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

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<th>SCHOOL</th>
<th>ENGINEERING</th>
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</thead>
<tbody>
<tr>
<td>ACADEMIC UNIT</td>
<td>DEPARTMENT OF COMPUTER SCIENCE &amp; ENGINEERING</td>
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<td>LEVEL OF STUDIES</td>
<td>GRADUATE</td>
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<tr>
<td>COURSE CODE</td>
<td>A0</td>
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<td>SEMESTER</td>
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</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>WEEKLY TEACHING HOURS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures/Laboratory Exercises</td>
<td>4</td>
</tr>
</tbody>
</table>

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

COURSE TYPE
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
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

• 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


TEACHING and LEARNING METHODS - EVALUATION

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

<table>
<thead>
<tr>
<th>TEACHING METHODS</th>
<th>Activity</th>
<th>Semester workload</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures</td>
<td>13 × 3 = 39 hours</td>
<td></td>
</tr>
<tr>
<td>Laboratory practice</td>
<td>13 × 1 = 13 hours</td>
<td></td>
</tr>
<tr>
<td>Student’s study hours</td>
<td>123 hours</td>
<td></td>
</tr>
<tr>
<td>STUDENT PERFORMANCE EVALUATION</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Description of the evaluation procedure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>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</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Language of evaluation: Greek</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Methods of Evaluation:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Final written examination with problem solving questions.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Homework assignments.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The evaluation procedure is accessible to students via the course website.</td>
<td></td>
<td></td>
</tr>
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</table>

### ATTACHED BIBLIOGRAPHY

A1. Algorithmic Graph Theory

COURSE OUTLINE

GENERAL

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<td>SEMESTER</td>
<td>Fall</td>
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<td>COURSE TITLE</td>
<td>ALGORITHMIC GRAPH THEORY</td>
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INDEPENDENT TEACHING ACTIVITIES

<table>
<thead>
<tr>
<th>WEEKLY TEACHING HOURS</th>
<th>CREDITS</th>
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<td>4</td>
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</tbody>
</table>

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

COURSE TYPE

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?

- 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).
- 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

<table>
<thead>
<tr>
<th>DELIVERY</th>
<th>Face-to-face, Distance learning, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY</td>
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<td>DELIVERY</td>
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<tr>
<th>TEACHING METHODS</th>
<th>Activity</th>
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<tr>
<td></td>
<td>Lectures</td>
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<td></td>
<td>Laboratory practice</td>
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<td>Student’s study hours</td>
<td>123 hours</td>
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</table>

| Course total | 175 hours |

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<th>STUDENT PERFORMANCE EVALUATION</th>
<th>Language of evaluation: Greek</th>
</tr>
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<tbody>
<tr>
<td>Methods of Evaluation:</td>
<td>i) Final written examination</td>
</tr>
<tr>
<td>Evaluation Types</td>
<td>Specific Examples</td>
</tr>
<tr>
<td>------------------------------------------</td>
<td>-----------------------------------------------------------------------------------</td>
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</table>
| 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 | ii) Lab projects examination  
iii) Evaluation of weekly assignments  
The evaluation procedure is accessible to students via the course website. |

**ATTACHED BIBLIOGRAPHY**

A2. Algorithms for Data Science

COURSE OUTLINE

GENERAL

<table>
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<tr>
<th>SCHOOL</th>
<th>ENGINEERING</th>
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<tbody>
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<td>ACADEMIC UNIT</td>
<td>DEPARTMENT OF COMPUTER SCIENCE &amp; ENGINEERING</td>
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<td>COURSE CODE</td>
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<td>SEMESTER</td>
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<td>COURSE TITLE</td>
<td>ALGORITHMS FOR DATA SCIENCE</td>
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INDEPENDENT TEACHING ACTIVITIES

<table>
<thead>
<tr>
<th>Lectures/Laboratory Exercises</th>
<th>WEEKLY TEACHING HOURS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>7</td>
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</tbody>
</table>

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

COURSE TYPE

<table>
<thead>
<tr>
<th>Special background</th>
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general background, special background, specialised general knowledge, skills development

PREREQUISITE COURSES:

NO

LANGUAGE OF INSTRUCTION

Greek

EXAMINATIONS:

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
- 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...

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

<table>
<thead>
<tr>
<th>DELIVERY</th>
<th>Face-to-face, Distance learning, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY</td>
<td>Use of ICT in teaching, laboratory education, communication with students</td>
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<td><img src="https://via.placeholder.com/150" alt="Image" /></td>
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<td>Face-to-face</td>
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<td>123 hours</td>
<td></td>
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</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

D0. Introduction In Data Analysis And Processing

COURSE OUTLINE

GENERAL

<table>
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<tr>
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<th>SCHOOL OF ENGINEERING</th>
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<tbody>
<tr>
<td>ACADEMIC UNIT</td>
<td>DEPT. OF COMPUTER SCIENCE &amp; ENGINEERING</td>
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<td>LEVEL OF STUDIES</td>
<td>GRADUATE</td>
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<td>COURSE TITLE</td>
<td>INTRODUCTION IN DATA ANALYSIS AND PROCESSING</td>
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<td>SEMESTER</td>
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INDEPENDENT TEACHING ACTIVITIES

<table>
<thead>
<tr>
<th>Lectures / Labs / Tutorials</th>
<th>WEEKLY TEACHING HOURS</th>
<th>CREDITS</th>
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<td>7</td>
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</table>

COURSE TYPE

<table>
<thead>
<tr>
<th>General background, special background, specialised general knowledge, skills development</th>
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</thead>
</table>

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

1. Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area
2. Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B
3. 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

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
Weekly lectures
Face-to-face, Distance learning, etc.

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.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Semester workload</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures</td>
<td>13*3 = 39 hours</td>
</tr>
<tr>
<td>Labs</td>
<td>13*1 = 13 hours</td>
</tr>
<tr>
<td>Tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</td>
<td></td>
</tr>
</tbody>
</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: Written exam*

**ATTACHED BIBLIOGRAPHY**

- **Suggested bibliography:**
  
  

- **Related academic journals:**
D2. Data Mining

COURSE OUTLINE

GENERAL

<table>
<thead>
<tr>
<th>SCHOOL</th>
<th>SCHOOL OF SCIENCES</th>
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<td>ACADEMIC UNIT</td>
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<tr>
<td>COURSE TITLE</td>
<td>Data Mining</td>
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</table>

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.

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<tr>
<th>Lectures/Laboratory Exercises</th>
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<td></td>
<td></td>
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</tbody>
</table>

COURSE TYPE

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.
- 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 (e.g. k-means), agglomerative clustering, spectral clustering, association rule mining, feature selection and extraction, scaling issues.

**TEACHING and LEARNING METHODS - EVALUATION**

<table>
<thead>
<tr>
<th>DELIVERY</th>
<th>Face-to-face, Distance learning, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY</td>
<td>Lecture slides, multimedia (video demonstrations), e-mail communication, course Web page maintenance.</td>
</tr>
</tbody>
</table>

**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>
<thead>
<tr>
<th>Activity</th>
<th>Semester workload</th>
</tr>
</thead>
<tbody>
<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>148 hours</td>
</tr>
</tbody>
</table>

Course total: 200 hours

**STUDENT PERFORMANCE EVALUATION**

Language of evaluation: Greek
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


D3. Optimization

COURSE OUTLINE

GENERAL

<table>
<thead>
<tr>
<th>SCHOOL</th>
<th>SCHOOL OF ENGINEERING</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACADEMIC UNIT</td>
<td>DEPT. OF COMPUTER SCIENCE &amp; ENGINEERING</td>
</tr>
<tr>
<td>LEVEL OF STUDIES</td>
<td>GRADUATE</td>
</tr>
<tr>
<td>COURSE CODE</td>
<td>D3</td>
</tr>
<tr>
<td>SEMESTER</td>
<td>Fall</td>
</tr>
<tr>
<td>COURSE TITLE</td>
<td>OPTIMIZATION</td>
</tr>
</tbody>
</table>

INDEPENDENT TEACHING ACTIVITIES

| Lectures / Labs / Tutorials | 4 | 7 |

WEEKLY TEACHING HOURS | CREDITS

COURSE TYPE

- Special background
- general background, special background, specialised general knowledge, skills development

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?

<table>
<thead>
<tr>
<th>Search for, analysis and synthesis of data and information, with the use of the necessary technology</th>
<th>Project planning and management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adapting to new situations</td>
<td>Respect for difference and multiculturalism</td>
</tr>
<tr>
<td>Decision-making</td>
<td>Respect for the natural environment</td>
</tr>
<tr>
<td>Working independently</td>
<td>Showing social, professional and ethical responsibility and sensitivity to gender issues</td>
</tr>
<tr>
<td>Team work</td>
<td>Criticism and self-criticism</td>
</tr>
<tr>
<td>Working in an international environment</td>
<td>Production of free, creative and inductive thinking</td>
</tr>
<tr>
<td>Working in an interdisciplinary environment</td>
<td>Others...</td>
</tr>
<tr>
<td>Production of new research ideas</td>
<td>......</td>
</tr>
</tbody>
</table>

- 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 modeling problems.

**SYLLABUS**

- Introduction to Optimization
- Optimality conditions
- One-dimensional optimization
- 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.

USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students

Weekly lectures

- 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

<table>
<thead>
<tr>
<th>Activity</th>
<th>Semester workload</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures</td>
<td>13*3 = 39 hours</td>
</tr>
<tr>
<td>Labs</td>
<td>13*1 = 13 hours</td>
</tr>
<tr>
<td>Self-study</td>
<td>123 hours</td>
</tr>
</tbody>
</table>

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:

- 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

<table>
<thead>
<tr>
<th>SCHOOL</th>
<th>SCHOOL OF ENGINEERING</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACADEMIC UNIT</td>
<td>DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING</td>
</tr>
<tr>
<td>LEVEL OF STUDIES</td>
<td>GRADUATE</td>
</tr>
<tr>
<td>COURSE CODE</td>
<td>D4</td>
</tr>
<tr>
<td>SEMESTER</td>
<td>Fall</td>
</tr>
<tr>
<td>COURSE TITLE</td>
<td>Video Processing and Compression</td>
</tr>
</tbody>
</table>

INDEPENDENT TEACHING ACTIVITIES

<table>
<thead>
<tr>
<th>COURSE TYPE</th>
<th>Special background</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>general background, special background, specialised general knowledge, skills development</td>
</tr>
</tbody>
</table>

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 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?

<table>
<thead>
<tr>
<th>Search for, analysis and synthesis of data and information, with the use of the necessary technology</th>
<th>Project planning and management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adapt to new situations</td>
<td>Respect for difference and multiculturalism</td>
</tr>
<tr>
<td>Decision-making</td>
<td>Respect for the natural environment</td>
</tr>
<tr>
<td>Working independently</td>
<td>Showing social, professional and ethical responsibility and sensitivity to gender issues</td>
</tr>
<tr>
<td>Team work</td>
<td>Criticism and self-criticism</td>
</tr>
<tr>
<td>Working in an international environment</td>
<td>Production of free, creative and inductive thinking</td>
</tr>
<tr>
<td>Working in an interdisciplinary environment</td>
<td>......</td>
</tr>
<tr>
<td>Production of new research ideas</td>
<td>Others...</td>
</tr>
</tbody>
</table>

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

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


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.
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>
<thead>
<tr>
<th>Activity</th>
<th>Semester workload</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures</td>
<td>13*3 = 39 hours</td>
</tr>
<tr>
<td>Labs</td>
<td>13*1 = 13 hours</td>
</tr>
<tr>
<td>Self-study</td>
<td>123 hours</td>
</tr>
<tr>
<td><strong>Course total</strong></td>
<td><strong>175 hours</strong></td>
</tr>
</tbody>
</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, etc.

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. 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.

ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- 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

<table>
<thead>
<tr>
<th>SCHOOL</th>
<th>ENGINEERING</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACADEMIC UNIT</td>
<td>DEPARTMENT OF COMPUTER SCIENCE &amp; ENGINEERING</td>
</tr>
<tr>
<td>LEVEL OF STUDIES</td>
<td>GRADUATE</td>
</tr>
<tr>
<td>COURSE CODE</td>
<td>D6</td>
</tr>
<tr>
<td>SEMESTER</td>
<td></td>
</tr>
<tr>
<td>COURSE TITLE</td>
<td>ONLINE SOCIAL NETWORKS AND MEDIA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>INDEPENDENT TEACHING ACTIVITIES</th>
<th>WEEKLY TEACHING HOURS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures / Exercises / Project</td>
<td>3</td>
<td>7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COURSE TYPE</th>
<th>Specialised general knowledge</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>PREREQUISITE COURSES:</th>
<th>NO</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>LANGUAGE OF INSTRUCTION and EXAMINATIONS:</th>
<th>Greek</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>IS THE COURSE OFFERED TO ERASMUS STUDENTS</th>
<th>YES</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>COURSE WEBSITE (URL)</th>
<th><a href="http://www.cs.uoi.gr/~tsap/teaching/cs-l14/">http://www.cs.uoi.gr/~tsap/teaching/cs-l14/</a></th>
</tr>
</thead>
</table>

### 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 |
| 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 sensitivity to gender issues |
| Working independently | Criticism and self-criticism |
| Team work | Production of free, creative and inductive thinking |
| Working in an international environment | Others... |
| Working in an interdisciplinary environment | 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

<table>
<thead>
<tr>
<th>DELIVERY</th>
<th>Face-to-face, Distance learning, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY</td>
<td>Lecture slides, multimedia (video demonstrations), e-mail communication, course Web page maintenance.</td>
</tr>
<tr>
<td>TEACHING METHODS</td>
<td>The manner and methods of teaching are described in detail.</td>
</tr>
<tr>
<td>Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Activity</th>
<th>Semester workload</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures</td>
<td>13x3=39 hours</td>
</tr>
<tr>
<td>Student’s study hours</td>
<td>123 hours</td>
</tr>
<tr>
<td>Final Project</td>
<td>13 hours</td>
</tr>
</tbody>
</table>
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 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

<table>
<thead>
<tr>
<th>SCHOOL</th>
<th>POLYTECHNIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACADEMIC UNIT</td>
<td>DEPARTMENT OF COMPUTER SCIENCE &amp; ENGINEERING</td>
</tr>
<tr>
<td>LEVEL OF STUDIES</td>
<td>GRADUATE</td>
</tr>
<tr>
<td>COURSE CODE</td>
<td>D8</td>
</tr>
<tr>
<td>SEMESTER</td>
<td></td>
</tr>
<tr>
<td>COURSE TITLE</td>
<td>Analysis and Processing of Biomedical Data</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>WEEKLY TEACHING HOURS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures / Labs / Exercices</td>
<td>3 / 1 / 10</td>
</tr>
</tbody>
</table>

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?

<table>
<thead>
<tr>
<th>Competence</th>
<th>Course Aim</th>
</tr>
</thead>
<tbody>
<tr>
<td>Search for, analysis and synthesis of data and information, with</td>
<td>Project planning and management</td>
</tr>
<tr>
<td>the use of the necessary technology</td>
<td>Respect for difference and multiculturalism</td>
</tr>
<tr>
<td>Decision-making</td>
<td>Respect for the natural environment</td>
</tr>
<tr>
<td>Working independently</td>
<td>Showing social, professional and ethical responsibility</td>
</tr>
<tr>
<td>Team work</td>
<td>and sensitivity to gender issues</td>
</tr>
<tr>
<td>Working in an international environment</td>
<td>Criticism and self-criticism</td>
</tr>
<tr>
<td>Working in an interdisciplinary environment</td>
<td>Production of free, creative and inductive thinking</td>
</tr>
<tr>
<td>Production of new research ideas</td>
<td>Others...</td>
</tr>
</tbody>
</table>

• 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>
<thead>
<tr>
<th>DELIVERY</th>
<th>Face-to-face, Distance learning, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY</td>
<td>Use of ICT in teaching, laboratory education, communication with students</td>
</tr>
<tr>
<td>TEACHING METHODS</td>
<td>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.</td>
</tr>
<tr>
<td>STUDENT PERFORMANCE EVALUATION</td>
<td>Description of the evaluation procedure</td>
</tr>
</tbody>
</table>

Language of evaluation: Greek

Methods of Evaluation:
1. Programming projects
2. Presentation
3. 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.
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)

- 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

<table>
<thead>
<tr>
<th>SCHOOL</th>
<th>SCHOOL OF ENGINEERING</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACADEMIC UNIT</td>
<td>DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING</td>
</tr>
<tr>
<td>LEVEL OF STUDIES</td>
<td>GRADUATE</td>
</tr>
<tr>
<td>COURSE CODE</td>
<td>H0</td>
</tr>
<tr>
<td>SEMESTER</td>
<td>-</td>
</tr>
<tr>
<td>COURSE TITLE</td>
<td>Introduction to Computer Hardware Systems</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>WEEKLY TEACHING HOURS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures / Tutorials</td>
<td>3+1</td>
</tr>
<tr>
<td></td>
<td>7</td>
</tr>
</tbody>
</table>

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

COURSE TYPE

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
  o the basic components of a robotic system and their functions
  o 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
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
● 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

<table>
<thead>
<tr>
<th>DELIVERY</th>
<th>Lectures and tutorials</th>
</tr>
</thead>
</table>
| **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.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Semester workload</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures</td>
<td>13x3 = 39 hours</td>
</tr>
<tr>
<td>Tutorials</td>
<td>1.3x1 = 13 hours</td>
</tr>
<tr>
<td>Quizzes</td>
<td>5x1 = 5 hours</td>
</tr>
<tr>
<td>Self-study</td>
<td>118 hours</td>
</tr>
<tr>
<td><strong>Course total</strong></td>
<td><strong>175 hours</strong></td>
</tr>
</tbody>
</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, etc.

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:
  - CMOS VLSI DESIGN: A CIRCUITS AND SYSTEMS PERSPECTIVE, N. Weste and D. Harris, Addison-Wesley, 2011.

- 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

<table>
<thead>
<tr>
<th>SCHOOL</th>
<th>SCHOOL OF ENGINEERING</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACADEMIC UNIT</td>
<td>DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING</td>
</tr>
<tr>
<td>LEVEL OF STUDIES</td>
<td>GRADUATE</td>
</tr>
<tr>
<td>COURSE CODE</td>
<td>H1</td>
</tr>
<tr>
<td>SEMESTER</td>
<td>Spring</td>
</tr>
</tbody>
</table>

INDEPENDENT TEACHING ACTIVITIES

<table>
<thead>
<tr>
<th>COURSE TYPE</th>
<th>Specialized general Knowledge</th>
</tr>
</thead>
</table>

PREREQUISITE COURSES:

- 

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

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
### 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?

<table>
<thead>
<tr>
<th>Competence</th>
<th>Course Aim</th>
</tr>
</thead>
<tbody>
<tr>
<td>Search for, analysis and synthesis of data and information, with the use of the necessary technology</td>
<td>Project planning and management</td>
</tr>
<tr>
<td>Adapting to new situations</td>
<td>Respect for difference and multiculturalism</td>
</tr>
<tr>
<td>Decision-making</td>
<td>Respect for the natural environment</td>
</tr>
<tr>
<td>Working independently</td>
<td>Sensitivity to gender issues</td>
</tr>
<tr>
<td>Team work</td>
<td>Criticism and self-criticism</td>
</tr>
<tr>
<td>Working in an international environment</td>
<td>Production of free, creative and inductive thinking</td>
</tr>
<tr>
<td>Working in an interdisciplinary environment</td>
<td></td>
</tr>
<tr>
<td>Production of new research ideas</td>
<td></td>
</tr>
</tbody>
</table>

- 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


**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.

**USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY**

Use of ICT in teaching, laboratory education, communication with students

Lectures, Project

- 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.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Semester workload</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures</td>
<td>$13 \times 3 = 39$ hours</td>
</tr>
<tr>
<td>Tutorials</td>
<td></td>
</tr>
<tr>
<td>Project</td>
<td>$10 \times 2 = 20$ hours</td>
</tr>
<tr>
<td>Self-study</td>
<td>116 hours</td>
</tr>
<tr>
<td>Course total</td>
<td>175 hours</td>
</tr>
</tbody>
</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**

(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:

- Συναφή επιστημονικά περιοδικά:
  - Transactions on Architecture and Code Optimization, Transactions on Computer Systems, ACM.
H2. Reliable Integrated Systems

COURSE OUTLINE

GENERAL

<table>
<thead>
<tr>
<th>SCHOOL</th>
<th>SCHOOL OF ENGINEERING</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACADEMIC UNIT</td>
<td>DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING</td>
</tr>
<tr>
<td>LEVEL OF STUDIES</td>
<td>POSTGRADUATE - MASTER LEVEL</td>
</tr>
<tr>
<td>COURSE CODE</td>
<td>Y2</td>
</tr>
<tr>
<td>SEMESTER</td>
<td>Fall</td>
</tr>
<tr>
<td>COURSE TITLE</td>
<td>Reliable Integrated Systems</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Lectures / Labs / Tutorials</th>
<th>WEEKLY TEACHING HOURS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4</td>
<td>7</td>
</tr>
</tbody>
</table>

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

COURSE TYPE

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 | Others... |
| 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

### DELIVERY
Face-to-face, lectures, lab courses, home-works

### USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY

<table>
<thead>
<tr>
<th>Use of ICT in teaching, laboratory education, communication with students</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Use of e-slides and interactive board during lectures.</td>
</tr>
<tr>
<td>• Use of computer-aided design tools at the laboratory (circuit design and simulation).</td>
</tr>
<tr>
<td>• Course website maintenance. Announcements and posting of teaching material (lecture slides and notes).</td>
</tr>
<tr>
<td>• Use of the ecourse facility.</td>
</tr>
<tr>
<td>• Use of email for information exchange and improved communication with students.</td>
</tr>
</tbody>
</table>

### 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
Project | 11 * 1 = 11 hours
Problems solving | 75 hours
Study & bibliography analysis | 75 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 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) 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.
Suggested bibliography:

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


Related academic journals:

- Design and Test Magazine, IEEE.
- Integration the VLSI Journal, Elsevier
- IEEE Transactions on Circuits and Systems I & II (TCAS).
## H5. Robotic Systems

### COURSE OUTLINE

### GENERAL

<table>
<thead>
<tr>
<th>SCHOOL</th>
<th>SCHOOL OF ENGINEERING</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACADEMIC UNIT</td>
<td>DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING</td>
</tr>
<tr>
<td>LEVEL OF STUDIES</td>
<td>GRADUATE</td>
</tr>
<tr>
<td>COURSE CODE</td>
<td>H5</td>
</tr>
<tr>
<td>SEMESTER</td>
<td>Spring</td>
</tr>
</tbody>
</table>

### INDEPENDENT TEACHING ACTIVITIES

<table>
<thead>
<tr>
<th>WEEKLY TEACHING HOURS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures / Labs / Tutorials</td>
<td>4</td>
</tr>
</tbody>
</table>

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.

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

### COURSE TYPE

Specialized general knowledge

### 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 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
- Team work
- Working in an interdisciplinary environment
- Working in an international 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
- 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

<table>
<thead>
<tr>
<th>DELIVERY</th>
<th>Lectures, lab courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face-to-face, Distance learning, etc.</td>
<td>Use of projector and computer during lectures.</td>
</tr>
<tr>
<td>Use of ICT in teaching, laboratory education, communication with students</td>
<td>Course website maintenance. Announcements and posting of teaching material (lecture slides and notes, exercises, example programs).</td>
</tr>
<tr>
<td></td>
<td>Use of robots in laboratories.</td>
</tr>
<tr>
<td></td>
<td>Announcement of assessment marks via the ecourse platform by UOI.</td>
</tr>
<tr>
<td></td>
<td>Use of email for information exchange and improved communication with students.</td>
</tr>
</tbody>
</table>
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>
<thead>
<tr>
<th>Activity</th>
<th>Semester workload</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures</td>
<td>13*3 = 39 hours</td>
</tr>
<tr>
<td>Labs</td>
<td>13*1 = 13 hours</td>
</tr>
<tr>
<td>Self-study</td>
<td>123 hours</td>
</tr>
<tr>
<td><strong>Course total</strong></td>
<td><strong>175 hours</strong></td>
</tr>
</tbody>
</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, etc.
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:

- Εμίρης, Δ., Κουλουριώτης, Δ.Ε., Ρομποτική, Εκδόσεις ΣΕΛΚΑ - 4Μ ΕΠΕ, 2006.

-Suggested bibliography in English:


-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

<table>
<thead>
<tr>
<th>SCHOOL</th>
<th>ENGINEERING</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACADEMIC UNIT</td>
<td>DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING</td>
</tr>
<tr>
<td>LEVEL OF STUDIES</td>
<td>POSTGRADUATE-MASTER LEVEL</td>
</tr>
<tr>
<td>COURSE TITLE</td>
<td>Analog Integrated Circuits and Systems</td>
</tr>
<tr>
<td>COURSE CODE</td>
<td>SEMESTER</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Lectures / Labs / Tutorials</th>
<th>4</th>
<th>7</th>
</tr>
</thead>
</table>

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 |
| Working in an international environment | Criticism and self-criticism |
| Working in an interdisciplinary environment | Production of free, creative and inductive thinking |
| Production of new research ideas | ...... |
| Production of free, creative and inductive thinking | Others... |

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, lectures, lab courses, homeworks |
| USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY | Use of ICT in teaching, laboratory education, 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. |

| 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

<table>
<thead>
<tr>
<th>Analysis</th>
<th>175 hours</th>
</tr>
</thead>
</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-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

- **Related academic journals:**
  - IEEE Transactions on Circuits and Systems I & II (TCAS).
  - Analog Integrated Circuits and Signal Processing
    International Journal of Circuit Theory and Applications
**S0. Introduction to Software Systems**

**COURSE OUTLINE**

<table>
<thead>
<tr>
<th>GENERAL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SCHOOL</strong></td>
</tr>
<tr>
<td><strong>ACADEMIC UNIT</strong></td>
</tr>
<tr>
<td><strong>LEVEL OF STUDIES</strong></td>
</tr>
<tr>
<td><strong>COURSE CODE</strong></td>
</tr>
<tr>
<td><strong>SEMESTER</strong></td>
</tr>
<tr>
<td><strong>COURSE TITLE</strong></td>
</tr>
</tbody>
</table>

**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.

<table>
<thead>
<tr>
<th>WEEKLY TEACHING HOURS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures / Labs / Exercises</td>
<td>3 / 1 / 0</td>
</tr>
</tbody>
</table>

**COURSE TYPE**

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 | 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 | Others... |
| Production of new research ideas | |

[48]
• 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

<table>
<thead>
<tr>
<th>Activity</th>
<th>Semester workload</th>
</tr>
</thead>
<tbody>
<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>
</tbody>
</table>

STUDENT PERFORMANCE EVALUATION

Description of the evaluation procedure

Language of evaluation: Greek

Methods of Evaluation: Course participation, in-class

[49]
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.

The exact evaluation procedure is announced to students on the course website.

ATTACHED BIBLIOGRAPHY

Proposed bibliography:


## S4. Computer Systems Security

### COURSE OUTLINE

<table>
<thead>
<tr>
<th>GENERAL</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SCHOOL</strong></td>
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<tr>
<td><strong>ACADEMIC UNIT</strong></td>
</tr>
<tr>
<td><strong>LEVEL OF STUDIES</strong></td>
</tr>
<tr>
<td><strong>COURSE CODE</strong></td>
</tr>
<tr>
<td><strong>SEMESTER</strong></td>
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<tr>
<td><strong>COURSE TITLE</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>INDEPENDENT TEACHING ACTIVITIES</th>
<th>WEEKLY TEACHING HOURS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures / Labs / Exercises</td>
<td>4</td>
<td>7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COURSE TYPE</th>
<th>Specialised general knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>PREREQUISITE COURSES:</td>
<td>NO</td>
</tr>
<tr>
<td>LANGUAGE OF INSTRUCTION and EXAMINATIONS:</td>
<td>Greek</td>
</tr>
<tr>
<td>IS THE COURSE OFFERED TO ERASMUS STUDENTS</td>
<td>YES</td>
</tr>
<tr>
<td><strong>COURSE WEBSITE (URL)</strong></td>
<td><a href="http://www.cse.uoi.gr/~stergios/teaching/l4">http://www.cse.uoi.gr/~stergios/teaching/l4</a></td>
</tr>
</tbody>
</table>

### 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](http://www.cse.uoi.gr/~stergios/teaching/l4)
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.

USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, 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

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<tr>
<th>Activity</th>
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</thead>
<tbody>
<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>148 hours</td>
</tr>
<tr>
<td>Course total</td>
<td>200 hours</td>
</tr>
</tbody>
</table>

STUDENT PERFORMANCE EVALUATION

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

<table>
<thead>
<tr>
<th>SCHOOL</th>
<th>SCHOOL OF ENGINEERING</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACADEMIC UNIT</td>
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</tr>
<tr>
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<td>COURSE TITLE</td>
<td>High Performance Systems and Software</td>
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</table>

INDEPENDENT TEACHING ACTIVITIES

<table>
<thead>
<tr>
<th>WEEKLY TEACHING HOURS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures / Labs</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>7</td>
</tr>
</tbody>
</table>

COURSE TYPE

Special background

general background,
special background, specialised general
knowledge, 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

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
- 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...

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

<table>
<thead>
<tr>
<th>DELIVERY</th>
<th>Face-to-face class lectures</th>
</tr>
</thead>
</table>
| USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY | • 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

<table>
<thead>
<tr>
<th>Activity</th>
<th>Semester workload</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures</td>
<td>13*3 = 39 hours</td>
</tr>
<tr>
<td>Labs</td>
<td>13*1 = 13 hours</td>
</tr>
<tr>
<td>Self-study</td>
<td>123 hours</td>
</tr>
<tr>
<td><strong>Course total</strong></td>
<td><strong>175 hours</strong></td>
</tr>
</tbody>
</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, etc.

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

**ATTACHED BIBLIOGRAPHY**

- Suggested bibliography:
  - P.S. Pacheco, *Εισαγωγή στον παράλληλο προγραμματισμό*, Κλειδάριθμος 2015
  - B. Wilkinson and M. Allen, *Parallel Programming: Techniques and Applications Using*
- Related academic journals:

- Transactions on Parallel and Distributed Systems, IEEE.
- 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

<table>
<thead>
<tr>
<th>SCHOOL</th>
<th>ENGINEERING</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACADEMIC UNIT</td>
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</tr>
<tr>
<td>LEVEL OF STUDIES</td>
<td>POSTGRADUATE</td>
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<td>COURSE CODE</td>
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<td>SEMESTER</td>
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</tr>
<tr>
<td>COURSE TITLE</td>
<td>Supervised Study</td>
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</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>WEEKLY TEACHING HOURS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>7</td>
</tr>
</tbody>
</table>

Courses 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.

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

<table>
<thead>
<tr>
<th>COURSE TYPE</th>
<th>Skills development</th>
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</thead>
<tbody>
<tr>
<td>general background, special background, specialised general knowledge, skills development</td>
<td></td>
</tr>
</tbody>
</table>

PREREQUISITE COURSES:

- 

LANGUAGE OF INSTRUCTION and EXAMINATIONS:

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<thead>
<tr>
<th>LANGUAGE OF INSTRUCTION</th>
<th>GREEK</th>
</tr>
</thead>
</table>

BS 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.
- Abstraction ability for problem modeling.
- Working in an interdisciplinary environment.
- Production of free, creative and inductive thinking.
- Respect for difference and multiculturalism.
- Productive thinking with a productive attitude.
- Project planning and management.
- Respecting the natural environment.
- Sensitivity to gender issues.
- Criticism and self-criticism.
- Production of free, creative and inductive thinking.
- Production of new research ideas.
- Working in an international environment.
- Respect for the natural environment.
- Showing social, professional and ethical responsibility and sensitivity to gender issues.
- Others...

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 pursues 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.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Semester workload</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elaboration of study/work and writing of results</td>
<td>150 hours</td>
</tr>
<tr>
<td>Meetings with the supervisor</td>
<td>25 hours</td>
</tr>
<tr>
<td>Course total</td>
<td>175 hours</td>
</tr>
</tbody>
</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

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

<table>
<thead>
<tr>
<th>SCHOOL</th>
<th>ENGINEERING</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACADEMIC UNIT</td>
<td>DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING</td>
</tr>
<tr>
<td>LEVEL OF STUDIES</td>
<td>GRADUATE</td>
</tr>
<tr>
<td>COURSE CODE</td>
<td>X3</td>
</tr>
<tr>
<td>SEMESTER</td>
<td></td>
</tr>
<tr>
<td>COURSE TITLE</td>
<td>Teaching Practice I</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>WEEKLY TEACHING HOURS</th>
<th>CREDITS</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>6</td>
</tr>
</tbody>
</table>

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

[61]
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

<table>
<thead>
<tr>
<th>Skills development</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adapting to new situations</td>
</tr>
<tr>
<td>Decision-making</td>
</tr>
<tr>
<td>Working independently</td>
</tr>
<tr>
<td>Team work</td>
</tr>
<tr>
<td>Showing social, professional and ethical responsibility and sensitivity to gender issues</td>
</tr>
</tbody>
</table>

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...

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

<table>
<thead>
<tr>
<th>DELIVERY</th>
<th>-</th>
</tr>
</thead>
<tbody>
<tr>
<td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY</td>
<td>● Use of email and social media for information exchange and improved communication with students.</td>
</tr>
<tr>
<td>Use of ICT in teaching, laboratory education, communication with students</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TEACHING METHODS</th>
<th>Activity</th>
<th>Semester workload</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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>
<thead>
<tr>
<th>Activity</th>
<th>Semester workload</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teaching Practice</td>
<td>150 hours</td>
</tr>
</tbody>
</table>

Course total 150 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

The successful completion of Teaching Practice is certified by the course instructor and offers students 6 credits.
ATTACHED BIBLIOGRAPHY
- Suggested bibliography:
- Related academic journals:
X4. Teaching Practice II

COURSE OUTLINE

GENERAL

<table>
<thead>
<tr>
<th>SCHOOL</th>
<th>ENGINEERING</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACADEMIC UNIT</td>
<td>DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING</td>
</tr>
<tr>
<td>LEVEL OF STUDIES</td>
<td>GRADUATE</td>
</tr>
<tr>
<td>COURSE CODE</td>
<td>X4</td>
</tr>
<tr>
<td>SEMESTER</td>
<td></td>
</tr>
<tr>
<td>COURSE TITLE</td>
<td>Teaching Practice II</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>WEEKLY TEACHING HOURS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>

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

COURSE TYPE

Skills Development

general background, special background, specialised general knowledge, 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...

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 |

| Activity | Semester workload |
| Teaching Practice | 50 hours |

| Course total | 50 hours |

| 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

<table>
<thead>
<tr>
<th>SCHOOL</th>
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</thead>
<tbody>
<tr>
<td>ACADEMIC UNIT</td>
<td>DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING</td>
</tr>
<tr>
<td>LEVEL OF STUDIES</td>
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<tr>
<td>SEMESTER</td>
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</table>

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

<table>
<thead>
<tr>
<th>WEEKLY TEACHING HOURS</th>
<th>CREDITS</th>
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</thead>
<tbody>
<tr>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

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

COURSE TYPE

Special Background

general background, special background, specialised general knowledge, skills development

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-criticim  
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

<table>
<thead>
<tr>
<th>DELIVERY</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Face-to-face, Distance learning, etc.</td>
<td>-</td>
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</tbody>
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<table>
<thead>
<tr>
<th>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY</th>
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</thead>
<tbody>
<tr>
<td>Use of ICT in teaching, laboratory education, communication with students</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TEACHING METHODS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>The manner and methods of teaching are described in detail.</td>
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</tr>
<tr>
<td>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.</td>
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</tr>
<tr>
<td>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>
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</table>

<table>
<thead>
<tr>
<th>Activity</th>
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<tbody>
<tr>
<td>Seminars</td>
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Course total 75 hours

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<tr>
<th>METHODS OF EVALUATION</th>
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<tbody>
<tr>
<td>The students' evaluation is based on the attendance at the seminars organised by the Department.</td>
<td></td>
</tr>
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</table>
students.

ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- Related academic journals:
X6. Seminar II

COURSE OUTLINE

GENERAL

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<thead>
<tr>
<th>SCHOOL</th>
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<tbody>
<tr>
<td>ACADEMIC UNIT</td>
<td>DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING</td>
</tr>
<tr>
<td>LEVEL OF STUDIES</td>
<td>GRADUATE</td>
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<td>COURSE CODE</td>
<td>X6</td>
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<tr>
<td>SEMESTER</td>
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</table>

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.

<table>
<thead>
<tr>
<th>WEEKLY TEACHING HOURS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3</td>
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</table>

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

<table>
<thead>
<tr>
<th>COURSE TYPE</th>
<th>Special Background</th>
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<tbody>
<tr>
<td>general background,</td>
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<tr>
<td>special background,</td>
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<tr>
<td>specialised general</td>
<td></td>
</tr>
<tr>
<td>knowledge, skills</td>
<td></td>
</tr>
<tr>
<td>development</td>
<td></td>
</tr>
</tbody>
</table>

PREREQUISITE COURSES:

- No

<table>
<thead>
<tr>
<th>LANGUAGE OF INSTRUCTION and EXAMINATIONS:</th>
<th>GREEK/ENGLISH</th>
</tr>
</thead>
</table>

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
- 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

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 | - |
| USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY | - |
| 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>
<thead>
<tr>
<th>Activity</th>
<th>Semester workload</th>
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</thead>
<tbody>
<tr>
<td>Seminars</td>
<td>75 hours</td>
</tr>
<tr>
<td>Course total</td>
<td>75 hours</td>
</tr>
</tbody>
</table>

METHODS OF EVALUATION

The students' evaluation is based on the attendance at the seminars organised by the Department.
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

<table>
<thead>
<tr>
<th>SCHOOL</th>
<th>ENGINEERING</th>
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<tbody>
<tr>
<td>ACADEMIC UNIT</td>
<td>DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING</td>
</tr>
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<tr>
<td>COURSE TITLE</td>
<td>Practical Training</td>
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</table>

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

<table>
<thead>
<tr>
<th>WEEKLY TEACHING HOURS</th>
<th>CREDITS</th>
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<tbody>
<tr>
<td>3.5</td>
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</tbody>
</table>

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

COURSE TYPE

Skills Development

general background, special background, specialised general knowledge, 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 | Others... |
| Production of new research ideas | Others... |

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 | - |
| USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY | - |

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>
<thead>
<tr>
<th>Activity</th>
<th>Semester workload</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practical Training</td>
<td>87.5 hours</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>SCHOOL</th>
<th>ENGINEERING</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACADEMIC UNIT</td>
<td>DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING</td>
</tr>
<tr>
<td>LEVEL OF STUDIES</td>
<td>GRADUATE</td>
</tr>
<tr>
<td>COURSE CODE</td>
<td>MSc THESES</td>
</tr>
<tr>
<td>SEMESTER</td>
<td>=&gt;2</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>WEEKLY TEACHING HOURS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30</td>
</tr>
</tbody>
</table>

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

COURSE TYPE

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 | Others… |
| 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**

<table>
<thead>
<tr>
<th>DELIVERY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face-to-face supervision from a faculty member</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of ICT in teaching, laboratory education, communication with students</td>
</tr>
<tr>
<td>- Bibliographic search and result integration via the exploitation of online libraries</td>
</tr>
<tr>
<td>- Use of cutting-edge techniques and tools</td>
</tr>
</tbody>
</table>

[77]
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>
<thead>
<tr>
<th>Activity</th>
<th>Semester workload</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bibliographic search and integration</td>
<td>150</td>
</tr>
<tr>
<td>Solution Design</td>
<td>150</td>
</tr>
<tr>
<td>Solution Implementation</td>
<td>300</td>
</tr>
<tr>
<td>Compilation of the final report</td>
<td>150</td>
</tr>
<tr>
<td><strong>Course total</strong></td>
<td><strong>750 hours</strong></td>
</tr>
</tbody>
</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, etc.

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:
  - MSc Thesis Template, by the Department

- Related academic journals: