## Graduate Programme Courses Outlines

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<tr>
<td>T12</td>
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<td>T13</td>
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Y07. Parallel Systems

COURSE OUTLINE

(1) GENERAL

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INDEPENDENT TEACHING ACTIVITIES

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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)


(2) LEARNING OUTCOMES

Learning outcomes

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

Consult Appendix A

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

Almost all modern computing systems are parallel, with multiple processors or cores, which can work concurrently towards the solution of a problem. This course teaches the organization, the operation and the programming of parallel computers. The basic architectural choices are presented, along with the corresponding problems one has to solve during the design and implementation of such systems. In addition, parallel programming is introduced, which is necessary for the full exploitation of parallel systems. Parallel programming is practiced through the use of the contemporary programming models. Finally, the course includes an introduction to performance analysis, and the implementation of system-level support. The course includes a survey of recent research problems and publications related to parallel systems organization and programming.
After successfully passing this course the students will be able to:

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

General Competences

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

| Search for, analysis and synthesis of data and information, with the use of the necessary technology | Project planning and management |
| 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… |

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

(3) 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 (NUMA)
- Multicore architectures
- SIMD and GPU organizations
- Principles and languages for parallel programming
- Programming in the shared address space model (threads, OpenMP)
- Programming in the message passing model (MPI)
(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY
Face-to-face lectures

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

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

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

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<td>148 hours</td>
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Course total: 200 hours

STUDENT PERFORMANCE EVALUATION

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

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

LANGUAGE OF EVALUATION: Greek

METHODS OF EVALUATION
(i) Homework problems and exercises
(ii) Programming assignments
(iii) Reading assignments and topic
(iv) Term project

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:
  - Γ. Πάντζιου, Β. Μάμαλης, Αλ. Τομαράς, Εισαγωγή στον Παράλληλο Υπολογισμό,
- Related academic journals:
  - Transactions on Parallel and Distributed Systems, IEEE.
  - Concurrency and Computation: Practice and Experience, Wiley.
  - Parallel Computing, Elsevier
Y10. Digital System Synthesis

COURSE OUTLINE

(1) GENERAL

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INDEPENDENT TEACHING ACTIVITIES

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<td></td>
<td>8</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

Specialized general Knowledge

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

PREREQUISITE COURSES:

- 

LANGUAGE OF INSTRUCTION and EXAMINATIONS:

GREEK & ENGLISH

IS THE COURSE OFFERED TO ERASMUS STUDENTS

YES

COURSE WEBSITE (URL)


(2) LEARNING OUTCOMES

Learning outcomes

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

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

This course aims to expose the students to the synthesis process of VLSI circuits and systems. All the stages of the synthesis process from the design description to the library binding are presented. The HDL description, the intermediate representation and transformations, the architectural synthesis, the scheduling algorithms, the data path allocation and control unit synthesis, the two-level and multi-level synthesis and the technology mapping are presented.

The students learn to use advanced features of circuit modeling, circuit synthesis and circuit simulation through an extended project on architectural design. Using the hardware description language VHDL, the students develop a simple microprocessor with a basic instruction set, and run software programs on this microprocessor. The microprocessor is
validated on FPGAs using hardware kits available at the laboratory.

After taking this course students will be able to:

- Understand the various stages of the synthesis process.
- Apply the basic synthesis algorithms.
- Transform a simple behavioral description into a circuit model.
- Differentiate the roles of data path and control unit.
- Understand the role of hierarchical design and hierarchical synthesis.
- Use the basic description structures.

### 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 free, creative and inductive thinking
- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Analysis of requirements for problem solving
- Team work

### SYLLABUS


Quality Measures (Area, Delay, Power Consumption) in Early Design Stages

High Level Hardware Description Languages: Basic Elements, Structural Description, Behavioral Description, VHDL-Verilog.


Architectural Synthesis: Scheduling, Unit Binding, Hierarchical Models.

Scheduling Algorithms, Data Path Allocation, Synthesis of Micro-programmable & Hardwired Control Units.


### TEACHING and LEARNING METHODS - EVALUATION

<table>
<thead>
<tr>
<th>DELIVERY</th>
<th>Lectures, Project</th>
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</thead>
<tbody>
<tr>
<td>Face-to-face, Distance learning, etc.</td>
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<tr>
<th>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY</th>
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<tbody>
<tr>
<td>Use of ICT in teaching, laboratory education, communication with students</td>
<td>Use of special electronic equipment and software for delivering the project.</td>
</tr>
<tr>
<td></td>
<td>Course website maintenance. Announcements and posting of teaching material (lecture slides and notes, programs).</td>
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</table>
- 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.

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

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

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

**LANGUAGE OF EVALUATION:** Greek

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

**ATTACHED BIBLIOGRAPHY**

- **Suggested bibliography:**
  Synthesis & Optimization of Digital Circuits, G. DeMicheli (Publisher: McGraw Hill)

- **Συναφή επιστημονικά περιοδικά:**
  - Transactions on Computer Aided Design of Circuits and Systems (TCAD), IEEE.
  - Transactions on VLSI Circuits and Systems (TVLSI), IEEE.
L02. Topics on Database Systems Applications

COURSE OUTLINE

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

COURSE TYPE

Special background

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

PREREQUISITE COURSES:

-

LANGUAGE OF INSTRUCTION

and EXAMINATIONS:

GREEK

IS THE COURSE OFFERED TO ERASMUS STUDENTS:

YES

COURSE WEBSITE (URL):

http://www.cs.uoi.gr/~pvassil/courses/graduate/02_DB_Topics/index.html

(2) 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 postgraduate courses Database Systems and Topics on Database Systems Applications aim at presenting in depth the fundamental concepts around database management systems. The syllabus of these courses are based on collections of the most classic articles published in the area, which formed more-or-less on one hand the research trends, and on the other hand the architecture and functionality of commercial database systems. The course Topics on Database Systems Applications typically specialises in database management topics which belong to one in two big categories, specifically: (a) the area of query evaluation (e.g., issues in aggregate query processing, top-k queries, etc.) and (b) the area of data management for non-traditional formats and environments (e.g., with a focus on spatiotemporal data, time-series, multidimensional data, or handling data privacy)
issues). The course specialises each year to a possibly different subarea; however, it begins by covering the fundamental concepts of each area (as well as how they are related to traditional database management) and later on goes deeper to techniques that cover research efforts and state-of-the-art tools.

In the academic year 2015-2016 the course will focus on the management of multidimensional data.

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

- Understand the state-of-the-art and the historical evolution of research in the area under study
- Understand in depth the critical elements of the DBMS architecture
- Organize the data using appropriate data representations both at the logical and physical levels, such that the data can be easily and efficiently retrieved
- Use specialized query evaluation algorithms, depending on the data domain
- Tune the writing of database queries in order for them to be evaluated more efficiently
- Tune the design of a relational database, aiming at data integrity and efficiency in query evaluation
- Develop a complete project wherein they apply the design and algorithmic knowledge obtained from the course in order to manage complex data collections

### 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...

### (3) SYLLABUS

Spatial Indexes and Queries
Dimensionality Reduction for Multimedia Data
Top-k queries and skyline queries
Data Warehouses and OLAP
### (4) TEACHING and LEARNING METHODS - EVALUATION

#### DELIVERY

**Weekly Lectures**

#### 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 course website.
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#### TEACHING METHODS

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**Course total** 200 hours

#### STUDENT PERFORMANCE EVALUATION

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

**LANGUAGE OF EVALUATION: Greek**

**METHODS OF EVALUATION**

(i) At each lecture, the students are asked to be prepared on the material of the lecture and to participate in the critical discussions that arise.

(ii) At each lecture, the students are asked to answer questions and exercises related to the learning outcomes of the previous lecture.

(iii) A large programming assignment (project).

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

- Suggested bibliography:


- Related academic journals:
  - ACM Transactions on Database Systems
  - IEEE Transactions on Knowledge and Data Engineering
  - The VLDB Journal, Springer
  - Information Systems, Elsevier
### L05. Topics on Information Systems: Infrastructure Technologies for Large-Scale Service Oriented Systems

#### COURSE OUTLINE

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<td>SEMESTER</td>
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#### INDEPENDENT TEACHING ACTIVITIES

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<tr>
<th>COURSE WEBSITE (URL)</th>
<th><a href="http://www.cse.uoi.gr/~magoutis/L05">http://www.cse.uoi.gr/~magoutis/L05</a></th>
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(2) LEARNING OUTCOMES

#### Learning outcomes

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Consult Appendix A
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- Guidelines for writing Learning Outcomes

The explosive growth of the Internet in recent years has created the need to design, implement, and manage infrastructures that support large-scale service-oriented systems. The course offers an introduction to the scalable infrastructure technologies designed to support large-scale e-services. In the course we will examine existing design techniques and research problems in the design and implementation of these systems. The course covers a range of topics including Cloud computing, scalable data stores (with particular emphasis on data replication techniques and NoSQL systems), large-scale Web services, and infrastructure management systems. The course is based on class discussions and analyses of important papers on the field.
After successfully passing this course the students will be able to:

- Understand the fundamental principles of designing, implementing, and managing large-scale service-oriented systems.
- Understand the main research challenges in achieving reliability and scalable performance in large-scale data stores, and indicative solutions to these challenges from the recent research literature.
- Understand the basic methods for evaluating reliability, availability, and performance of large-scale service-oriented systems.

**General Competences**

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

- 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
- Ability to abstract and model problems
- Working independently
- Team work

**SYLLABUS**

**Introduction to Large-Scale Service-Oriented Infrastructures:** Introduction to the aspects of scalability (expandability, performance, availability, manageability) and infrastructure technologies in Data Centers, review of basic principles, examples.

**Large-scale Data Stores:** The Paxos distributed consensus algorithm, replication and reconfiguration, consistency models, comparative study of replication systems with regard to performance, high availability, reliability, methods of metadata management in large-scale data stores.

**Cloud Infrastructure Technologies:** Introduction to virtualization technologies and to the cloud computing model, load balancing techniques, soft state management and distributed caching systems.

**TEACHING and LEARNING METHODS - EVALUATION**

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<td>• Use of projector and interactive board during lectures.</td>
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Use of ICT in teaching, laboratory education, communication with students

- Use of networked computers in laboratories for development and testing of distributed systems software.
- Course website maintenance. Announcements and posting of teaching material (lecture slides and notes, programs).
- Announcement of course grades via the UOI electronic course administration system.
- Use of email for information exchange and improved communication with students.

TEACHING METHODS

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

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

<table>
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<tr>
<th>Activity</th>
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<tbody>
<tr>
<td>Lectures</td>
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<td>Project</td>
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<td>Self-study</td>
<td>109 hours</td>
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<td>Course total</td>
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</table>

STUDENT PERFORMANCE EVALUATION

Description of the evaluation procedure

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

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

LANGUAGE OF EVALUATION: Greek

METHODS OF EVALUATION

(i) Final examination, including open-ended questions and problem solving.
(ii) Written report and oral presentation in class.

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- Related academic journals:
  - IEEE Transactions on Parallel and Distributed Systems.
  - SpringerOpen Journal of Internet Services and Applications
## COURSE OUTLINE

### (1) GENERAL

<table>
<thead>
<tr>
<th>SCHOOL</th>
<th>SCHOOL OF SCIENCES</th>
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<tbody>
<tr>
<td>ACADEMIC UNIT</td>
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<tr>
<th>INDEPENDENT TEACHING ACTIVITIES</th>
<th>WEEKLY TEACHING HOURS</th>
<th>CREDITS</th>
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<tbody>
<tr>
<td>Lectures/Laboratory Exercises</td>
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Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).

<table>
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<tr>
<th>COURSE TYPE</th>
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<tr>
<td>PREREQUISITE COURSES:</td>
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<table>
<thead>
<tr>
<th>LANGUAGE OF INSTRUCTION and EXAMINATIONS:</th>
<th>Greek</th>
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<table>
<thead>
<tr>
<th>IS THE COURSE OFFERED TO ERASMUS STUDENTS</th>
<th>YES</th>
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</thead>
</table>

| COURSE WEBSITE (URL) | http://www.cse.uoi.gr/~arly/courses/dm/dm.html |

### (2) LEARNING OUTCOMES

**Learning outcomes**

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

Consult Appendix A

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

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

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

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

General Competences
Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?
Search for, analysis and synthesis of data and information, with the use of the necessary technology
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

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

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

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<thead>
<tr>
<th>DELIVERY</th>
<th>Face-to-face, Distance learning, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY</td>
<td>Lecture slides, multimedia (video demonstrations), e-mail communication, course Web page maintenance.</td>
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<tr>
<td>TEACHING METHODS</td>
<td>Activity</td>
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<td>Lectures</td>
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<td>Laboratory practice</td>
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<td></td>
<td>Student’s study hours</td>
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<td>Course total</td>
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## 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>
</table>

**Methods of Evaluation:**

i) Final written examination  
ii) Lab projects examination  
iii) Evaluation of weekly assignments

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

---

### (5) ATTACHED BIBLIOGRAPHY

**Book:** P. Tan, M. Steinbach and V. Kumar, “Introduction to Data Mining”, Addison-Wesley 2006.  
(1) GENERAL

<table>
<thead>
<tr>
<th>SCHOOL</th>
<th>SCHOOL OF SCIENCES</th>
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</thead>
<tbody>
<tr>
<td>ACADEMIC UNIT</td>
<td>DEPT. OF COMPUTER SCIENCE &amp; ENGINEERING</td>
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<tr>
<td>COURSE TITLE</td>
<td>Optimization</td>
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</table>

**INDEPENDENT TEACHING ACTIVITIES**

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

<table>
<thead>
<tr>
<th>Lectures / Labs / Tutorials</th>
<th>WEEKLY TEACHING HOURS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 / 1 / 0</td>
<td>8</td>
<td></td>
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</tbody>
</table>

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

**COURSE TYPE**

Special background

**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/~kostasp/courses/Optimization.html

(2) LEARNING OUTCOMES

**Learning outcomes**

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

Consult Appendix A

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

Optimization is the branch of Mathematics that deals with the detection of optimal solutions. Typically, a solution to a given problem is modeled via a parametric “objective” function, the minima of which may correspond to desired solutions. Also, the problem may contain a set of constraints, typically defined through equality and/or inequality relations.

In this course, we study Optimization algorithms that exploit the mathematical characteristics of the objective function (continuity, differentiability) for the detection of a local minimum. Such algorithms are the Steepest Descent, Newton and modified Newton, Quasi-Newton, Conjugate Gradient, etc., which employ first- and second-order derivatives. Also, Line Search and Trust Region techniques are presented. Moreover, Direct Search methods that do not use derivatives, such as Pattern Search, Nonlinear irregular Simplex and Multi-Directional Search, are considered. Finally, optimality conditions for the case of...
constrained problems are given, along with different techniques to address them.

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

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

### General Competences

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

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

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

### (3) SYLLABUS

**Introduction to Optimization**

- Optimality conditions
- One-dimensional optimization

**Direct Methods:** Simplex, Hook & Jeeves, Multidirectional search

**Gradient based methods:** Newton and modifications, Quasi-Newton, Conjugate Gradients.

The line-search and the trust-region approaches.

Optimality conditions and solution techniques for constrained problems.

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

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

<table>
<thead>
<tr>
<th>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY</th>
<th></th>
</tr>
</thead>
</table>
| Use of ICT in teaching, laboratory education, communication with students | • Course webpage where literature and free material is provided.  
• Live simulations in the classroom.  
• Use of email services and social media for communication with the students. |
**TEACHING METHODS**

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

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<tr>
<th>Activity</th>
<th>Semester workload</th>
</tr>
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<tbody>
<tr>
<td>Lectures</td>
<td>$13 \times 3 = 39$ hours</td>
</tr>
<tr>
<td>Labs</td>
<td>$13 \times 1 = 13$ hours</td>
</tr>
<tr>
<td>Self-study</td>
<td>148 hours</td>
</tr>
</tbody>
</table>

**Course total**  **200 hours**

**STUDENT PERFORMANCE EVALUATION**

Description of the evaluation procedure

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

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

LANGUAGE OF EVALUATION: Greek

METHODS OF EVALUATION: Public presentation and submission of written report.

(5) **ATTACHED BIBLIOGRAPHY**

- **Suggested bibliography:**
  
  
  

- **Related academic journals:**
  
  - Optimization Letters, SPRINGER.
  
  - Journal of Optimization Theory and Applications, SPRINGER.
  
  - SIAM Journal on Optimization, SIAM.
E06. Global Optimization Methods

COURSE OUTLINE

(1) GENERAL

<table>
<thead>
<tr>
<th>SCHOOL</th>
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<tr>
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INDEPENDENT TEACHING ACTIVITIES

<table>
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<td>Lectures / Labs / Tutorials</td>
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Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).

<table>
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<th>COURSE TYPE</th>
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<td>and EXAMINATIONS:</td>
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<td>IS THE COURSE OFFERED TO</td>
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<td><a href="http://www.cse.uoi.gr/~kostasp/courses/Global_Optimization_Methods.html">http://www.cse.uoi.gr/~kostasp/courses/Global_Optimization_Methods.html</a></td>
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</table>

(2) LEARNING OUTCOMES

Learning outcomes

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

Consult Appendix A

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

Global Optimization is a branch of Applied Mathematics that deals with the detection of global minimizers of a function, according to a number of predetermined criteria. Often, such problems are accompanied by a set of constraints, which are typically modeled with inequality and equality relations. There is a multitude of factors that may affect the degree of difficulty of solving a Global Optimization problem. Such factors are the form and mathematical properties of the objective function, the type and form of the constraints, the presence of noise in function values etc.

The aim of this course is to familiarize the students with a set of methods for solving Global Optimization problems, their properties, as well as their advantages and weaknesses. Also,
techniques for the implementation of the algorithms in serial and parallel computation environments are presented.

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

- Determine the most appropriate algorithm for a given problem.
- Distinguish and exploit special characteristics of the problem.
- Design variants of the algorithms for serial and parallel computing environments, as well as for challenging applications.

### General Competences

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

| Search for, analysis and synthesis of data and information, with the use of the necessary technology | 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.
- Decision-making.
- Search for, analysis and synthesis of data and information.
- Development of algorithmic thinking.
- Ability of analyzing and modeling problems.

### (3) SYLLABUS

**Introduction:** Introduction to Optimization. Review of Local Search algorithms.


**Metaheuristics:** Trajectory-based methods. Simulated Annealing and Tabu Search. Evolutionary Algorithms and Swarm Intelligence. Techniques for the alleviation of local minima and for the detection of multiple global minimizers. Parallel implementations and applications.

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

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

**USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY**

- Course webpage where literature and free material is provided.
- Live simulations in the classroom.
- Use of email services and social media for communication with the students.
TEACHING METHODS
The manner and methods of teaching are described in detail. Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.

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

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</table>

STUDENT PERFORMANCE EVALUATION
Description of the evaluation procedure

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

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

LANGUAGE OF EVALUATION: Greek
METHODS OF EVALUATION: Public presentation and submission of written report.

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- Related academic journals:
  - Journal of Global Optimization, SPRINGER.
  - Optimization Letters, SPRINGER.
  - Journal of Optimization Theory and Applications, SPRINGER.
  - SIAM Journal on Optimization, SIAM.
  - IEEE Transactions on Evolutionary Computation, IEEE.
  - Evolutionary Computation, MIT PRESS.
  - Swarm Intelligence, SPRINGER.
  - Soft Computing, SPRINGER.
  - Applied Soft Computing, ELSEVIER.
## T10. Robotics

### COURSE OUTLINE

#### (1) GENERAL

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<td>LEVEL OF STUDIES</td>
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<td>COURSE TITLE</td>
<td>Robotics</td>
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#### 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>
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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

- Specialized general knowledge

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#### LANGUAGE OF INSTRUCTION and EXAMINATIONS:

- GREEK

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</table>

#### (2) LEARNING OUTCOMES

Learning outcomes

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

Consult Appendix A

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

The main course objective is to introduce students with more advanced aspects in selected areas of robotics, such as non-linear control, and motion planning of a robotic platform.

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

- Understand, design, and implement advanced control methodologies for robotic manipulators and mobile platforms.
- Demonstrate advanced knowledge in motion planning of a robotic platform.
- Study and solve real life complex problems in motion planning, and control of robotic systems.
- Understand research papers in the field of robotics, and try out some new ideas.
General Competences

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

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

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

(3) SYLLABUS

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

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

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

**Advanced control of robotic systems:** Control based on dynamics, compliance control, impedance control, non-linear control, vision-based control.

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<thead>
<tr>
<th>DELIVERY</th>
<th>Lectures, lab courses</th>
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</thead>
<tbody>
<tr>
<td>Face-to-face, Distance learning, etc.</td>
<td>Use of projector during lectures.</td>
</tr>
<tr>
<td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY</td>
<td>Course website maintenance. Announcements and posting of teaching material (lecture slides and notes, exercises, example programs).</td>
</tr>
<tr>
<td>Use of ICT in teaching, laboratory education, communication with students</td>
<td>Use of robots in laboratories.</td>
</tr>
<tr>
<td></td>
<td>Announcement of assessment marks via the ecourse platform by UOI.</td>
</tr>
<tr>
<td></td>
<td>Use of email for information exchange and improved communication with students.</td>
</tr>
</tbody>
</table>
TEACHING METHODS
The manner and methods of teaching are described in detail. Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.

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

<table>
<thead>
<tr>
<th>Activity</th>
<th>Semester workload</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures</td>
<td>$13 \times 3 = 39$ hours</td>
</tr>
<tr>
<td>Labs</td>
<td>$13 \times 1 = 13$ hours</td>
</tr>
<tr>
<td>Self-study</td>
<td>148 hours</td>
</tr>
</tbody>
</table>

Course total | 200 hours |

STUDENT PERFORMANCE EVALUATION
Description of the evaluation procedure

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

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

LANGUAGE OF EVALUATION: Greek

METHODS OF EVALUATION
(i) Final written examination.
(ii) Homework.

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
T12. Statistical Signal Processing

COURSE OUTLINE

(1) GENERAL

<table>
<thead>
<tr>
<th>SCHOOL</th>
<th>SCHOOL OF SCIENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACADEMIC UNIT</td>
<td>DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING</td>
</tr>
<tr>
<td>LEVEL OF STUDIES</td>
<td>GRADUATE</td>
</tr>
<tr>
<td>COURSE CODE</td>
<td>T12</td>
</tr>
<tr>
<td>SEMESTER</td>
<td>-</td>
</tr>
<tr>
<td>COURSE TITLE</td>
<td>Statistical Signal Processing</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>4</td>
<td>8</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)


(2) LEARNING OUTCOMES

Learning outcomes

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

Consult Appendix A

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

The goal of the course is the learning of the basic theory of stochastic processes and its applications in signal processing.

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

- Understand the basic notions of stochastic processes.
- Apply minimum mean square error estimation to various problems.
- Understand the notions of stationarity and ergodicity.
- Analyze systems with stochastic inputs.
- Understand the notion of power spectral density.
- Apply the theory of stochastic processes to various 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
- Decision-making
- Production of free, creative and inductive thinking
- Evaluation of different solutions and selection of the most appropriate one
- Use of structured mathematical thinking for the development and reinforcement of arguments
- 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...

(3) SYLLABUS


Minimum mean square error estimation. Linear and nonlinear estimation. Orthogonality principle.


(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<thead>
<tr>
<th>DELIVERY</th>
<th>Lectures, lab sessions</th>
</tr>
</thead>
</table>
| USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY | • Use of projector during lectures.  
• Use of Matlab in the lab.  
• Use of the ecourse electronic platform for course announcements, uploading of class notes, homework assignment, and grade announcement.  
• Use of email and social media for more effective communication with the students |

<table>
<thead>
<tr>
<th>TEACHING METHODS</th>
<th>Activity</th>
<th>Semester workload</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures</td>
<td>13*3 = 39 hours</td>
<td></td>
</tr>
<tr>
<td>Labs</td>
<td>13*1 = 13 hours</td>
<td></td>
</tr>
</tbody>
</table>
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>Self-study</td>
<td>148</td>
</tr>
<tr>
<td>Course total</td>
<td>200</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. The students are asked to solve statistical signal processing problems.

(ii) Homework assignments. The students are asked to solve statistical signal processing problems.

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

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

(5) **ATTACHED BIBLIOGRAPHY**

- **Suggested bibliography:**

- **Related academic journals:**
  - IEEE Transactions on Signal Processing
  - IEEE Signal Processing Magazine
  - IEEE Signal Processing Letters
T13. CMOS Circuit Design Techniques

COURSE OUTLINE

(1) GENERAL

<table>
<thead>
<tr>
<th>SCHOOL</th>
<th>SCHOOL OF SCIENCE</th>
</tr>
</thead>
<tbody>
<tr>
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<td>DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING</td>
</tr>
<tr>
<td>LEVEL OF STUDIES</td>
<td>POSTGRADUATE - MASTER LEVEL</td>
</tr>
<tr>
<td>COURSE CODE</td>
<td>T13</td>
</tr>
<tr>
<td>SEMESTER</td>
<td></td>
</tr>
<tr>
<td>COURSE TITLE</td>
<td>CMOS Circuit Design Techniques</td>
</tr>
</tbody>
</table>

INDEPENDENT TEACHING ACTIVITIES

<table>
<thead>
<tr>
<th>WEEKLY TEACHING HOURS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lectures / Labs / Tutorials</td>
<td>4</td>
</tr>
<tr>
<td>Credits</td>
<td>8</td>
</tr>
</tbody>
</table>

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

COURSE TYPE
Specialized General knowledge, Skills development

PREREQUISITE COURSES:
VLSI Circuits

LANGUAGE OF INSTRUCTION and EXAMINATIONS:
GREEK - ENGLISH

IS THE COURSE OFFERED TO ERASMUS STUDENTS:
YES

COURSE WEBSITE (URL): http://www.cs.uoi.gr/~tsiatouhas/M-CCD.htm

(2) LEARNING OUTCOMES

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

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

This course aims at introducing to students the fundamentals of nanometre CMOS circuit analysis, synthesis, design and simulation.

After successfully passing this course the students will be able to:
- Understand nanometer manufacturing technologies of CMOS integrated circuits and the problems related to their scaling.
- Understand CMOS circuit operation.
- Analyze complex CMOS circuits.
- Synthesize CMOS circuits.
- Solve performance related problems (high-speed or low-power operation, cost, reliability issues) in CMOS circuits.
- Design and simulate CMOS circuits and verify their performance characteristics.

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

### (3) SYLLABUS

CMOS digital integrated circuit design techniques for high speed, low power consumption and low voltage operation. Clocking styles and timing techniques (slack borrowing and time stealing). Design for testability (DFT) and diagnosis techniques for VLSI circuits (scan testing, built-in self test, IDDQ testing, on-line testing, memory testing) and testing standards IEEE 1149.1 and IEEE 1500.

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

<table>
<thead>
<tr>
<th>DELIVERY</th>
<th>Face-to-face, lectures, lab courses, home-works</th>
</tr>
</thead>
<tbody>
<tr>
<td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY</td>
<td>Use of e-slides and interactive board during lectures.</td>
</tr>
<tr>
<td></td>
<td>Use of computer-aided design tools at the laboratory (circuit design and simulation).</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>

- 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>Laboratory practice</td>
<td>11*1 = 11 hours</td>
</tr>
<tr>
<td>Problems solving</td>
<td>75 hours</td>
</tr>
<tr>
<td>Study &amp; bibliography analysis</td>
<td>75 hours</td>
</tr>
</tbody>
</table>

**Course total**

| Course total                 | 200 hours         |

*LANGUAGE OF EVALUATION: Greek - English*

**METHODS OF EVALUATION**

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

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

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

### 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.

### (5) ATTACHED BIBLIOGRAPHY

- *Suggested bibliography:*

  **Book [41963448]:** CMOS VLSI DESIGN: A CIRCUITS AND SYSTEMS PERSPECTIVE, N. Weste and D. Harris, Addison-Wesley, 2011.


  **Βιβλίο VLSI TEST PRINCIPLES AND ARCHITECTURES, L-T. Wang, C-W Wu, X. We, Εκδ.: MORGAN-KAUFMANN, 2006.**

  **Βιβλίο VLSI TEST PRINCIPLES AND ARCHITECTURES, L-T. Wang, C-W Wu, X. We, Εκδ.: MORGAN-KAUFMANN, 2006.**

  **Βιβλίο SYSTEM ON CHIP TEST ARCHITECTURES, L-T. Wang, C. Stroud, N. Touba, Εκδ.: MORGAN-KAUFMANN, 2008.**

  **Βιβλίο THE BOUNDARY-SCAN HANDBOOK, K. Parker, Εκδ.: KLUWER ACADEMIC PUBLISHERS, 2002.**

  **Βιβλίο POWER MANAGEMENT OF DIGITAL CIRCUITS IN DEEP SUB-MICRON TECHNOLOGIES, **
- Related academic journals:
  - Integration the VLSI Journal, Elsevier
  - IEEE Transactions on Circuits and Systems I & II (TCAS).