Department of Computer Science and Engineering
University of Ioannina

Undergraduate Programme:
Outlines of Elective Courses

ACADEMIC YEAR 2025-2026

Undergraduate Programme: Elective Courses

MYE002. Machine Learning

COURSE OUTLINE

GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**MYE002**	**SEMESTER**	**>=6**
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*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures / Labs / Tutorials	**5**	**5**

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized general knowledge
PREREQUISITE COURSES:	-
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	http://www.cs.uoi.gr/~kblekas/courses/ML/

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

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, Baeysian

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

DELIVERY *Face-to-face, Distance learning, etc.*	Lectures
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• Use of projector during lectures. • Use of computer for demos • Course website maintenance: announcements, assignments and posting of teaching material (lecture slides, notes, work papers, demos, etc.). • 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*	
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 (70%) (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%) The evaluation procedure is accessible to students via the course website.

Activity	*Semester workload*
Lectures	13*3 = 39 hours
Labs and Tutorials	13*2 = 26 hours
Self-study	60 hours
Course total	**125 hours**

ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- **Book [86053413]:** ΑΝΑΓΝΩΡΙΣΗ ΠΡΟΤΥΠΩΝ ΚΑΙ ΜΗΧΑΝΙΚΗ ΜΑΘΗΣΗ, C.M. Bishop
- **Book [86198212]:** ΜΗΧΑΝΙΚΗ ΜΑΘΗΣΗ, ΚΩΝΣΤΑΝΤΙΝΟΣ ΔΙΑΜΑΝΤΑΡΑΣ, ΔΗΜΗΤΡΗΣ ΜΠΟΤΣΗΣ
- **Book [9743]:** Νευρωνικά Δίκτυα και Μηχανική Μάθηση, Haykin Simon

- **Book [94691948]:** ΝΕΥΡΩΝΙΚΑ ΔΙΚΤΥΑ ΚΑΙ ΒΑΘΙΑ ΜΑΘΗΣΗ, Charu C. Aggarwal

-Scientific International Journals:

- Pattern Recognition, ELSEVIER.
- Machine Learning, Springer
- Journal of Machine Learning Research
- IEEE Transactions on Neural Networks and Learning Systems
- IEEE Transactions on Pattern Analysis & Machine Intelligence (PAMI)

MYE004. Software Development II

COURSE OUTLINE

GENERAL

SCHOOL	ENGINEERINGS		
ACADEMIC UNIT	DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**MYE004**	**SEMESTER**	**>=6**
COURSE TITLE	Software Development II		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures, laboratory exercises	**5**	**5**
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	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
Working in an international 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

Working in an interdisciplinary environment *Production of new research ideas*	*……* *Others…* *…….*

- 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

DELIVERY *Face-to-face, Distance learning, etc.*	Weekly lectures
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• Use of transparencies and interactive white board. • Maintenance of a web page dedicated to the course that provides announcements, reading material, grades, etc.
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*	

Activity	*Semester workload*
Lectures	13*3 = 39 hours
Laboratory practice	13*2 = 26 hours
Study hours	60 hours

visits, project, essay writing, artistic creativity, etc. *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*	<table><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td>***Total***</td><td>***125 hours***</td></tr></table>
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	LANGUAGE: 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.

ATTACHED BIBLIOGRAPHY

- *Suggested bibliography:*

Book [13600]: OO Design: UML, principles, patterns and rules, A. Xatzigeorgiou.

Book [13596]: Program Development in Java: Abstraction, Requirements and OO Design, B. Liskov and J. Guttag.

- *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

MYE005. Computer Architecture II

COURSE OUTLINE

GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**MYE005**	**SEMESTER**	**>=6**
COURSE TITLE	Computer Architecture II		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures / Labs / Tutorials	**5**	**5**
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special background
PREREQUISITE COURSES:	-
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	http://ecourse.uoi.gr/enrol/index.php?id=1270

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

- Production of free, creative and inductive thinking
- Search for, analysis and synthesis of data and information, with the use of the necessary 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

Introduction: Performance measurement. Energy consumption metrics. Reliability metrics. Benchmark programs.

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

Instruction-level parallelism: Dynamic/static superscalar processors. Dynamic scheduling. . Out of order execution. Speculative execution. Branch prediction.

Memory subsystem: memory technology. Organization and operation of cache memories. Performance evaluation of cache memory. Virtual memory, fast memory address translation, virtually/physically addressed caches.

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

TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Lectures
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• Course website maintenance. Announcements and posting of teaching material (lecture slides and notes). • Use of projector and interactive board during lectures. • Announcement of assessment marks via the ecourse platform by UOI. •
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography,*	

Activity	***Semester workload***
Lectures	13*3 = 39 hours
Labs	2*12= 24 hours
Self-study	62 hours

tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc. *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*		
	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 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 [68370526]: Δ. Νικολός: Αρχιτεκτονική Υπολογιστών.
Βιβλίο [94644180]: Hennessy John L., Patterson David A., ΑΡΧΙΤΕΚΤΟΝΙΚΗ ΥΠΟΛΟΓΙΣΤΩΝ: ΜΙΑ ΠΟΣΟΤΙΚΗ ΠΡΟΣΕΓΓΙΣΗ.

- *Related academic journals:*

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

MYE006. Wireless Networks

COURSE OUTLINE

GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**MYE006**	**SEMESTER**	**>=6**
COURSE TITLE	Wireless Networks		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures / Labs / Tutorials	**5**	**5**

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/~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 of state-of-the-art wireless technologies, b) analyze the differences compared to traditional wired networking, and 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 difference and multiculturalism*
Decision-making	*Respect for the natural environment*
Working independently	*Showing social, professional and ethical responsibility and sensitivity to gender issues*
Team work	*Criticism and self-criticism*
Working in an international environment	*Production of free, creative and inductive thinking*
Working in an interdisciplinary environment	*……*
Production of new research ideas	*Others…*
	…….

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

SYLLABUS

Introduction to wireless networking. Overview of the history, evolution, and compatibility of wireless standards. The special problems of wireless and mobile computing. Wireless transmission: Free space path loss, Path loss models, Noise, Interference, Antennae (antenna types, antenna gain), Multipath fading, Diversity techniques. Modulation: Analog and Digital Modulation techniques. Spread Spectrum Techniques: Direct Sequence SS, Frequency Hopping SS. Cellular Networks: Architecture, Frequency allocation, Handover, GSM-based networks, Evolution of Cellular networks. Satellite Networks. Wireless Local Area Networks: Application scenarios, Network types (infrared, microwave, spread spectrum), Standardization (Bluetooth, IEEE 802.11, HIPERLAN). IEEE802.11 Networks: Physical layer, Infrastructure and ad-hoc networks, Medium Access Control (DCF and PCF), Mobility management, Security, IEEE 802.11e. Mobile Internet protocol.

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 interactive board during lectures. • Use of computers and networking facilities 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.*	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.

Activity	*Semester workload*
Lectures	13*3 = 39 hours
Labs	13*2 = 26 hours
Self-study	60 hours
Course total	***125 hours***

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. POMPORTSIS

- 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.

MYE007. Security of Computer Systems and Networks

COURSE OUTLINE

GENERAL

SCHOOL	SCHOOL OF SCIENCE		
ACADEMIC UNIT	DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**MYE007**	**SEMESTER**	**>=6**
COURSE TITLE	Security of Computer Systems and Networks		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures / Labs / Tutorials	**3/2/0**	**5**
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	
PREREQUISITE COURSES:	-
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	http://www.cse.uoi.gr/~stergios/teaching/mye007

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 teach students basic cryptographical methods, principles of systems and software security, secure protocols for the Internet and the web, develop hands-on experience in software and network attacks.

At the successful completion of the course, the student is expected to:

- Learn basic methods and applications of symmetric and public-key cryptography.
- Understand computer systems security and access control.
- Get familiar with web security and distributed authentication.

Get hands-on experience with buffer overflow and network attacks.

General Competences

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

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

- Abstraction ability for problem modeling
- Adapting to new situations
- Analysis of requirements for problem solving
- Algorithmic thinking
- 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
- Working independently

SYLLABUS

Introduction to security: computer security, security model, attacks, OSI security architecture, functional requirements and strategy
Symmetric cryptography: definitions, requirements, Feistel structure, DES, 3DES, AES, stream ciphers, modes, secret key distribution
Elements of number theory: birthday paradox, divisibility and prime numbers, Euler's Totient function, Euclidian algorithm
Public-key cryptography: steps, requirements, RSA, Diffie-Hellman, message authentication code (MAC), one-way hash function (SHA-1, SHA-512, MD5), HMAC, digital signatures
Software security: buffer-overflow attack, shellcode, secure programming, defensive programming, command/SQL injection, cross-site scripting (XXS), time-of-check-to-time-of-use (TOCTOU)
Security of computer systems: access control, discretionary access control, role-based access control, mandatory access control (Bell-Lapadula, Biba), trusted computing, trusted platform module (TPM)
Network security: denial of service, spoofing, reflection, firewall, network address translation (NAT)
Internet security: Internet Protocol Security (IPSec) protocol, security association, authentication header and encapsulating security payload, transport and tunnel mode
Web security: protocol for web traffic security (SSL/TLS), protocol for secure use of credit cards (SET)
Distributed authentication: Kerberos protocol, X.509 authentication service
Blockchain and cryptocurrency: block, blockchain, address, transaction, consensus, proof of work, mining

Programming development of software (buffer overflow) and network (man-in-the-middle) attacks.

TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Lectures, tutorials, lab exercises.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• 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 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*	
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 (i) Final examination, which includes questions and problem solving. (ii) Optional project. The evaluation procedure is accessible to students via the course website.

Activity	*Semester workload*
Lectures	13*3= 39 hours
Tutorials	
Self-study	
Course total	**125 hours**

ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

Textbook [12777632]: Κρυπτογραφία για ασφάλεια δικτύων: αρχές και εφαρμογές, William Stallings, Έκδοση 1η, 2011

Textbook [13618]: Βασικές αρχές ασφάλειας δικτύων: εφαρμογές και πρότυπα, William Stallings, Έκδοση 3η, 2008

Textbook [50656354]: Ασφάλεια υπολογιστών: αρχές και πρακτικές, William Stallings, Lawrie Brown, Έκδοση 3η , 2016

- Related academic journals:

MYE008. Optimization

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*		**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures / Labs / Tutorials		3 / 0 / 2	5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized general knowledge		
PREREQUISITE COURSES:	-		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	http://ecourse.uoi.gr/course/view.php?id=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.
2. Derivative-free methods: Nelder-Mead, Hooke-Jeeves, pattern search.
3. Stochastic and evolutionary algorithms for global optimization: random search, simulated annealing, genetic algorithms, particle swarm optimization.

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?

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

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

SYLLABUS

- Introduction to optimization
- Optimality conditions
- 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

DELIVERY *Face-to-face, Distance learning, etc.*	Weekly lectures
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• Course webpage where literature and freely available 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	***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.* *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*	Lectures: 13*3 = 39 hours Tutorials: 13*2 = 26 hours Self-study: 60 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.*	LANGUAGE OF EVALUATION: Greek METHODS OF EVALUATION: Final written exams (80%) and submission of written work (20%)

ATTACHED BIBLIOGRAPHY

[Book 18549025] Γ.Α. Ροβιθάκης, **Τεχνικές Βελτιστοποίησης**, Εκδ. Τζιόλα, 2007.
[Book 11113] Α.Κ. Γεωργίου, Π.Χ.Γ. Βασιλείου, **Μη Γραμμικές Μέθοδοι Βελτιστοποίησης**, Εκδ. Ζήτη, 1993.
[Book 3483] D.Z. Du, P.M. Pardalos, W. Wu, **Μαθηματική Θεωρία Βελτιστοποίησης**, Εκδ. Νέων Τεχνολογιών, 2005.

W. Sun, Y. Yuan: **Optimization Theory and Methods**, Springer, 2006.
R. Fletcher: **Practical Methods of Optimization**, 2nd edition, Wiley, 2000.
D. Bertsekas: **Nonlinear Programming**, 2nd edition, Athena Scientific, 2004.
J. Nocedal, S.J. Wright, **Numerical Optimization**, 2nd edition, Springer, 2006.
Z. Michalewicz: **Genetic Algorithms + Data Structures = Evolution Programs**, 3rd edition, Springer, 1999.
K.E. Parsopoulos, M.N. Vrahatis: **Particle Swarm Optimization and Intelligence: Advances and Applications**, IGI Global, 2010.

MYE010. Electronic system testing and reliability

COURSE OUTLINE

GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**MYE010**	**SEMESTER**	**>=6**
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*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Lectures / Labs / Tutorials	**3/2/0**	**5**
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	GENERAL BACKGROUND		
PREREQUISITE COURSES:	-		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	http://ecourse.uoi.gr/enrol/index.php?id=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?

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

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

SYLLABUS

Introduction and challenges in VLSI testing. Automatic test pattern generation. Fault simulation. Design for testability (DfT). Scan testing and architectures (full scan, partial scan, at-speed scan testing). Built-in self testing – BIST (pattern generation, output response analysis, architectures). Logic diagnosis. On-line testing.

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.
4. Development of built-in self test architectures.
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

DELIVERY *Face-to-face, Distance learning, etc.*	• Lectures, Laboratory Exercises
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• 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 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*	

Activity	*Semester workload*
Lectures	13*3= 39 hours
Lab excersises	10*2 = 20 hours
Tutorials	6 hours
Self-study	60 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.*	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 [64314]: Ψηφιακή Σχεδίαση με VHDL, Peter J Ashenden
Book [13944]: ΨΗΦΙΑΚΑ ΟΛΟΚΛΗΡΩΜΕΝΑ ΚΥΚΛΩΜΑΤΑ: ΜΙΑ ΣΧΕΔΙΑΣΤΙΚΗ ΠΡΟΣΕΓΓΙΣΗ, JAN M. RABAEY, ANANTHA CHANDRAKASAN, BORIVOJE NIKOLIC

- Related academic journals:

MYE012. Data Mining

COURSE OUTLINE

GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**MYE012**	**SEMESTER**	**>=6**
COURSE TITLE	Data Mining		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Lectures / Labs / Tutorials	**5**	**5**
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized General Knowledge		
PREREQUISITE COURSES:	-		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	http://www.cs.uoi.gr/~tsap/teaching/cse012		

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	*……*
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-Hashing Sketches and Locality Sensitive Hashing.

Dimensionality Reduction: Singular Value Decomposition. Principal Component Analysis.

Clustering: Definition of Clustering. Partitional and Hierarchical Clustering. K-means. Density based clustering. The EM algorithm. Evaluation.

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

<table>
<tr><td>DELIVERY
Face-to-face, Distance learning, etc.</td><td>Lectures, lab courses</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students</td><td>• 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.</td></tr>
<tr><td>TEACHING METHODS
The manner and methods of teaching are described in detail.
Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.

The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</td><td>
<table>
<tr><th>Activity</th><th>Semester workload</th></tr>
<tr><td>Lectures</td><td>13*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>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td>125 hours</td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
Description of the evaluation procedure

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

Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</td><td>LANGUAGE OF EVALUATION: Greek (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.</td></tr>
</table>

ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

Book [94700707]: Εξόρυξη από Μεγάλα Σύνολα Δεδομένων - 3η Έκδοση, Anand Rajaraman, Jeffrey David Ullman, Jure Leskovec

Book [68386089]: ΕΞΟΡΥΞΗ ΚΑΙ ΑΝΑΛΥΣΗ ΔΕΔΟΜΕΝΩΝ: ΒΑΣΙΚΕΣ ΕΝΝΟΙΕΣ ΚΑΙ ΑΛΓΟΡΙΘΜΟΙ, MOHAMMED J. ZAKI, WAGNER MEIRA JR.

Book [77107675]: Εισαγωγή στην εξόρυξη δεδομένων, 2η Έκδοση, Tan Pang - Ning,Steinbach Michael,Kumar Vipin, Βερύκιος Βασίλειος (επιμέλεια)

Book [122074432]: Επιστήμη των Δεδομένων-Εγχειρίδιο Σχεδιασμού, Skiena S.S.

- Related academic journals:

- ACM Transactions on Knowledge Discovery from Data (TKDD).
- ACM Transactions on Knowledge and Data Engineering (TKDE)

MYE014. Graph Theory

COURSE OUTLINE

GENERAL

SCHOOL	ENGINEERINGS		
ACADEMIC UNIT	DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**MYE014**	**SEMESTER**	**>=6**
COURSE TITLE	Graph Theory		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures/Laboratory Exercices	5	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	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)	

LEARNING OUTCOMES

Learning outcomes

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

Consult Appendix A

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

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

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

•apply the abstract concepts of graph theory in several practical problems;

•develop a number of standard and powerful algorithms, as well as demonstrate methodologies in graph techniques; and

•use the graphs in the solution of complex problems.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma

Supplement and appear below), at which of the following does the course aim?

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

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

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

DELIVERY *Face-to-face, Distance learning, etc.*	Lectures, exercises
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	•Use of projector and interactive board during lectures. •Course website maintenance. Announcements and posting of teaching material (lecture slides and notes, programs). •Announcement of assessment marks via the e-course platform by UOI.
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of*	

Activity	***Semester workload***
Lectures	13*3 = 39 hours
Laboratory practice	13*1 = 13 hours
Student's study hours	73 hours
Course total	***125 hours***

the ECTS	
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	Language of evaluation: Greek Methods of Evaluation: i) Final written examination ii) Written work 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.

MYE015. Information Theory

COURSE OUTLINE

GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**MYE015**	**SEMESTER**	**>=6**
COURSE TITLE	**Information theory and coding**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures / Labs / Tutorials	**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 *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.cs.uoi.gr/~cnikou/Information_Theory.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 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?

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	*Others…* *…….*

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

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-ρ 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.*	• Lectures, Homework (problem sets and programming assignments)
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• 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 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*	

Activity	*Semester workload*
Lectures	13*3= 39 hours
Individual study and problem solving	86 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,*	LANGUAGE OF EVALUATION: Greek (slides may be in English) METHODS OF EVALUATION (i) Final examination, which includes questions and problem solving.

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

- 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

MYE017. Distributed Systems

COURSE OUTLINE

GENERAL

SCHOOL	SCHOOL OF SCIENCE		
ACADEMIC UNIT	DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**MYE017/ΠΛΕ007**	**SEMESTER**	**>=5**
COURSE TITLE	Distributed Systems		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures / Labs / Tutorials		**3**	**5**
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).			
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	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*

Distributed Systems consist of independent networked computers that communicate by exchanging messages, and that appear to their users as a single, coherent system. The study of distributed systems in this course focuses on communication (remote procedure calls, multicasting), coordination (clock synchronization, logical clocks, totally ordered multicasting, vector clocks, causally ordered multicasting, leader election, mutual exclusion, global state, distributed commitment), reliable communication within a group of processes (atomic multicasting, virtual synchrony), data replication, consistency protocols, and fault tolerance (checkpoints, logging, recovery).

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

- Understand the basic principles and fundamental models of distributed systems, and the main methods used in solving basic coordination problems
- Understand the impact of failures on the correctness and reliability of distributed systems, and the main methods with which those properties can be achieved

- Understand the basic principles of data replication and the main consistency models that characterize it.
- Implement different types of group communication, such as totally ordered and causally ordered multicasting, and basic consensus protocols such as distributed commitment.

General Competences

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

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

- Production of free, creative and inductive thinking
- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Analysis of requirements for problem solving
- Algorithmic thinking
- Ability to abstract and model problems
- Working independently

SYLLABUS

Introduction to Distributed Systems: Organization, main properties, transparency, scalability, fundamental models of distributed systems.

Communication: Point-to-point communication, remote procedure calls, multicasting.

Coordination: Clock synchronization, causality, logical and vector clocks, totally ordered multicasting, causally ordered multicasting, leader election, mutual exclusion, global state.

Reliable group communication: Reliable multicasting, atomic multicasting, virtual synchrony, distributed commitment.

Consistency protocols and replication: Strict consistency, linearizability, sequential consistency, local and remote write protocols, leases, active replication, quorum replication protocols.

Fault tolerance: Remote procedure calls in the presence of failures, creation of checkpoints, maintaining a log, recovery.

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 interactive board during lectures. • 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*	
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) Laboratory exercises in program development and testing, and oral examination on them by course staff. The evaluation procedure is accessible to students via the course website.

Activity	***Semester workload***
Lectures	13*3 = 39 hours
Labs	13*3 = 39 hours
Self-study	72 hours
Course total	***150 hours***

ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- Related academic journals:

- IEEE Transactions on Parallel and Distributed Systems.
- ACM Journal of Parallel and Distributed Computing.

MYE018. VLSI Circuits

COURSE OUTLINE

GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**MYE018**	**SEMESTER**	**≥6**
COURSE TITLE	VLSI Circuits		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Lectures / Labs / Tutorials	**5 (3,2,0)**	**5**
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	General 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/~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 *Project planning and management*

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*	*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

MOS transistor theory. CMOS technology and integrated circuit manufacturing. CMOS combinational circuit design, complex gates and logic families (static, dynamic, Domino, CVSL, pass transistor logic). Sequential circuits. Circuit characterization and performance estimation. Logical effort. Interconnect, clocking strategies and power consumption. Clock and power distribution techniques. Sub-circuit design (adders, counters, multipliers, memories, data paths). Placement and routing. Floor-planning. FPGAs. Memory organization. VLSI testing and design for testability techniques.

TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face, lectures, lab courses, home-works
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• Use of e-slides and interactive board during lectures. • Use of computer-aided design tools at the laboratory (circuit design and simulation). • Use of components and instruments (signal generators, power supplies, multi-meters, oscilloscopes) at the laboratory for circuit implementation and measurement. • Ecourse website maintenance. • Course website maintenance. Announcements and posting of teaching material (lecture slides and notes). • Use of email for information exchange and improved communication with students.
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice,*	

Activity	*Semester workload*
Lectures	13*3 = 39 hours
Laboratory practice	11*2 = 22 hours

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*	Problems solving	8 hours
	Study & bibliography analysis	56 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.*	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.

Book [18548832]: CMOS DIGITAL INTEGRATED CIRCUITS: ANALYSIS AND DESIGN, Sung-Mo Kang and Yusuf Leblebici, McGraw-Hill, 2003.

Book [13944]: DIGITAL INTEGRATED CIRCUITS, Jan M. Rabaey, A. Chandrakasan, B. Nikolic, Prentice Hall, 2003.

- 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.

MYE020. Compilers II

COURSE OUTLINE

GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**MYE020**	**SEMESTER**	**>=5**
COURSE TITLE	**Compilers II**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures / Labs / Tutorials	**3/2/0**	**5**
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized general knowledge
PREREQUISITE COURSES:	-
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	http://ecourse.uoi.gr/enrol/index.php?id=1636

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 act complementary to the course “Compilers” and present more specialized topics from the field of compiler construction. The students deliver a large project which allows them make their knowledge in the field more complete and acquire more skills in the compiler development.

It is expected that the students after taking the course will be able to:

- understand advanced concepts of compiler construction theory
- use tools for developing compilers for high level programming languages
- design, write a grammar and implement a compiles for an object oriented programming language
- implement complex data structures like matrices, linked lists and records
- apply optimizing transforms to the code in the source level, in the IR or in the assembly level

- apply automatic parallelization techniques
- generate code for commercial processors
- further understand concepts in the field easily

General Competences

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

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

- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Production of free, creative and inductive thinking
- Analysis of requirements for problem solving
- Program design and development
- Programming skills
- Adapting to new situations
- Algorithmic thinking
- Abstraction ability for problem modeling
- Team work

SYLLABUS

Lexical and syntax analysis using compiler tools: development of lexical and syntax analyzers using lex, bison, antlr or java libraries

Advanced topics is grammars design: LL(1), First – Follow sets, LL(1) parsing table, attribute grammars.

Complex data structures in compiler construction: arrays, linked lists, records

Compiler design and implementation for object oriented languages: classes, objects, inheritance, polymorphism, static and dynamic linking

Advanced topics in code optimization: optimizing transforms in source, IR and assembly level

Advanced topics in parallelizing compilers: data and control dependencies, parallelizing transforms, nested loops

The term project includes the design and implementation of a small object oriented language with complex data structures. Tools for the automatic generation of code for developing compilers are used.

TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
Face-to-face, Distance learning, etc.</td><td>Lectures, tutorials, exercises and examples</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students</td><td>• 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 email direct communication with students.</td></tr>
<tr><td>TEACHING METHODS
The manner and methods of teaching are described in detail.
Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.

The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</td><td>
<table>
<tr><th>Activity</th><th>Semester workload</th></tr>
<tr><td>Lectures</td><td>13*3= 39 hours</td></tr>
<tr><td>Project</td><td>20 hours</td></tr>
<tr><td>Self-study</td><td>46 hours</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td>105 hours</td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
Description of the evaluation procedure

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

Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</td><td>LANGUAGE OF EVALUATION: Greek

METHODS OF EVALUATION
(i) Final examination.
(ii) project.</td></tr>
</table>

ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

Book [45346]: Μεταγλωττιστές, Παπασπύρου Νικόλαος Σ.,Σκορδαλάκης Εμμανουήλ Σ.
Book [12713790]: Μεταγλωττιστές, Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman
Book [77108866]: ΣΧΕΔΙΑΣΗ ΚΑΙ ΚΑΤΑΣΚΕΥΗ ΜΕΤΑΓΛΩΤΤΙΣΤΩΝ, Keith D. Cooper, Linda Torczon

- Related academic journals:

ACM Transactions on Programming Languages and Systems (TOPLAS)

MYE023. Parallel Systems and Programming

COURSE OUTLINE

GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**MYE023**	**SEMESTER**	**>= 5**
COURSE TITLE	Parallel Systems and Programming		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures / Labs		**5**	**5**
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)	https://www.cse.uoi.gr/course/parallel-systems-and-programming/?lang=en		

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
- Program GPUs using OpenMP, CUDA
- 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	*……*
Production of new research ideas	*Others…*
	…….

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

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)
- GPU programming (OpenMP, CUDA)
- Performance analysis (speedup, efficiency, cost, scalability)

TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face class lectures
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• Use of projector electronic slides. • Use of computers for the Lab exercises. • Course website maintenance with

	announcements and posting of teaching material (lecture slides and notes). • 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*	
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) 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.

Activity	***Semester workload***
Lectures	13*3 = 39 hours
Labs	13*2 = 26 hours
Self-study	60 hours
Course total	***125 hours***

ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- Β. Δημακόπουλος, *Παράλληλα Συστήματα και Προγραμματισμός*, Σύνδεσμος Ελληνικών Ακαδημαϊκών Βιβλιοθηκών, 2017
- P. Pacheco, *Εισαγωγή στον παράλληλο προγραμματισμό*, Εκδόσεις Κλειδάριθμος, 2015
- Γ. Πάντζιου, Β. 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 μαζικά παράλληλων επεξεργαστών*, Εκδόσεις Κλειδάριθμος, 2010

- Related academic journals:

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

MYE025. Multimedia

COURSE OUTLINE

GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**MYE025**	**SEMESTER**	**>=6**
COURSE TITLE	**Multimedia**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures / Labs / Tutorials	**3/2/0**	**5**
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	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=890

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 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	*Others…* *…….*

- 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

Communication media and information sources. Multimedia: Digitization and compression. Image compression and relevant standards. Video compression and relevant standards. Audio compression and relevant standards. Error resilience and error concealment for video. Video transmission over networks.

Laboratory exercises (using Matlab or Octave) on compression of images, video, and audio.

TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Lectures and laboratory exercises.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• 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 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*	
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 (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.

Activity	*Semester workload*
Lectures	13*3= 39 hours
Self-study	86 hours
Course total	**125 hours**

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.
Book [13256967]: Συστήματα Πολυμέσων: Αλγόριθμοι, Πρότυπα και Εφαρμογές, Havaldar P., Medioni G.

- Related academic journals:

IEEE Transactions on Multimedia
IEEE Transactions on Circuits and Systems for Video Technology

MYE028. Advanced Algorithm and Data Structure Design

COURSE OUTLINE

GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**MYE028**	**SEMESTER**	**>=6**
COURSE TITLE	**Advanced Algorithm and Data Structure Design**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures / Labs / Tutorials	**3/2/0**	**5**
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialized general knowledge
PREREQUISITE COURSES:	NO
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	http://ecourse.uoi.gr/course/view.php?id=1043

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 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?

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

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

DELIVERY *Face-to-face, Distance learning, etc.*	Lectures.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• 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 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,*	

Activity	***Semester workload***
Lectures	13*3= 39 hours
Fieldwork	15
Project	30

tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc. *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*	Self-study	41
	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 (i) Final examination, which includes questions and problem solving. (ii) Written work. The evaluation procedure is accessible to students via the course website.	

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:

MYE030. Advanced Topics of Database Technology and Applications

COURSE OUTLINE

GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**MYE030**	**SEMESTER**	**>=6**
COURSE TITLE	Advanced Topics of Database Technology and Applications		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures / Labs / Tutorials	**5**	**5**
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	General 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/~pvassil/courses/db_III

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 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

General Competences

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

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

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

Query Optimization. Query optimization space. Left-deep trees. Dynamic programming for query optimization.

Transactions and concurrency control in databases. Concurrency problems and transaction correctness. Serializabilty. Serializability graphs. Locks. The 2 Phase Locking Protocol. SQL Isolation levels.

Recovery from failures. Log files. Write-ahead Logging. Algorithms for recovering from failures.

Physical design and tuning of databases. Indexing. Partitioning. Query rewriting.

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

<table>
<tr><td>DELIVERY
Face-to-face, Distance learning, etc.</td><td>Lectures, lab courses</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students</td><td>• Use of projector and interactive board during lectures.
• Use of computer for demonstation 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.</td></tr>
<tr><td>TEACHING METHODS
The manner and methods of teaching are described in detail.
Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.

The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</td><td>
<table>
<tr><th>Activity</th><th>Semester workload</th></tr>
<tr><td>Lectures</td><td>13*3 = 39 hours</td></tr>
<tr><td>Labs</td><td>13*2 = 26 hours</td></tr>
<tr><td>Self-study & project</td><td>60 hours</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td>125 hours</td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
Description of the evaluation procedure

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

Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</td><td>LANGUAGE OF EVALUATION: Greek

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

ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

Book [133031084]: Συστήματα διαχείρισης βάσεων δεδομένων, Συγγραφείς: Ramakrishnan Raghu, Gehrke Johannes, Έκδοση: 3η Βελτιωμένη Έκδοση, ISBN: 9786182210987, Διαθέτης (Εκδότης): ΕΚΔΟΣΕΙΣ Α. ΤΖΙΟΛΑ & ΥΙΟΙ Α.Ε.

Book [50662846]: Θεμελιώδεις αρχές συστημάτων βάσεων δεδομένων, Συγγραφείς: Elmasri Ramez,Navathe Shamkant B., Έκδοση: 7η Έκδοση Αναθεωρημένη/2016, ISBN: 978-960-531-343-2, Διαθέτης (Εκδότης): ΔΙΑΥΛΟΣ Α.Ε. ΕΚΔΟΣΕΙΣ ΒΙΒΛΙΩΝ

Book [102070677]: Συστήματα Βάσεων Δεδομένων, Συγγραφείς: Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Έκδοση: 7η έκδ./2021, ISBN: 978-960-512-743-5, Διαθέτης (Εκδότης): Χ. ΓΚΙΟΥΡΔΑ & ΣΙΑ ΕΕ

- *Related academic journals:*

- Information Systems, Elsevier
- IEEE Transactions on Knowledge and Data Engineering
- The VLDB Journal, Springer
- ACM Transactions on Database Systems

MYE031. Robotics

COURSE OUTLINE

GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**MYE031**	**SEMESTER**	**>=6**
COURSE TITLE	Robotics		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures / Labs / Tutorials	**5**	**5**
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	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=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 *Adapting to new situations* *Decision-making* *Working independently* *Team work* *Working in an international environment* *Working in an interdisciplinary environment* *Production of new research ideas*	*Project planning and management* *Respect for difference and multiculturalism* *Respect for the natural environment* *Showing social, professional and ethical responsibility and sensitivity to gender issues* *Criticism and self-criticism* *Production of free, creative and inductive thinking* *……* *Others…* *…….*

- Search for, analysis and synthesis of data and information, with the use of the necessary technology.
- Decision-making.
- 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

DELIVERY *Face-to-face, Distance learning, etc.*	Lectures, seminars, team project
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• Use of projector during lectures. • Course website maintenance. Announcements and posting of teaching material (lecture slides and notes, exercises, example programs). • Use of robots in team projects. • Announcement of assessment marks via the ecourse platform by UOI. • Use of email for information exchange and improved communication with students.
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art*	

Activity	*Semester workload*
Lectures	13*3 = 39 hours
Self-study	86 hours

workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc. *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*		
	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 written examination (70%). (ii) Team project (30%). The evaluation procedure is accessible to students via the course website.	

ATTACHED BIBLIOGRAPHY

-Προτεινόμενη Βιβλιογραφία :

Book [11768]: Δουλγέρη, Ζ., Ρομποτική: Κινηματική, Δυναμική και Έλεγχος Αρθρωτών Βραχιόνων, Εκδόσεις Κριτική, 2007.

Book [32997955]: Siciliano B., Sciavicco L., Villani L., Oriolo G., Ρομποτική: Μοντελοποίηση, Σχεδιασμός και Έλεγχος, Εκδόσεις Γ. Χ. Φούντας, 2013

Book [133028825]: Craig, J.J., Εισαγωγή στη Ρομποτική, 4η Βελτιωμένη Έκδοση, Εκδόσεις Τζιόλα, 2024.

Book [94643354]: Peter Corke, ΡΟΜΠΟΤΙΚΗ, ΟΡΑΣΗ ΚΑΙ ΕΛΕΓΧΟΣ, Εκδόσεις Γ. Χ. Φούντας, 2020

-Συναφή επιστημονικά περιοδικά:

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

MYE034. Computational Geometry

COURSE OUTLINE

GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**MYE034**	**SEMESTER**	**>=6**
COURSE TITLE	**Computational Geometry**		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures / Labs / Tutorials	**3/1/1**	**5**
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

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

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
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international 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

Working in an interdisciplinary environment *Production of new research ideas*	*……* *Others…* *…….*

- 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

Main geometric objects and their computer representation. Art-Gallery theorem. Sweep-line paradigm. Triangulation, tetrahedralization. Convex-hulls in two and three dimensions. Voronoi diagram, Delaunay triangulation. Arrangements of lines, the zone theorem, levels, duality. Geometric searching, point location. Range searching. Geometric data structures.

(1) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face, Assignment of exercises
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• Visualizations of geometric algorithms • Maintenance of course website with posting of teaching material and announcements • Use of email for communication with the students
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*	

Activity	*Semester workload*
Lectures	13*3= 39 hours
Labs	13*1= 13 hours
Tutorials	13*1= 13 hours
Self-study	60 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.*	LANGUAGE OF EVALUATION: Greek METHODS OF EVALUATION (i) Final examination, which includes questions on the material taught and problem solving (ii) 3 sets of homework exercises The evaluation procedure is accessible to students via the course website.

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

MYE035. Computational Intelligence

COURSE OUTLINE

GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**MYE035**	**SEMESTER**	**>=6**
COURSE TITLE	Computational Intelligence		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures/Laboratory Exercices	5	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	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	*Project planning and management*
Adapting to new situations	*Respect for difference and multiculturalism*
Decision-making	*Respect for the natural environment*
Working independently	*Showing social, professional and ethical responsibility and sensitivity to gender issues*
Team work	*Criticism and self-criticism*
Working in an international environment	*Production of free, creative and inductive thinking*
Working in an interdisciplinary environment	*……*
Production of new research ideas	*Others…*
	…….

- Search for, analysis and synthesis of data and information, with the use of the necessary technology.
- Decision Making
- Production of free, creative and inductive thinking
- Team Work

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

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Lecture slides, multimedia (video demonstrations), e-mail communication, course Web page maintenance**.**
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*	

Activity	***Semester workload***
Lectures	13x3=39 hours
Laboratory practice	13x2=26 hours
Student's study hours	60 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,*	Language of evaluation: Greek Methods of Evaluation: iii) Final written examination iv) 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

Book (in Greek): S. Haykin, «Νευρωνικά Δίκτυα & Μηχανική Μάθηση», ISBN 978-960-7182-64-7, Εκδόσεις Παπασωτηρίου, 2010.

Book (in Greek): Κ. Διαμαντάρας, «Τεχνητά Νευρωνικά Δίκτυα», ISBN 978-960-461-080-8, Εκδόσεις Κλειδάριθμος, 2007.

MYE036. Computability and Complexity

COURSE OUTLINE

GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**MYE036**	**SEMESTER**	**>= 6**
COURSE TITLE	Computability and Complexity		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures/Laboratory/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 *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.cs.uoi.gr/~cnomikos/courses/coco/coco-main.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 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?

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

- Adapting to new situations
- 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

DELIVERY *Face-to-face, Distance learning, etc.*	Lectures, Labs
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• Use of projector and interactive board during lectures. • Maintenance of a course website, in which announcements, exercises, lecture notes, solution to exercises and other useful material is posted. • Use of email for communication with students. • Announcement of assessment marks via the ecourse platform by UOI.

TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*	

Activity	***Semester workload***
Lectures	13*3 = 39 hours
Tutorial	13*2 = 26 hours
Self-study	60 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.*	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)
- Theory of Computing Systems (Springer)
- Journal of Complexity (Elsevier)
- Bulletin of the EATCS

MYE041. Complex Data Management

COURSE OUTLINE

GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**MYY041**	**SEMESTER**	**>=6**
COURSE TITLE	Complex Data Management		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures / Tutorials	**5**	**5**
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	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=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., Euclideand, 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 imdexing 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	*Project planning and management*
Adapting to new situations	*Respect for difference and multiculturalism*
Decision-making	*Respect for the natural environment*
Working independently	*Showing social, professional and ethical responsibility and sensitivity to gender issues*
Team work	*Criticism and self-criticism*
Working in an international environment	*Production of free, creative and inductive thinking*
Working in an interdisciplinary environment	*……*
Production of new research ideas	*Others…*
	…….

- Production of free, creative and inductive thinking
- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Adapting to new situations
- Analysis of requirements for problem solving
- Algorithmic thinking
- Abstraction ability for problem modeling
- Working independently
- Production of new research ideas

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

<table>
<tr><td>DELIVERY
Face-to-face, Distance learning, etc.</td><td>Weekly Lectures.</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students</td><td>• 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.</td></tr>
<tr><td>TEACHING METHODS
The manner and methods of teaching are described in detail.
Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.

The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</td><td>
<table>
<tr><th>Activity</th><th>Semester workload</th></tr>
<tr><td>Lectures</td><td>13*4 = 52 hours</td></tr>
<tr><td>Self-study</td><td>73 hours</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td>150 hours</td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
Description of the evaluation procedure

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

Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</td><td>LANGUAGE OF EVALUATION: Greek

METHODS OF EVALUATION
(i) Final examination, 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.</td></tr>
</table>

ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

Book [22694245]: Συστήματα Διαχείρισης Βάσεων Δεδομένων, Raghu Ramakrishnan, Joahannes Gehrke, ΕΚΔΟΣΕΙΣ Α. ΤΖΙΟΛΑ & ΥΙΟΙ Α.Ε., 2012.

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

Book [102070677]: Συστήματα Βάσεων Δεδομένων 7η Έκδοση, Abraham Silberschatz,Henry F. Korth,S. Sudarshan, Χ. ΓΚΙΟΥΡΔΑ & ΣΙΑ ΕΕ, 7η έκδ./2021.

- *Related academic journals:*

- ACM Transactions on Database Systems (TODS)
- the VLDB Journal, Springer
- IEEE Transactions on Knowledge and Data Engineering (TKDE)

MYE048. Wireless Links

COURSE OUTLINE

GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**MYE048**	**SEMESTER**	**>=6**
COURSE TITLE	Wireless Links		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures / Labs / Tutorials	**5**	**5**
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	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 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	*Project planning and management*
Adapting to new situations	*Respect for difference and multiculturalism*
Decision-making	*Respect for the natural environment*
Working independently	*Showing social, professional and ethical responsibility and sensitivity to gender issues*
Team work	*Criticism and self-criticism*
Working in an international environment	*Production of free, creative and inductive thinking*
Working in an interdisciplinary environment	*……*
Production of new research ideas	*Others…*
	…….

- Production of free, creative and inductive thinking
- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Analysis of requirements for problem solving
- 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
  - Flat earth loss
  - Two ray model
  - Diffraction loss
  - Fresnel zones
  - Link Budget
- Empirical propagation loss models
  - Outdoor models (Okumura Hata, Egli, IEEE, ITU-R P1546, WINNER)
  - Indoor models (COST 231, ITU-R P1238)
- Wireless Link Fading
  - Small scale fading
  - Large scale fading
  - 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*	

Activity	*Semester workload*
Lectures	13*3 = 39 hours
Labs	13*2 = 26 hours
Self-study	60 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.*	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

- Suggested 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.

MYE050. Teaching of Informatics

COURSE OUTLINE

GENERAL

SCHOOL	SCHOOL OF SCIENCE		
ACADEMIC UNIT	DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	MYE050	**SEMESTER**	
COURSE TITLE	Teaching of Informatics		
INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*		**WEEKLY TEACHING HOURS**	**CREDITS**
	Lectures / Labs / Tutorials	**3/2/0**	**5**
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).			
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	GENERAL BACKGROUND		
PREREQUISITE COURSES:	-		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES		
COURSE WEBSITE (URL)	https://ecourse.uoi.gr/enrol/index.php?id=1916		

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

- Production of free, creative and inductive thinking
- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- 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)
5. **Teaching design, educational scenarios, didactic interventions.** (Exploiting Logo-like and Scratch-like Environments, Role Playing, Computer Games, Educational Robotics - Using NXT Lego Robots, Arduino).
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

<table>
<tr><td>DELIVERY
Face-to-face, Distance learning, etc.</td><td>• Lectures</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students</td><td>• 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</td></tr>
<tr><td>TEACHING METHODS
The manner and methods of teaching are described in detail.
Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.

The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</td><td>
<table>
<tr><th>Activity</th><th>Semester workload</th></tr>
<tr><td>Lectures</td><td>13x3=39 hours</td></tr>
<tr><td>Laboratory practice</td><td>13x2=26 hours</td></tr>
<tr><td>Student’s study hours</td><td>60 hours</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course total</td><td>125 hours</td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION
Description of the evaluation procedure

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

Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</td><td>LANGUAGE OF EVALUATION: Greek (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.</td></tr>
</table>

ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

Βιβλίο [2606]: Διδακτικές Προσεγγίσεις και Εργαλεία για τη Διδασκαλία της Πληροφορικής,

Μ. Γρηγοριάδου κ.ά., Εκδόσεις Νέων Τεχνολογιών, Αθήνα, 2009. (ISBN 978-960- 6759-23-9)
Βιβλίο [13678] : Εισαγωγή στη διδακτική της πληροφορικής, Β. Ι. Κόμης, Κλειδάριθμος, 2005, ISBN: 9789602098387
Βιβλίο [68374254]: Διδακτική και Σχεδιασμός Εκπαιδευτικών Δραστηριοτήτων STEM και ΤΠΕ, Ψυχάρης Σαράντος, Καλοβρέκτης Κωνσταντίνος, ΕΚΔΟΣΕΙΣ Α. ΤΖΙΟΛΑ & ΥΙΟΙ Α.Ε, ISBN: 978-960-418-706-5
- Related academic journals:

MYE054. Analog Circuits

COURSE OUTLINE

GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**MYE054**	**SEMESTER**	**≥ 6**
COURSE TITLE	Analog Circuits		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures / Labs / Tutorials	**5 (2,2,1)**	**5**
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	General 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 aims at introducing to students the fundamentals of electronic circuit analysis, synthesis, design, simulation, implementation and measurement.

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

- Understand manufacturing technologies of nanometer integrated circuits.
- Understand logic circuit operation and physical implementation (layout) at the transistor level.
- Analyze simple or complex analog circuits.
- Synthesize analog circuits at the transistor level.
- Design and simulate basic analog electronic circuits.
- Implement analog electronic circuits in schematic and layout level, measure their

characteristics and verify their performance after parasitic extraction.

General Competences

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

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

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

SYLLABUS

MOS transistor theory. CMOS technology and integrated circuit manufacturing. Introduction to photolithography. Design in schematic and layout level of MOS differential amplifier. Design in schematic and layout level of circuits using Operational Amplifier, Operational Transconductance Amplifier. Design in schematic and layout level of analog filters. Non linear applications of Operational Amplifiers. Circuits of Oscillation.

TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face, lectures, lab courses, home-works
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• Use of e-slides and interactive board during lectures. • Use of computer-aided design tools at the laboratory (circuit design and simulation). • Use of components and instruments (signal generators, power supplies, multi-meters, oscilloscopes) at the laboratory for circuit implementation and measurement. • Course website maintenance. Announcements and posting of teaching material (lecture slides and notes). • Use of email for information exchange and improved communication with students.
TEACHING METHODS	***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.* *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*	Lectures	13*3 = 39 hours
	Laboratory practice	11*2 = 22 hours
	Problems solving	36 hours
	Study & bibliography analysis	28 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.*	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 exercises on circuit design and simulation as well as on circuit implementation and measurements. The students are evaluated during their work at the laboratory and with final examination at the laboratory. The evaluation procedure is accessible to students via the course website.

ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

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

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

- Related academic journals:

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

MYE1000. Practical Training

COURSE OUTLINE

GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**MYE1000**	**SEMESTER**	**>6**
COURSE TITLE	Practical Training		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
		2

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

LEARNING OUTCOMES

Learning outcomes

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

Consult Appendix A

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

The goal of the course is the students:

- to know workplaces, where they get in touch with current market developments, to give them the opportunity to acquire new knowledge, to participate actively in teamwork and decision making, to develop their skills, to participate in design and finish projects and to have a first full working experience
- to transfer their knowledge and experience to the companies and the opposite, with the aim of upgrading the studies at the Department and maintaining the high level of knowledge provided

Finally, Practical Training strengthens the department's relationships with stakeholders and the local community and creates job opportunities for its graduates.

General Competences

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

Search for, analysis and synthesis of data and *Project planning and management*

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*	*Respect for difference and multiculturalism* *Respect for the natural environment* *Showing social, professional and ethical responsibility and sensitivity to gender issues* *Criticism and self-criticism* *Production of free, creative and inductive thinking* *……* *Others…* *…….*

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

SYLLABUS

Practical Training of students is part of the Department's Undergraduate Program of Studies since its approval by the General Assembly of the Department of Computer Science (4 November 1998). Practical Training has been incorporated as an elective course. Students may participate by completing the sixth (6) semester of study and must have over than 120 ECTS at the time of application (which is the 2/5 of the ECTS required to obtain the diploma). The duration of the Practical Training is 2 months. Each student can participate once. The selection of students is based on criteria set by the Department's Practical Training Committee. Specifically the selection is made considering

• the student's average rating

• the student's ECTS credits at the time of the application

TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	-
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• Use of email and social media for information exchange and improved communication with students.
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning*	

Activity	*Semester workload*
Practical Training	50 hours

activity are given as well as the hours of non-directed study according to the principles of the ECTS	***Course total*** | ***50 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 At the end of the Internship, the required forms are submitted by the student,the institution and his / her academic supervisor. If the student is judged to have successfully completed the practice then one point with degree excellent (10) is added in her/his card. The acceptance of this point and the degree is approved by the Assembly of the Department.

ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- Related academic journals: