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

ACADEMIC YEAR 2018/2019
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A1. Algorithmic Graph Theory

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>A1</td>
</tr>
<tr>
<td>SEMESTER</td>
<td></td>
</tr>
<tr>
<td>COURSE TITLE</td>
<td>ALGORITHMIC GRAPH THEORY</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/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

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>
<td>Use of ICT in teaching, laboratory education, communication with students</td>
</tr>
<tr>
<td>Use of projector and interactive board during lectures.</td>
<td></td>
</tr>
<tr>
<td>- Course website maintenance. Announcements and posting of teaching material (lecture slides and notes, programs).</td>
<td></td>
</tr>
<tr>
<td>- Announcement of assessment marks via the e-course platform by UOI.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TEACHING METHODS</th>
</tr>
</thead>
<tbody>
<tr>
<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 workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.</td>
</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>
</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>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

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

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

**ATTACHED BIBLIOGRAPHY**

A2. Algorithms for Data Science

COURSE OUTLINE

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<table>
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<th>SCHOOL</th>
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<tr>
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<tr>
<td>LEVEL OF STUDIES</td>
<td>GRADUATE</td>
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<tr>
<td>COURSE CODE</td>
<td>A2</td>
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<tr>
<td>SEMESTER</td>
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</tr>
<tr>
<td>COURSE TITLE</td>
<td>ALGORITHMS FOR DATA SCIENCE</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.

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<tr>
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<td></td>
<td>4</td>
</tr>
<tr>
<td></td>
<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

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

PREREQUISITE COURSES:

NO

LANGUAGE OF INSTRUCTION and EXAMINATIONS:

Greek

IS THE COURSE OFFERED TO ERASMUS STUDENTS:

YES

COURSE WEBSITE (URL)

LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

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

After attending the course students should be able to:

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

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Project planning and management
- Respect for difference and multiculturalism
- Respect for the natural environment
- 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

- 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

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<th>DELIVERY</th>
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<td>Course website maintenance. Announcements and posting of teaching material (lecture slides and notes, programs).</td>
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<td></td>
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</tr>
</tbody>
</table>

#### Activity

<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>Laboratory practice</td>
<td>$13 \times 1 = 13$ 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>

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

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

**ATTACHED BIBLIOGRAPHY**

D1. Machine Learning

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</td>
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<td>COURSE CODE</td>
<td>D1</td>
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<td>SEMESTER</td>
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<tr>
<td>COURSE TITLE</td>
<td>MACHINE LEARNING</td>
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</table>

INDEPENDENT TEACHING ACTIVITIES

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

- Special background

PREREQUISITE COURSES:

- 

LANGUAGE OF INSTRUCTION and EXAMINATIONS:

- GREEK

IS THE COURSE OFFERED TO ERASMUS STUDENTS:

- YES

COURSE WEBSITE (URL)


LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area
- Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B
- Guidelines for writing Learning Outcomes

The objective of this course is to provide a detailed description of machine learning problems and solutions. The main problems presented and studied are related to supervised learning (classification, regression), unsupervised learning (clustering, dimensionality reduction, density estimation) and reinforcement learning. 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 machine learning 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 such SVMs, deep neural networks, Gaussian Processes, mixture models.
- the skill to apply all the algorithmic steps required for building machine learning...
models 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?

<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>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>
</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
- Team work
- Algorithmic thinking
- Apply research results in solving practical problems
- Literature studying and management

**SYLLABUS**


**TEACHING and LEARNING METHODS - EVALUATION**

<table>
<thead>
<tr>
<th>DELIVERY</th>
<th>Weekly Lectures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face-to-face, Distance learning, etc.</td>
<td>Use of projector during lectures.</td>
</tr>
<tr>
<td></td>
<td>Method demonstration using demos and videos.</td>
</tr>
<tr>
<td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY</td>
<td>Course website maintenance. Announcements and posting of teaching material (lecture slides and notes, programs).</td>
</tr>
<tr>
<td>Use of ICT in teaching, laboratory education, communication with students</td>
<td>Use of email to improve 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 as follows:

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

The student’s study hours for each learning activity are as follows:
activity are given as well as the hours of non-directed study according to the principles of
the ECTS

| Course total | 175 hours |

**STUDENT PERFORMANCE EVALUATION**

*Description of the evaluation procedure*

Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other

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

**LANGUAGE OF EVALUATION:** Greek

**METHODS OF EVALUATION**

(i) Final exams
(ii) Project

**ATTACHED BIBLIOGRAPHY**

- Suggested bibliography:
D5. Computer Vision

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>D5</td>
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<tr>
<td>SEMESTER</td>
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<tr>
<td>COURSE TITLE</td>
<td>Computer Vision</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)


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
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- Guidelines for writing Learning Outcomes

Upon completion of this course, students will:

- Have acquired the intuition behind understanding the 3D world from images
- Be familiar with both the theoretical and practical aspects of computing with images
- Have described the foundation of image formation, measurement, and analysis
- Have implemented common methods for robust image matching and alignment
- Understand the geometric relationships between 2D images and the 3D world
- Have gained exposure to object and scene recognition and categorization from images
- Grasp the principles of state-of-the-art regression and classification methods in computer vision
• Have developed the practical skills necessary to build computer vision applications.

**General Competences**

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

| Search for, analysis and synthesis of data and information, with the use of the necessary technology | 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 multiculturalism |
| Team work | 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 | Others… |

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

**SYLLABUS**

• Linear filtering
• Edge detection
• Frequency representation, image pyramids, template matching
• Local features: corners
• Local features: scale and interest point descriptors
• Machine learning for computer vision
• Segmentation by clustering: mean shift
• Segmentation by clustering: normalized cut
• Segmentation by fitting a model: Hough transform and least squares fitting
• Segmentation by fitting a model: robust estimators and RANSAC
• Registration
• PCA and eigenfaces
• Face detection
• Fitting probability models
• Learning and inference in computer vision
• The pinhole camera
• Singular value decomposition
• Models for transformations
• Multiple cameras
• More features (LBP, shape context, dual PCA)
• Models for grids (grpah cut)
• Regression
TEACHING and LEARNING METHODS - EVALUATION

<table>
<thead>
<tr>
<th>DELIVERY</th>
<th>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face-to-face, Distance learning, etc.</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>
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<tr>
<th>Activity</th>
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<tbody>
<tr>
<td>Lectures</td>
<td>13x3=39 hours</td>
</tr>
<tr>
<td>Labs</td>
<td>13x1=13 hours</td>
</tr>
<tr>
<td>Student’s autonomous study of the theory, problem solving and response to homework assignments</td>
<td>123 hours</td>
</tr>
<tr>
<td>Course total</td>
<td>175 hours</td>
</tr>
</tbody>
</table>

STUDENT PERFORMANCE EVALUATION

Language of evaluation: Greek

Methods of Evaluation:

iv) Weekly lab and theoretical assignments
v) Mid-term examination
vi) Final examination

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

ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- Related academic journals:

IEEE Transactions on Pattern Analysis and Machine Intelligence
<table>
<thead>
<tr>
<th>International Journal of Computer Vision</th>
</tr>
</thead>
<tbody>
<tr>
<td>IEEE Transactions on Image Processing</td>
</tr>
<tr>
<td>Image and Vision Computing</td>
</tr>
<tr>
<td>Computer Vision and Image Understanding</td>
</tr>
<tr>
<td>Pattern Recognition</td>
</tr>
<tr>
<td>Journal of Mathematical Imaging and Vision</td>
</tr>
<tr>
<td>Machine Vision and Applications</td>
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D6. Online Social Networks and Media

COURSE OUTLINE

GENERAL

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INDEPENDENT TEACHING ACTIVITIES

<table>
<thead>
<tr>
<th>Lectures / Exercises/ Project</th>
<th>WEEKLY TEACHING HOURS</th>
<th>CREDITS</th>
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<td>7</td>
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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/~tsap/teaching/cs-l14/

LEARNING OUTCOMES

Learning outcomes

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- 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
- 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

- 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></td>
</tr>
<tr>
<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>
<td></td>
</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>
<td></td>
</tr>
<tr>
<td>Activity</td>
<td>Semester workload</td>
</tr>
<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>
<tr>
<td>Course total</td>
<td>175 hours</td>
</tr>
</tbody>
</table>

STUDENT PERFORMANCE EVALUATION

Language of evaluation: Greek or English

Methods of Evaluation:
- vii) Assignments
- viii) Presentation
| open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other | ix) Final project
The evaluation procedure is accessible to students via the course website. |

ATTACHED BIBLIOGRAPHY
Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A
- Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area
- Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B
- Guidelines for writing Learning Outcomes

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

- Describe the structure and operational characteristics of a pipelined microprocessor.
- Demonstrate an understanding of pipeline hazards and interlocks, out-of-order execution, scoreboards and reservation tables, branch prediction
- Evaluate the performance of a processor and memory system.
- Describe the memory coherency issues involved when designing a multiprocessor system, and explain the behaviour of a typical cache coherency protocol.
- Adapt existing simulators, run simulations and present a critical evaluation of the results.
General Competences
Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

| Search for, analysis and synthesis of data and information, with the use of the necessary technology | Project planning and management |
| Adapting to new situations | Respect for difference and multiculturalism |
| Decision-making | Respect for the natural environment |
| Working independently | Showing social, professional and ethical responsibility and sensitivity to gender issues |
| 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 | Others... |

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

SYLLABUS


Pipelined processor organization: Instruction dependencies, pipeline hazards, data forwarding, pipeline stall, delayed branches. Code scheduling.


Out of order execution. Speculative execution. Branch prediction.


Parallel systems: Shared-memory multicore systems. Memory coherence, memory consistency.

TEACHING and LEARNING METHODS - EVALUATION

<table>
<thead>
<tr>
<th>DELIVERY</th>
<th>Lectures, Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY</td>
<td>Use of projector and interactive board during lectures.</td>
</tr>
<tr>
<td>Use of special electronic equipment and software for delivering the project.</td>
<td></td>
</tr>
<tr>
<td>Course website maintenance. Announcements and posting of teaching material (lecture slides and notes, programs).</td>
<td></td>
</tr>
<tr>
<td>Announcement of assessment marks via the ecourse platform by UOI.</td>
<td></td>
</tr>
<tr>
<td>Use of email for information exchange and improved 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</td>
<td>13 * 3 = 39 hours</td>
<td></td>
</tr>
</tbody>
</table>
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>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tutorials</td>
<td></td>
</tr>
<tr>
<td>Project</td>
<td>10*2 = 20 hours</td>
</tr>
<tr>
<td>Self-study</td>
<td>116 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, 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.
H3. 3D Systems on Chip

COURSE OUTLINE

GENERAL

<table>
<thead>
<tr>
<th>SCHOOL</th>
<th>DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACADEMIC UNIT</td>
<td>SCHOOL OF ENGINEERING</td>
</tr>
<tr>
<td>LEVEL OF STUDIES</td>
<td>GRADUATE</td>
</tr>
<tr>
<td>COURSE CODE</td>
<td>H3</td>
</tr>
<tr>
<td>SEMESTER</td>
<td>-</td>
</tr>
<tr>
<td>COURSE TITLE</td>
<td>3D SYSTEMS ON CHIP</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>3+1</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

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 students acquire the basic knowledge on the design and test of 3-Dimensional Systems-on-Chip. Initially they understand the 2D limitations that led to the 3D integration and then they study the basic mechanisms for solving such problems. The students emphasize on the design, manufacturing and test methods proposed to attack electrical, temperature and power-dissipation issues in 3D stacks, while at the same time they face problems related to the embedding of multiple cores/memory and they understand the proposed solutions for each case. Finally, they study applications of 3D manufacturing.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Adapting to new situations
- Decision-making
- Working independently
- Team work
- Project planning and management
- Respect for difference and multiculturalism
- Respect for the natural environment
- Showing social, professional and ethical responsibility and sensitivity to gender issues
- Criticism and self-criticism
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
- Analysis of requirements for problem solving

SYLLABUS


TEACHING and LEARNING METHODS - EVALUATION

<table>
<thead>
<tr>
<th>DELIVERY</th>
<th>Lectures</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FACE-TO-FACE, DISTANCE LEARNING, ETC.</strong></td>
<td>The teaching is performed through powerpoint slides and the communication is conducted by electronic means (ecourse, email etc)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY</strong></th>
<th>Lectures</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Use of ICT in teaching, laboratory education, communication with students</em></td>
<td>Lectures (13x3)</td>
</tr>
<tr>
<td><strong>TEACHING METHODS</strong></td>
<td>Tutorials (13x1)</td>
</tr>
<tr>
<td><em>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.</em></td>
<td>Labs -</td>
</tr>
<tr>
<td><em>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</em></td>
<td>Self-study (123)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>STUDENT PERFORMANCE EVALUATION</strong></th>
<th>Course total: 175 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DESCRIPTION OF THE EVALUATION PROCEDURE</strong></td>
<td><strong>LANGUAGE OF EVALUATION</strong>: Greek / English</td>
</tr>
<tr>
<td><em>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</em></td>
<td><strong>METHOD OF EVALUATION</strong>: Written Exam</td>
</tr>
<tr>
<td><em>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</em></td>
<td></td>
</tr>
</tbody>
</table>
ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- 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
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></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 / Tutorials</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

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

Specialized general knowledge

PREREQUISITE COURSES:

- 

LANGUAGE OF INSTRUCTION AND EXAMINATIONS:

GREEK

IS THE COURSE OFFERED TO ERASMUS STUDENTS

YES

COURSE WEBSITE (URL)


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?

<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>Team work</td>
<td>Showing social, professional and ethical responsibility 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>

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

SYLLABUS

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

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

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

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

TEACHING and LEARNING METHODS - EVALUATION

<table>
<thead>
<tr>
<th>DELIVERY</th>
<th>Lectures, lab courses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY</strong></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>$13 \times 3 = 39$ hours</td>
</tr>
<tr>
<td>Labs</td>
<td>$13 \times 1 = 13$ 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, other
Specifically-defined evaluation criteria are given, and if and where they are accessible to students.

LANGUAGE OF EVALUATION: Greek
METHODS OF EVALUATION
(i) Final written examination.
(ii) Project.
The evaluation procedure is accessible to students via the course website.

ATTACHED BIBLIOGRAPHY
-Suggested bibliography in Greek:
- 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.
S1. Software & Data Evolution

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</td>
</tr>
<tr>
<td>COURSE CODE</td>
<td>S1</td>
</tr>
<tr>
<td>SEMESTER</td>
<td></td>
</tr>
<tr>
<td>COURSE TITLE</td>
<td>SOFTWARE &amp; DATA EVOLUTION</td>
</tr>
</tbody>
</table>

INDEPENDENT TEACHING ACTIVITIES

| Lectures / Tutorials | 3/1 | 7 |

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

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

- Understand the state-of-the-art and the historical evolution of research in the area under study.
- Understand in depth the critical steps in the process of re-engineering.
- Reverse engineer an existing system and produce (a) an abstract model of the system and (b) the appropriate documentation that goes along with the abstract model.
- Identify symptoms of bad design and rigidity and prioritize them in terms of re-engineering.
- Understand the role of re-engineering patterns in the process of software maintenance, their interrelationships and tradeoffs.
- Design specific solutions for the identified problems and assess both the “forces” that constrain the solution space as well as the trade-offs that each candidate solution incurs.
- Acquire hands-on experience by developing a complete project wherein they apply the design and algorithmic knowledge obtained from the course in order to re-engineer an existing complex software system.
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
- Working independently
- Working in an international environment
- Working in an interdisciplinary environment
- Production of new research ideas

... Others...

- Production of free, creative and inductive thinking
- Decision making
- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Team work
- Algorithmic thinking
- Abstraction ability for problem modeling
- Apply research results in solving practical problems
- Literature studying and management

SYLLABUS

The course Software and Data Evolution offers an in-depth coverage of a core topic within the broader field of information systems engineering -- specifically, the evolution and re-engineering of software and data. The course starts by reviewing software evolution in general. Then, it proceeds to cover in an in-depth analysis, the area of the re-engineering of legacy software. The course presents the general method of re-engineering a legacy system into a new, well-designed and maintainable object-oriented system. Then, the particular steps of the method, along with patterns and anti-patterns are covered: reverse engineering, abstract modeling of an OO system, identification of bad design symptoms, re-engineering patterns and forces. The course moves on to cover the evolution of data, and presents typical patterns by which database schemata evolve, and techniques to handle schema evolution.

A team project where a large and complex software system is re-engineered accompanies the theoretical lecturing.

TEACHING and LEARNING METHODS - EVALUATION

| DELIVERY | Weekly Lectures
| --- | --- |
| USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY | Use of projector during lectures.  
Course website maintenance. Announcements and posting of teaching material (lecture slides and notes, programs).  
Use of email to improve communication with students. |

<table>
<thead>
<tr>
<th>TEACHING METHODS</th>
<th>Activity</th>
<th>Semester workload</th>
</tr>
</thead>
<tbody>
<tr>
<td>The manner and methods of teaching are</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>
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>
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<tr>
<th>Activity</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures</td>
<td>13*3 = 39 hours</td>
</tr>
<tr>
<td>Tutorials</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) A large programming assignment in groups (project).

(ii) At each lecture, the students are asked to be prepared on the material of the lecture and to participate in the critical discussions that arise concerning their project. Moreover, the students are regularly required to report on intermediate milestones of their project.

(iii) Each student is assigned either (a) a data analysis task or (b) a literature survey, on topics relevant to the material of the course. The assignment involves the authoring of a report, to be publicly presented in class at the end of the semester.

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

**ATTACHED BIBLIOGRAPHY**

- Suggested bibliography:

  Design Patterns: Elements of Reusable Object-Oriented Software, E. Gamma, R. Helm, Richard, R. Johnson, Ralph, J. Vlissides, Addison-Wesley, ISBN 0-201-63361-2.
S3. Cloud Computing 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 &amp; ENGINEERING</td>
</tr>
<tr>
<td>LEVEL OF STUDIES</td>
<td>GRADUATE</td>
</tr>
<tr>
<td>COURSE CODE</td>
<td>S3</td>
</tr>
<tr>
<td>SEMESTER</td>
<td></td>
</tr>
<tr>
<td>COURSE TITLE</td>
<td>CLOUD COMPUTING 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 / Labs / Exercises</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>7</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://www.cse.uoi.gr/~stergios/teaching/l3

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 cloud computing systems. Examined issues include cluster management, virtualization, data storage and networking, dataflow processing, heterogeneous systems, and cloud security.
- 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 experimental evaluation of modern cloud computing 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
- 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

- 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 and implementation of cloud computing systems, such as communication, synchronization, scheduling, dependability, data storage, security.
- The syllabus is adjusted every year according to the latest publications of the related literature published in international conferences and journals.

TEACHING and LEARNING METHODS - EVALUATION

DELIVERY

Face-to-face, Distance learning, etc.

Face-to-face

USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY

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

- Lecture slides
- Web page maintenance with bibliography and other course material.
- 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

STUDENT PERFORMANCE EVALUATION

Description of the evaluation procedure

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...
<table>
<thead>
<tr>
<th>public presentation, laboratory work, clinical examination of patient, art interpretation, other</th>
<th>the course website.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</td>
<td></td>
</tr>
</tbody>
</table>

**ATTACHED BIBLIOGRAPHY**

- ACM Symposium on Cloud Computing
- ACM Symposium on Operating Systems Principles
- ACM SIGCOMM Conference
- ACM European Conference on Computer Systems
- USENIX Annual Technical Conference
- USENIX Symposium on Operating Systems Design and Implementation
- USENIX Symposium on Network Systems Design and Implementation
- IEEE Computer
- Communications of the ACM
S5. Mobile and Wireless Networks

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>
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<td>LEVEL OF STUDIES</td>
<td>POSTGRADUATE</td>
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<td>COURSE CODE</td>
<td>S5</td>
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<tr>
<td>SEMESTER</td>
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<td>COURSE TITLE</td>
<td>Mobile and Wireless Networks</td>
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</table>

INDEPENDENT TEACHING ACTIVITIES

<table>
<thead>
<tr>
<th>COURSE TYPE</th>
<th>LECTURES / TUTORIALS</th>
<th>WEEKLY TEACHING HOURS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3/1</td>
<td></td>
<td>7</td>
</tr>
</tbody>
</table>

PREREQUISITE COURSES:

- 

LANGUAGE OF INSTRUCTION and EXAMINATIONS:

GREEK

IS THE COURSE OFFERED TO ERASMUS STUDENTS:

YES

COURSE WEBSITE (URL)

http://www.cs.uoi.gr/~epap/L05

LEARNING OUTCOMES

The course offers an insight into wireless and mobile networking. To this end, the course will analyze the most well-known technologies for wireless and mobile networks as well as the users’ needs met by each technology. The course also focuses on new trends in building wireless and mobile networks. After successfully completing the course, a student should be able to:

- understand the basic challenges in wireless and mobile networking
- understand the basic architectures and networking technologies implemented in real-life wireless mobile networks as well as the users’ needs that each of these technologies meets
- comprehend the basic networking mechanisms and how these mechanisms influence the network’s performance
- be able to evaluate the performance of a network in the context of limited
resources that are available in a mobile node

- be able to identify open issues and challenges and propose possible solutions

**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
- Team work
- Algorithmic thinking
- Apply research results in solving practical problems
- Literature studying and management
- Abstraction ability for problem modeling
- Working independently

**SYLLABUS**

The course focuses on the key enabling technologies for wireless and mobile networks and delineates their fundamental operating principles. In the first part, the course examines the dominant technologies in the field of wide area and metropolitan area infrastructured networks such as LTE and WiMAX. Then, the course focuses on ad hoc networks, such as Mobile Ad Hoc Networks (MANETs) and opportunistic networks, as well as on Delay Tolerant Networking (DTN). Finally, the course discusses key technologies proposed in the context of 5G networks. Summarizing, the following technologies will be examined during the course:

- 4G Networks and LTE
- Wireless Metropolitan Access Networks (WiMAX)
- Mobile Ad Hoc Networks (MANETs) and Opportunistic Networks, Mobile Social Networks
- Delay Tolerant Networks (DTNs)
- Machine-to-Machine Communication (M2M), Internet of Things (IoT) in 5G Networks
- Software Defined Networking (SDN), Network Slicing

**TEACHING and LEARNING METHODS - EVALUATION**

<table>
<thead>
<tr>
<th>DELIVERY</th>
<th>Weekly Lectures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face-to-face, Distance learning, etc.</td>
<td></td>
</tr>
</tbody>
</table>
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY

- Use of projector during lectures.
- Course website maintenance. Announcements and posting of teaching material (lecture slides and notes, programs).
- Use of email to improve 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>
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</thead>
<tbody>
<tr>
<td>Lectures</td>
<td>(13 \times 3 = 39) hours</td>
</tr>
<tr>
<td>Tutorials</td>
<td>(13 \times 1 = 13) hours</td>
</tr>
<tr>
<td>Self-study</td>
<td>123 hours</td>
</tr>
<tr>
<td></td>
<td><strong>Course total</strong></td>
</tr>
</tbody>
</table>

STUDENT PERFORMANCE EVALUATION

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

(iii) Final exams
(iv) Project

ATTACHED BIBLIOGRAPHY

- Suggested bibliography:
  - Scholarly articles published in the relevant scientific journals

- Relevant scientific journals
  - IEEE/ACM Transactions on Networking
  - IEEE Transactions on Mobile computing
  - IEEE Transactions on Wireless Communications
  - IEEE JOURNAL ON SELECTED AREAS IN COMMUNICATIONS (J-SAC)
  - Elsevier Ad Hoc Networks
S7. Computer Graphics and Game Development

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</td>
</tr>
<tr>
<td>COURSE CODE</td>
<td>S7</td>
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<tr>
<td>COURSE TITLE</td>
<td>COMPUTER GRAPHICS AND GAME DEVELOPMENT</td>
</tr>
</tbody>
</table>

INDEPENDENT TEACHING ACTIVITIES

<table>
<thead>
<tr>
<th>WEEKLY TEACHING HOURS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures /Laboratory exercises</td>
<td>3/1</td>
</tr>
</tbody>
</table>

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

COURSE TYPE

Special background

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

With the successful completion of the course, students will:

acquire all background and foundations for computer graphics and game development,

be able to design and develop 3D graphics software,

be able to design and develop computer games.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology

Project planning and management

Adapting to new situations

Respect for difference and multiculturalism

Decision-making

Respect for the natural environment

Working independently

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

Team work

Criticism and self-criticism

Working in an international environment

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

- Production of free, creative and inductive thinking
- Decision-making
- Criticism and self-criticism
- Project planning and management
- Working in an interdisciplinary environment
- Production of new research ideas
- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Adapting to new situations
- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Team work

SYLLABUS

Computer graphics principles, libraries and development tools for computer graphics, 3D and 2D representations for objects, the rendering pipeline, textures, shadows and illumination, photorealistic and non-photorealistic rendering, techniques for fast computer graphics algorithms, computing intersections in real time graphics, collision detection, animation, computer graphics and game engine, shaders and GPUs, game design, game development, low poly for games, pseudo-photorealism, crowd simulation.

Term project for designing and developing a game.

TEACHING and LEARNING METHODS - EVALUATION

<table>
<thead>
<tr>
<th>DELIVERY</th>
<th>Weekly Lectures</th>
</tr>
</thead>
<tbody>
<tr>
<td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY</td>
<td>Project website with online literature, tutorials, manuals and other reading material.</td>
</tr>
<tr>
<td></td>
<td>Use of asynchronous e-learning platform for discussion for a, online turn-in, wiki reporting, etc</td>
</tr>
<tr>
<td></td>
<td>Use of e-mailing lists and social media for</td>
</tr>
</tbody>
</table>
TEACHING METHODS

Communicating with students.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Semester workload</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures</td>
<td>13*3 = 39 hours</td>
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<tr>
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The manner and methods of teaching are described in detail. Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.

The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS.

STUDENT PERFORMANCE EVALUATION

Description of the evaluation procedure

Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, etc.

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

LANGUAGE OF EVALUATION: Greek/English

METHODS OF EVALUATION

(v) 2-3 homeworks
(vi) Term Project

ATTACHED BIBLIOGRAPHY

- Suggested bibliography:


- Scientific Journals and Magazines:
  - ACM Transactions on Computer Graphics
  - IEEE Transactions on Visualization and Computer Graphics
  - Visual Computer
  - Computer Graphics Forum
  - The Computer Games Journal
  - 3D Research