Undergraduate Programme:
Outlines of Elective Courses

ACADEMIC YEAR 2020-2021
Undergraduate Programme: Elective Courses

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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>UNDERGRADUATE</td>
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<tr>
<td>COURSE CODE</td>
<td>MYE001</td>
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<tr>
<td>SEMESTER</td>
<td>≥6</td>
</tr>
<tr>
<td>COURSE TITLE</td>
<td>Human Computer Interaction</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>3/2/0</td>
<td>5</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)

http://ecourse.uoi.gr/course/view.php?id=64

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

Learning principles, guidelines, rules and practices for developing interactive software. Awareness of IDEs, technologies, tools and libraries for GUI development. Training software engineers to develop user centered systems.

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

- Knowhow and skills for designing and developing interactive software.
- Understand the basic principles of Human Computer Interaction.
- Comprehend the principles, rules and practices for software usability.
- Learn how to measure software usability.
- Become acquainted with principles and methods for designing interactive software systems of high usability.
- Learn how to evaluate interactive software systems.
- Learn about the software implementation architectures for User Interface development.
- Acquire knowledge regarding the various tools, IDE, libraries that are available for developing UI.
- Understand the principles of interactivity in virtual reality.

**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 | Sensitivity to gender issues |
| Team work | Criticism and self-criticism |
| Working in an international environment | Production of free, creative and inductive thinking |
| Working in an interdisciplinary environment | ...... |
| Production of new research ideas | Others... |

- Production of free, creative and inductive thinking
- Team work
- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Analysis of requirements for problem solving
- Working independently
- Ability to design, develop and evaluate user centered software systems.

**SYLLABUS**

- Introduction. Issues and examples.
- Defining and measuring usability.
- Learnability.
- Theories, principles and guidelines.
- Interaction styles.
- Specifying the interaction protocol.
- Design considerations.
- Development and assessment.
- Error recovery.
- Adaptive systems. Prototyping.
- Alternative interaction methods and virtual reality.
- GUI development tools. Libraries and tools for building GUIs: IDE, visual editors, GUI libraries, web GUI development frameworks, prototyping tools, 3D GUIs. Term project.

**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></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY</th>
<th>Use of projector and interactive board during lectures.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of ICT in teaching, laboratory education,</td>
<td></td>
</tr>
</tbody>
</table>
communication with students

- 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 and forums for information exchange and improved communication with students.
- Use of asynchronous platform for distance learning (moodle)

**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>
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<tr>
<td>Labs</td>
<td>13*2 = 26 hours</td>
</tr>
<tr>
<td>Self-study</td>
<td>60 hours</td>
</tr>
</tbody>
</table>

Course total: 125 hours

**STUDENT PERFORMANCE EVALUATION**
Description of the evaluation procedure

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

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

**LANGUAGE OF EVALUATION:** Greek

**METHODS OF EVALUATION**
(i) Final examination, which includes questions for applying principles, theory and foundations to solve graphics problems. The exam papers are evaluated based on the correctness and completeness of answers.
(ii) One term take-home programming assignment: To design, develop and evaluate the interactive part (front end) of an interactive software system.

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

**ATTACHED BIBLIOGRAPHY**

- **Suggested bibliography:**
  **Book [12304]:** Dix Alan, Finlay Janet, Abowd Gregory D., Beale Russell. Επικοινωνία ανθρώπου – υπολογιστή, Έκδοση: 3η έκδ./2007,
  **Book [59366672]:** Εισαγωγή Στην Αλληλεπίδραση Ανθρώπου-Υπολογιστή, Ν. Αβούρης, Χ. Κατασάνος, Ν. Τσέλιος, Κ. Μουστάκας. Α Έκδοση.
  **Book:** M. J. Sebern. Building OSF/MOTIF Applications, A Practical Introduction. Prentice Hall,


- Related academic journals:
  - Communications of the ACM, ACM
  - IEEE Computer, IEEE
  - ACM Transactions of Human Computer Interaction, ACM
# 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>Undergraduate</td>
</tr>
<tr>
<td>Course Code</td>
<td>MYE002</td>
</tr>
<tr>
<td>Semester</td>
<td>(\geq 6)</td>
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</tbody>
</table>

**Course Title**: Machine Learning

**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>5</td>
<td>5</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

**Is the Course Offered to Erasmus Students**: Yes

**Course Website (URL)**: [http://www.cs.uoi.gr/~klekas/courses/ML/](http://www.cs.uoi.gr/~klekas/courses/ML/)

## Learning Outcomes

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

Consult Appendix A

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

This course aims to expose the students to Machine Learning problems and applications and also to methodologies and tools for analyzing patterns and solve them. Basic notions of statistical pattern analysis, Bayesian analysis and inference methods, decision theory, neural networks and discriminant analysis are introduced. At the end of this course, students will be able to analyze complex data, to model simple and complex pattern recognition problems, to establish a parametric learning mechanism and to construct a decision support system. Also, they will display knowledge and understanding of the mathematical theory underlying the main classes of constrained (mainly) optimisation problems and the practical contexts in which such problems may arise.

Students develop methods and techniques for pattern recognition in the laboratory using (mainly) the Python and Matlab programming environment as well as . The objective is to design and understand basic and advanced methods for data processing and analysis such as:

- Statistical analysis of data
• Clustering: discovering and constructing groups of data
• Classification: building statistical decision support systems,
• Using Neural Networks, Support Vector Machines, and advanced deep learning methods
• Regression: constructing function approximation approaches, and
• Dimension reduction: transformation methods for data and selecting most important features.

Another direction is to discover the possibilities of all these methods as tools for data handling and knowledge extraction. For this purpose students either develop their own routines, or apply ready routines from Python and Matlab.

**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 |
| Decision-making | Respect for difference and multiculturalism |
| Adapting to new situations | 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... |

After successfully completing this course, the student is able to:

• Recognize pattern recognition problems and select algorithms and methodologies to solve them,
• Learn some of the traditional as well as the more recent tools for classification, clustering and regression problems,
• Construct a learning system to solve a given simple pattern recognition problem, using algorithms, tools and existing software,
• Read and comprehend recent articles in computer science and engineering-oriented pattern recognition journals, such as Journal of Machine Learning Research, Pattern Recognition, IEEE Transactions on Pattern Analysis & Machine Intelligence and Transactions on Neural Networks and Learning Systems,
• Get hands-on experience in using some of these techniques, through the homework assignments.

**SYLLABUS**

**Introductory concepts.** Bayes Decision theory, Bayes error, the normal multivariate distribution, discriminated analysis

**Classifiers:** linear functions and decision surfaces, perceptron algorithm. Nonlinear classifiers: Neural Networks, feedforward architectures, deep learning, convolutional neural networks, generalized linear classifiers, Support vector machines (SVM), Kernel-based classifiers.

**Regression:** linear regression and kernel-based regression models.

**Probability density estimation:** (non-parametric) Parzen-windows and k-nearest neighbors, and (parametric) unbiased estimator, likelihood function, maximum likelihood estimation,
application on the general multivariate case, maximum a-posteriori estimation, Bayesian estimators.

**Clustering techniques - Unsupervised learning:** clustering and applications, k-means algorithm and its extensions, Hierarchical (or tree-based) clustering, Spectral clustering, Probabilistic clustering with mixture models.

**Dimension Reduction:** Curse of dimensionality, Feature Extraction: Principal Component Analysis (PCA), Independent Component Analysis (ICA) and Linear Discriminant Analysis (LDA). Feature selection methods.

### TEACHING and LEARNING METHODS - EVALUATION

<table>
<thead>
<tr>
<th>DELIVERY</th>
<th>Lectures</th>
</tr>
</thead>
<tbody>
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<td>Face-to-face, Distance learning, etc.</td>
<td>- Use of projector during lectures.</td>
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<thead>
<tr>
<th>TEACHING METHODS</th>
<th>Activity</th>
<th>Semester workload</th>
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<td>Self-study</td>
<td>60 hours</td>
</tr>
<tr>
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<td>Course total</td>
<td>125 hours</td>
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<table>
<thead>
<tr>
<th>STUDENT PERFORMANCE EVALUATION</th>
<th>LANGUAGE OF EVALUATION: Greek</th>
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</thead>
<tbody>
<tr>
<td>Description of the evaluation procedure</td>
<td>METHODS OF EVALUATION</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>(i) Final examination (70%)</td>
</tr>
<tr>
<td>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</td>
<td>(ii) Take-home assignments. The assignments are marked based on their correctness and completeness. The evaluation procedure is accessible to students via the course website. Programming assignments on studying pattern recognition methods in real-life applications and applications related to scientific data analysis. (30%)</td>
</tr>
<tr>
<td></td>
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</tr>
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</table>

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- Suggested bibliography:
  - Book [86053413]: ΑΝΑΓΝΩΡΙΣΗ ΠΡΟΤΥΠΩΝ ΚΑΙ ΜΗΧΑΝΙΚΗ ΜΑΘΗΣΗ, C.M. Bishop
  - Book [86198212]: ΜΗΧΑΝΙΚΗ ΜΑΘΗΣΗ, ΚΩΝΣΤΑΝΤΙΝΟΣ ΔΙΑΜΑΝΤΑΡΑΣ, ΔΗΜΗΤΡΗΣ ΜΠΟΤΣΗΣ
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<thead>
<tr>
<th>Scientific International Journals:</th>
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<tbody>
<tr>
<td>• Pattern Recognition, ELSEVIER.</td>
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<tr>
<td>• Machine Learning, Springer</td>
</tr>
<tr>
<td>• Journal of Machine Learning Research</td>
</tr>
<tr>
<td>• IEEE Transactions on Neural Networks and Learning Systems</td>
</tr>
<tr>
<td>• IEEE Transactions on Pattern Analysis &amp; Machine Intelligence (PAMI)</td>
</tr>
</tbody>
</table>
COURSE OUTLINE

GENERAL

SCHOOL: ENGINEERING
ACADEMIC UNIT: DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
LEVEL OF STUDIES: UNDERGRADUATE
COURSE CODE: MYE003
SEMESTER: >=6
COURSE TITLE: Information Retrieval

INDEPENDENT TEACHING ACTIVITIES

<table>
<thead>
<tr>
<th>WEEKLY TEACHING HOURS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures / Labs / Tutorials</td>
<td>5</td>
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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)

http://www.cs.uoi.gr/~pitoura/courses/ap/ap20/

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.

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- 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

This course aims at introducing the basic principles, structures, algorithm and applications of information retrieval from document collections and the web.

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

- Apply appropriate pre-processing steps (including stop word removal, stemming, lemmatization, etc.) to construct indexes for information retrieval
- Build and use appropriate data structures (dictionaries, inverted indexes, etc) for efficient information retrieval from document collections
- Apply compression techniques
- Evaluate the results of information retrieval tasks using appropriate metrics such as relevance and precision.
- Combine various criteria for raking search results
- Use link analysis to improve the quality of results
- Understand how search engines work
• Design and implement information retrieval systems using appropriate tools

General Competences

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

| Search for, analysis and synthesis of data and information, with the use of the necessary technology | Project planning and management |
| Adapting to new situations | Respect for difference and multiculturalism |
| Decision-making | Respect for the natural environment |
| Working independently | Showing social, professional and ethical responsibility and sensitivity to gender issues |
| Team work | Criticism and self-criticism |
| Working in an international environment | Production of free, creative and inductive thinking |
| Working in an interdisciplinary environment | Others... |
| 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
• Adapting to new situations
• Analysis of requirements for problem solving
• Algorithmic thinking
• Abstraction ability for problem modeling
• Working independently
• Team work

SYLLABUS

Introduction to Information Retrieval: basic concepts and applications, types of information retrieval systems, the Boolean model.

Pre-processing and natural language processing: document delineation, stemming, lemmatization, tokenization, stop-word removal

Search queries: phrase queries, proximity queries, tolerant retrieval, phonetic corrections, edit distance, k-gram indexes

Information retrieval models: the vector model, term frequency (tf), inverted document frequency (idf), the probabilistic model

Data structures: dictionary, inverted index, posting lists, Zipf’s law, Heap’s law, zone indexes

Compression: lossy and lossless compression, variable byte codes

Evaluation: relevance, precision, recall, precision/recall curve, mean average precision, discounted cumulative gain, kappa statistics

Implementation issues: term-at-a-time, document-at-a-time retrieval, parallel retrieval, result summarization, the Lucene system.

Search Engines: link analysis, PageRank, HITS, advertisements

TEACHING and LEARNING METHODS - EVALUATION

DELIVERY

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

USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY

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

• Use of online material and interactive board in lectures.
• Building information retrieval systems using
appropriate tools (e.g., Lucene)
• Course web site, announcement and posting of teaching material (lecture slides, notes, SQL programs)
• Announcement of grades via the UOI ecourse platform
• Use of email and social media for information exchange and improved communication with students.

<table>
<thead>
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<th>Activity</th>
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</tbody>
</table>

Course total 125 hours

STUDENT PERFORMANCE EVALUATION

Language of evaluation: Greek

METHODS OF EVALUATION

(i) Final exam which includes short-answer questions, and problem solving
(ii) Design and implementation of an information retrieval system using appropriate tools. Students are evaluated for the correctness and functionality of their system.
(iii) Written assignments. Students are evaluated based on the correctness and completeness of their answers.

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

ATTACHED BIBLIOGRAPHY

- Suggested bibliography:
  Book [12532681]: Εισαγωγή στην Ανάκτηση, Christopher D. Manning, Prabhakar Raghavan, Hinrich Schutze, Κλειδάριθμος 2012
  Book [41954965]: Ανάκτηση Πληροφορίας, 2η Έκδοση, Baeza-Yates Ricardo, Ribeiro-Neto Berthier, Εκδόσεις Τζιόλα, 2014

- Related academic journals:
  • ACM Transactions on Information Systems (TOIS).
  • IEEE Transactions on Knowledge and Data Engineering (TKDE)
  • Information Retrieval, Springer
COURSE OUTLINE

GENERAL

<table>
<thead>
<tr>
<th>SCHOOL</th>
<th>ENGINEERINGS</th>
</tr>
</thead>
<tbody>
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<td>ACADEMIC UNIT</td>
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<tr>
<td>LEVEL OF STUDIES</td>
<td>UNDERGRADUATE</td>
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<td>SEMESTER</td>
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<tr>
<td>COURSE TITLE</td>
<td>Software Development II</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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<thead>
<tr>
<th>WEEKLY TEACHING HOURS</th>
<th>CREDITS</th>
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<tbody>
<tr>
<td>Lectures, laboratory exercises</td>
<td>5</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

IS THE COURSE OFFERED TO ERASMUS STUDENTS

YES

COURSE WEBSITE (URL)

http://www.cs.uoi.gr/~zarras/soft_devII.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

The main objective of this course is the study and application of best practices, patterns and refactoring techniques that allow to avoid issues of poor software design/implementation

The main outcomes of the course is that the students will be capable to:

- Identify issues of poor software design/implementation.
- Improve the quality of software that suffers from issues of poor software design/implementation by applying refactoring techniques.

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 synthesize of data and information, with the use of the necessary technology.
- Decision making.
- Team work.
- Project planning and management.
- Ability to abstract and model problems.

SYLLABUS

This course focuses on issues related to the development of clean software. More specifically, the course consists of the following parts.

**Fundamental principles, conventions, standards, and best practices for the development of clean code:** Basic concepts, naming (conventions, standards and best practices for naming selection), comments (types of good/bad comments, conventions, standards and best practices for writing comments), formatting (properties of horizontal formatting, properties of vertical, code density, code transparency, formatting conventions, standards and best practices), source code organization (properties of clean functions, properties of clean classes, conventions, standards and best practices for the implementation of clean code), principles of object-oriented design (dependency inversion, open close principle, single responsibility principle, interface segregation, etc.), error handling issues.

**Software refactoring:** Basic concepts, design and code smells, refactoring techniques for the composition of methods, refactoring techniques for the simplification of conditional logic, refactoring techniques to improve responsibility assignment, refactoring techniques for generalization/specialization, advanced refactoring techniques, refactoring to patterns.

The course also comprises a project that aims at the development of a large software system in groups of 2-3 students. The project consists of two phases. The goal of the 1st phase is the development of an initial version of the software system, while the goal of the 2nd phase is to refactor the outcome of the 1st phase. The objective of the project is to train the students in the use of integrated development environments and refactoring.

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>Use of transparencies and interactive white board.</td>
</tr>
<tr>
<td></td>
<td>Maintenance of a web page dedicated to the course that provides announcements, reading material, grades, etc.</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></td>
<td>13*3 = 39 hours</td>
</tr>
<tr>
<td>Laboratory practice</td>
<td></td>
<td>13*2 = 26 hours</td>
</tr>
<tr>
<td>Study hours</td>
<td></td>
<td>60 hours</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>STUDENT PERFORMANCE EVALUATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of the evaluation procedure</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>
</tr>
<tr>
<td>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</td>
</tr>
</tbody>
</table>

| LANGUAGE: Greek |
| METHOD: |
| 1. Final written exam with questions, problems and practical exercises. |
| 2. Oral examination and evaluation of the different phases of the project (requirements analysis, design, implementation & testing). |
| Information about the specific evaluation process is provided in the course’s web page. |

<table>
<thead>
<tr>
<th>ATTACHED BIBLIOGRAPHY</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Suggested bibliography:</td>
</tr>
</tbody>
</table>

| - Related academic journals: |
| ● IEEE Transaction on Software Engineering |
| ● ACM Transaction on Software Engineering and Methodology |
| ● Information and Software Technology |
| ● Information Systems |
| ● Journal of Systems and Software |
| ● IEEE Software |
# 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>UNDERGRADUATE</td>
</tr>
<tr>
<td>COURSE CODE</td>
<td>MYE005</td>
</tr>
<tr>
<td>SEMESTER</td>
<td>&gt;=6</td>
</tr>
<tr>
<td>COURSE TITLE</td>
<td>Computer Architecture II</td>
</tr>
</tbody>
</table>

### INDEPENDENT TEACHING ACTIVITIES

<table>
<thead>
<tr>
<th>Activities</th>
<th>WEEKLY TEACHING HOURS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures / Labs / Tutorials</td>
<td>5</td>
<td>5</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 primary aim of the course is to convey an understanding high-performance architecture of processor 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
- 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
- Respect for the natural environment
- Showing social, professional and ethical responsibility and sensitivity to gender issues
- 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 techniques
• Algorithmic thinking
• Use abstraction to understand and analyze complex systems/problems
• Working independently
• Adapting to new situations
• Communicate information, ideas, problems and solutions to experts in the field

SYLLABUS


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


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

TEACHING and LEARNING METHODS - EVALUATION

<table>
<thead>
<tr>
<th>DELIVERY</th>
<th>Lectures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face-to-face, Distance learning, etc.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY</th>
<th>Activity</th>
<th>Semester workload</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of ICT in teaching, laboratory education, communication with students</td>
<td>Lectures</td>
<td>13*3 = 39 hours</td>
</tr>
<tr>
<td></td>
<td>Labs</td>
<td>2*12= 24 hours</td>
</tr>
<tr>
<td></td>
<td>Self-study</td>
<td>62 hours</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>Course total</th>
<th>125 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

**METHODS OF EVALUATION**

(i) Final examination, which includes argument development questions and problem solving.

(ii) Programming exercises on the development and use of simple simulators. The exercises are evaluated based on correctness and completeness.

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

**ATTACHED BIBLIOGRAPHY**

- **Suggested bibliography:**

  **Book [18548925]**: Hennessy John L., Patterson David A., Αρχιτεκτονική Υπολογιστών.

  **Book [68370526]**: Δ. Νικόλος: Αρχιτεκτονική Υπολογιστών.

- **Related academic journals:**

  - Transactions on Architecture and Code Optimization, Transactions on Computer Systems, ACM.
# 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>UNDERGRADUATE</td>
</tr>
<tr>
<td>COURSE CODE</td>
<td>MYE006</td>
</tr>
<tr>
<td>SEMESTER</td>
<td>&gt;=6</td>
</tr>
</tbody>
</table>

### INDEPENDENT TEACHING ACTIVITIES

<table>
<thead>
<tr>
<th>Lectures / Labs / Tutorials</th>
<th>WEEKLY TEACHING HOURS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>5</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

### PREREQUISITE COURSES:

-  

### LANGUAGE OF INSTRUCTION and EXAMINATIONS:

- GREEK

### IS THE COURSE OFFERED TO ERASMUS STUDENTS:

- YES

### COURSE WEBSITE (URL)

- [http://www.cse.uoi.gr/~epap/asurmata](http://www.cse.uoi.gr/~epap/asurmata)

## 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 provides an introduction to wireless networks and their applications. It first discusses the fundamental properties of wireless transmission in order to illustrate the need for specialized networking protocols and technologies. A wide range of wireless networks, extending from wireless local area networks to cellular systems, are presented and analyzed in order to:

- a) provide theoretical as well as practical information on state-of-the-art wireless technologies,
- b) analyze the differences compared to traditional wired networking,
- c) explain the challenges in building a wireless network.

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

- understand the communication paradigms that necessitate the use of wireless networks.
- understand the challenges and the limitations in designing wireless networks imposed by wireless transmission and user mobility.
- explain how wireless networking protocols are different from wired ones.
• be able to identify the most significant types of wireless networks and the corresponding networking principles.
• understand and be able to describe how most well-known wireless networking protocols work.
• choose the optimal parameter setting for a wireless network in order to achieve the desired performance.
• choose and combine known wireless networking concepts for creating a network that meets specific performance requirements.
• understand new trends and the challenges in wireless networking.

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 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 | |
| Working in an interdisciplinary environment | |
| Production of new research ideas | |

SYLLABUS

TEACHING and LEARNING METHODS - EVALUATION

<table>
<thead>
<tr>
<th>DELIVERY</th>
<th>Lectures, lab courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY</td>
<td>• Use of projector and interactive board during lectures. • Use of computers and networking facilities in</td>
</tr>
</tbody>
</table>

Face-to-face, Distance learning, etc.
Use of ICT in teaching, laboratory education, communication with students
laboratories.
• Course website maintenance. Announcements and posting of teaching material (lecture slides, programs).
• Announcement of assessment marks via the course webpage.
• 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>Lectures</td>
<td>13*3 = 39 hours</td>
</tr>
<tr>
<td>Labs</td>
<td>13*2 = 26 hours</td>
</tr>
<tr>
<td>Self-study</td>
<td>60 hours</td>
</tr>
</tbody>
</table>

**Course total** 125 hours

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

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

**LANGUAGE OF EVALUATION**: Greek

**METHODS OF EVALUATION**
(i) Final examination, which includes questions and problem solving.
(ii) Optional project.

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

### ATTACHED BIBLIOGRAPHY
- **Suggested bibliography:**
  **Book [50655989]:** Ασύρματες Επικοινωνίες, Δίκτυα και Συστήματα, Stallings W. - Beard C.
  **Book [13615]:** ΑΣΥΡΜΑΤΑ ΔΙΚΤΥΑ, P. NICOPOLITIDIS, M. S. OBAIDAT, G. I. PAPADIMITRIOU, A. S. POMPORTIS

- **Related academic journals:**
  - IEEE Transactions on Wireless Communications, IEEE.
  - IEEE Wireless Communications, IEEE.
  - IEEE Transactions on Mobile Computing, IEEE.
  - Wireless Networks: The Journal of Mobile Communication, Computation and Information, Springer
  - Ad Hoc Networks, ELSEVIER.
  - IEEE Transactions on Networking (TON), IEEE.
  - IEEE JOURNAL ON SELECTED AREAS IN COMMUNICATIONS (J-SAC), IEEE.
  - Computer Networks: The International Journal of Computer and Telecommunications Networking, ELSEVIER.
COURSE OUTLINE

GENERAL

SCHOOL | SCHOOL OF ENGINEERING
ACADEMIC UNIT | DEPT. OF COMPUTER SCIENCE & ENGINEERING
LEVEL OF STUDIES | UNDERGRADUATE
COURSE CODE | MYE008
PLE030
SEMESTER | >=6
COURSE TITLE | OPTIMIZATION

INDEPENDENT TEACHING ACTIVITIES

if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits

| Lectures / Labs / Tutorials | 3 / 0 / 2 | 5 |

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

COURSE TYPE | Specialized general knowledge

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) | http://ecourse.uoi.gr/course/view.php?id=329

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 of parametric function. In this course, we study methods for various types of local and global optimization problems such as the following:

1. Gradient-based methods: gradient descent, Newton, quasi-Newton, conjugate gradients, in combination with line search and trust region techniques.
After 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.

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>Decision-making</td>
<td>Respect for difference and multiculturalism</td>
</tr>
<tr>
<td>Working independently</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>

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

SYLLABUS

- Introduction to optimization
- Optimality conditions
- Gradient-based methods: steepest descent, Newton, quasi-Newton, conjugate gradients
- Line search and trust region techniques
- Derivative-free methods: Nelder-Mead, Hook-Jeeves, pattern search
- Stochastic and evolutionary algorithms for global optimization: random search, simulated annealing, genetic algorithms, particle swarm optimization
- Problems with simple constraints
- Methods for the detection of multiple optimizers

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></td>
</tr>
<tr>
<td>Use of ICT in teaching, laboratory education,</td>
<td>Course webpage where literature and freely available material is provided.</td>
</tr>
<tr>
<td>communication with students</td>
<td>Live simulations in the classroom.</td>
</tr>
<tr>
<td></td>
<td>Use of the asynchronous tele-education services of University of Ioannina.</td>
</tr>
<tr>
<td></td>
<td>Use of email services and social media for</td>
</tr>
</tbody>
</table>
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>Tutorials</td>
<td>13*2 = 26 hours</td>
</tr>
<tr>
<td>Self-study</td>
<td>60 hours</td>
</tr>
<tr>
<td><strong>Course total</strong></td>
<td><strong>125 hours</strong></td>
</tr>
</tbody>
</table>

**LANGUAGE OF EVALUATION:**

Greek

**METHODS OF EVALUATION:**

Final written exams (80%) and submission of written work (20%)

**ATTACHED BIBLIOGRAPHY**


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>UNDERGRADUATE</td>
</tr>
<tr>
<td>COURSE CODE</td>
<td>MYE010</td>
</tr>
<tr>
<td>SEMESTER</td>
<td>&gt;=5</td>
</tr>
</tbody>
</table>

COURSE TITLE: Electronic system testing and reliability

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>3/2/0</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

geneneral 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)

http://ecourse.uoi.gr/enrol/index.php?id=950

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

Introduction to basic VLSI testing principles and architectures. The course aims to make students familiar with modern testing and design for testability practices. The students understand VLSI testing challenges and learn how to apply proper design techniques to improve testability and enhance reliability in nanometer technology electronics systems. At the end of this course, students will be able to analyze electronic system testing requirements and develop simple testing solutions to support systems reliability.

After taking this course students will be able to:

- Understand automatic test pattern generation and fault simulation principles.
• Analyze electronic system testing requirements.
• Combine design for testability techniques and apply them in electronic systems.
• Develop scan testing and BIST solutions.
• Synthesize on-line testing schemes.
• Understand the basic fault generation mechanisms in IC’s, the basic fault models and the basic testing algorithms.

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</td>
<td>Project planning and management</td>
</tr>
<tr>
<td>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</td>
</tr>
<tr>
<td>Team work</td>
<td>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</td>
</tr>
<tr>
<td>Production of new research ideas</td>
<td>thinking</td>
</tr>
</tbody>
</table>

SYLLABUS


The students understand design for testability techniques through lab exercises which include the following topics:

1. Understanding of basic Fault Models.
2. Test Pattern Generation and Fault simulation.
3. Familiarization with scan testing schemes.
5. Design DfT schemes and apply them to electronic systems.
6. Fault models, defect types and test algorithms for memory IC’s.

TEACHING and LEARNING METHODS - EVALUATION

<table>
<thead>
<tr>
<th>DELIVERY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face-to-face, Distance learning, etc.</td>
</tr>
<tr>
<td>• Lectures, Laboratory Exercises</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Use of projector and board during lectures.</td>
</tr>
<tr>
<td>• Course website maintenance. Announcements and</td>
</tr>
</tbody>
</table>
**Use of ICT in teaching, laboratory education, communication with students**

- posting of teaching material (lecture slides and notes, data and code).
- Use of email direct 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*3 = 39 hours</td>
</tr>
<tr>
<td>Lab excercises</td>
<td>10*2 = 20 hours</td>
</tr>
<tr>
<td>Tutorials</td>
<td>6 hours</td>
</tr>
<tr>
<td>Self-study</td>
<td>60 hours</td>
</tr>
<tr>
<td><strong>Course total</strong></td>
<td><strong>125 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 (slides in Greek with English terminology also available)

**METHODS OF EVALUATION**

(i) Final examination, which includes questions and problem solving.

(ii) Laboratory work.

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

---

**ATTACHED BIBLIOGRAPHY**

- Suggested bibliography:

  **Book [9779]:** Σχεδίαση Ολοκληρωμένων Κυκλωμάτων CMOS VLSI, Weste Neil H., Eshraghian Kamran, Δημήτριος Σούντρης, Κ. Πεκμεστζή
  **Book [13944]:** ΨΗΦΙΑΚΑ ΟΛΟΚΛΗΡΩΜΕΝΑ ΚΥΚΛΩΜΑΤΑ: ΜΙΑ ΣΧΕΔΙΑΣΤΙΚΗ ΠΡΟΣΕΓΓΙΣΗ, JAN M. RABAEY, ANANTHA CHANDRASKAN, BORIVOJE NIKOLIC
  **Book [64314]:** Ψηφιακή Σχεδίαση με VHDL, Peter J Ashenden

- Related academic journals:
COURSE OUTLINE

GENERAL

<table>
<thead>
<tr>
<th>SCHOOL</th>
<th>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>UNDERGRADUATE</td>
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<tr>
<td>COURSE CODE</td>
<td>MYE011</td>
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<tr>
<td>SEMESTER</td>
<td>&gt;= 6</td>
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<tr>
<td>COURSE TITLE</td>
<td>EVOLUTIONARY COMPUTATION</td>
</tr>
</tbody>
</table>

INDEPENDENT TEACHING ACTIVITIES

<table>
<thead>
<tr>
<th>Lectures / Labs / Tutorials</th>
<th>WEEKLY TEACHING HOURS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3 / 0 / 2</td>
<td>5</td>
</tr>
</tbody>
</table>

COURSE TYPE

- general background
- special background, specialised general knowledge, skills development
- Specialized 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
- Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B
- Guidelines for writing Learning Outcomes

The course presents modern Computational Optimization methods from the fields of Evolutionary Computation and Swarm Intelligence. Typically, these methods are based on models of optimization procedures in natural systems, using mathematical tools such as Probability Theory and Dynamical Systems. Nevertheless, there are no prerequisite mathematical conditions for their application.

This property renders these algorithms suitable for solving problems where analytical models and desirable mathematical characteristics (continuity, differentiability) are absent or problems where the model is contaminated by noise and / or incomplete information. Also, their inherent parallelization properties make these algorithms suitable for computationally demanding problems.

During the course, the basic principles of algorithms such as Genetic Algorithms, Evolutionary Algorithms, Particle Swarm Optimization, Differential Evolution, and Ant Colony Optimization are presented. Also, applications are discussed with an emphasis on
Global Optimization problems from various scientific and technological fields, such as Operations Research, Astrophysics, Engineering etc.

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

- Design and implement evolutionary algorithms.
- Determine the most appropriate algorithm for a given problem.
- Exploit specific characteristics of the problem (mixed variables, multiple local / global minimizers).
- Design variants of the algorithms for serial and parallel computing environments.

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 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 | ..... |
| 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.
- Development of algorithmic thinking.
- Ability of analyzing and modeling problems.

SYLLABUS

Introduction: Introduction to Optimization. Basic definitions. Types of problems and algorithms.


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 ICT in teaching, laboratory education, communication with students | |

- Course webpage where literature and free material is provided.
- Live simulations in the classroom.
- Use of the asynchronous tele-education
services of University of Ioannina.
• 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>
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</thead>
<tbody>
<tr>
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<tr>
<td>Tutorials</td>
<td>13*2 = 26 hours</td>
</tr>
<tr>
<td>Self-study</td>
<td>60 hours</td>
</tr>
<tr>
<td><strong>Course total</strong></td>
<td><strong>125 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:** Final written examination based on full essay questions.

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

### Attached Bibliography

- **Suggested bibliography:**
  

  **Book [12278503]:** Μεθευρετικοί και Εξελικτικοί Αλγόριθμοι σε Προβλήματα Διοικητικής Επιστήμης, Ι. Μαρινάκης, Μ. Μαρινάκη, Ν.Φ. Ματσατσίνης, Κ. Ζοπουνίδης, Εκδόσεις Κλειδάριθμος, 2011.

- **Related academic journals:**
  
  • IEEE Transactions on Evolutionary Computation, IEEE.
  • Evolutionary Computation, MIT PRESS.
  • Swarm Intelligence, SPRINGER.
  • Applied Soft Computing, ELSEVIER.
MYE012. Data Mining

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>UNDERGRADUATE</td>
</tr>
<tr>
<td>COURSE CODE</td>
<td>MYE012</td>
</tr>
<tr>
<td>SEMESTER</td>
<td>&gt;=6</td>
</tr>
</tbody>
</table>

INDEPENDENT TEACHING ACTIVITIES

- Lectures / Labs / Tutorials
  - WEEKLY TEACHING HOURS: 5
  - CREDITS: 5

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

Data mining refers to the extraction of knowledge from large quantities of data. This course aims at introducing the students to basic and advanced concepts, algorithms and tools of Data Mining, and give them hands on experience with the analysis of real data using state-of-the-art tools.

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

- Understand the main concepts and problems involved in Data Mining.
- Understand algorithmic data mining techniques and utilize them to design algorithms for solving practical problems.
- Understand the theoretical underpinnings and the mathematics behind the Data Mining techniques, and utilize them to analyze the theoretical properties of data mining algorithms.
- Utilize state-of-the-art data mining tools for implementing data mining
algorithms.

- Deal with the requirements and challenges of analyzing large amounts of real data.
- Solve new data mining problems using the algorithms, theory and existing tools.
- Design and develop a data mining pipeline for large data analysis.
- Think about new problems and solutions in data mining.

### 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
- Algorithmic thinking
- Abstraction ability for problem modeling
- Working independently
- Team work

### SYLLABUS

**Introduction to Data Mining:** What is Data Mining? Why is it important? The Data Mining Pipeline

**Frequent Itemsets and Association Rules:** Algorithms, Theory, Evaluation.

**Similarity and Distance:** Definitions of Similarity and Distance. Recommendation Systems. Min-Hash Sketches and Locality Sensitive Hashing.

**Dimensionality Reduction:** Singular Value Decomposition. Principal Component Analysis.


**Minimum Description Length Principle:** Introduction to Information Theory. Use of MDL for co-clustering.

**Classification:** Decision Trees, Logistic Regression, SVM Classifiers, Naïve Bayes Classifier. Evaluation.

**Link Analysis Ranking:** PageRank and HITS. Random Walks. Absorbing Random Walks.

**Coverage:** The Minimum Set Cover and Maximum Coverage Problems and their applications. Approximation Algorithms.

**Data Mining With Python:** Iron Python, Pandas, the Sci-Kit library.

**Specialized topics:** The Map-Reduce Programming Paradigm.
TEACHING and LEARNING METHODS - EVALUATION

DELIVERY
Face-to-face, Distance learning, etc.

Lectures, lab courses

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

- Use of projector and board during lectures.
- Use of computer for demonstration of python scripts.
- Course website maintenance. Announcements and posting of teaching material (lecture slides and notes, data and code).
- Use of email direct communication with students.
- Use of open source code and data for assignments.

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*5= 39 hours</td>
</tr>
<tr>
<td>Tutorials</td>
<td>13*2 = 26 hours</td>
</tr>
<tr>
<td>Self-study</td>
<td>60 hours</td>
</tr>
</tbody>
</table>

Course total 125 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 (slides in English)

METHODS OF EVALUATION
Take-home assignments that include theoretical questions, algorithm design, implementation of algorithms, and application of existing tools in data analysis. The assignments are marked based on their correctness and completeness.

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

ATTACHED BIBLIOGRAPHY

- Suggested bibliography:
  Book [22768468]: Mining Massive Datasets, Anand Rajaraman, Jeffrey David Ullman
  Book [68386089]: DATA MINING AND ANALYSIS - FUNDAMENTAL CONCERTS AND ALGORITHMS, MOHAMMED J. ZAKI, WAGNER MEIRA JR.

- Related academic journals:
  - ACM Transactions on Knowledge Discovery from Data (TKDD).
  - ACM Transactions on Knowledge and Data Engineering (TKDE)
# COURSE OUTLINE

## GENERAL

<table>
<thead>
<tr>
<th>SCHOOL</th>
<th>ENGINEERINGS</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>UNDERGRADUATE</td>
</tr>
<tr>
<td>COURSE CODE</td>
<td>MYE014</td>
</tr>
<tr>
<td>SEMESTER</td>
<td>&gt;=6</td>
</tr>
<tr>
<td>COURSE TITLE</td>
<td>Graph Theory</td>
</tr>
</tbody>
</table>

### INDEPENDENT TEACHING ACTIVITIES

<table>
<thead>
<tr>
<th>Lectures/Laboratory Exercises</th>
<th>WEEKLY TEACHING HOURS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5</td>
<td>5</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

Special background, 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-BSc-GT.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 interesting 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

SYLLABUS

The course covers the basic definitions and concepts related to classical graph theoretic problems. The course also covers a number of applications in which graph modeling are known to be useful. Topics:

1. Introduction and basic definitions
2. Graph representations and graph isomorphism
3. Trees - special properties and applications
4. Connectivity, Euler tours and Hamiltonian cycles
5. Coverings and matching
6. Cliques and independent sets
7. Vertex colorings and edge colorings
8. Directed graphs and applications
9. Planar graphs and networks
10. General applications

TEACHING and LEARNING METHODS - EVALUATION

<table>
<thead>
<tr>
<th>DELIVERY</th>
<th>Lectures, exercises</th>
</tr>
</thead>
</table>
| USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY | • Use of projector and interactive board during lectures.  
• Course website maintenance. Announcements and posting of teaching material (lecture slides and notes, programs).  
• Announcement of assessment marks via the e-course platform by UOI. |
| TEACHING METHODS | Activity | Semester workload |
| 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. | Lectures | 13 * 3 = 39 hours |
| | Laboratory practice | 13 * 1 = 13 hours |
| | Student’s study hours | 73 hours |
| | Course total | 125 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.

<table>
<thead>
<tr>
<th>Language of evaluation: Greek</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methods of Evaluation:</td>
</tr>
<tr>
<td>i) Final written examination</td>
</tr>
<tr>
<td>ii) Written work</td>
</tr>
</tbody>
</table>

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

### ATTACHED BIBLIOGRAPHY

- **Suggested bibliography:**
  
  **Book (in Greek) [33134148]:** Θεωρία και Αλγόριθμοι Γράφων, Ι. Μανωλόπουλος, Α. Παπαδόπουλος, Κ. Τσίχλας, ΕΚΔΟΣΕΙΣ ΝΕΩΝ ΤΕΧΝΟΛΟΓΙΩΝ ΜΟΝ. ΕΠΕ, 1η/2013.

  Πρόσθετο Διδακτικό Υλικό:
  
  **Book (in Greek) [320159]:** Αλγοριθμική Θεωρία Γραφημάτων, Σ. ΝΙΚΟΛΟΠΟΥΛΟΣ, ΓΕΩΡΓΙΑΔΗΣ Λ., ΠΑΛΗΟΣ Λ., Αποθετήριο “Κάλλιπος”, 1/2016.
## 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>UNDERGRADUATE</td>
</tr>
<tr>
<td>COURSE CODE</td>
<td>MYE015</td>
</tr>
<tr>
<td>SEMESTER</td>
<td>&gt;=6</td>
</tr>
<tr>
<td>COURSE TITLE</td>
<td>Information theory and coding</td>
</tr>
</tbody>
</table>

### INDEPENDENT TEACHING ACTIVITIES

<table>
<thead>
<tr>
<th></th>
<th>WEEKLY TEACHING HOURS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures / Labs / Tutorials</td>
<td>3/0/2</td>
<td>5</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

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The course aims to introduce the students to the foundations of the source and the channel of an information transfer system. The notions of entropy, source coding, mutual information and channel coding are examined in depth.

It is expected that the student after attending the course will be able to analyze an information transfer system (source-channel-receiver) and design source codes and error correcting codes.

### 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></td>
</tr>
</tbody>
</table>
SYLLABUS

Information, Entropy, Joint Entropy, Conditional Entropy, Mutual Information, Extensions of Information Sources, Information Sources with Memory, Memoryless Information Sources, Markov chains, Continuous Information Source. Information Channel, Channel Capacity (Maximum Mutual Information), Muroga Method. Coding in Noiseless environment, the Kraft inequality, Shannon’s Noiseless Coding Theorem, Shannon Coding, Shannon-Fano Coding, Huffmann Code, Shannon’s Fundamental Coding Theorem, Error Correcting Codes, Hamming Code. Algebraic Coding, Groups, Fields, Rings, Vector Spaces, modulo-p and modulo-k(x) algebra, Error Correcting Codes, Group Codes (Hamming, Hadamard, Golay), Cyclic Codes (Hamming, Golay, BCH), Convolutional Codes.

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 |

<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>Individual study and problem solving</td>
<td>86 hours</td>
</tr>
<tr>
<td>Course total</td>
<td>125 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, etc.

LANGUAGE OF EVALUATION: Greek (slides may be in English)

METHODS OF EVALUATION

(i) Final examination, which includes questions and problem solving.
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

- Suggested bibliography:

**Book [59374208]:** Εισαγωγή στη Θεωρία Πληροφοριών, Κωδίκων και Κρυπτογραφίας, Ν. Αλεξανδρής, Β. Χρυσικόπουλος, Κ. Πατσάκης

**Book [12401966]:** Θεωρία της Πληροφορίας, David Luenberger

**Book [41957449]:** ΣΤΟΙΧΕΙΑ ΤΗΣ ΘΕΩΡΙΑΣ ΠΛΗΡΟΦΟΡΙΑΣ, THOMAS M. COVER - JOY A. THOMAS

- Related academic journals: IEEE Transactions on Information Theory
MYE016. Computer Science and Engineering in Biomedicine

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>UNDERGRADUATE</td>
</tr>
<tr>
<td>COURSE CODE</td>
<td>MYE016</td>
</tr>
<tr>
<td>SEMESTER</td>
<td>&gt;=6</td>
</tr>
</tbody>
</table>

COURSE TITLE

Computer Science and Engineering in Biomedicine

INDEPENDENT TEACHING ACTIVITIES

Lectures / Labs / Tutorials

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

WEEKLY TEACHING HOURS | CREDITS
--- | ---
3 | 5

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

This course objective is to introduce the students into the field of Biomedical Engineering.

The aim is not to focus on a specific subarea of Biomedical Engineering but cover a wide range of applications and subjects with special interest and research challenges.

It is expected that the students after taking the course will:

- have an overview of applications and areas of research interest in the field
- enrich their background with concepts, knowledge and skills related to the field
- be able to focus on an subarea of the field if they wish

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
<table>
<thead>
<tr>
<th>Working in an international environment</th>
<th>Production of new research ideas</th>
</tr>
</thead>
<tbody>
<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>

**SYLLABUS**


Each student develops a large application, different for each student, with increased difficulty and significant weight in the final grade. The subject is related to a subarea of Biomedical Engineering and is selected based on the student’s interests and possible future area of expertise.

**TEACHING and LEARNING METHODS - EVALUATION**

<table>
<thead>
<tr>
<th>DELIVERY</th>
<th>Lectures, tutorials.</th>
</tr>
</thead>
<tbody>
<tr>
<td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY</td>
<td>Use of projector and board 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, data and code).</td>
</tr>
<tr>
<td>Use of email direct 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>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>Lectures</td>
<td>13*3= 39 hours</td>
</tr>
<tr>
<td></td>
<td>Self - Study</td>
<td>26 hours</td>
</tr>
<tr>
<td></td>
<td>study and analysis of bibliography</td>
<td>10 hours</td>
</tr>
<tr>
<td></td>
<td>project</td>
<td>50 hours</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Course total 125 hours</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>STUDENT PERFORMANCE EVALUATION</th>
<th>LANGUAGE OF EVALUATION: Greek (slides in English)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of the evaluation procedure</td>
<td>METHODS OF EVALUATION</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>(i) Final examination, which includes questions and problem solving.</td>
</tr>
<tr>
<td>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</td>
<td>(ii) Optional project.</td>
</tr>
<tr>
<td></td>
<td>The evaluation procedure is accessible to students via the course website.</td>
</tr>
<tr>
<td>ATTACHED BIBLIOGRAPHY</td>
<td></td>
</tr>
<tr>
<td>------------------------</td>
<td></td>
</tr>
<tr>
<td>- Suggested bibliography:</td>
<td></td>
</tr>
<tr>
<td><strong>Book [18548926]</strong>: Εισαγωγή στη βιοϊατρική τεχνολογία και ανάλυση ιατρικών σημάτων, Κουτσούρης Διονύσης - Δημήτρης, Παυλόπουλος Σωτήρης Α., Πρέντζα Ανδριάνα Α.</td>
<td></td>
</tr>
</tbody>
</table>

Πρόσθετο Διδακτικό Υλικό:
| **Book [320163]**: ΙΑΤΡΙΚΗ ΠΛΗΡΟΦΟΡΙΚΗ, ΜΑΡΚΟΣ ΤΣΙΠΟΥΡΑΣ, ΝΙΚΟΛΑΟΣ ΠΙΑΝΝΑΚΕΑΣ, ΕΥΑΓΓΕΛΟΣ ΚΑΡΒΟΥΝΗΣ, ΑΛΕΞΑΝΔΡΟΣ ΤΖΑΛΛΑΣ |

**Book [59303593]**: ΗΛΕΚΤΡΟΝΙΚΗ ΥΓΕΙΑ, ΠΑΝΤΕΛΗΣ ΑΓΓΕΛΙΔΗΣ |

- Related academic journals:
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>UNDERGRADUATE</td>
</tr>
<tr>
<td>COURSE CODE</td>
<td>MYE018</td>
</tr>
<tr>
<td>SEMESTER</td>
<td>≥6</td>
</tr>
<tr>
<td>COURSE TITLE</td>
<td>VLSI Circuits</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>5 (3,2,0)</td>
<td>5</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:

-

LANGUAGE OF INSTRUCTION and EXAMINATIONS:

GREEK

IS THE COURSE OFFERED TO ERASMUS STUDENTS:

YES

COURSE WEBSITE (URL)

http://www.cs.uoi.gr/~tsiatouhas/MYE018-VLSI.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 VLSI circuit analysis, synthesis, design and simulation.

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

- Understand manufacturing technologies of nanometer integrated circuits.
- Understand logic circuit operation at the transistor level.
- Analyze simple or complex digital circuits.
- Synthesize digital circuits at the transistor level.
- Solve performance related problems in VLSI circuits.
- Design and simulate VLSI circuits, perform measurements on their characteristics and verify their performance.

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
Adapting to new situations
Analysis of requirements for problem solving
Abstraction ability for problem modeling
Combination of existing methods for the synthesis of high performance circuits
Working independently
Team work

SYLLABUS


TEACHING and LEARNING METHODS - EVALUATION

<table>
<thead>
<tr>
<th>DELIVERY</th>
<th>Use of e-slides and interactive board during lectures.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Use of computer-aided design tools at the laboratory (circuit design and simulation).</td>
</tr>
<tr>
<td></td>
<td>Use of components and instruments (signal generators, power supplies, multi-meters, oscilloscopes) at the laboratory for circuit implementation and measurement.</td>
</tr>
<tr>
<td></td>
<td>Ecourse website maintenance.</td>
</tr>
<tr>
<td></td>
<td>Course website maintenance. Announcements and posting of teaching material (lecture slides and notes).</td>
</tr>
<tr>
<td></td>
<td>Use of email for information exchange and improved communication with students.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY</th>
<th>TEACHING METHODS</th>
<th>Activity</th>
<th>Semester workload</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of ICT in teaching, laboratory education, communication with students</td>
<td>Face-to-face, lectures, lab courses, home-works</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures</td>
<td>13*3 = 39 hours</td>
</tr>
<tr>
<td>Laboratory practice</td>
<td>11*2 = 22 hours</td>
</tr>
<tr>
<td>Problems solving</td>
<td>8 hours</td>
</tr>
<tr>
<td>Study &amp; bibliography analysis</td>
<td>56 hours</td>
</tr>
<tr>
<td><strong>Course total</strong></td>
<td><strong>125 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 (80%).

(ii) Laboratory exercises on circuit design and simulation. The students are evaluated during their work at the laboratory and also with the final examination of a design project at the laboratory (20%).

(iii) Home-works on problem solving. The home-works are marked based on their correctness and completeness ((bonus up to 10% in case of successful evaluation in i & ii).

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

**ATTACHED BIBLIOGRAPHY**

- Suggested bibliography:
  
  **Book [9779]:** CMOS VLSI DESIGN: A CIRCUITS AND SYSTEMS PERSPECTIVE, N. Weste and D. Harris, Addison-Wesley, 2011.
  
  

- Related academic journals:

  - Transactions on VLSI Circuits and Systems (TVLSI), IEEE.
  - Integration the VLSI Journal, Elsevier.
  - Transactions on Circuits and Systems I & II (TCAS), IEEE.
  - Journal of Solid-State Circuits (JSSC), IEEE.
MYE023. Parallel Systems and Programming

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>UNDERGRADUATE</td>
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<tr>
<td>COURSE CODE</td>
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<tr>
<td>SEMESTER</td>
<td>&gt;= 6</td>
</tr>
<tr>
<td>COURSE TITLE</td>
<td>Parallel Systems and Programming</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</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>5</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

Special background

PREREQUISITE COURSES:

-

LANGUAGE OF INSTRUCTION and EXAMINATIONS:

GREEK

IS THE COURSE OFFERED TO ERASMUS STUDENTS

YES

COURSE WEBSITE (URL)

http://www.cse.uoi.gr/index.php?menu=m219&id=MYE023%20/%20%CE%A0%CE%9B%CE%95079

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

Almost all modern computing systems are parallel, with multiple processors or cores, which can work concurrently towards the solution of a problem. This course is an introduction to the organization and operation of parallel computers and to their architectural categories. An engineer should know the problem which appear and the solutions he/she can give, as well as judge the appropriateness of the techniques involved. In addition, the course teaches parallel programming which is a highly sought qualification. The general parallel programming knowledge is complemented with actual programming assignments which utilize the most important parallel programming models.

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

- Study and understand the organization of a parallel computer.
- Analyze the pros and cons of architectural choices.
• Synthesize the organization of a parallel system.
• Understand the problems of the memory hierarchy, cache coherency and memory consistency.
• 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.
• Analyze the performance of a parallel 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 | 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 | ..... |

• Working independently
• Production of free, creative and inductive thinking
• Search for, analysis and synthesis of data and information, with the use of the necessary technology
• Project planning and management
• Adapting to new situations

**Syllabus**

• Basic principles of parallelism
• Shared memory organization
• The problems of cache coherency and memory consistency
• Distributed memory organization
• Interconnection networks, topologies, routing, high-performance switching
• Distributed shared memory and non-uniform memory access
• Multicore architectures
• SIMD and GPU organizations
• Principles of parallel programming
• Programming in the shared address space model (threads, OpenMP)
• Programming in the message passing model (MPI)
• Performance analysis (speedup, efficiency, cost, scalability)

**Teaching and Learning Methods - Evaluation**

| Delivery | Face-to-face class lectures |
| Use of Information and Communications Technology | Use of projector electronic slides. |

Face-to-face, Distance learning, etc.
communication with students

- Use of computers for the Lab exercises.
- Course website maintenance with announcements and posting of teaching material (lecture slides and notes).
- Announcement of assessment marks via the ecourse platform by UOI.
- 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>$13 \times 3 = 39$ hours</td>
</tr>
<tr>
<td>Labs</td>
<td>$13 \times 2 = 26$ hours</td>
</tr>
<tr>
<td>Self-study</td>
<td>60 hours</td>
</tr>
</tbody>
</table>

Course total: 125 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, etc.

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

LANGUAGE OF EVALUATION: Greek

METHODS OF EVALUATION

(i) Two or three lab exercises which require the design and development of parallel programs.

(ii) Written final examination.

The lab exercises count for 20-30% and the final exam counts for 70-80% of the course grade.

ATTACHED BIBLIOGRAPHY

- Suggested bibliography:
  - Γ. Παντζιου, B. Μάμαλης, Αλ. Τομαράς, Εισαγωγή στον Παράλληλο Υπολογισμό, Εκδόσεις Νέων Τεχνολογιών, 2013
  - Σ. Παπαδάκης, Κ. Διαμαντάρας, Προγραμματισμός και Αρχιτεκτονική Συστημάτων Παράλληλης Επεξεργασίας, Εκδόσεις Κλειδάριθμος, 2012
  - D. B. Kirk, W-m. W. Hwu, Προγραμματισμός μαζίκα παράλληλων επεξεργαστών, Εκδόσεις Κλειδάριθμος, 2010

- Related academic journals:
  - Transactions on Parallel and Distributed Systems, IEEE.
  - Concurrency and Computation: Practice and Experience, Wiley.
  - Parallel Computing, Elsevier
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>UNDERGRADUATE</td>
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<tr>
<td>COURSE CODE</td>
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<td>SEMESTER</td>
<td>&gt;=6</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>COURSE TYPE</th>
<th>Special background</th>
</tr>
</thead>
<tbody>
<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>COURSE WEBSITE (URL)</td>
<td><a href="http://ecourse.uoi.gr/course/view.php?id=890">http://ecourse.uoi.gr/course/view.php?id=890</a></td>
</tr>
</tbody>
</table>

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 the course is the introduction of the student to the compression and transmission of multimedia signals, with emphasis on images, video, and audio. It is expected that, at the end of the course, the student will be able to:

- Understand the basic principles of signal compression.
- Understand and use the current standards for image, video, and audio compression.
- Know the basic error resilience and error concealment techniques for video.
- Understand the techniques for video transmission over networks

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
- 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 new research ideas

• Search for, analysis and synthesis of data and information, with the use of the necessary technology
• Production of free, creative and inductive thinking
• Working independently
• Use of structured mathematical thinking for the development of arguments
• Algorithmic thinking

SYLLABUS


TEACHING and LEARNING METHODS - EVALUATION

<table>
<thead>
<tr>
<th>DELIVERY</th>
<th>Lectures and laboratory exercises.</th>
</tr>
</thead>
<tbody>
<tr>
<td>USE OF INFORMATION AND COMMUNICATION TECHNOLOGY</td>
<td>Use of projector and board 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, data and code).</td>
</tr>
<tr>
<td>USE OF INFORMATION AND COMMUNICATION TECHNOLOGY</td>
<td>Use of email direct communication with students.</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>Lectures</td>
<td>13*3=39 hours</td>
</tr>
<tr>
<td>Self-study</td>
<td>86 hours</td>
</tr>
<tr>
<td>Course total</td>
<td>125 hours</td>
</tr>
</tbody>
</table>

STUDENT PERFORMANCE EVALUATION

| LANGUAGE OF EVALUATION: Greek (slides in English) |
| METHODS OF EVALUATION |
| (i) Final examination (70%), which includes questions and problem solving. |
| (ii) Laboratory exercises (30%). |

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

- Suggested bibliography:

**Book [12387]**: Πολυμέσα Θεωρία και Πράξη, Steinmetz Ralf

**Book [13914]**: ΤΕΧΝΟΛΟΓΙΑ ΠΟΛΥΜΕΣΩΝ ΚΑΙ ΠΟΛΥΜΕΣΙΚΕΣ ΕΠΙΚΟΙΝΩΝΙΕΣ, ΓΕΩΡΓΙΟΣ Β. ΞΥΛΩΜΕΝΟΣ, ΓΕΩΡΓΙΟΣ Κ. ΠΟΛΥΖΟΣ

**Book [18549030]**: Τεχνολογία πολυμέσων, Δημητριάδης Σταύρος Ν., Πομπόρτσης Ανδρέας Σ., Τριανταφύλλου Ευάγγελος Γ.

- Related academic journals:

IEEE Transactions on Multimedia
IEEE Transactions on Circuits and Systems for Video Technology
**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>
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</tr>
<tr>
<td>Course Code</td>
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<td>Semester</td>
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<tr>
<td>Course Title</td>
<td>Advanced Algorithm and Data Structure Design</td>
</tr>
</tbody>
</table>

**Independent Teaching Activities**

<table>
<thead>
<tr>
<th>Lectures / Labs / Tutorials</th>
<th>Weekly Teaching Hours</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/2/0</td>
<td></td>
<td>5</td>
</tr>
</tbody>
</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>Specialized general knowledge</th>
</tr>
</thead>
</table>

**Prerequisite Courses:**

NO

**Language of Instruction and Examinations:**

Greek

**Is the Course Offered to Erasmus Students:**

Yes

**Course Website (URL):**


**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 the course is to acquaint students with:
- More elaborate use of fundamental techniques for the design and analysis of algorithms and data structures.
- Advanced techniques for the design and analysis of algorithms and data structures.
- Mathematical tools such as probabilistic analysis, amortized analysis, and competitive analysis.
- Important algorithms and data structures for fundamental problems.
- Topics in computational complexity, approximate solutions, and randomization.

Students who complete the course successfully learn to:
- Apply advanced techniques for the design and analysis of algorithms and data structures.
- Provide appropriate mathematical models for various problems.
- Compare the efficiency and suitability of different algorithms and data structures.
for solving specific problems.
- 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?**

<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
- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Algorithmic thinking
- Abstraction ability for problem modeling
- Working independently
- Team work
- Working in an international environment

### SYLLABUS

Selected topics from the following areas: Network optimization problems: Algorithms (shortest paths, maximum flows, connectivity, maximum matchings, minimum-cost flows) and related data structures (Fibonacci heaps, dynamic trees). Randomized algorithms (shortest paths, minimum spanning trees, minimum cuts, random walks, Markov chains, universal hashing). Algorithms and data structures for external memory. Number theoretic algorithms (cryptosystems, primality testing). Online algorithms (list accessing, paging, load balancing). NP-hard problems and approximation algorithms (heuristic methods, linear programming and rounding ).

### TEACHING and LEARNING METHODS - EVALUATION

<table>
<thead>
<tr>
<th>DELIVERY</th>
<th>Lectures.</th>
</tr>
</thead>
<tbody>
<tr>
<td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY</td>
<td>Use of projector and board 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, data and code).</td>
</tr>
<tr>
<td>Use of email direct 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>The manner and methods of teaching are described in detail. Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography,</td>
<td>Lectures</td>
<td>13*3(=39) hours</td>
</tr>
<tr>
<td></td>
<td>Fieldwork</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Project</td>
<td>30</td>
</tr>
<tr>
<td>STUDENT PERFORMANCE EVALUATION</td>
<td>LANGUAGE OF EVALUATION: Greek (slides in English)</td>
<td></td>
</tr>
<tr>
<td>--------------------------------</td>
<td>--------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Description of the evaluation procedure</td>
<td>METHODS OF EVALUATION</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>(i) Final examination, which includes questions and problem solving.</td>
<td></td>
</tr>
<tr>
<td>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</td>
<td>(ii) Written work.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The evaluation procedure is accessible to students via the course website.</td>
<td></td>
</tr>
</tbody>
</table>

**ATTACHED BIBLIOGRAPHY**

- Suggested bibliography:

  **Book [13898]**: ΣΧΕΔΙΑΣΜΟΣ ΑΛΓΟΡΙΘΜΩΝ, JON KLEINBERG, EVA TARDOS
  **Book [33134148]**: Θεωρία και Αλγόριθμοι Γράφων, Ιωάννης Μανωλόπουλος, Απόστολος Παπαδόπουλος, Κωνσταντίνος Τσίχλας

- Related academic journals:
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 twofold: one the one hand, the first goal is to present advanced topics of database management and on the other hand, a second goal concerns the hands-on experience of students with the design and implementation of a data-centric information system. Concerning the first goal, the students are presented with the software architecture of a Database Management System (DBMS) along with the techniques, theoretical foundations and algorithms used by DBMSs for their three fundamental tasks: query processing, concurrency control and recovery from failures. Concerning the programming part, the students are exposed via a project to the design and implementation of an information system with a relational DBMS as its back-end and a graphical user interface on the front-end.

The expected outcomes of the course include the following skills for a successful student:
- The ability to tune the queries submitted to a DBMS with the goal of efficiency
The ability to tune the concurrency control and the recovery from failures with the goals of data integrity and efficiency

- The ability to tune the design of a database with the goals of data integrity and efficiency in performance

- The ability to design and implement a complete information system with a relational DBMS back-end and an interactive GUI as a front-end

<table>
<thead>
<tr>
<th>General Competences</th>
</tr>
</thead>
<tbody>
<tr>
<td>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?</td>
</tr>
<tr>
<td>Search for, analysis and synthesis of data and information, with the use of the necessary technology</td>
</tr>
<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>Working in an international environment</td>
</tr>
<tr>
<td>Working in an interdisciplinary environment</td>
</tr>
<tr>
<td>Production of new research ideas</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
- Abstraction ability for problem modeling
- Design & implementation of data intensive information systems

SYLLABUS

Architecture of a Database Management System. Processes, memory structures and data storage. Internal architecture of a DBMS.

Query processing. The general context of query processing. Algebraic operators and algorithms for their implementation (selection, join, aggregation).


Security and access control for databases.

Data warehouses. General architecture of data warehouses. OLAP. ETL. Star & Snowflake schemata. Query processing in data warehouses

Implementation of a sizeable project, concerning an information system, built on top of database.
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 projector and interactive board during lectures.
- Use of computer for demonstration of programming.
- Use of computers in laboratories for development and testing of programs.
- Course website maintenance. Announcements and posting of teaching material (lecture slides and notes, programs).
- Announcement of assessment marks via the course website.
- 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>Lectures</td>
<td>13*3 = 39 hours</td>
</tr>
<tr>
<td>Labs</td>
<td>13*2 = 26 hours</td>
</tr>
<tr>
<td>Self-study &amp; project</td>
<td>60 hours</td>
</tr>
<tr>
<td>Course total</td>
<td>125 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 questions of program development and testing. The exam papers are evaluated based on the correctness and completeness of answers.
(ii) Project developed by the students on their own that has a significant level of complexity and volume in terms of programming
(iii) Take-home exercises. To be marked based on their correctness and completeness.

The final score is a weighted sum of the final exam (50%), home exercises (20%), project (30%) and a possible bonus of 10% for the best project.

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

ATTACHED BIBLIOGRAPHY

- Suggested bibliography:


- Related academic journals:
  - Information Systems, Elsevier
  - IEEE Transactions on Knowledge and Data Engineering
  - The VLDB Journal, Springer
  - ACM Transactions on Database 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>UNDERGRADUATE</td>
</tr>
<tr>
<td>COURSE CODE</td>
<td>MYE031</td>
</tr>
<tr>
<td>SEMESTER</td>
<td>&gt;=6</td>
</tr>
<tr>
<td>COURSE TITLE</td>
<td>Robotics</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>5</td>
</tr>
<tr>
<td></td>
<td>5</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

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

PREREQUISITE COURSES:

- |

LANGUAGE OF INSTRUCTION and EXAMINATIONS:

| GREEK |

IS THE COURSE OFFERED TO ERASMUS STUDENTS:

| YES |

COURSE WEBSITE (URL)

| http://ecourse.uoi.gr/course/view.php?id=1036 |

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 objectives are to:

- Offer an introduction to theoretical and practical aspects on the design and modeling of robotic systems, on the trajectory generation, as well as on the analysis and control of classical robotic mechanisms.
- Bring students closer and make them familiar with mathematical tools for studying robotic mechanisms and offer a comprehensive analysis to the usability and functionalities of robots in our daily life.

A student that successfully attends this course should be able to:

- Understand basic topics in the theory and practical implementation of robotics.
- Understand the basic functionalities of a typical robotic platform as well as the mathematical models for modeling the motion and behavior of robots.
Study and solve simple problems in robotic manipulation, dynamic behavior and trajectory generation.

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.
- Team work.
- Working in an interdisciplinary environment.
- Production of free, creative and inductive thinking.
- Abstraction ability for problem modeling.

SYLLABUS

Introduction: History, robot structure and categories, position and orientation.

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

Dynamics: Acceleration of a rigid body, manipulator dynamics, dynamics of a mobile robot, Lagrangian formulation, simulation.

Trajectory and motion design: Trajectory generation, trajectories in joint-space, trajectories in Cartesian-space, motion design of mobile robots.

Control of robotic systems: Actuators and sensors, position control, programming and simulation software for robotic systems (ROS, Octave).

TEACHING and LEARNING METHODS - EVALUATION

<table>
<thead>
<tr>
<th>DELIVERY</th>
<th>Lectures, seminars, team project</th>
</tr>
</thead>
<tbody>
<tr>
<td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY</td>
<td>Use of projector during lectures.</td>
</tr>
<tr>
<td></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 team projects.</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>

<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>Self-study</td>
<td>86 hours</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.

| Course total | 125 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, 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 (70%).
(ii) Team project (30%).

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

**ATTACHED BIBLIOGRAPHY**

-Προτεινόμενη Βιβλιογραφία:


-Συναφή επιστημονικά περιοδικά:
  - The International Journal of Robotics Research.
  - IEEE Transactions on Robotics.
  - *IEEE/ASME Transactions on Mechatronics*
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>UNDERGRADUATE</td>
</tr>
<tr>
<td>COURSE CODE</td>
<td>MYE034</td>
</tr>
<tr>
<td>SEMESTER</td>
<td>&gt;=6</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 |
| Lectures / Labs / Tutorials     | 3/1/1       |
| CREDITS                         | 5           |

COURSE TYPE

<table>
<thead>
<tr>
<th>SPECIAL BACKGROUND</th>
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</table>

PREREQUISITE COURSES:

- 

LANGUAGE OF INSTRUCTION and EXAMINATIONS:

| GREEK |

IS THE COURSE OFFERED TO ERASMUS STUDENTS

| YES |

COURSE WEBSITE (URL)

| http://www.cse.uoi.gr/~palios/comp_geom/ |

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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Knowledge of main algorithmic methodologies, algorithms, and data structures for problems involving geometric objects.

Ability to apply the algorithmic methodologies in the solution of new problems.

Ability to effectively represent geometric objects and to use them in computer programs as well as to code algorithms for geometric objects.

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 free, creative and inductive thinking
- Algorithmic thinking
- Search for, analysis of and synthesis of data and information, with the use of the necessary technology
- Abstraction ability for problem modeling
- Working independently
- Team work

### SYLLABUS


### (1) TEACHING and LEARNING METHODS - EVALUATION

<table>
<thead>
<tr>
<th>DELIVERY</th>
<th>Use of Information and Communications Technology</th>
<th>Teaching Methods</th>
<th>Student Performance Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face-to-face, Assignment of exercises</td>
<td>Use of ICT in teaching, laboratory education, communication with students</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>
<td>Description of the evaluation procedure</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<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, etc.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>LANGUAGE OF EVALUATION: Greek</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>METHODS OF EVALUATION</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(i) Final examination, which includes questions on the material taught and problem solving</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(ii) 3 sets of homework exercises</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>The evaluation procedure is accessible to students via the course website.</td>
</tr>
</tbody>
</table>

**Activity** | **Semester workload**  
--- | ---  
Lectures | 13*3= 39 hours  
Labs | 13*1= 13 hours  
Tutorials | 13*1= 13 hours  
Self-study | 60 hours  
Course total | 125 hours
**ATTACHED BIBLIOGRAPHY**

- **Suggested bibliography:**

**Book [12407978]:** ΥΠΟΛΟΓΙΣΤΙΚΗ ΓΕΩΜΕΤΡΙΑ - ΑΛΓΟΡΙΘΜΟΙ ΚΑΙ ΕΦΑΡΜΟΓΕΣ, MARK DE BERG, OTFRIED CHEONG, MARK VAN KREVELD, MARK OVERMARS

**Book [13936]:** ΥΠΟΛΟΓΙΣΤΙΚΗ ΓΕΩΜΕΤΡΙΑ: ΜΙΑ ΣΥΓΧΡΟΝΗ ΑΛΓΟΡΙΘΜΙΚΗ ΠΡΟΣΕΓΓΙΣΗ, ΓΙΑΝΝΗΣ Ζ. ΕΜΙΡΗΣ
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>UNDERGRADUATE</td>
</tr>
<tr>
<td>COURSE CODE</td>
<td>MYE035</td>
</tr>
<tr>
<td>SEMESTER</td>
<td>&gt;=6</td>
</tr>
</tbody>
</table>

COURSE TITLE: Computational Intelligence

INDEPENDENT TEACHING ACTIVITIES

<table>
<thead>
<tr>
<th>ACTIVITY</th>
<th>WEEKLY TEACHING HOURS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures/Laboratory Exercises</td>
<td>5</td>
<td>5</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.cse.uoi.gr/~arly/courses/nn/nn.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

This course aims at first to provide a general description of computational intelligence problems and methods. Then the emphasis is given to artificial neural network methods and applications. The main course objective is to provide understanding of the learning from data paradigm as a general methodology for solving real-world problems. The most successful neural network models and learning algorithms are presented for supervised learning (classification, regression) and unsupervised learning (clustering, topographical mapping) problems. Moreover, a clear understanding of the notion of generalization and the typical methods used for model order selection constitute another important objective of this course.

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

- deep knowledge of the learning from the data problem solving paradigm
- a clear understanding of the various categories of learning problems
- a clear understanding of the notions of generalization and overtraining
• the ability to solve classification, regression and clustering problems using neural network methods

**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
- 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
- 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**

Introduction to computational intelligence, biological neural networks, introduction to artificial neural networks, learning from examples, the perceptron, the multilayer perceptron, RBF networks, learning and generalization, competitive learning, the LVQ algorithm, self-organizing maps, associative memories (the Hopfield network), neurofuzzy systems.

**TEACHING and LEARNING METHODS - EVALUATION**

<table>
<thead>
<tr>
<th>DELIVERY</th>
<th>Lecture slides, multimedia (video demonstrations), e-mail communication, course Web page maintenance.</th>
</tr>
</thead>
<tbody>
<tr>
<td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY</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. 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>Laboratory practice</td>
<td>13x2=26 hours</td>
</tr>
<tr>
<td>Student’s study hours</td>
<td>60 hours</td>
</tr>
<tr>
<td>Course total</td>
<td><strong>125 hours</strong></td>
</tr>
</tbody>
</table>

**STUDENT PERFORMANCE EVALUATION**

Description of the evaluation procedure

Language of evaluation: Greek

Methods of Evaluation:

- Final written examination
- Lab projects 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 evaluation procedure is accessible to students via the course website.

ATTACHED BIBLIOGRAPHY


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>UNDERGRADUATE</td>
</tr>
<tr>
<td>COURSE CODE</td>
<td>MYE036</td>
</tr>
<tr>
<td>SEMESTER</td>
<td>&gt;= 6</td>
</tr>
<tr>
<td>COURSE TITLE</td>
<td>Computability and Complexity</td>
</tr>
</tbody>
</table>

INDEPENDENT TEACHING ACTIVITIES

<table>
<thead>
<tr>
<th>Activity</th>
<th>WEEKLY TEACHING HOURS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures/Laboratory/Tutorials</td>
<td>3/0/2</td>
<td>5</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 course objective is to formally define the notion of computational problem, introduce basic models of computation such as Turing Machines, show that there exist problems that are unsolvable, define time and space requirements of a Turing Machine, introduce non-determinism, classify solvable problems in complexity classes and investigate the relations between these classes.

A student that successfully attends the course will know:

- what a computational problem is
- some basic models of computation
- how we can give a formal definition for the informal notion of a computable function
- that there exist computational problems that are unsolvable
- that there exist solvable problems that are intractable
- how to prove that a problem is unsolvable using diagonalization or reduction.
• how to prove that a problem is intractable using polynomial time reduction.
• some basic complexity classes and the relations between them.

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>

• Adapting to new situations
• Working independently
• Production of free, creative and inductive thinking
• Decision-making

SYLLABUS
Computational problems and formal languages.
Primitive recursive functions.
Recursive functions.
Turing machines and equivalent models of computation.
Church's Thesis.
Kleene normal form.
Unsolvability.
Recursive and recursively enumerable sets.
The arithmetic hierarchy.
Non-deterministic Turing machines.
Complexity classes.
The classes P, NP and PSPACE.
Reductions and Completeness.
NP-complete problems.
Grammars and the Chomsky Hierarchy.

TEACHING and LEARNING METHODS - EVALUATION

<table>
<thead>
<tr>
<th>DELIVERY</th>
<th>Lectures, Labs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face-to-face, Distance learning, etc.</td>
<td>Use of projector and interactive board during lectures.</td>
</tr>
<tr>
<td>USE OF INFORMATION AND COMMUNICATION TECHNOLOGY</td>
<td>Maintenance of a course website, in which announcements, exercises, lecture notes, solution to exercises and other useful material is posted.</td>
</tr>
<tr>
<td>Use of ICT in teaching, laboratory education, communication with students</td>
<td>Use of email for communication with students.</td>
</tr>
<tr>
<td></td>
<td>Announcement of assessment marks via the ecourse platform by UOI.</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>Tutorial</td>
<td>13*2 = 26 hours</td>
</tr>
<tr>
<td>Self-study</td>
<td>60 hours</td>
</tr>
</tbody>
</table>

Course total = 125 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

METHOD OF EVALUATION:

(i) Final written examination
(ii) Take-home assignments

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

ATTACHED BIBLIOGRAPHY

- Suggested bibliography:
  - "Introduction to the Theory of Computation", M. Sipser.
  - "Basic Computability Theory", Ch. Hartonas.

- Related academic journals:
  - Computational Complexity (Springer)
  - SIAM Journal on Computing
  - Journal of the ACM
  - Journal of Computer and System Sciences (Elsevier)
  - Theoretical Computer Science (Elsevier)
  - Information and Computation (Elsevier)
  - Journal of Complexity (Elsevier)
  - Bulletin of the EATCS
**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>UNDERGRADUATE</td>
</tr>
<tr>
<td>COURSE CODE</td>
<td>MYY041</td>
</tr>
<tr>
<td>SEMESTER</td>
<td>&gt;=6</td>
</tr>
<tr>
<td>COURSE TITLE</td>
<td>Complex Data Management</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 / Tutorials</th>
<th>WEEKLY TEACHING HOURS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5</td>
<td>5</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:**

- 

**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=1040

**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 management techniques for complex data used in extended database systems. The focus is on indexing such data in order to efficiently search and analyse them. The data types examined include spatial data, data on spatial networks, multidimensional data, set-valued data, data on graphs, multimedia data and time-series.

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

- Understand the types and sources of complex data
- Understand how the relationships, the distance, and the similarity between data is defined in different spaces (e.g., Euclidean, metric spaces, graphs)
- Express queries on complex data
- Apply search and analysis techniques on complex data
- Design extensions of relational database systems that manage complex data
• Design indexing methods and search algorithms for complex data

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

Advanced topics on managing relational data: relational data, query languages, indexing, query evaluation, query optimization.

Spatial data: storing spatial data in databases, spatial relationships, spatial queries, the R-tree, spatial query evaluation, nearest neighbor queries, spatial joins.

Spatial networks: data on spatial networks, distance in spatial networks, storage of network and data, indexing, shortest path search, spatial queries on networks, precomputation techniques.

Multidimensional data: multimedia data, feature vectors, collections of multidimensional data, indexing, dimensionality reduction, similarity queries, time-series, containment queries on time-series, indexing time-series, dynamic time warping.

Top-k and skyline queries: multidimensional data, top-k query variants, top-k query evaluation, indexing for top-k queries, top-k joins, dominance between multidimensional points, skyline queries, skyline computation on raw data, skyline computation on indexed data.

Set-valued data and text: document databases, containment and similarity queries on text, indexing set-valued data, signature files, inverted files, query evaluation, string matching, suffix trees and arrays, approximate string matching, edit distance computation.

Geo-textual and geo-social data: queries on geo-textual data, query evaluation, indexing, distance between social network nodes, PageRank, Personalized PageRank, query evaluation on geo-social data.
TEACHING and LEARNING METHODS - EVALUATION

DELIVERY

<table>
<thead>
<tr>
<th>Weekly Lectures.</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.
- 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 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**
--- | ---
Lectures | $13 \times 4 = 52$ hours
Self-study | 73 hours

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, 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, which includes questions on problem solving for complex data management. The exam papers are evaluated based on the correctness and completeness of answers.

(ii) Take-home programming assignments. The assignments are marked based on their correctness and completeness.

(iii) Midterm examination, which includes questions on problem solving for complex data management. The exam papers are evaluated based on the correctness and completeness of answers.

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

ATTACHED BIBLIOGRAPHY

- Suggested bibliography:
  
  
  Book [22690971]: Συστήματα Βάσεων Δεδομένων (Σε έναν Τόμο), Garcia-Molina, Ullman, Widom, Ι.Ε ΠΑΝΕΠΙΣΤΗΜΙΑΚΕΣ ΕΚΔΟΣΕΙΣ ΚΡΗΤΗΣ, 1η/2012.

- Related academic journals:
  - ACM Transactions on Database Systems (TODS)
  - the VLDB Journal, Springer
  - IEEE Transactions on Knowledge and Data Engineering (TKDE)
**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>UNDERGRADUATE</td>
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<tr>
<td>COURSE CODE</td>
<td>MYE047</td>
</tr>
<tr>
<td>SEMESTER</td>
<td>&gt;=6</td>
</tr>
<tr>
<td>COURSE TITLE</td>
<td>Algorithms for Big Data</td>
</tr>
</tbody>
</table>

**INDEPENDENT TEACHING ACTIVITIES**

- Lectures / Labs / Tutorials: 3/0/2
- WEEKLY TEACHING HOURS: 3
- CREDITS: 5

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

**COURSE TYPE**

- 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):**

- http://www.cse.uoi.gr/~kontog/courses/Algorithms-For-Big-Data/

**LEARNING OUTCOMES**

The design of algorithms for efficient processing of large data sets poses unique challenges. This course will discuss algorithmic paradigms that have been developed to efficiently process data sets that cannot fit in main memory, and/or need to be processed not as a whole but as a real-time stream which we may access via only a limited number of passes. This course will cover: streaming and sketching algorithms that produce compact data structures capable of giving satisfactory answers for measurements of the entire data set; dimension reduction techniques that preserve geometric structure; efficient algorithms for numerical linear algebra; graph sparsification methods for providing meaningful graph sketches; sampling and property-testing techniques; and impossibility results for all these techniques.

By the end of the course, the student must be able to:

- Understand the challenges posed by the scale and the temporal aspect of large data sets and streams.
- Design efficient algorithms for variations of problems discussed in class.
• Analyze space/time/communication complexity of randomized algorithms.
• Choose an appropriate algorithmic tool for big data problem at hand.
• Use modern programming environments to implement and test their own solutions on real-world benchmark data sets.

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 | 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

Selected topics from the following areas:

Streaming: For a large dataset that is revealed as a stream, we shall see techniques for approximating its basic properties using a very small memory footprint. For example, stream sampling; estimation of statistical measurements (number of distinct elements, heavy hitters, frequency moments), or approximately solving graphs problems such as connectivity, shortest path distances, maximum matchings; stream filtering (bloom filters).

Sketching: Construct a carefully designed set of measurements (i.e., a sketch) C(X) of a data set X, so as to we can learn the main parameters of X by only reading its sketch C(X). We will cover several results for p-stable sketches, sparse recovery and property testing, that answer this question for a range of fundamental problems.

Graph stream algorithms: We shall discuss data sets representing graph structures, and elementary combinatorial problems on them, such as nearest neighbor, connectivity, distances, cut/spectral sparsifiers, spanners, matching, and graph sketching.

Locality sensitive hashing: We shall study similarity estimation, and exploration of frequent itemsets in data sets, techniques for approximate nearest neighbour search, and data dependent hashing.

Dimension reduction: The Johnson-Lindenstrauss lemma, principal component analysis, low-rank (e.g., SVD, CURE) approximation.

Limited communication requirements: We shall discuss how to design algorithms for modern distributed computation models (e.g. MapReduce, Hadoop) that have low communication requirements. We will discuss graph sketching, a recently developed approach for designing low communication algorithms for processing dynamically changing
graphs, as well as other techniques.

**TEACHING and LEARNING METHODS - EVALUATION**

**DELIVERY**
- Weekly lectures in class.
- Bi-weekly homework assignments (problem sets and programming tasks).

**USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY**
- Use of projector and board during lectures.
- Course website maintenance.
- Announcements and posting of teaching material (lecture slides and notes, data and code).
- Use of publicly available data sets, and open-source code, for experimentation.

**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>In-class solution to exercises and examples</td>
<td>13*2 = 26 hours</td>
</tr>
<tr>
<td>Individual study and problem solving</td>
<td>60 hours</td>
</tr>
<tr>
<td><strong>Course total</strong></td>
<td><strong>125 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 (slides may be in English)

**METHODS OF EVALUATION**
(i) Final examination, which includes questions and problem solving.
(ii) Optional programming project.
(iii) Homework assignments.

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

**ATTACHED BIBLIOGRAPHY (in greek)**

- Suggested bibliography:

**Book [68386089]**

ΈΞΟΡΥΞΗ ΚΑΙ ΑΝΑΛΥΣΗ ΔΕΔΟΜΕΝΩΝ: ΒΑΣΙΚΕΣ ΕΝΝΟΙΕΣ ΚΑΙ ΑΛGORΙΘΜΟΙ

Έκδοση: 1η/2017

Συγγραφείς: ΜΟHAMMED J. ΖΑΚΙ, WAGNER MEIRA JR.


Τύπος: Σύγγραμμα

Διαθέτεις (Εκδότης): ΕΚΔΟΣΕΙΣ ΚΛΕΙΔΑΡΙΘΜΟΣ ΕΠΕ
Related academic journals and conferences:

- SIAM Journal on Computing
- Journal of the ACM
- Journal of Computer and System Sciences (Elsevier)
- Theoretical Computer Science (Elsevier)
- Information and Computation (Elsevier)
- ACM Symposium on Theory of Computing (STOC)
- IEEE Symposium on Foundations of Computer Science (FOCS)
- International Colloquium on Automata, Languages, and Programming (ICALP)
- European Symposium on Algorithms (ESA)
- ACM-SIAM Symposium on Discrete Algorithms (SODA)
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>UNDERGRADUATE</td>
</tr>
<tr>
<td>COURSE CODE</td>
<td>MYE048</td>
</tr>
<tr>
<td>SEMESTER</td>
<td>&gt;=5</td>
</tr>
<tr>
<td>COURSE TITLE</td>
<td>Wireless Links</td>
</tr>
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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 / Tutorials</td>
<td>5</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

Special background

PREREQUISITE COURSES:

- 

LANGUAGE OF INSTRUCTION and EXAMINATIONS:

GREEK

IS THE COURSE OFFERED TO ERASMUS STUDENTS

YES

COURSE WEBSITE (URL)

LEARNING OUTCOMES

The course provides an introduction to wireless propagation and the principles of designing wireless links. The course aims at providing students with the knowledge required to understand all the phenomena related to wireless propagation as well as to provide them with the basic principles used to design a wireless link in the context of wireless communications.

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

- understand the challenges and the limitations imposed by wireless propagation in designing wireless link
- explain how wireless link is different from a wired one
- be able to identify and explain the phenomena related to propagation and qualitatively evaluate the performance of a wireless link.
- estimated the impact of several parameters on the link performance
• solve typical link budget problems

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

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
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

• 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
• Algorithmic thinking
• Abstraction ability for problem modeling
• Working independently
• Team work

SYLLABUS

The course examines fundamental principles of propagation loss and focuses on designing a wireless link budget. The main area covered are:

• Fundamental principles of wireless propagation
• Wireless propagation modelling
• Analytical propagation loss models
  o Flat earth loss
  o Two ray model
  o Diffraction loss
  o Fresnel zones
  o Link Budget
• Empirical propagation loss models
  o Outdoor models (Okumura Hata, Egli, IEEE, ITU-R P1546, WINNER)
  o Indoor models (COST 231, ITU-R P1238)
• Wireless Link Fading
  o Small scale fading
  o Large scale fading
  o Empirical determination of path loss

TEACHING and LEARNING METHODS - EVALUATION

DELIVERY
Face-to-face, Distance learning, etc.
Lectures, lab courses.
The course includes a series of lab exercises. Those exercises involve the use of specialized software. The lab exercises are based on the principles examined during the course and are oriented towards the design of a wireless link. The MATLAB software is also used in the context of the course.

**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 computers in laboratories.
- Course website maintenance. Announcements and posting of teaching material (lecture slides, programs).
- Announcement of assessment marks via the course webpage.
- Use of email and social media for information exchange and improved communication with students.

**TEACHING METHODS**

The manner and methods of teaching are described in detail. Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.

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

**STUDENT PERFORMANCE EVALUATION**

*Description of the evaluation procedure*

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

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

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<tr>
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</thead>
<tbody>
<tr>
<td>Lectures</td>
<td>13*3 = 39 hours</td>
</tr>
<tr>
<td>Labs</td>
<td>13*2 = 26 hours</td>
</tr>
<tr>
<td>Self-study</td>
<td>60 hours</td>
</tr>
<tr>
<td><strong>Course total</strong></td>
<td><strong>125 hours</strong></td>
</tr>
</tbody>
</table>

**LANGUAGE OF EVALUATION:** Greek

**METHODS OF EVALUATION**

(i) Final written examination.
(ii) Lab exercises.

The exact evaluation procedure can be found on the course website.

**ATTACHED BIBLIOGRAPHY**

- **Book** [33154041]: Συστήματα Κινητών Επικοινωνιών, Έκδοση: 2η/2013, Συγγραφείς: Κανάτας Αθανάσιος, Κωνσταντίνου Φίλιππος, Πάντος Γεώργιος, Εκδόσεις: Α. ΠΑΠΑΣΩΤΗΡΙΟΥ & ΣΙΑ Ι.Κ.Ε

- **Related academic journals:**
  - IEEE Transactions on Wireless Communications, IEEE.
  - IEEE Wireless Communications, IEEE.
  - IEEE Transactions on Mobile Computing, IEEE.
• Wireless Networks: The Journal of Mobile Communication, Computation and Information, Springer
• IEEE JOURNAL ON SELECTED AREAS IN COMMUNICATIONS (J-SAC), IEEE.
COURSE OUTLINE

GENERAL

<table>
<thead>
<tr>
<th>SCHOOL</th>
<th>SCHOOL OF SCIENCE</th>
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<td>ACADEMIC UNIT</td>
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<tr>
<td>LEVEL OF STUDIES</td>
<td>UNDERGRADUATE</td>
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<td>COURSE CODE</td>
<td>MYE050</td>
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<td>SEMESTER</td>
<td></td>
</tr>
<tr>
<td>COURSE TITLE</td>
<td>Teaching of Informatics</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>3/0</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

PREREQUISITE COURSES:

- 

LANGUAGE OF INSTRUCTION

GREEK

IS THE COURSE OFFERED TO ERASMUS STUDENTS

YES

COURSE WEBSITE (URL)

http://ecourse.uoi.gr/

LEARNING OUTCOMES

Learning outcomes

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

Consult Appendix A

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

This course aims to help students:

- understand the principles of effective teaching and teaching IT in Primary and Secondary Education
- learn teaching methods for use in subjects on general algorithms and programming
- learn innovative methods for teaching programming
- learn about software used for IT in Primary, Middle School, High School/Lyceum and Professional Lyceum.

After taking this course students will be able to:

- effectively plan teachings for Computer Science and Informatics topics using worksheets.
- design and implement teaching scenarios on IT in a school environment (Primary and Secondary Education).
- use and integrate educational software into the teaching process.
### 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 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 |

- Production of free, creative and inductive thinking
- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Abstraction ability for problem modeling
- Working independently
- Team work
- Analysis of the requirements for problem solving and decision making
- Synthetic use of methods to solve new problems
- Applying knowledge to real life situations
- Adapting to new situations
- Working in an interdisciplinary environment
- Production of new research ideas

### SYLLABUS

1. **Informatics as a subject and a cognitive tool.**
2. **Informatics as a subject in the Greek educational system** (Computer Science in Primary School, Middle School, High School/Lyceum and Vocational Education - Basic axes of teaching, Curriculum, Syllabus)
3. **Teaching and teaching of Informatics: conceptual framework**
4. **Learning Theories, Didactic Models, Didactic Techniques** (Didactic Transformation of Concepts of Computer Science, Mental Models and Representations of Informatics)
6. **Evaluation topics.**
7. **Programming instruction** (Teaching methods for teaching programming concepts, types of knowledge in programming, Modern technological environments for introductory programming and computational thinking).
8. **Teaching of general purpose software.**
9. **Teaching of software for educational purposes.**
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
- Use of projector and board during lectures.
- Course website maintenance. Announcements and posting of teaching material (lecture slides and notes, data and code).
- Use of suitable software for teaching algorithms-programming

TEACHING METHODS

The manner and methods of teaching are described in detail.

Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.

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

STUDENT PERFORMANCE EVALUATION

Description of the evaluation procedure

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

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

Activity | Semester workload
--- | ---
Lectures | 13x3=39 hours
Laboratory practice | 13x2=26 hours
Student’s study hours | 60 hours

Course total | 125 hours

LANGUAGE OF EVALUATION: Greek (slides in Greek with English terminology also available)

METHODS OF EVALUATION

(i) Final written examination assess the level of theoretical knowledge with multiple choice and other questions. In addition, the ability to design appropriate teaching scenarios and course plans on various IT topics will be assessed.

(ii) Laboratory work.

Design of teaching scenarios and worksheets. Students are encouraged to apply modern teaching methods and suggest the development of worksheets for teaching topics on programming and algorithms.

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

ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

**Book [13678]** : Εισαγωγή στη διδακτική της πληροφορικής, Β. Ι. Κόμης, Κλειδάριθμος, 2005,
ISBN: 9789602098387


- *Related academic journals:*