and Implementations, The MIT Press, 2005.

-Related academic journals:

- The International Journal of Robotics Research.
- IEEE Transactions on Robotics.
- IEEE/ASME Transactions on Mechatronics

H7. Analog Integrated Circuits and Systems

COURSE OUTLINE

GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING		
LEVEL OF STUDIES	POSTGRADUATE-MASTER LEVEL		
COURSE CODE		**SEMESTER**	
COURSE TITLE	Analog Integrated Circuits and Systems		
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**	**7**
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized General knowledge, Skills development		
PREREQUISITE COURSES:	Basic Circuit Theory, Electronics, Analog Electronics.		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK-ENGLISH		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)			

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 at introducing to students the fundamentals of electronic circuit analysis, synthesis, design, simulation, implementation and measurement.

After successfully passing this course the students will be able to:

- Understand manufacturing technologies of nanometer integrated circuits.
- Understand logic circuit operation and physical implementation (layout) at the transistor level.
- Analyze simple or complex analog circuits.
- Synthesize in schematic and layout level of analog circuits at the transistor level.
- Design and simulate basic analog electronic circuits appropriate for biomedical applications.
- Design and simulate in schematic and layout level of analog integrated circuits and systems, measure their characteristics, and verify their performance after parasitic extraction.

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…*
	…….

- Production of free, creative and inductive thinking
- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Adapting to new situations
- Analysis of requirements for problem solving
- Abstraction ability for problem modeling
- Combination of existing info for the synthesis of new knowledge
- Working independently
- Team work

SYLLABUS

MOS transistor theory. CMOS technology and integrated circuit manufacturing. Introduction to photolithography. Design in schematic and layout level of MOS. Design in schematic and layout level of circuits using active elements (Operational Amplifier, Operational Transconductance Amplifier, Current Conveyors). Design in schematic and layout level of current mirrors and optimization in layout techniques. Design in schematic and layout level of differentiator, integrator topologies. Introduction in Fractional Calculus and utilization in biomedical applications.

TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face, lectures, lab courses, home-works
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• Use of e-slides and interactive board during lectures. • Use of computer-aided design tools at the laboratory (circuit design, layout and simulation). • Course website maintenance. Announcements and posting of teaching material (lecture slides and notes). • Use of email for information exchange and improved 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 practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are*	

Activity	***Semester workload***
Lectures	13*3 = 39 hours
Laboratory practice	11*1 = 11 hours
Problems solving	62.5 hours
Study & bibliography	62.5 hours

given as well as the hours of non-directed study according to the principles of the ECTS	analysis	
	Course total	**175 hours**
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-English METHODS OF EVALUATION (i) Final examination, which includes problem solving. The exam papers are evaluated based on the correctness and completeness of answers. (ii) Laboratory exercises on circuit design and simulation as well as on circuit implementation and measurements. The students are evaluated during their work at the laboratory and with final examination at the laboratory. The evaluation procedure is accessible to students via the course website.	

ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

Book: Design of Analog CMOS Integrated Circuits, Behzad Razavi, Press: Klidarithmos (Greek Edition), 2019

Book: Fundamentals of Microelectronics, Behzad Razavi, Press: Klidarithmos (Greek Edition), 2018

Book: MICROELECTRONIC CIRCUITS, Adel S. Sedra και Kenneth C. Smith, Press: Papasotiriou (Greek Edition), 2017.

- Related academic journals:

- IEEE Transactions on Circuits and Systems I & II (TCAS).
- IEEE Journal of Solid-State Circuits (JSSC).
- Analog Integrated Circuits and Signal Processing
  International Journal of Circuit Theory and Applications

S0. Introduction to Software Systems

COURSE OUTLINE

GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING		
LEVEL OF STUDIES	GRADUATE		
COURSE CODE	S0	**SEMESTER**	
COURSE TITLE	Introduction to Software Systems		
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/ Exercices	3 / 1/ 0	7
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialised general knowledge		
PREREQUISITE COURSES:	NO		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	http://ecourse.uoi.gr/course/view.php?id=1726		

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 course L0 “Introduction to Software Systems” aims to provide post-graduate students with the necessary background on advanced topics in the area of software systems.

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
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas
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
Production of free, creative and inductive thinking
……
Others…

…….
• Production of free, creative and inductive thinking • Decision making • Search for, analysis and synthesis of information, and use of the necessary technology. • Team work • Autonomous work • Ability to apply research results to the solution of practical problems

SYLLABUS

The course covers the following areas of software systems
• Programming languages • Software technology • Virtualization • Security • Networking • Fault tolerance and consistency • Parallelism

TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Weekly lectures
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Lecture slides, course Web page maintenance (slides and course notes), e-mail communication
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*	***Activity*** / ***Semester workload*** Lectures — 13x3=39 hours Laboratory practice — 13x1=13 hours Student's study hours — 123 hours Course total — ***175 hours***
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of*	Language of evaluation: Greek Methods of Evaluation: Course participation, in-class

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.*	quizzes, programming exercises The exact evaluation procedure is announced to students on the course website

ATTACHED BIBLIOGRAPHY

Proposed bibliography:

Guide to the Software Engineering Body of Knowledge, Version 3.0, P. Bourque and R.E. Fairley, eds., IEEE Computer Society, 2014, ISBN 978-0-7695-5166-1

Ανάπτυξη Προγραμμάτων σε Java: αφαιρέσεις, προδιαγραφές, και αντικειμενοστρεφής σχεδιασμός, B. Liskov and J. Guttag, Κλειδάριθμος, 2007, ISBN 978-960-461-063-1

Software Engineering - Theory & Practice, S. L. Pfleeger, Κλειδάριθμος, 2012, ISBN 978-960-461-477-6

Software Engineering, I. Sommerville, Κλειδάριθμος, 2009, ISBN 978-960-461-220-8

UML 2 and the Unified Process: Practical Object-Oriented Analysis and Design (2nd Edition). Jim Arlow, Ila Neustadt. Addison-Wesley Professional, 2005, ISBN 978-020-177-060-5

Principles of Computer System Design: An Introduction, J. H. Saltzer, M. F. Kaashoek, Morgan Kaufmann/Elsevier, 2009, ISBN 978-012-374-957-4

Introduction to High Performance Scientific Computing, Victor Eijkhout (2nd edition), 2016, ISBN 978-125-799-254-6

S4. Computer Systems Security

COURSE OUTLINE

GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING		
LEVEL OF STUDIES	GRADUATE		
COURSE CODE	L4	**SEMESTER**	
COURSE TITLE	COMPUTER SYSTEMS SECURITY		
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/ Exercices	4	7
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialised general knowledge		
PREREQUISITE COURSES:	NO		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	http://www.cse.uoi.gr/~stergios/teaching/l4		

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 course covers traditional and latest research publications on computer systems security. Examined issues include cryptographic techniques, storage and network security, web and mobile security, hardware security, anonymity and privacy, blockchains.
- Participating students are expected to actively contribute to the critical discussions during paper reading sessions.
- Additionally, the students under the guidance of the instructor will work on a project of their choice that will explore interesting research directions.
- Overall, the course will help students get familiar with the design, implementation and analysis of modern computer systems security.

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 *Project planning and management*

information, with the use of the necessary technology	*Respect for difference and multiculturalism*
Adapting to new situations	*Respect for the natural environment*
Decision-making	*Showing social, professional and ethical responsibility and*
Working independently	*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 for, analysis and synthesis of data and information, with the use of the necessary technology.
- Decision making
- Production of free, creative and inductive thinking
- Team work
- Autonomous work
- Production of new research ideas

SYLLABUS

- The course covers topics in the design, implementation and analysis of computer systems security, such as cryptography, authentication, confidentiality, authorization, integrity and security protocols.
- The syllabus is adjusted every year according to the latest publications of the related literature published in international conferences and journals.

TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• Lecture slides, • E-mail communication, • Course Web page maintenance.
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*	***Activity*** — ***Semester workload*** Lectures — 13x3=39 hours Laboratory practice — 13x1=13 hours Student's study hours — 148 hours Course total — ***200 hours***
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*	Language of evaluation: Greek Methods of Evaluation: i. Participation in paper reading sessions ii. Evaluation of weekly assignments iii. Project or final written examination The evaluation procedure is accessible to students via

examination of patient, art interpretation, other *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	the course website.

ATTACHED BIBLIOGRAPHY

- ACM Conference on Computer and Communications Security
- USENIX Security Symposium
- ACM Symposium on Cloud Computing
- ACM Symposium on Operating Systems Principles
- USENIX Annual Technical Conference
- USENIX Symposium on Operating Systems Design and Implementation
- USENIX Symposium on Network Systems Design and Implementation
- ACM Transactions on Privacy and Security
- IEEE Transactions on Dependable and Secure Computing

S8. High Performance Systems and Software

COURSE OUTLINE

GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING		
LEVEL OF STUDIES	GRADUATE		
COURSE CODE	**S8**	**SEMESTER**	**Spring**
COURSE TITLE	High Performance Systems and Software		
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	**4**	**7**
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special background		
PREREQUISITE COURSES:	-		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)			

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*

High performance systems are nowadays synonymous to parallel computers, i.e. computing systems with multiple processors or cores which can work concurrently towards the solution of a problem. This course teaches the organization, the operation and the programming of parallel computers. The basic architectural choices are presented, along with the corresponding problems one has to solve during their design and implementation. In addition, parallel programming is introduced, which is necessary for the full exploitation of these systems. Parallel programming is taught through the use of contemporary programming models. Finally, the course includes a survey of recent research problems and publications related to high performance systems.

After successfully concluding this course the students will be able to:

- Study, understand and analyze the organization of high performance system.
- Understand the problems of memory hierarchy, cache coherency and memory consistency, and select the most suitable solutions.
- Understand and analyze the topology, the switching scheme and the routing protocols in processor interconnection networks.
- Synthesize parallel software.
- Program in the shared address space model using threads and OpenMP
- Program in the message passing model using MPI.
- Use the international bibliography for related research problems and 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…*
	…….

- Working independently
- Production of free, creative and inductive thinking
- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Project planning and management
- Adapting to new situations
- Production of new research ideas
- Working in an international environment

SYLLABUS

- History and importance of high performance systems
- Basic principles of parallelism at the hardware and software levels, and fundamental performance laws
- Shared memory organization and multicore architectures.
- The problems of cache coherency and memory consistency
- Distributed memory organization and computational clusters.
- Interconnection networks, topologies, routing, high-performance switching
- Distributed shared memory and non-uniform memory access (NUMA)
- SIMD and GPU organizations
- Principles and languages for parallel programming
- Programming in the shared address space model (threads, OpenMP)
- Programming in the message passing model (MPI)

TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face class lectures
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• Use of projector electronic slides. • Use of computers for the Lab exercises. • Course website maintenance with announcements and posting of teaching material (lecture slides and notes). • Use of email for communicating 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 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*	
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 METHODS OF EVALUATION (i) Homework problems and exercises (ii) Programming assignments (iii) Reading assignments and topic (iv) Term project

Activity	*Semester workload*
Lectures	13*3 = 39 hours
Labs	13*1 = 13 hours
Self-study	123 hours
Course total	**175 hours**

ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- Thomas Sterling Matthew Anderson Maciej Brodowicz, *High Performance Computing, Modern Systems and Practices*, Morgan Kaufmann, 2017
- Β. Δημακόπουλος, *Παράλληλα Συστήματα και Προγραμματισμός*, Εκδόσεις ΣΕΑΒ, Φεβ. 2016
- P.S. Pacheco, *Εισαγωγή στον παράλληλο προγραμματισμό*, Κλειδάριθμος 2015
- T. Rauber, G. Runger, *Parallel Programming for Multicore and Cluster Systems*, Springer, 2010
- B. Wilkinson and M. Allen, *Parallel Programming: Techniques and Applications Using*

Networked Workstations and Parallel Computers, Pearson, 2004.

- A. Grama, A. Gupta, G. Karypis and V. Kumar, *Introduction to Parallel Computing*, Addison Wesley, 2003.
- Ερευνητικές δημοσιεύσεις από συνέδρια και περιοδικά

- Related academic journals:

- Transactions on Parallel and Distributed Systems, IEEE.
- Journal of Parallel and Distributed Computing, Elsevier.
- International Journal of Parallel Programming, Springer.
- Concurrency and Computation: Practice and Experience, Wiley.
- Parallel Computing, Elsevier
- Journal of Supercomputing, Springer
- ACM Transactions on Parallel Computing

X1. Supervised study

COURSE OUTLINE

GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING		
LEVEL OF STUDIES	POSTGRADUATE		
COURSE CODE	**X1**	**SEMESTER**	**Fall**
COURSE TITLE	**Supervised Study**		

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**
		7
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Skills development
PREREQUISITE COURSES:	-
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	

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 supervised study aims to carry out an independent study or work under the supervision of a faculty member of the Department.
Upon successful completion of the supervised study, the student will be able to:
• Identify the main problems to be solved in a research area and fully recognize their main and secondary aspects.
• Describe and document the basic knowledge related to the subject of the study.
• Summarize existing scientific knowledge and expertise on the subject.
• Evaluate the approaches and solutions that have been proposed in the international bibliography and comment on their relative advantages and disadvantages

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* *Working in an international environment* *Working in an interdisciplinary environment* *Production of new research ideas*	*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* *Production of free, creative and inductive thinking* *……* *Others…* *…….*
- Search for, analysis and synthesis of data and information, with the use of the necessary technology. - Adapting to new situations. - Decision making. - Working independently. - Abstraction ability for problem modeling. - Working in an interdisciplinary environment. - Production of free, creative and inductive thinking.	

SYLLABUS

In the context of this course, the graduate student should prepare an independent study or work on a topic determined in consultation with the supervising faculty member.

TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	The student pursuits his study/work. As part of the student's guidance, scheduled meetings are held with the supervising teacher to discuss intermediate stages and results. Finally, the writing of a report on the results of the study/work and a statement of facts is carried out.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	- Bibliographic search and organization from electronic libraries. - Use of state-of-the-art techniques and tools in Data and Computing Systems Engineering.
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*	

Activity	***Semester workload***
Elaboration of study/work and writing of results	150 hours
Meetings with the supervisor	25 hours
Course total	***175 hours***

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 or English. METHODS OF EVALUATION At the end of the course, the outcomes of the study, the activity report and the grade of the student are submitted by the supervisor to the coordinating committee of the program.

ATTACHED BIBLIOGRAPHY

- Suggested bibliography

X3. Teaching Practice I

COURSE OUTLINE

GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING		
LEVEL OF STUDIES	GRADUATE		
COURSE CODE	**X3**	**SEMESTER**	
COURSE TITLE	Teaching Practice I		
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**
			6
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).			
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Skills Development		
PREREQUISITE COURSES:	-		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	-		
COURSE WEBSITE (URL)			

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 goal of the course is for the students:

- to obtain experience in the teaching of undergraduate students of the Department
- to learn teaching methods for undergraduate-level university courses as well as the various tools that are used
- to collaborate in the teaching effort with the course instructors as well as other graduate students
- to reinforce their knowledge on the subject of the course to which they contribute in teaching

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

Respect for difference and multiculturalism

Adapting to new situations *Decision-making* *Working independently* *Team work* *Working in an international environment* *Working in an interdisciplinary environment* *Production of new research ideas*	*Respect for the natural environment* *Showing social, professional and ethical responsibility and sensitivity to gender issues* *Criticism and self-criticism* *Production of free, creative and inductive thinking* *……* *Others…* *…….*

- Skills development
- Adapting to new situations
- Decision-making
- Working independently
- Team work
- Showing social, professional and ethical responsibility and sensitivity to gender issues

SYLLABUS

Teaching Practice I is part of the MSc Program of the Department and has been included as a compulsory course. Students participate in the training process of undergraduate students of the Department by offering teaching assistant services (participation in the teaching of labs, grading of homework). Students must serve as teaching assistants for two semesters, thus the successful completion of courses X3: Teaching Practice I and X4: Teaching Practice II is required.

TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	-
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• Use of email and social media for information exchange and improved 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 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*	<table><tr><th>Activity</th><th>Semester workload</th></tr><tr><td>Teaching Practice</td><td>150 hours</td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td>Course total</td><td>150 hours</td></tr></table>
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*	LANGUAGE OF EVALUATION: Greek METHODS OF EVALUATION The successful completion of Teaching Practice is certified by the course instructor and offers students 6 credits.

students.	

ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- Related academic journals:

X4. Teaching Practice II

COURSE OUTLINE

GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING		
LEVEL OF STUDIES	GRADUATE		
COURSE CODE	**X4**	**SEMESTER**	
COURSE TITLE	Teaching Practice II		
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**
			2
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).			
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Skills Development		
PREREQUISITE COURSES:	-		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	-		
COURSE WEBSITE (URL)			

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 goal of the course is for the students:

- to obtain experience in the teaching of undergraduate students of the Department
- to learn teaching methods for undergraduate-level university courses as well as the various tools that are used
- to collaborate in the teaching effort with the course instructors as well as other graduate students
- to reinforce their knowledge on the subject of the course to which they contribute in teaching

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

Respect for difference and multiculturalism

Adapting to new situations *Decision-making* *Working independently* *Team work* *Working in an international environment* *Working in an interdisciplinary environment* *Production of new research ideas*	*Respect for the natural environment* *Showing social, professional and ethical responsibility and sensitivity to gender issues* *Criticism and self-criticism* *Production of free, creative and inductive thinking* *……* *Others…* *…….*

- Skills development
- Adapting to new situations
- Decision-making
- Working independently
- Team work
- Showing social, professional and ethical responsibility and sensitivity to gender issues

SYLLABUS

Teaching Practice I is part of the MSc Program of the Department and has been included as a compulsory course. Students participate in the training process of undergraduate students of the Department by offering teaching assistant services (participation in the teaching of labs, grading of homework). Students must serve as teaching assistants for two semesters, thus the successful completion of courses X3: Teaching Practice I and X4: Teaching Practice II is required.

TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	-
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• Use of email and social media for information exchange and improved 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 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*	<table><tr><th>Activity</th><th>Semester workload</th></tr><tr><td>Teaching Practice</td><td>50 hours</td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td>Course total</td><td>50 hours</td></tr></table>
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*	LANGUAGE OF EVALUATION: Greek METHODS OF EVALUATION The successful completion of Teaching Practice is certified by the course instructor and offers students 6 credits.

students.	

ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- Related academic journals:

X5. Seminar I

COURSE OUTLINE

GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING		
LEVEL OF STUDIES	GRADUATE		
COURSE CODE	**X5**	**SEMESTER**	**>=1**
COURSE TITLE	Seminar I		
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**
			3
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).			
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special Background		
PREREQUISITE COURSES:	-		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK/ENGLISH		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No		
COURSE WEBSITE (URL)	https://www.cse.uoi.gr/drastiriotites/seminaria/ (all the seminars organized by the Department are announced on this website)		

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 goal of Seminar I is to provide postgraduate students with the opportunity to acquire special knowledge on various topics related to the main field of the postgraduate program. Students are expected to familiarise themselves with modern research methods, to get introduced to recent research results, as well as to get acquainted with experienced researchers who are involved in the scientific area of Data and Computer Systems Engineering.
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* *Respect for difference and multiculturalism*

Adapting to new situations *Decision-making* *Working independently* *Team work* *Working in an international environment* *Working in an interdisciplinary environment* *Production of new research ideas*	*Respect for the natural environment* *Showing social, professional and ethical responsibility and sensitivity to gender issues* *Criticism and self-criticism* *Production of free, creative and inductive thinking* *……* *Others…* *…….*

- Adapting to new situations
- Production of new research ideas
- Decision making
- Criticism and self-criticism
- Production of free, creative and inductive thinking

SYLLABUS

Seminar I constitutes part of the Postgraduate Programme's Curriculum, as an approved compulsory activity of the postgraduate students and it has been included as a compulsory course. Upon successful completion of the course, students are expected to have attended at least 5 seminars during one semester, among the seminars organised by the Department.

TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	-
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• Use of email and social media for information exchange and improved 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 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*	<table><tr><th>Activity</th><th>Semester workload</th></tr><tr><td>Seminars</td><td>75 hours</td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td>Course total</td><td>75 hours</td></tr></table>
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*	METHODS OF EVALUATION The students' evaluation is based ont the attendance at the seminars organised by the Department.

students.	

ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- Related academic journals:

X6. Seminar II

COURSE OUTLINE

GENERAL

SCHOOL	ENGINEERING			
ACADEMIC UNIT	DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING			
LEVEL OF STUDIES	GRADUATE			
COURSE CODE	**X6**	**SEMESTER**	**>=2**	
COURSE TITLE	Seminar II			
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**
				3
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).				
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special Background			
PREREQUISITE COURSES:	-			
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK/ENGLISH			
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No			
COURSE WEBSITE (URL)	https://www.cse.uoi.gr/drastiriotites/seminaria/ (all the seminars organized by the Department are announced on this website)			

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 goal of Seminar II is to provide postgraduate students with the opportunity to acquire special knowledge on various topics related to the main field of the postgraduate program. Students are expected to familiarise themselves with modern research methods, to get introduced to recent research results, as well as to get acquainted with experienced researchers who are involved in the scientific area of Data and Computer Systems Engineering.
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…*
	…….

- Adapting to new situations
- Production of new research ideas
- Decision making
- Criticism and self-criticism
- Production of free, creative and inductive thinking

SYLLABUS

Seminar II constitutes part of the Postgraduate Programme's Curriculum, as an approved optional activity of the postgraduate students and it has been included as an elective course. Upon successful completion of the course, students are expected to have attended at least 5 seminars during one semester, among the seminars organised by the Department.

TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	-
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• Use of email and social media for information exchange and improved 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 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*	
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*	METHODS OF EVALUATION The students' evaluation is based ont the attendance at the seminars organised by the Department.

Activity	***Semester workload***
Seminars	75 hours
Course total	***75 hours***

Specifically-defined evaluation criteria are given, and if and where they are accessible to students.	

ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- Related academic journals:

X9. Practical Training

COURSE OUTLINE

GENERAL

SCHOOL	ENGINEERING			
ACADEMIC UNIT	DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING			
LEVEL OF STUDIES	GRADUATE			
COURSE CODE	**X9**	**SEMESTER**	**>1**	
COURSE TITLE	Practical Training			
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**
				3.5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).				
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Skills Development			
PREREQUISITE COURSES:	-			
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK/ENGLISH			
IS THE COURSE OFFERED TO ERASMUS STUDENTS	-			
COURSE WEBSITE (URL)				

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 goal of the course is for the students: • to get to know workplaces, where they get in touch with current market developments, to give them the opportunity to acquire new knowledge in the field of Data and Computer Systems Engineering, to participate actively in teamwork and decision making, to develop their skills, to participate in the design and completion of projects and gain work experience

- to transfer their knowledge and experience to the companies and vice versa, with the aim of upgrading the studies at the Department and maintaining the high level of knowledge provided

Moreover, Practical Training strengthens the department's relationships with stakeholders and provides job opportunities for its graduates.

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 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
- Working in an interdisciplinary environment
- Project planning and management
- Showing social, professional and ethical responsibility and sensitivity to gender issues
- Criticism and self-criticism
- Production of free, creative and inductive thinking

SYLLABUS

Practical Training is part of the MSc Program of the Department as an approved optional activity of the graduate students and has been included as an elective course. Students can participate having completed the first (1) semester of studies. The duration of the Practical Training is from 2 to 4 months, and each student can register once for this course. The selection of both students and employment agencies is made by the Practical Training Committee of the MSc Program, which makes a recommendation to the Department's Assembly.

TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	-
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• Use of email and social media for information exchange and improved 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 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*	***Activity*** | ***Semester workload*** Practical Training | 87,5 hours ***Course total*** | ***87,5 hours***
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 or English METHODS OF EVALUATION At the end of the Internship, the required forms are submitted by the student, the institution, and his / her academic supervisor. The successful completion of Practical Training offers students 3.5 credits.

ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- Related academic journals:

MSc Thesis

COURSE OUTLINE

GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING		
LEVEL OF STUDIES	GRADUATE		
COURSE CODE		**SEMESTER**	**=>2**
COURSE TITLE	MSc THESIS		
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**
			30
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).			
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Skills Development - specialised		
PREREQUISITE COURSES:	-		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek/English		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	-		
COURSE WEBSITE (URL)			

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 MSc Thesis is either of a research or technical content and must be sufficiently original or demonstrate in-depth knowledge of a specific subject that is included in the general subject of Data and Computer Systems Engineering.

At the end of the MSc Thesis, the student will be able to:

- Collect and integrate the available information on state-of-the-art techniques in the study area.
- Apply research methods, techniques and problem solving approaches.
- Develop and evaluate original ideas and adapt with originality the aforementioned techniques and methods to the specificities of the given

problem.
- Evaluate alternatives to the given problem and consciously pick one based on the prioritization of the dimensions of the problem.
- Organize and communicate results via a technical report (in the form of a master's thesis), which, in addition to being submitted in writing, is also orally defended in a public presentation.
- Develop initiatives to facilitate the above tasks and take responsibility for their achievement.

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 for, analysis and synthesis of data and information, with the use of the necessary technology
- Adapting to new situations
- Decision-making
- Working independently
- Working in an interdisciplinary environment
- Project planning and management
- Production of free, creative and inductive thinking
- Project planning and management for Computer Science projects

SYLLABUS

The MSc Thesis is an important part and culmination of the educational process in the MSc Program. During the preparation of the MSc Thesis, students utilize their knowledge, apply research methods, and develop original ideas. The MSc Thesis aims to implement a scientific research or development project, using state-of-the-art tools and methods according to the latest developments in research and technology in Data and Computing Systems Engineering. At the same time, postgraduate students are invited to convey their thoughts and results in writing and orally, and to communicate scientific information, challenges, and findings to both specialized and general audiences.

TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to face supervision from a faculty member
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	- Bibliographic search and result integration via the exploitation of online libraries - Use of cutting-edge techniques and tools

	in the area of Data and Computing Systems Engineering - Use of ICT in the defense of thesis
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*	

Activity	*Semester workload*
Bibliographic search and integration	150
Solution Design	150
Solution Implementation	300
Compilation of the final report	150
Course total	***750 hours***

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 or English METHODS OF EVALUATION - Dissertation text (“MSc Thesis”) - Public presentation - Students preparing a MSc Thesis must complete and submit the text of the final report and present the results of their work in a public lecture. - The MSc Thesis is examined and graded by a three-member faculty committee.

ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- R.J. Wieringa. Design Science Methodology for Information Systems and Software Engineering. Springer 2014. DOI 10.1007/978-3-662-43839-8
- Justin Zobel. Writing for Computer Science. Springer 2014. DOI 10.1007/978-1-4471-6639-9
- D. Evans, P. Gruba, J. Zobel. How to Write a Better Thesis. Springer 2014
- MSc Thesis Template, by the Department

- Related academic journals: