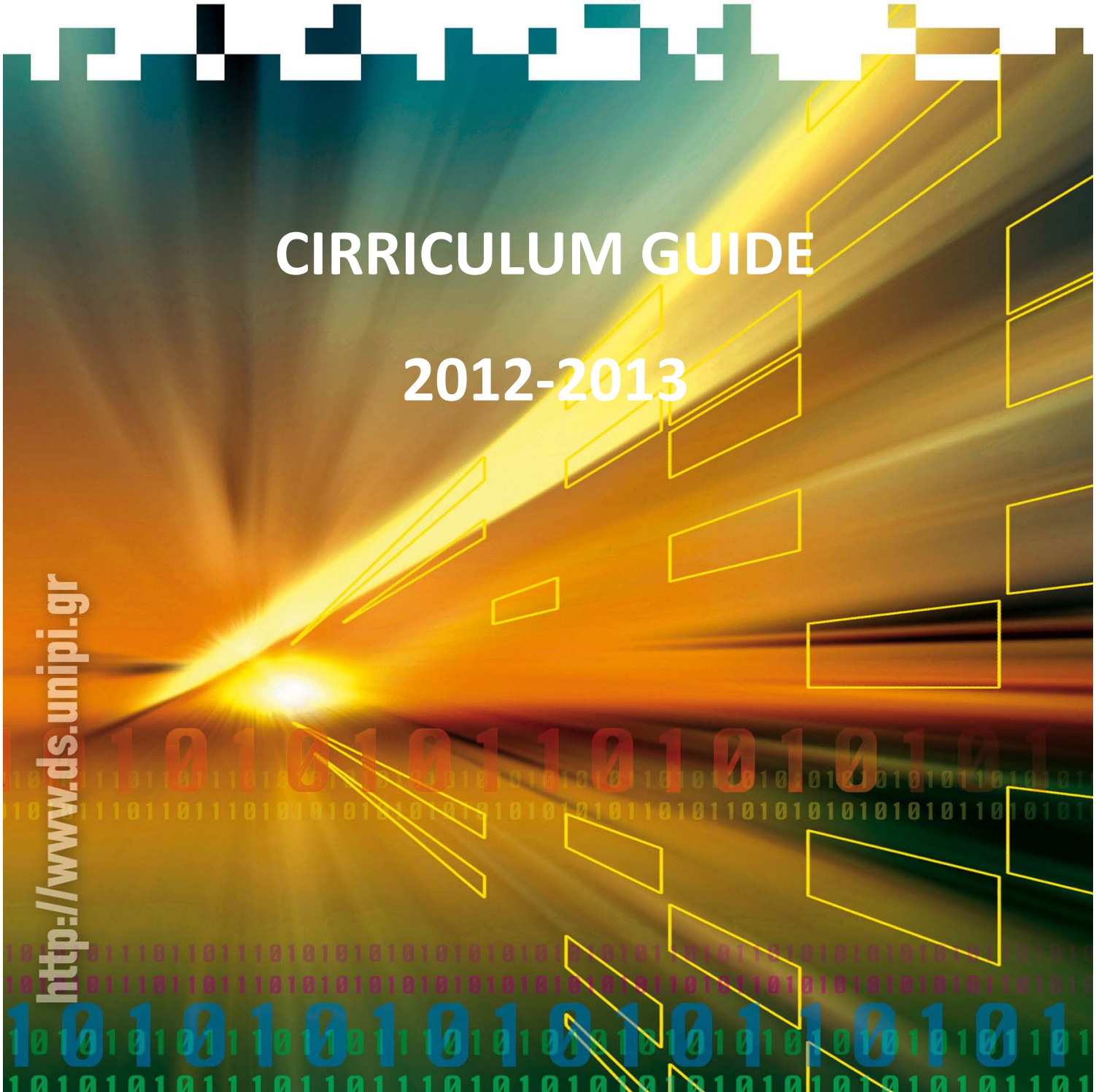
UNIVERSITY OF PIRAEUS

DEPARTMENT OF DIGITAL SYSTEMS



CIRRICULUM GUIDE

2012-2013

http://www.ds.unipi.gr

TABLE OF CONTENTS

1. UNIVERSITY OF PIRAEUS

1.1 General Description of the Institute

The University of Piraeus was founded in 1938 by the Industrialists and Tradesmen Association, under the title "*School for Industrial Studies*" and it was renamed to "*Graduate School of Industrial Studies*" in 1958. From 1966, it operates as a public Higher Education legal entity and in 1989 it was renamed to "*University of Piraeus"*. Today, the University of Piraeus has the following Academic Departments: Economics, Business Administration, Statistics and Insurance Science, Banking and Financial Management, Industrial Management, Maritime Studies, Informatics, Digital Systems, International and European Studies.

All Academic Departments offer both Undergraduate Programmes (4-year long), Postgraduate Programmes (Masters) and Ph.D. Programmes.

Contact Details	
Name:	University of Piraeus
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Zip Code:	185 34
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1.2 Academic Authorities

The Senate of the University of Piraeus consists of the Rector, the Vice-Rectors, the Heads of the Academic Departments, as well as, representatives from the Academic, Research, Technical and Administrative Staff and the Undergraduate and Postgraduate Students.

For academic year 2012-2013:

Rector:	Professor Georgios Oikonomou
Vice-Rectors:	Professor George Vassilacopoulos
	Professor Nikolaos Georgopoulos

1.3 Academic Calendar for the Academic Year 2012-2013

Winter Semester	
Courses Start Date:	Thursday 4 October 2012
Courses End Date:	Friday 11 January 2013
Public Holidays:	Wednesday 12 December 2012
	24 December 2012 until 7 January 2013 – Christmas Holidays
Winter Semester Exam Period	
Exam Start Date:	Monday 14 January 2013
Exam End Date:	Tuesday 12 February 2013
Grades Announcement:	Until Tuesday 12 March 2013
Spring Semester	
Courses Start Date:	Thursday 28 February 2013
Courses End Date:	Friday 7 June 2013
Public Holidays:	Monday 18 March 2013
	Moday 25 March 2013
	29 April 2013 until 10 May 2013 – Easter Holidays
	Wednesday 1 May 2013
	Monday 24 June 2013
Spring Semester Exam Period	
Exams Start Date:	Monday 10 June 2013
Exams End Date:	Friday 12 July 2013
Grades Announcement:	Until Monday 29 July 2013
Complementary Exam Period	
Exams Start Date:	Monday 2 September 2013
Exams End Date:	Saturday 28 September 2013
Grades Announcement:	Until Wednesday 30 October 2013

2. DEPARTMENT OF DIGITAL SYSTEMS

2.1 Educational and Professional Goals

The Department of **Digital Systems** was established in ***1999*** as one of the newest academic departments at the University of Piraeus, in response to the societal demand for higher education academic teaching and research that support the Knowledge Society. The Department of Digital Systems offers one Undergraduate Programme in "Digital Systems" (four-year Programme – 240 ECTS), two Master's Degree (M.Sc.) in "Technology Education and Digital Systems" (started 2004 – 90 ECTS) and "Techno-economics Management and Digital Systems Security" (started 2009 – 90 ECTS) and a Ph.D. Programme.

Moreover, the Professional status (if applicable) for the graduates of Department includes:

- Qualification for appointment in ICT posts of the public sector. (Gov. Newspaper 315/A'/31-12-2003)
- Qualification for appointment in ICT teaching posts (primary, secondary and vocational education) of the public sector (Gov. Newspaper 268/A'/28-12-2004)
- Professional Certification of diploma holders Engineers and degree holders from higher education institutions in ICT (Pres. Decree 44/2009, Gov. Newspaper 58/8-4-2009)
- Pedagogic Sufficiency Certification (Act. 3794/2009, Gov. Newspaper 156/A'/4-9-2009)

2.2 Department's Degree Programmes

Undergraduate Programme in "Digital Systems"

This is a four-year undergraduate programme in "Digital Systems" **(240 ECTS)** with two areas of studies, namely:

- Communication Systems and Networks
- Electronic Services

Postgraduate Programme in "Technology Education and Digital Systems"

This is a postgraduate programme leading to a Master's Degree (M.Sc.) in "Technology Education and Digital Systems" **(90 ECTS)** with three areas of studies, namely:

- Digital Communications and Networks
- Network Oriented Systems
- e-Learning

Postgraduate Programme in "Techno-economics Management and Digital Systems Security"

This is a postgraduate programme leading to a Master's Degree (M.Sc.) in "Techno-economics Management and Digital Systems Security" **(90 ECTS)** with two areas of studies, namely:

- Techno-economics Management
- Digital Systems Security

Ph.D. Programme

This is a research programme leading to a Ph.D. degree in «Digital Systems» with research focusing namely the following areas:

- Network Oriented Systems and Services
- Digital Health Services
- Telecommunication Networks and Integrated Services
- Security Systems
- Intelligent Systems and Multimedia Technologies
- Telecommunication Systems
- Technology – enhanced Learning

2.3 Academic Personnel

I. Professors

George Vassilacopoulos

Sokratis Katsikas

Nikitas-Marinos Sgouros

George Vouros

Panagiotis Demestichas - *Head of Department*

Athanasios Kanatas

Demetrios G. Sampson

II. Associate Professors

Ioannis Maniatis - *on leave (Greek Parliament)*

Symeon Retalis

George Efthymoglou

Costas Lambrinoudakis

Flora Malamateniou

Angelos Rouskas

Marinos Themistocleous

III. Assistant Professors

Angeliki Alexiou

Fotini Paraskeva

Andriana Prentza

Vera-Alexandra Stavroulaki

Christos Xenakis

Maria Halkidi - *ECTS Coordinator*

Ilias Maglogiannis

IV. Lecturers

Christos Doulkeridis

Apostolos Meliones - *ERASMUS Coordinator*

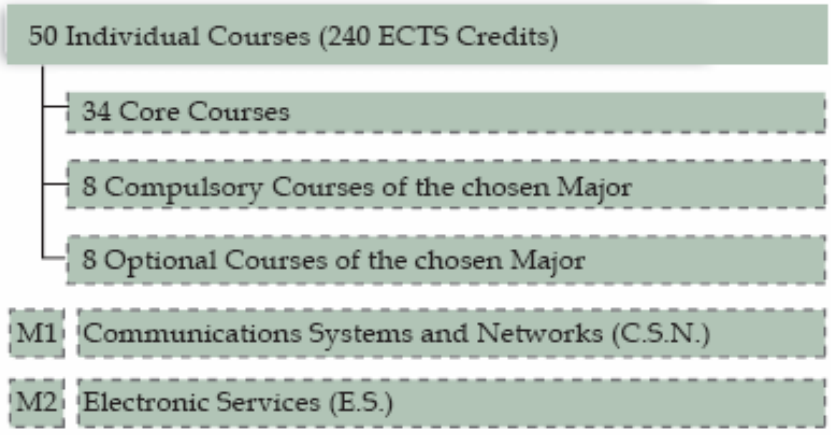
2.4 Undergraduate Programme

The Undergraduate Programme in "Digital Systems" lasts for a minimum period of **eight (8) academic semesters** with a total of **fifty (50)** individual courses corresponding to **240 credits** of the European Credit Transfer System (ECTS). The instructions are given in Greek. The individual courses are divided into the following types:

- Core Courses **[C]**
- Compulsory Courses for major "Electronic Services" **[CC-ES]**
- Compulsory Courses for major "Communication Systems and Networks" **[CC-CSN]**
- Optional Courses for major "Electronic Services" **[OC-ES]**
- Optional Courses for major "Communication Systems and Networks" **[OC- CSN]**
- Optional Courses for both majors "Electronic Services" and "Communication Systems and Networks" **[OC-ES, OC- CSN]**
- Seminar Courses **[SC]**

The students of the Department are assessed on the basis of their performance in written exams, lab exercises and project work.

The structure of the Undergraduate Programme is illustrated in the following figure.



The Undergraduate Programme for the academic year 2012-2013 is summarized in the following table.

Code	Title	Type	Year of Study/ Semester	Theory/ Lab Sessions	ECTS Credits	Academic Personnel
DS 001	Mathematical Analysis I	[C]	1st/ 1st	4/ 0	4	Sokratis Katsikas, Professor
DS 010	Probability Theory	[C]	1st/ 1st	4/ 0	4	Angeliki Alexiou, Assistant Professor
DS 003	Linear Algebra	[C]	1st/ 1st	4/ 0	4	Athanasios Kanatas, Professor
DS 501	C Programming	[C]	1st/ 1st	3/ 2	5	Vera-Alexandra Stavroulaki, Assistant Professor
DS 201	Computer Architecture	[C]	1st/ 1st	3/ 2	5	Kostas Lambrinoudakis, Associate Professor
DS 005	Mathematical Logic	[C]	1st/ 1st	4/ 0	4	Apostolos Meliones, Lecturer
DS 706	Instructional Methods	[C]	1st/ 1st	3/ 1	4	Fotini Paraskeva, Assistant Professor
DS 002	Mathematical Analysis II	[C]	1st/ 2nd	4/ 0	4	G.Efthymoglou, Associate Professor
DS 012	Stochastic Processes	[C]	1st/ 2nd	4/ 0	4	Angeliki Alexiou, Assistant Professor
DS 004	Discrete Mathematics	[C]	1st/ 2nd	4/ 0	4	Sokratis Katsikas, Professor
DS 202	Operating Systems I	[C]	1st/ 2nd	3/ 2	5	Kostas Lambrinoudakis, Associate Professor
DS 502	Object-Oriented Programming	[C]	1st/ 2nd	3/2	5	Andriana Prentza, Assistant Professor
DS 508	Systems Analysis and Design	[C]	1st/ 2nd	3/ 1	4	Andriana Prentza, Assistant Professor
DS 011	Statistics	[C]	1st/ 2nd	4/ 0	4	Angeliki Alexiou, Assistant Professor
DS 205	Operating Systems II – UNIX	[C]	2nd/ 3rd	3/ 2	5	Kostas Lambrinoudakis, Associate Professor
DS 301	Introduction to Telecommunications	[C]	2nd/ 3rd	3/ 2	5	Athanasios Kanatas, Professor
DS 503	Data Structures	[C]	2nd/ 3rd	3/ 2	5	George Vassilacopoulos, Professor Christos Doulkeridis, Lecturer
DS 509	Human - Computer Interaction	[C]	2nd/ 3rd	3/ 2	5	Symeon Retalis, Associate Professor
DS 805	Information Theory	[C]	2nd/ 3rd	3/ 2	5	Christos Xenakis, Assistant Professor
DS 507	Software Engineering	[C]	2nd/ 3rd	3/ 2	5	Andriana Prentza, Assistant Professor
DS 504	Database Systems Design	[C]	2nd/ 4th	3/ 2	5	George Vassilacopoulos, Professor Maria Halkidi, Assistant Professor
DS 510	Web Programming	[C]	2nd/ 4th	3/ 2	5	Symeon Retails, Associate Professor

Code	Title	Type	Year of Study/ Semester	Theory/ Lab Sessions	ECTS Credits	Academic Personnel
DS 402	Multimedia Technology	[C]	2nd/ 4th	3/ 2	5	Nikitas-Marinos Sgouros, Professor
DS 207	Distributed Systems	[C]	2nd/ 4th	3/ 2	5	Apostolos Meliones, Lecturer
DS 320	Computer Networks I	[C]	2nd/ 4th	3/ 2	5	Panagiotis Demestichas, Professor
DS 101	Algorithms and Complexity	[C]	2nd/ 4th	3/ 2	5	George Vouros, Professor
DS 321	Computer Networks II	[C]	3rd/ 5th	3/ 2	5	Panagiotis Demestichas, Professor
DS 801	Security Policies and Security Management	[C]	3rd/ 5th	3/ 2	5	Sokratis Katsikas, Professor
DS-518	Artificial Intelligence	[C]	3rd / 5th	3/ 2	5	George Vouros, Professor
DS 505	Database Systems	[C]	3rd/ 5th	3/ 2	5	George Vassilacopoulos, Professor Maria Halkidi, Assistant Professor
DS 511	Workflow Systems	[CC-ES]	3rd/ 5th	3/ 2	5	Flora Malamateniou, Associate Professor
DS 305	Digital Communications	[CC- CSN]	3rd/ 5th	3/ 2	5	Georgios Efthymoglou, Associate Professor
DS 013	Queuing Systems	[CC-CSN]	3rd/ 5th	3/ 2	5	Panagiotis Demestichas, Professor
DS 516	Semantic Web - XML	[CC-ES, CC-CSN]	3rd/ 5th	3/ 2	5	Andriana Prentza, Assistant Professor
DS 403	Computer Graphics and Virtual Reality	[OC-ES, OC-CSN]	3rd/ 5th	3/ 2	5	Nikitas-Marinos Sgouros, Professor
DS 206	Compilers	[OC-ES, OC-CSN]	3rd/ 5th	3/ 2	5	Nikitas-Marinos Sgouros, Professor
DS 708	Educational Psychology	[OC-ES]	3rd/ 5th	3/ 2	5	Fotini Paraskeva, Assistant Professor
DS 701	Educational Digital Systems	[OC-ES]	3rd/ 5th	3/ 2	5	Demetrios Sampson, Professor
DS 302	Signals and Systems	[OC-CSN]	3rd/ 5th	3/ 2	5	Georgios Efthymoglou, Associate Professor
DS-311	Simulation of Telecommunication Systems and Networks	[OC- CSN]	3rd / 5th	3/ 2	5	Angelos Rouskas, Associate Professor
DS 905	Management	[OC-ES, OC-CSN]	3rd/ 5th	3/ 2	5	Academic staff, Department of Business Administration
DS 908	Marketing	[OC-ES, OC-CSN]	3rd/ 5th	3/2	5	Academic staff, Department of Business Administration
DS 909	Technology and Innovation Management	[OC-ES, OC-CSN]	3rd/ 5th	3/2	5	Academic staff, Department of Business Administration
DS 326	Internet Protocols	[C]	3rd/ 6th	3/ 2	5	Vera-Alexandra Stavroulaki, Assistant Professor
DS 512	Information Systems	[C]	3rd/ 6th	3/ 2	5	George Vassilacopoulos, Professor Marinos Themistocleous, Associate Professor

Code	Title	Type	Year of Study/ Semester	Theory/ Lab Sessions	ECTS Credits	Academic Personnel
DS 327	Network Services	[CC-ES]	3rd/ 6th	3/ 2	5	Vera-Alexandra Stavroulaki, Assistant Professor
DS 506	Data Warehouses and Data Mining	[CC-ES]	3rd/ 6th	3/ 2	5	Maria Halkidi, Assistant Professor
DS 304	Wireless Communications	[CC-CSN]	3rd/ 6th	3/ 2	5	Athanasios Kanatas, Professor
DS 803	Network Security	[CC-CSN]	3rd/ 6th	3/ 2	5	Christos Xenakis, Assistant Professor
DS 306	Digital Signal Processing	[OC-ES, OC-CSN]	3rd/ 6th	3/ 2	5	Georgios Efthymoglou, Associate Professor
DS 707	Digital Media in Education	[OC-ES]	3rd/ 6th	3/ 2	5	Demetrios Sampson, Professor
DS 720	e-Health Services	[OC-ES]	3rd/ 6th	3/ 2	5	Flora Malamateniou, Associate Professor
DS 702	Didactics of Digital Technologies	[OC-ES]	3rd/ 6th	3/ 2	5	Symeon Retalis, Associate Professor
DS 710	IT-Centric Professional Development	[OC-ES]	3rd/ 6th	3/ 2	5	Fotini Paraskeva, Assistant Professor
DS 807	Privacy Enhancing Technologies	[OC-ES, OC-CSN]	3rd/ 6th	3/ 2	5	Kostas Lambrinoudakis, Associate Professor
DS 401	Intelligent Systems	[OC-ES, OC-CSN]	3rd/ 6th	3/ 2	5	Nikitas-Marinos Sgouros, Professor
DS 325	Intelligent Networks	[OC-ES, OC-CSN]	3rd/ 6th	3/ 2	5	Angelos Rouskas, Associate Professor
DS 521	Information Retrieval	[OC-CSN]	3rd/ 6th	3/2	5	Christos Doulkeridis, Lecturer
DS 405	Digital Image Processing	[OC-CSN]	3rd/ 6th	3/2	5	Ilias Maglogiannis, Assistant Professor
DS 901	Operations Research	[OC-ES, OC-CSN]	3rd/ 6th	3/ 2	5	Academic staff, Department of Business Administration
DS 904	Total Quality Management	[OC-ES, OC-CSN]	3rd/ 6th	3/ 2	5	Academic staff, Department of Business Administration
DS 911	Entrepreneurship I	[OC-CSN]	3rd/ 6th	3/2	5	Academic staff, Department of Economics
DS 906	Final Year Project	[C]	4th/ 7th	3/ 2	5	Department's Academic Staff
DS 902	Project Management	[C]	4th/ 7th	3/ 2	5	Flora Malamateniou, Associate Professor
DS 703	e-Learning Systems	[CC-ES]	4th/ 7th	3/ 2	5	Demetrios Sampson, Professor
DS 513	Network Oriented Information Systems	[CC-ES]	4th/ 7th	3/ 2	5	George Vassilacopoulos, Professor Marinos Themistocleous, Assistant Professor
DS 309	Broadband Networks	[CC-CSN]	4th/ 7th	3/ 2	5	Angeliki Alexiou, Assistant Professor
DS 303	Satellite Communications	[CC-CSN]	4th/ 7th	3/ 2	5	Athanasios Kanatas, Professor
DS 705	Instructional Design of Adult Learning Programs	[OC-ES]	4th/ 7th	3/ 2	5	Symeon Retalis, Associate Professor

Code	Title	Type	Year of Study/ Semester	Theory/ Lab Sessions	ECTS Credits	Academic Personnel
DS 514	e-Business	[OC-ES]	4th/ 7th	3/ 2	5	Marinos Themistocleous, Associate Professor
DS 517	Web Applications Development	[OC-ES, OC-CSN]	4th/ 7th	3/ 2	5	Vera-Alexandra Stavroulaki, Assistant Professor
DS 806	Cryptography	[OC-ES, OC-CSN]	4th/ 7th	3/ 2	5	Christos Xenakis, Assistant Professor
DS 310	Wireless Sensor Networks	[OC-ES, OC-CSN]	4th/ 7th	3/ 2	5	Angeliki Alexiou, Assistant Professor
DS 324	Design and Optimization of Telecommunication Systems and Networks	[OC-CSN]	4th/ 7th	3/ 2	5	Angelos Rouskas, Associate Professor
DS-313	Development of Telecommunication Systems	[OC-CSN]	4th/ 7th	3/ 2	5	Apostolos Meliones, Lecturer
DS 903	Human Factor Management	[OC-ES]	4th/ 7th	3/ 2	5	Academic staff, Department of Business Administration
DS 912	Entrepreneurship II	[OC-ES, OC-CSN]	4th/ 7th	3/ 2	5	Academic staff, Department of Economics
DS 910	Business Policy and Strategic	[OC-ES, OC-CSN]	4th/ 7th	3/ 2	5	Department of Business Administration
DS 920	Student Placement	[OC-ES, OC-CSN]	4th/ 7th	3/ 2	5	Department's Academic Staff
DS 522	Data Management on the Web	[OC-CSN]	4th/ 7th	3/ 2	5	Christos Doulkeridis, Lecturer
DS 408	Semantic Web and Ontologies	[OC-CSN]	4th/ 7th	3/ 2	5	George Vouros, Professor
DS 523	Laboratory of Database Applications	[OC-CSN]	4th/ 7th	3/ 2	5	Maria Halkidi, Assistant Professor
DS 907	Final Year Project	[C]	4th/ 8th	3/ 2	5	Department's Academic Staff
DS 323	Mobile and Personal Communication Networks	[C]	4th/ 8th	3/ 2	5	Angelos Rouskas, Associate Professor
DS 515	Information Systems Management	[CC-ES]	4th/ 8th	3/ 2	5	Marinos Themistocleous, Associate Professor
DS 802	Information Systems Security	[CC-ES]	4th/ 8th	3/ 2	5	Sokratis Katsikas, Professor
DS 302	Mobile Communication Systems	[CC-CSN]	4th/ 8th	3/ 2	5	Athanasios Kanatas, Professor
DS 322	Network Management	[CC-CSN]	4th/ 8th	3/ 2	5	Panagiotis Demestichas, Professor
DS 704	Knowledge and Competence Management	[OC-ES]	4th/ 8th	3/ 2	5	Demetrios Sampson, Professor
DS 709	Collaborative Learning Environments	[OC-ES]	4th/ 8th	3/ 2	5	Fotini Paraskeva, Assistant Professor
DS 804	Mobile and Wireless Communications Security	[OC-CSN]	4th/ 8th	3/ 2	5	Christos Xenakis, Assistant Professor

Code	Title	Type	Year of Study/ Semester	Theory/ Lab Sessions	ECTS Credits	Academic Personnel
DS 312	Advanced Topics in Wireless Communications	[OC-CSN]	4th/ 8th	3/ 2	5	Angeliki Alexiou, Assistant Professor
DS 520	Intelligent Agents and Multiagent Systems	[OC-ES, OC-CSN]	4th/ 8th	3/ 2	5	George Vouros , Professor
DS 308	Performance Evaluation of Telecommunication Systems	[OC-CSN]	4th/ 8th	3/ 2	5	Georgios Efthymoglou, Associate Professor
DS 721	Healthcare Information Systems	[OC-ES]	4th/ 8th	3/ 2	5	Flora Malamateniou, Associate Professor
DS 203	Embedded Systems	[OC-ES, OC-CSN]	4th/ 8th	3/ 2	5	Apostolos Meliones, Lecturer
DS 920	Student Placement	[OC-ES, OC-CSN]	4th/ 8th	3/ 2	5	Department's Academic Staff
DS 525	Laboratory of Information Processing Systems on the Web	[OC-CSN]	4th/ 8th	3/ 2	5	Christos Doulkeridis, Lecturer
DS 722	Telemedicine	[OC-CSN]	4th/ 8th	3/ 2	5	Ilias Maglogiannis, Assistant Professor

2.4.1 Undergraduate Programme Individual Course Description

1st Semester

Course Code:	DS 001
Course Title:	Mathematical Analysis I
Type of Course:	[C]
Year of Study/ Semester:	1st/ 1st
Theory/ Lab Sessions:	4 hours/ 0 hours
ECTS Credits:	4
Academic Personnel:	S.Katsikas, Professor

Objective

This course attempts to extend the knowledge gained at the high school in the area of mathematics. In doing so, the course provides an appropriate mathematical background that supports the students to study the fields of computers and computer networks.

Prerequisites: -

Course Contents

Sets. Actions. Functions. Circular functions. Taylor's theory. Application of derivatives. Integrals. Defined integrals. Integrals techniques. Undefined integrals. Techniques and applications. Generalized integrals. Beta and gamma. 1st level differential equations. Sequences. Series. Dynamic-series.

Recommended Reading

1. Schroder, B. S. (2007): Mathematical Analysis: A Concise Introduction, Wiley-Interscience.

Course Code:	DS 010
Course Title:	Probability Theory
Type of Course:	[C]
Year of Study/ Semester:	1st/ 1st
Theory/ Lab Sessions:	4 hours/ 0 hours
ECTS Credits:	4
Academic Personnel:	A.Alexiou, Assistant Professor

Objective

The aim of the course is to introduce the area of probability theory and explain the fundamental concepts.

Prerequisites: -

Course Contents

Accidental experiment, samples and possibilities. Definitions of possibilities. Finite samples with results of equal possibilities. Provisions. Combinations. Binomial theorem. Committed probability. The multiplicative theorem. Total probability and Bayes theorem. Independent trials. Random variables. Probability distributions. Parameters of distributions. Interrelation of distribution accidental variables. One-dimensional distributions. Continuous distributions. Generators of proneness. Probabilities generators.

Recommended Reading

1. Durrett, R. (2004): Probability: Theory and Examples (3rd Edition), Duxbury Press.

Course Code:	DS 003
Course Title:	Linear Algebra
Type of Course:	[C]
Year of Study/ Semester:	1st/ 1st
Theory/ Lab Sessions:	4 hours/ 0 hours
ECTS Credits:	4
Academic Personnel:	A.Kanatas, Professor

Objective

The aim of the course is to present subjects from the area of Linear Algebra. The course introduces the students to fundamental algebraic structures of linear spaces of finite dimension, and calculus of tables. Particular attention is given to linear space of tables.

Prerequisites: -

Course Contents

Sets and sets' functions. Boolean algebra. Vectors spaces. sub-spaces. Linear independence. Base and dimension. Table functions. Linear spaces. Degree table. Fixing. Attributes fixing. Methods of calculation. Minor fixing and algebraic supplement. Calculation of reverse table. Linear systems. General solution. Cramer's method. Linear spaces. Cauchy-Schwartz inequality. Norm. Orthogonality. Orthogonal tables. Pythagorean theorem. Gram-Schmidt method. Polynomial characteristic. Caley-Hamilton theorem. Applications (difference equations. Markov evolution). Singular value decomposition. Orthogonal and symmetrical tables.

Recommended Reading

1. Strang, G. (2005): Linear Algebra and Its Applications (4th Edition), Brooks Cole.

Course Code:	DS 501
Course Title:	C Programming
Type of Course:	[C]
Year of Study/ Semester:	1st/ 1st
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	V. A. Stavroulaki, Assistant Professor

Objective

The goal of this course is to introduce basic programming principles using the C programming language. C is a principal programming language and a fundamental component of C++ and Java. During the course the students become familiar with the concepts and principles of structured programming, and they gain the basic knowledge for the comprehension and easier learning of other programming languages in the sequel.

Prerequisites: -

Course Contents

Algorithms. Pseudo code. Concepts of programming languages. Main elements of a c program. Data types. Variables. Operands and expressions: types. Declarations and variable initialization. Type modifiers. Type casting. Flow control: if, if…else, for, while, do, etc. Use of logical and relational operands. Arrays and strings: use. Creation and management of single-dimension and multi-dimensional arrays. Use. Creation and management of strings. Pointers. Definition and initialization. Use of pointers. Functions: function prototypes. Recursive functions. Function arguments/parameters. Passing arguments to the main() function. Input/output functions. File management. Structures. Unions and enumerations.

Recommended Reading

1. Kernighan, B.W. & Ritchie, D. M. (1998): C Programming Language (2nd Edition), Prentice Hall.
2. Jones, B.L. & Aitken, P. (2002): Sams Teach Yourself C in 21 Days (6th Edition), Sams.

Course Code:	DS 201
Course Title:	Computer Architecture
Type of Course:	[C]
Year of Study/ Semester:	1st/ 1st
Theory/ Lab Sessions:	3 hours/ 2 hour
ECTS Credits:	5
Academic Personnel:	K. Lambrinoudakis, Associate Professor

Objective

The main objective of the course is the familiarization of the students with the binary logic, the digital design methodologies and the basic architectural characteristics and structure of a computer system.

Prerequisites: -

Course Contents

Digital Systems History. Numerical Systems: Binary, Octal, Hexadecimal, conversions from one system to the other. Binary Arithmetic Operations, Use of Complements, Binary Codes. Logic Gates. Boolean Algebra. Truth Tables, Karnaugh Charts, Examples of Logic Circuits Design. Introduction to the Synchronous Sequential Circuits. Flip – Flops (D, T, RS and JK-type). Design of Counters, Registers and Shift Registers. Methodology for Designing and Analyzing Synchronous Sequential Circuits. Structure, Organization and Operation of Computer Systems, Von Neumann Architecture. Data Representation (Fixed and Floating Point formats), Instruction Sets. Organization and Operation of the Central Processing Unit. Control Unit. Memory Hierarchy, Memory Cell, Addressing Modes, Design of a Random Access Memory, Interconnecting the Memory and the Central Processing Unit. Virtual Memory. Paging and Segmentation. Cache Memory.

Recommended Reading

1. Mano, M. (2003): Digital Design, Pearson Education Limited.
2. Stallings, W. (2002): Computer Organization and Architecture, Pearson Education Limited.

Course Code:	DS 005
Course Title:	Mathematical Logic
Type of Course:	[C]
Year of Study/ Semester:	1st/ 1st
Theory/ Lab Sessions:	4 hours/ 0 hours
ECTS Credits:	4
Academic Personnel:	A. Meliones, Lecturer

Objective

To introduce the language and semantics of propositional and first order predicate logic. To introduce and demonstrate the natural deduction and tableaux proof systems.

Prerequisites: -

Course Contents

First-order predicate logic: Syntax. Variables. Structures. Informal and formal semantics. Propositional logic. Logical connectives; adequacy of connectives. Disjunctive and conjunctive normal forms. Validity. Satisfiability. Semantic entailment. Proof systems: natural deduction and tableaux for propositional and predicate logic.

Recommended Reading

1. Mendelson, E. (1997): Introduction to Mathematical Logic (4th Edition), Chapman & Hall.

Course Code:	DS 706
Course Title:	Instructional Methods
Type of Course:	[C]
Year of Study/ Semester:	1st/ 1st
Theory/ Lab Sessions:	3 hours/ 1 hour
ECTS Credits:	4
Academic Personnel:	F. Paraskeva, Assistant Professor

Objective

This course introduces students to fundamental educational theories. By doing so, it develops and evaluates educational models for students supported by digital systems and tools.

Prerequisites: -

Course Contents

Education - Learning - Instruction – Training. Learning, educational theories/models and instructional design. Taxonomies and learning objectives (design patterns, methods, learning strategies, techniques, activities, assessment and evaluation). Applications using ICT. Personal and psychological factors in learning and instruction.

Recommended Reading

1. Driscoll, M. P. (2004): Psychology of Learning for Instruction (3rd Edition), Prentice Hall.

2. Gredler, M. E. (2004): Learning and Instruction : Theory into Practice (5th Edition), Prentice Hall.

3. Gagne, R.M., Wager W.W., Golas, K. & Keller, J.M. (2004): Principles of Instructional Design, Wadsworth Pub Co.

2nd Semester

Course Code:	DS 002
Course Title:	Mathematical Analysis II
Type of Course:	[C]
Year of Study/ Semester:	1st/ 2nd
Theory/ Lab Sessions:	4 hours/ 0 hours
ECTS Credits:	4
Academic Personnel:	G. Efthymoglou, Associate Professor

Objective

This course attempts to enhance the knowledge gained in the course Mathematical Analysis I and to provide an appropriate mathematical background that enables the students to study the fields of computers and computers networks.

Prerequisites: DS 001 - Mathematical Analysis I.

Course Contents

Vectors in the level and in the space. Vector interrelations. Applications: laws of Kepler. Interrelations of multiple variables (definition, graphic representation, limits, constantly, certain derivative, derivative as for direction, total differential gear, very little - biggest). Precise differential equations. Double and triple integrals. Change of coordinates – applications. Laplace transformations. Fourier transformations. Completion of vector fields (bent - divergence – turn, curve integrals, surface integrals, theorems green, gauss, stokes).

Recommended Reading

1. Zygmund, A. (2003): Trigonometric Series (3rd Edition), Cambridge University Press.

Course Code:	DS 012
Course Title:	Stochastic Processes
Type of Course:	[C]
Year of Study/ Semester:	1st/ 2nd
Theory/ Lab Sessions:	4 hours/ 0 hours
ECTS Credits:	4
Academic Personnel:	A. Alexiou, Assistant Professor

Objective

This course provides an introduction to stochastic processes in communications, signal processing and digital and computer systems. Topics include continuous and discrete random processes, correlation and power spectral density, Markov chains, and queuing theory.

Prerequisites: -

Course Contents

Introduction: review of probability theory. Stochastic Processes. Types of stochastic processes. Mean and ergodicity. Gaussian stochastic processes: multi-variable stochastic processes. Independent, identically distributed random sequences. Discrete stochastic processes. Continuous stochastic processes. Poisson processes: theory and applications. Stationary processes. Transmission of a random process through a linear time-invariant filter. Power spectral density. Markov chains: introduction to Markov chains. Discrete-time Markov chains.

Recommended Reading

1. Papoulis, A., Unnikrishna, S. & Pillai (2002): Probability, Random Variables and Stochastic Processes, McGraw-Hill Education – Europe.
2. Yates, R. & Goodman, D. J. (2004): Probability and Stochastic Processes, John Wiley & Sons.

Course Code:	DS 004
Course Title:	Discrete Mathematics
Type of Course:	[C]
Year of Study/ Semester:	1st/ 2nd
Theory/ Lab Sessions:	4 hours/ 0 hours
ECTS Credits:	4
Academic Personnel:	S.Katsikas, Professor

Objective

The aim is to present and analyse elements of Mathematical Logic that are important in computer science. In doing so, the course presents elements from the theories of graphs, trees, complexity and algorithms.

Prerequisites: -

Course Contents

Sets and proposals: finite. Countable and uncountable totals. Mathematic induction. Proposals. Combinational elements: changes. Combinations. Provisions. Calculable and typical languages: Rusell's paradox. Languages. Syntax types and languages. Retrospective relations and retrospective algorithms: linear relations. Homogenous. Special and total solutions. Not linear relations. Solutions with the method of generators of interrelations. Trees: trees with roots. Lengths of paths. Binary search trees. Graphs: multiple graphs and weighted graphs. Paths and cycles. Paths and cycles (Euler-Hamilton). Analysis of algorithms: time complexity.

Recommended Reading

1. Rosen, K.H. (2006): Discrete Mathematics and Its Applications (6th Edition), McGraw-Hill Science.

Course Code:	DS 204
Course Title:	Operating Systems I
Type of Course:	[C]
Year of Study/ Semester:	1st/ 2nd
Theory/ Lab Sessions:	3 hours/ 2 hour
ECTS Credits:	5
Academic Personnel:	K. Lambrinoudakis, Associate Professor

Objective

The main objective of the course is the familiarization of the students with the fundamental concepts of an operating system. Furthermore, they will be presented with the main operating system design principles, the technical problems that they manage and how the distinct characteristics of each operating system may influence the overall system functionality.

Prerequisites: -

Course Contents

Fundamental Concepts and History of Operating Systems. Operating System Structure. Processes: Properties and Creation, Interprocess Communication and Process Scheduling. Use and Creation of Threads, Pop-Up Threads, Making Single-Threaded Code Multithreaded, Thread Scheduling. Deadlocks: The Ostrich Algorithm, Detection, Recovery, Avoidance, Prevention. Memory Management: Virtual Memory, Design and Implementation of the Paging Mechanism, Page Replacement Algorithms, Segmentation. Input/Output: Hardware and Software, Disks, Terminals. File System: Files and Directories, File System Implementation.

Recommended Reading

1. Silberschatz, A., Galvin, P.B. & Gagne, G. (2005): Operating System Concepts, John Wiley and Sons Ltd.

2. Tanenbaum, A. (2001): Modern Operating Systems (2nd Edition), Prentice Hall.

Course Code:	DS 502
Course Title:	Object-Oriented Programming
Type of Course:	[C]
Year of Study/ Semester:	1st/ 2nd
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	A. Prentza, Assistant Professor

Objective

The aim of this course is the comprehension of the fundamentals of Object Oriented Programming (OOP), the familiarisation of students with an OOP language such as Java, the conceptual and practical comprehension of OOP approach with Java and the awareness of problems during the development of net-centric information systems using the OO Approach.

Prerequisites: DS 501 - C Programming.

Course Contents

Introduction to Object Oriented Technology. OOP and basic models. OOP with Java: introduction to Java, development of program applications in Java. Introduction to classes and objects/methods. Data types. Operators. Control statements. Java methods. Java API. Arrays in Java. Inheritance and polymorphism. Exception handling. Files and streams. Java Graphical User Interface (GUI). Introduction to Java applets. Threads and multithreading.

Recommended Reading

1. Deitel, H.M. & Deitel, P.J. (2007): Java How to program (7th Edition), Prentice Hall.
2. Savitch, W. & Carrano, F. (2008): Java: Introduction to problem solving and programming (5th Edition), Prentice Hall.

Course Code:	DS 508
Course Title:	Systems Analysis and Design
Type of Course:	[C]
Year of Study/ Semester:	1st/ 2nd
Theory/ Lab Sessions:	3 hours/ 1 hour
ECTS Credits:	4
Academic Personnel:	A. Prentza, Assistant Professor

Objective

The aim of this course is the understanding of the basic concepts of Systems analysis and design and the methodologies used for the development of Systems, the familiarization and application of graphical modelling languages with emphasis on Unified Modelling Language (UML) and the understanding of the concepts of object oriented analysis and design.

Prerequisites: DS 502 - Object-Oriented Programming.

Course Contents

Introduction to Systems analysis and design. Basic concepts of systems theory. Systemic approach. Systems structure, environment, methodology, models. Selecting systems theories. Object oriented approach. Graphical modelling techniques. Introduction to UML. Use of UML diagrams for systems analysis, design and development. UML tools. Use case models. UML diagrams (use case diagrams, class diagrams, object diagrams, sequence and communication diagrams, activity diagrams, state diagrams, component and deployment diagrams). Rational Unified Process (RUP).

Recommended Reading

1. Maciaszek, L.A. (2007): Requirements Analysis and Systems Design (3rd Edition), Addison Wesley.
2. Booch, G., Rumbaugh, J. & Jacobson, I. (2005): Unified Modeling Language User Guide (2nd Edition), Addison Wesley.

Course Code:	DS 011
Course Title:	Statistics
Type of Course:	[C]
Year of Study/ Semester:	1st/ 2nd
Theory/ Lab Sessions:	4 hours/ 0 hours
ECTS Credits:	4
Academic Personnel:	A.Alexiou, Assistant Professor

Objective

The aim of this course is the understanding of the fundamental concepts of statistics.

Prerequisites: DS 010 - Probability Theory.

Course Contents

Sample theory, samples, replacement. Random samples and numbers. Sampling distributions and statistical interrelations. Frequency and relative frequency. Cluster sampling. Stratified sampling. Systematic sampling. Statistical estimations unbiased estimations. Reliability and confidence intervals. Hypotheses testing and importance of statistics hypotheses. Significance level. Normal distribution testing. Interpretation of criterion t for dependent and independent samples. Adaptation test x2. Adaptation curve. Regression and cross-correlation adaptation curve. Regression. Least square. Multiple regression. Estimation fault. Factors of cross-correlation. Correlation and independence. Interpretation of indicators of cross-correlation. Pearson. Spearman. Biserial. ϕ. Propagation analysis. Interpretation of propagation analysis. Multiple-variables statistical analysis.

Recommended Reading

1. McClave, J.T. & Sincich, T. (2006): Statistics (10th Edition), Prentice Hall.

3rd Semester

Course Code:	DS 205
Course Title:	Operating Systems II – UNIX
Type of Course:	[C]
Year of Study/ Semester:	2nd/ 3rd
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	K. Lambrinoudakis, Associate Professor

Objective

The course will highlight the special characteristics of operating systems for multiprocessors, multicomputers, distributed systems and multimedia systems. Furthermore, issues related to the security of an operating system will be presented. As a case-study, the course will end up with an overview of the UNIX

operating system, the use and programming of the Bourne shell and the basic system administration principles.

Prerequisites: DS 204 – Operating Systems I.

Course Contents

Operating systems for Multiprocessors, Multicomputers, Distributed Systems. Multimedia Systems: Multimedia Files, Video Compression. Multimedia Process Scheduling. Operating Systems Security: Threats, Attacks, User Identification, Access Control Mechanisms. Operating Systems Design Principles. Operating Systems for Smart Cards: Multi-application – Single Service Provider, Multi-application – Multiple Service Providers, JAVA cards. UNIX History and Main Principles: The File System, The UNIX Shell, Supporting Programs, The Kernel Structure. UNIX Processes. UNIX Memory Management. UNIX Input – Output. The UNIX File System. Bourne Shell: Usage, Customization, Redirecting Input/Output. Shell Programming: Variables, Flow Control, Regular Expressions, Signals. System Administration, User and Group Administration, Disk and File System Administration, Software Installation.

Recommended Reading

1. Wrightson, K. & Merlino, J. (2000): Matering UNIX, Sybex.
2. Kernighan, B. W. & Pike, R. (1984): The Unix Programming Environment, Pearson Education Limited.

Course Code:	DS 301
Course Title:	Introduction to Telecommunications
Type of Course:	[C]
Year of Study/ Semester:	2^{nd}/ 3^{rd}
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	A. Kanatas, Professor

Objective

The course seeks to introduce telecommunication systems by focusing on the technologies of the physical layer. It provides the basic principles of analysis and design of telecommunication systems and the necessary mathematical tools. Moreover, basic analogue and digital communication systems are presented. The students are introduced in the telecommunications fundamentals and the basic transmission principles.

Prerequisites: DS 001 – Mathematical Analysis I, DS 003 – Linear Algebra, DS 012 – Stochastic Processes.

Course Contents

Signals in telecommunications (signal types, basic signals, signal transformations). Systems in telecommunications (categories, linear time invariant systems, impulse response, convolution, cross and auto correlation). Geometrical signal representation (Hilbert space, signal space, bases, orthogonal signals, Gram-Schmidt ortho-normalization). Fourier series (periodic signals, real signals and trigonometric Fourier

series representation, response of linear time invariant systems to periodic signals, Parseval theorem). Fourier transformation (real signals, periodic signals, energy and power spectral density). Filters (ideal filters and categories). Noise (white noise and AWGN model). Capacity (Nyquist and Shannon limits). Sampling theorem. Quantization, PCM, analogue modulation techniques (AM, FM).

Recommended Reading

1. Haykin, S. (2001): Communication Systems, 4th Edition, Wiley.
2. Proakis, J. G. & Salehi, M. (2005): Fundamentals of Communication Systems, Pearson Prentice Hall.

Course Code:	DS 503
Course Title:	Data Structures
Type of Course:	[C]
Year of Study/ Semester:	2nd/ 3rd
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	G. Vassilacopoulos, Professor C. Doulkeridis, Lecturer

Objective

The course aims to analyze the basic data structures and learn how the choice of data structures and algorithm design impacts the performance of programs. It studies specific data structures such as linear lists, stacks, queues, hash tables, binary trees, binary search trees, and graphs.

Prerequisites: DS 502 – Object-Oriented Programming.

Course Contents

Introduction to data types. Arrays. Algorithm analysis and performance evaluation. Stacks. Queues. Linked lists. Priority queues. Binary trees. Search trees. Hash tables. Graphs: definition and properties, graph algorithms.

Recommended Reading

1. Sahni, S. (2004): Data Structures, Algorithms, and Applications in Java, Silicon Press.
2. Goodrich, M. & Tamassia, R. (2003): Data Structures and Algorithms in Java, John Wiley & Sons.

Course Code:	DS 509
Course Title:	Human - Computer Interaction
Type of Course:	[C]
Year of Study/ Semester:	2nd/ 3rd
Theory/ Lab Sessions:	3 hours/ 2 hours

ECTS Credits:	5
Academic Personnel:	Symeon Retalis, Associate Professor

Objective

The course emphasizes learning and problem solving issues surrounding the design of interactive systems using computational systems. Students will gain knowledge in software usability, interactive multimedia applications design, interactive systems evaluation and acquire dexterities in the designing, development and evaluation of multimedia applications.

Prerequisites: -

Course Contents

Topics in human computer interaction. The human as a computer user. Cognitive models. Visual coding. Focus and memory. Knowledge representation and management. Models of the mind. User conceptual models. Interaction technologies. Input/output devices. Graphical environments. Direct manipulation. Collaborative systems. Virtual reality. Interactive systems design methods. User-centred design. Usability requirements. Task analysis. Dialogue and internet interfaces design. System design - hierarchical task analysis. Prototyping. Usability evaluation methods and techniques. Design patterns. Special purpose interactive systems. Computer-supported cooperative work. Voice communication. Assistive technologies.

Recommended Reading

1. Dix, A., Finlay, J., Abowd, G. & Beale, R. (2004). Human-Computer Interaction, Prentice Hall.
2. Sears, A. & Jacko, J.A. (2007). The Human-Computer Interaction Handbook, CRC Press.

Course Code:	DS 805
Course Title:	Information Theory
Type of Course:	[C]
Year of Study/ Semester:	2^{nd}/ 3^{rd}
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	C. Xenakis, Assistant Professor

Objective

The aim of this course is to support the students in learning the principles, concepts and applications of Information Theory. Information theory is a discipline in applied mathematics involving the quantification of data with the goal of enabling as much data as possible to be reliably stored on a medium or communicated over a channel. The measure of information, known as information entropy, is usually expressed by the average number of bits needed for storage or communication.

Prerequisites: -

Course Contents

Concepts of entropy and information. Basic definitions of probabilities. Source coding. Channel capacity. Channel coding. The Shannon's theorem. Error correction codes and decoding methods.

Recommended Reading

1. Cover, T.M. & Thomas, J.A. (2006): Elements of Information Theory, 2nd Edition, Wiley.
2. MacKay, D.J.C. (2003): Information Theory, Inference, and Learning Algorithms, Cambridge University Press.

Course Code:	DS 507
Course Title:	Software Engineering
Type of Course:	[C]
Year of Study/ Semester:	2nd/ 3rd
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	A. Prentza, Assistant Professor

Objective

The aim of the course is the acquaintance of students with the scientific area of Software Engineering, the presentation of important process models of the software lifecycle, the familiarization with the basic methodologies, techniques and tools for the systematic analysis, design, development, testing, operation and maintenance of software solutions of good quality on time and within budget.

Prerequisites: -

Course Contents

Introduction to Software Engineering. Need and objectives. Software lifecycle process models. Requirements analysis and modeling: structured analysis approach, data flow diagrams, state diagrams, software needs document. Software design: architecture and detailed design, software plan description document. Software coding. Standards and good programming practices. Software testing: components and integration testing. Software cost estimation: estimation techniques, algorithmic cost modeling. Software quality.

Recommended Reading

1. Pressman, R.S. (2005): Software Engineering - A Practitioner's Approach, 6th Edition, McGraw-Hill.
2. Sommerville, I. (2007): Software Engineering, 8th Edition, Addison-Wesley.

4th Semester

Course Code:	DS 504
Course Title:	Database Systems Design
Type of Course:	[C]
Year of Study/ Semester:	2nd/ 4th
Theory/ Lab Sessions:	3 hours/ 2 hours

ECTS Credits:	5
Academic Personnel:	G. Vassilacopoulos, Professor M. Halkidi, Assistant Professor

Objective

This course introduces the students to the main concepts of Relational Database Systems. It focuses on issues regarding the database modeling, design and programming in SQL. It also provides an overview of the basic data storage structures and file organization techniques.

Prerequisites: DS 503 - Data Structures.

Course Contents

Introduction to Relational databases. Relational model: Relations, Attributes, Relational schema, Relational algebra (operations), Relational calculus. Normalization: Integrity constraints, Functional dependencies, Decomposition, Normal forms. Entity-Relationship Model: Basic concepts, Entity Sets, Relationship Sets. Design Issues: Keys, E-R Diagram, Design of an E-R Database Schema, Reduction of an E-R schema to tables. SQL: Basic structure, Set Operations, Aggregate Functions, Joins, Nested sub-queries, Views, Modification of the Database (insert, update, delete), Triggers. Database internal storage and data retrieval methods. Characteristics of various storage means. Data and file structures. Data access techniques such as indices, B+-trees, Hashing.

Recommended Reading

1. Ramakrishnan, R. & Gehrke, J. (2002): Database Management Systems (3rd Edition), McGraw Hill.
2. Elmasri & Navathe. (2007): Fundamentals of Database Systems (5th Edition), Addison-Wesley.

Course Code:	DS 510
Course Title:	Web Programming
Type of Course:	[C]
Year of Study/ Semester:	2nd/ 4th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	S. Retalis, Associate Professor

Objective

This course addresses concepts and technologies concerning the development of internet systems and applications.

Prerequisites: -

Course Contents

The course introduces students to the principles and development techniques of static and dynamical internet systems. It includes: Web servers. Client and server-side programming. Development of internet

applications using HTML, CSS, JavaScript. Development of internet applications interconnecting with data bases PHP and MySQL. Development of high-level internet application using Flash.

Recommended Reading

1. Ullman, L. (2003): PHP and MySQL for Dynamic Web Sites, Peachpit Press.
2. Brooks, D.R. (2007): An Introduction to HTML and JavaScript for Scientists and Engineers, Springer.

Course Code:	DS 402
Course Title:	Multimedia Technology
Type of Course:	[C]
Year of Study/ Semester:	2nd/ 4th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	N.-M. Sgouros, Professor

Objective

The goal of this course is the description and analysis of the basic technologies in multimedia systems. The course focuses especially on methods for coding and processing of multimedia content.

Prerequisites: -

Course Contents

Definition and classification of multimedia technologies. Audio and visual perception. Audio processing. Image and video processing. Design and development of multimedia systems.

Recommended Reading

1. Steinmetz, R. & Nahrstedt, K. (2002): Multimedia Systems, X.media publishing.
2. Mandal M.Kr. (2002): Multimedia Signals and Systems, Springer.

Course Code:	DS 207
Course Title:	Distributed Systems
Type of Course:	[C]
Year of Study/ Semester:	2nd/ 4th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	A. Meliones, Lecturer

Objective

This course focuses on distributed systems and studies their: (a) theoretical background, (b) design and implementation, (c) components, (d) concepts and (e) approaches.

Prerequisites: DS 502 – Object-Oriented Programming.

Course Contents

Introduction. Concepts of distributed systems. Advantages and disadvantages. Hardware and software issues. Design. The client server model. Algorithms for distributed systems. Web services. Parallel and distributed systems.

Recommended Reading

1. Tanenbaum, A.S. & van Steen, M. (2002): Distributed Systems: Principles and Paradigms (1st Edition), Prentice Hall,.
2. Coulouris, G., Dollimore, J. & Kindberg, T. (2000): Distributed Systems: Concepts and Design (3rd Edition), Addison Wesley.

Course Code:	DS 320
Course Title:	Computer Networks I
Type of Course:	[C]
Year of Study/ Semester:	2nd/ 4th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	P. Demestichas, Professor

Objective

The aim of this course is to introduce computer networks, protocol hierarchies, and explain the network layer.

Prerequisites: DS 301 - Introduction to Telecommunications.

Course Contents

Introduction to networks, need for networks, categories of networks. Network elements and communication links; Protocols and protocol hierarchies/stacks, role of protocols. Functionality of network layer, switching, circuit switching. Packet switching, datagrams, virtual circuits. Routing, link state routing, Dijkstra algorithm, open shortest path first (OSPF), internal gateway protocol (IGP), distance vector routing, Bellman-Ford algorithm, border gateway protocol (BGP);external gateway protocol (EGP), multicast routing, spanning trees, minimum cost spanning trees, broadcast routing; congestion control. Students are asked to conduct small projects, related to the implementation of network level functionality and algorithms, through the use of C/C++ and/or Java.

Recommended Reading

1. Haykin, S. (1994): Communication systems, Wiley.
2. Tanenbaum, A. (2003): Computer Networks, Prentice Hall.

Course Code:	DS 101
Course Title:	Algorithms and Complexity
Type of Course:	[C]
Year of Study/ Semester:	2nd/ 4th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	G. Vouros, Professor

Objective

This course attempts to familiarize the students with problem solving using algorithms and algorithmic analysis. Common software problems will be addressed and corresponding algorithms will be analysed. Students familiarize themselves with algorithms implementation in the C/C++ languages.

Prerequisites: -

Course Contents

Problems and algorithms. Designing and analyzing algorithms (requirements and restrictions). The problem of connectivity. Complexity. Notations and basic functions. Sequential and binary search. Elements and data structures in C. Sieve of Heratosthenes. Recursion (introduction, divide & conquer, dynamic programming). Sorting (abstract implementation, selection sort, insertion sort, bubble sort, quicksort). Strings (fundamental functions, searching in files).

Recommended Reading

1. Cormen, T.H., Leiserson, C.E., Rivest, R.L. & Stein, C. (2001): Introduction to Algorithms (2nd Edition), The MIT Press.

2. Sedgewick, R. (2002): Algorithms in C++: Fundamentals, Data Structures, Sorting, Searching and Graph Algorithms (3rd Edition), Addison Wesley.

5th Semester

Course Code:	DS 321
Course Title:	Computer Networks II
Type of Course:	[C]
Year of Study/ Semester:	3rd/ 5th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	P. Demestichas, Professor

Objective

The course attempts to analyse the functionality of the Data Link Layer (DLL), Medium Access Control (MAC) and Logical Link Control (LLC) layers.

Prerequisites: DS 320 - Computer Networks I.

Course Contents

Introduction to the functionality of the Data Link Layer (DLL). Medium Access Control (MAC) and Logical Link Control (LLC) layers. Error control. Error detection. Error correction. Retransmission techniques. Error detection techniques. Cyclic Redundancy Codes (CRC). Error correction techniques. Hamming techniques. Forward Error Correction (FEC). Retransmission techniques. Stop-and-Wait (S&W). Alternating Bit Protocol (ABP). Automatic Repeat Request (ARQ). Sliding window techniques. Go Back N (GBN). Soptional Repeat (SRP). MAC protocols. Aloha. Carrier Sense Multiple Access (CSMA). MAC protocols in Wireless LANs/MANs/PANs. IEEE 802.x standards. LLC protocols. 802.2 standard.

Recommended Reading

1. Walrand, J. (1997): Communication Networks, Prentice Hall.
2. Tanenbaum, A. (2003): Computer Networks, Prentice Hall.

Course Code:	DS 801
Course Title:	Security Policies and Security Management
Type of Course:	[C]
Year of Study/ Semester:	3rd/ 5th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	S. Katsikas, Professor

Objective

The aim of the course is the acquaintance of students with the field of information security, the familiarization with its fundamental principles, the acquisition of knowledge and application competencies of techniques and methods for managing security.

Prerequisites: -

Course Contents

Introduction: the need for protecting information and a protection framework. Definitions and primary concepts. Information systems security approaches. Information systems risk analysis and management methodologies. Available methods. The CRAMM method. Case study. Information systems security policies. Business continuity. Development phases. Information systems auditing: basic concepts. Importance and character of audit. Audit mechanisms. Steps of the audit plan. Security assurance and security evaluation. Criteria structure. Evaluation systems. Protection of personal data: supra-national initiatives. International conventions. National legal framework. Personal data protection problems in the internet. Deontology codes: fundamental principles.

Recommended Reading

1. Peltier, T. (1999): Information Security, Policy and Procedures: a Practitioner's Reference, CRC Press LLC.

2. Pfleeger, C. (1997): Security in Computing, Prentice Hall.

Course Code:	DS 505
Course Title:	Database Systems
Type of Course:	[C]
Year of Study/ Semester:	3rd/ 5th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	G. Vassilacopoulos, Professor M. Halkidi, Assistant Professor

Objective

The aim of this course is to introduce the students to the principles of the Database Management System (DBMS). It covers issues related to the query processing, query optimization, transaction management and database system recovery. It also presents the main concepts of object-orient databases and describes the object-relational data model.

Prerequisites: DS 504 – Database Systems Design.

Course Contents

Introduction to Database Management Systems: Presentation of the fundamental concepts of DBMS, applications of database systems. Methods for query processing and optimization. Transaction management: characteristics of a transaction management system. Control synchronization and integrity of the system, multi-user access to the same data. Object oriented databases: basic concepts of OOP and how they are used in the context of Object Oriented Data Model, object relational data models. Distributed databases: design, query processing and transaction management in distributed systems.

Recommended Reading

1. Ramakrishnan, R. & Gehrke, J. (2002): Database Management Systems (3rd Edition), McGraw Hill.
2. Elmasri & Navathe. (2007): Fundamentals of Database Systems (5th Edition), Addison-Wesley.

Course Code:	DS 518
Course Title:	Artificial Intelligence
Type of Course:	[C]
Year of Study/ Semester:	3rd/ 5th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	G. Vouros, Professor

Objective

This is an introductory course into the field of Artificial Intelligence. It covers basic elements of AI, such as search, knowledge representation, ontologies, inference, planning. The course is tailored towards undergraduate students who wish to learn about the basic techniques in the field, and share the excitement.

Prerequisites:

Course Contents

Introduction to AI and to Intelligent. Blind Search Algorithms: breadth-first search, uniform-cost search, depth-first search, depth-limited search, iterative deepening depth-first search, bi-directional search. Heuristic Search Algorithms and Heuristic Functions: greedy best-first search, A*-search. Local Search: hill-climbing, simulated annealing, local beam search, genetic algorithms. Using Logic to Represent Knowledge. Ontologies and Semantic Web: Representation and Reasoning. Planning.

Recommended Reading

1. Stuart Russel and Peter Norvig. Artificial Intelligence: A Modern Approach, Prentice Hall, 2nd edition (2003).
2. Nilsson, N., Artificial Intelligence: A New Synthesis, San Francisco: Morgan Kaufmann, 1998. Nilsson, N., Principles of Artificial Intelligence, San Francisco: Morgan Kaufmann, 1980.David Poole, Alan Mackworth and Randy Goebel. Computational Intelligence: A Logical Approach, Oxford University Press, New York, 1998. http://www.cs.ubc.ca/spider/poole/ci.html.
3. Matthew L. Ginsberg. Essentials of Artificial Intelligence, Morgan Kaufmann, 1993.
4. Elaine Rich and Kevin Knight, Artificial Intelligence, 2nd edition, Mc Graw Hill, 1990.
5. M. Genesereth and N. Nilsson: Logical Foundations of Artificial Intelligence, Morgan Kaufmann, 1987.
6. R.J. Brachman and H.J. Levesque, ”Knowledge Representation and Reasoning”, Morgan Kaufmann, 2004.
7. Steffen Staab and Rudi Studer Handbook on Ontologies (International Handbooks on Information Systems), 2009.
8. Dean Allemang and James Hendler Semantic Web for the Working Ontologist: Effective Modeling in RDFS and OWL.

Course Code:	DS 511
Course Title:	Workflow Systems
Type of Course:	[CC-ES]
Year of Study/ Semester:	3rd/ 5th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	F. Malamateniou, Associate Professor

Objective

The main objective of the course is to introduce business processes and workflows, to describe and elaborate on related concepts such as business process modeling and reengineering, architectural designs and security of workflow systems, operation of workflow systems and Workflow Management Systems (WfMS).

Prerequisites: DS 507 - Software Engineering, DS 504 – Database Systems Design, DS 505 - Database Systems, DS 320 - Computer Networks I, DS 321 - Computer Networks II, DS 502 - Object-Oriented Programming.

Course Contents

Business Processes. Processes and Workflows. Dimensions of Workflow. User Support. Categories of Workflow. Workflow-based applications. Business Engineering. Workflow Terminology. Workflow Management Systems Basics. Workflow Management Systems Structure. Workflow Management Systems Architecture. Workflow Management Systems Standards. Workflow Reference Model. Process Concepts and Structure. Control Flow of Workflow Model & UML. Business processes with BPEL4WS. Workflow Patterns.

Recommended Reading

1. Leymann, F. & Roller, D. (2000): Production Workflow: Concepts and Techniques, Prentice Hall.
2. Van der Aalst, W.M.P. & Van Hee K.M. (2002): Workflow Management: Models, Methods and Systems, MIT Press.

Course Code:	DS 305
Course Title:	Digital Communications
Type of Course:	[CC-CSN]
Year of Study/ Semester:	3rd/ 5th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	G. Efthymoglou, Associate Professor

Objective

This course introduces the methods of digital modulations at baseband (MPAM) and passband (MFSK, MPSK, QAM). It also presents the detection theory of these signals using the method of matched filtering and evaluates their performance in channels with noise and fading.

Prerequisites: DS 301 – Introduction to Telecommunications.

Course Contents

Telecommunication budget analysis. Noise figure. Composite noise figure and noise temperature. Calculation of effective receiver temperature. Baseband transmission methods. Probability of error for matched filter detection in AWGN. Filters with zero ISI (Nyquist filters). Binary passband modulations: ASK, FSK, and PSK. M-ary signalling: M-FSK, M-PSK, and QAM. Demodulation techniques and symbol error probability in AWGN and fading channels. Spectral efficiency of digital modulations. Link Budget according to system specifications. Channel coding. Convolutional codes and Viterbi algorithm. Performance of convolutional codes in AWGN channel.

Recommended Reading

1. Proakis, J. & Salehi, M. (2001). Communication Systems Engineering, 2nd Edition, Prentice Hall.
2. Sklar, B. (2001): Digital Communications: Fundamentals and Applications, 2nd Edition, Prentice Hall.

Course Code:	DS 013
Course Title:	Queuing Systems
Type of Course:	[CC-CSN]
Year of Study/ Semester:	3rd/ 5th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	P. Demestichas, Professor

Objective

This course seeks to teach Markov chains, birth-death processes, queuing systems, and networks of queuing systems.

Prerequisites: DS 320 - Computer Networks I.

Course Contents

Structure of queuing systems. Arrival process. Queues. Service systems. Review of relevant probability laws. Probability density functions. Stochastic processes. Continuous time Markov chains. Discrete time Markov chains. Birth – death processes. M/M/1. M/M/κ. M/M/1/κ. M/M/κ/κ. M/G/1. G/G/1 Models. Networks of queuing systems. Kleinrock approximation. Jackson networks. Applications. Students are asked to conduct small projects with the use of C/C++ and/or Java related to queuing systems and the analytical evaluation of communication and computer systems.

Recommended Reading

1. Kleinrock, L. (1975): Queueing Systems, John Wiley & Sons.
2. Walrand, J. (1997): Communication Networks, Prentice Hall.

Course Code:	DS 516
Course Title:	Semantic Web – XML
Type of Course:	[CC-ES, CC-CSN]
Year of Study/ Semester:	3rd/ 5th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	A. Prentza, Assistant Professor

Objective

The aim of the course is the introduction to Semantic Web and exploration of means for semantic information management, familiarization with semantic web languages and related technologies with focus on XML, RDF and OWL and presentation of tools for the creation and processing of ontologies.

Prerequisites: DS 510 - Web Programming.

Course Contents

Introduction to Semantic Web. XML, DTDs, XML Schemas, accessing and querying XML documents, XSLT. RDF, RDF Schemas. Role of ontologies. Ontologies terminology. Web ontology languages (OWL). Ontology engineering. Tools and methods. Ontology management. Tools and frameworks. Ontology management. Ontologies and applications.

Recommended Reading

1. Antoniou, G. & van Harmelen, F. (2004): A semantic Web primer, MIT Press.
2. Davies, J., Fensel, D. & van Harmelen, F. (2003): Towards the Semantic Web: Ontology-Driven Knowledge Management, John Wiley.

Course Code:	DS 403
Course Title:	Computer Graphics and Virtual Reality
Type of Course:	[OC-ES, OC-CSN]
Year of Study/ Semester:	3rd/ 5th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	N.-M. Sgouros, Professor

Objective

This course seeks to describe and analyze basic methods for image synthesis in digital systems. Apart from the algorithmic description of relevant methods, the course emphasizes specific implementations of 3D graphic systems.

Prerequisites: -

Course Contents

Definition and types of computer graphics systems. Modeling (basic geometric shapes - coordinate systems - geometric transformations, perspective projection). Shading and lighting (color models, modeling of light sources, rendering methods). Programming environments for computer graphics.

Recommended Reading

1. Edward, A. (2008): Interactive Computer Graphics: A Top-Down Approach using OpenGL (5th Edition), Addison Wesley.
2. Watt, A. & Policarpo, F. (1998): The Computer Image, Addison Wesley.

Course Code:	DS 206
Course Title:	Compilers
Type of Course:	[OC-ES, OC-CSN]
Year of Study/ Semester:	3rd/ 5th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	N.-M. Sgouros, Professor

Objective

The analysis of the basic design and implementation principles of programming languages. The description of the ways with which these principles are applied in modern programming languages.

Prerequisites: -

Course Contents

Introduction – Overview of Modern Programming Languages, Language Definition (Regular Expressions - Automata – Context-Free Grammars). Programming Language Structure (Variables, Types and Scoping, Control Flow and Evaluation of Expressions, Subroutines, Iterative and Recursive Processes, Memory Management and Communication). The Compiling/Interpretation Process (Lectical Analysis, Syntactic Analysis, Code Production & Optimization, Linking).

Recommended Reading

1. Scott, M. L. (2005): Programming Language Pragmatics (2nd Edition), Morgan Kaufmann.
2. Aho, A.V., Lam, M.S., Sethi R. & Ullman, J.D. (2006): Compilers: Principles, Techniques and Tools (2nd Edition), Addison Wesley.

Course Code:	DS 708
Course Title:	Educational Psychology
Type of Course:	[OC-ES]
Year of Study/ Semester:	3rd/ 5th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	F. Paraskeva, Assistant Professor

Objective

This course introduces students to basic learning theories as well as different conditions of learning environments. The aim of the course is the theoretical and applied aspects of learning theories based on digital system technologies. (digital learning environments & tools).

Prerequisites: DS 706 - Instructional Methods, DS 509 - Human - Computer Interaction.

Course Contents

Learning and Digital Systems (software tools, open learning environments, communication and collaborative tools). Behavioral approaches of learning to collaborative learning environments (communities of practices). Psychological Learning theories: i) Behavioral Learning Theories. ii) Social Cognitive Learning theories (self-efficacy & self-regulation). iii) Cognitive Learning theories and tools. iv) Social Constructivism: Vygotsky's Theory (open-ended learning environments). Critical approaches of learning theories based on digital learning environments. Applications in different conditions of schooling (primary-secondary), tertiary educational programs. Life long learning programs for professional development and job training (marketing, sales, advertising, health).

Recommended Reading

1. Biehler, R.F. & Snowman J. (2006): Psychology applied to teaching, Houghton Mifflin.
2. Slavin, R. (2007): Educational Psychology, Allyn & Bacon.

Course Code:	DS 701
Course Title:	Educational Digital Systems
Type of Course:	[OC-ES]
Year of Study/ Semester:	3rd/ 5th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	D. Sampson, Professor

Objective

The goal of this course is to get students acquainted with the principles methods and tools of Technology-enhanced Teaching and Learning within the framework of School Education and to help them develop a set of critical competences that will enable them to design, and evaluate, develop , implement Teaching Strategies and Activities supported by Digital Systems.

Prerequisites: DS 706 - Instructional Methods.

Course Contents

Technology-enhanced Learning (Theoretical Foundations, Basic Principles, a Teaching and Learning Framework for integrating Technology in School Education). Classification of Educational Digital Systems (Tutorials, Drill and Practice, Tests and Assessments, Problem Solving and Simulations, Modeling and Digital Games, Exploratory and Guided Discovery, Microworlds). Issues on Educational Design in Technology-enhanced Teaching and Learning. Best Practice Examples in Primary and Secondary School Education.

Recommended Reading

1. Smaldino, S.E., Russell, J.D., Heinich R.,et al., (2004): Instructional Technology and Media for Learning, 8th Edition, Prentice Hall.
2. Jonassen, D.H., Howland, J., Moore, J. & Marra, R.M. (2003): Learning to Solve Problems with Technology: A Constructivist Perspective, 2nd Edition, Prentice Hall.

Course Code:	DS 307
Course Title:	Signals and Systems
Type of Course:	[OC-CSN]
Year of Study/ Semester:	3rd/ 5th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	G. Efthymoglou, Associate Professor

Objective

This course is an introduction to the analysis and design of analogue and digital linear systems. The material covers the theoretical tools for the analysis of signals and systems in the time and frequency domains.

Prerequisites: DS 301 – Introduction to Telecommunications.

Course Contents

Spectrum of continuous energy signals. Power spectral density of periodic signals. Parseval's theorem. Laplace transform and inverse Laplace transform. Transfer function of linear analogue systems, bode plots. Impulse response and analogue convolution. Sampling theorem. Spectrum of sampled signals. Difference equations. Discrete time convolution. Z transform. Frequency response of discrete time signals and systems. Inverse-Z transform. Stability of linear systems. Design and analysis of a complete system. Signal quantization and quantization noise. Line coding and signal spectrum. Matched filtering. Discrete Fourier Transform (DFT), Inverse DFT. Circular convolution. Linear convolution using DFT. Spectral analysis using DFT. Orthogonal Frequency Division Modulation(OFDM) transmission and reception. Fading channel weight estimation using pilot symbols inside an OFDM symbol. OFDM performance in a channel with fading and noise.

Recommended Reading

1. Mulgrew, B., Grant, P. & Thomson, J. (2003): Digital Signal Processing Concepts and Applications, 2nd Edition, Palgrave Mackmillan.

2. Proakis, J. & Manolakis, D. (2007): Digital Signal Processing: Principles, Algorithms and Applications, 4th Edition Prentice Hall.

Course Code:	DS-311
Course Title:	Simulation of Telecommunication Systems and Networks
Type of Course:	[OC- CSN]
Year of Study/ Semester:	3rd/ 5th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	A.Rouskas, Associate Professor

Objective

The course presents simulation techniques with emphasis on simulation of computer and communication networks. At the end of the course the students will be able to design and develop simulation programs for the study and performance evaluation of complex network communication models.

Prerequisites:

Course Contents

Introduction to dynamic discrete event systems. Development of discrete system models, event-advance design, time-advance design, activity-based design. Pseudorandom number generation, random variables generation. Overview of simulation languages and platforms. Development of

simulation programs using general purpose programming languages. Measurement techniques, traffic load and experiment design. Statistical analysis of simulation experiments, transient and steady state, data collection, confidence intervals, variation reduction techniques. Simulation exercises and examples of telephone and data networks; theoretical results verification.

Recommended Reading

1. Law A.M. & Kelton, W. D. (1991): Simulation Modeling and Analysis, McGraw-Hill, Inc.
2. Issariyakul T. & Hossain E. (2008): Introduction to Network Simulator NS2, Springer.

Course Code:	DS 905
Course Title:	Management
Type of Course:	[OC-ES, OC-CSN]
Year of Study/ Semester:	3rd/ 5th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	Academic staff, Department of Business Administration

This course offered by the Department of *Business Administration* of University of Piraeus.

Course Code:	DS 908
Course Title:	Marketing
Type of Course:	[OC-ES, OC-CSN]
Year of Study/ Semester:	3rd/ 5th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	Academic staff,, Department of Business Administration

This course offered by the Department of *Business Administration* of University of Piraeus.

Course Code:	DS 909
Course Title:	Technology and Innovation Management
Type of Course:	[OC-ES, OC-CSN]
Year of Study/ Semester:	3rd/ 5th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	Academic staff, Department of Business Administration

This course offered by the Department of *Business Administration* of University of Piraeus.

6th Semester

Course Code:	DS 326
Course Title:	Internet Protocols
Type of Course:	[C]
Year of Study/ Semester:	3rd/ 6th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	V.-A. Stavroulaki, Assistant Professor

Objective

The focus of this course is on the architectures and protocols of the first three layers that are used by Internet. The course presents theoretical aspects of the above topics, as well as exercises and programming issues on network services.

Prerequisites: DS 321 - Computer Networks II.

Course Contents

Introduction to the Internet, Main concepts, Terminology, Protocols, Applications. Internet architectures: Protocol hierarchies, Access networks, Autonomous systems, Core networks, Internet Service Providers (ISPs). Protocols: PPP (Point to Point Protocol), Role in the access and core networks, Functions, Packet format, IP (Internet Protocol), Functions, Packet format IPv4, IPv6, Segmentation, Addressing. Internet routing: Routing protocols, IGP (Internal Gateway Protocol), OSPF (Open Shortest Path First), BGP (Border Gateway Protocol), RIP (Routing Internet Protocol), ARP (Address Resolution Protocol). Quality of Service. QoS: Differentiated Services (DiffServ), Integrated Services (IntServ), MPLS (Multi; Protocol Label Switching). Mobile IP: main concepts, Addressing.

Recommended Reading

1. Forouzan, B.A. (2005): TCP/IP Protocol Suite, McGraw-Hill, 3rd Edition.
2. Tanenbaum, A.S. (2002): Computer Networks (4th Edition), Prentice Hall.

Course Code:	DS 512
Course Title:	Information Systems
Type of Course:	[C]
Year of Study/ Semester:	3rd/ 6th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	G. Vassilacopoulos, Professor M. Themistocleous, Associate Professor

Objective

This course analyses the five components of an Information System, the different types of IS and issues associated with the implementation and application of information systems.

Prerequisites: DS 508 – Ανάλυση και Σχεδιασμός Συστημάτων, DS 505 – Database Systems.

Course Contents

Information system (IS). Component hardware. Component software. Component data. Component processes. Component human actors. Information systems lifecycles. Types of IS. Critical path analysis. Business process analysis. IDEF0 IDEF3. DFD. Business process reengineering. Business process improvement. Factors influencing IS implementation. The impact of information systems on organization. Practical examples of IS. Case studies. IS implementation.

Recommended Reading

1. Stair, R. & Reynolds, G. (2007): Fundamentals of Information Systems, 4th Edition, Thomson Publications.
2. O'Brien, J. (2005): Introduction to Information Systems, McGraw Hill.

Course Code:	DS 327
Course Title:	Network Services
Type of Course:	[CC-ES]
Year of Study/ Semester:	3rd/ 6th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	V.-A. Stavroulaki, Assistant Professor

Objective

This course deals with the application and transport layers of the Internet protocol stack and it seeks to present operations and protocols for the support of network services and applications in these two levels.

Prerequisites: DS 321 - Computer Networks II, DS 501 - C Programming, DS 502 - Object-Oriented Programming.

Course Contents

Introduction to the transport and application layers: Concepts, Operations, Protocols, Client- server model. Quality of Service – QoS. Transport layer: Operations. Transmission Control Protocol (TCP). User Datagram Protocol (UDP). Application Programming Interfaces (APIs): Client-server model. TCP and UDP Socket programming. Application layer: Application layer protocols. Hypertext Transfer Protocol (HTTP). File Transfer Protocol (FTP). Simple Mail Transfer Protocol (SMTP). POP. IMAP. Real time applications and the Internet: Protocol SIP (Session Initiation Protocol). Protocol RTP (Real-Time Protocol). IMS platform (IP Multimedia System). VoIP (Voice over IP). VoD (Video on Demand) applications.

Recommended Reading

1. Forouzan, B. A. (2005): TCP/IP Protocol Suite (3rd Edition), McGraw-Hill.
2. Tanenbaum, A.S. (2002): Computer Networks (4th Edition), Prentice Hall.

Course Code:	DS 506
Course Title:	Data Warehouses and Data Mining
Type of Course:	[CC-ES]
Year of Study/ Semester:	3rd/ 6th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	M. Halkidi, Assistant Professor

Objective

In this course we explore the main concepts of the Knowledge and Mining Process while we also discuss main data mining methods. Furthermore, the main techniques regarding the design and development of data warehouses are presented.

Prerequisites: DS 505 – Database Systems, DS 516 – Semantic Web - XML.

Course Contents

Introduction to the main data mining concepts and techniques. The main steps of knowledge and data discovery. Requirements of developing data mining approaches. Data pre-processing: data cleaning, transformation, dimensionality reduction. Data warehouses: multidimensional models, architecture, implementation of data warehouses, OLAP servers (ROLAP, MOLAP, HOLAP). Clustering: partitional, hierarchical, density-based, grid-based, spectral clustering, clustering applications; Classification: Bayesian classifiers, decision trees, neural networks, k-nearest neighbours; Association rules: Apriori, representative association rules; Quality assessment in data mining: evaluation of classification models, association rules interestingness measures, cluster validity; Web mining: link analysis, text mining, web search, page ranking algorithms.

Recommended Reading

1. Han, J. & Kamber, M. (2006): Data Mining: Concepts and Techniques (2nd Edition), Morgan Kaufmann.
2. Chakrabarti, S. (2002): Mining the Web, Discovering Knowledge from Hypertext Data, Morgan Kaufman Publishers.

Course Code:	DS 304
Course Title:	Wireless Communications
Type of Course:	[CC-CSN]
Year of Study/ Semester:	3rd/ 6th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	A. Kanatas, Professor

Objective

The aim of the course is to enable students to understand the basic principles of electromagnetic systems for wireless communications. Using antennas as the interface of telecommunication systems with the transmission media, the course covers the characteristics and parameters of radiating systems and the electromagnetic waves they produce.

Prerequisites: DS 002 – Mathematical Analysis II, DS 301 – Introduction to Telecommunications.

Course Contents

Fundamentals on circuit theory (sinus steady state, phasors, characteristic impedance, complex power). Electromagnetic fields (electric field, displacement density, Gauss law, potential, potential lines, equipotential surfaces, divergence theorem, Poisson and Laplace equations, magnetic induction, magnetic flux density, magnetic field strength, ampere law for current elements, magnetic vector potential). Maxwell's equations. Electromagnetic waves in free space (sinusoidal time variation, wave equation, plane waves, transversal e/m waves, standing waves, energy and power of waves, linear, circular and elliptical polarization). Point sources and e/m waves. Antenna radiation regions. Field and power antenna patterns. Basic antenna parameters (gain, directive gain, directivity, etc.). Antenna equivalent circuits (transmission and reception). Aperture antennas. Antenna polarization and loss factor. Transition from spherical to plane waves. A generic methodology for the calculation of radiated fields. Far field approximations. Basic antenna examples (hertz dipole, longer dipoles, λ/2 dipole, small loops, etc.). Basic wireless propagation equations (Friis' equation, reflection, scattering, diffraction).

Recommended Reading

1. Kraus, J. (1998). Electromagnetics, McGraw-Hill.
2. Balanis, C. (2005): Antenna Theory: Analysis and Design, 3rd Edition, Wiley.

Course Code:	DS 803
Course Title:	Network Security
Type of Course:	[CC-CSN]
Year of Study/ Semester:	3rd/ 6th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	C. Xenakis, Assistant Professor

Objective

The aim of this course is to present and analyze the provisions made in an underlying computer network infrastructure, policies adopted by the network administrator to protect the network and the network-accessible resources from unauthorized access and the effectiveness (or lack) of these measures combined together. This course focuses on the security solutions, which are mainly employed in wired networks that use the Internet technology. It presents and analyses the security mechanisms and protocols that protect the network operation and users data.

Prerequisites: -

Course Contents

Security at lower layers. Network layer security solutions. Application layer security solutions. Key management protocols. Identity management protocols. Firewalls. Trust management. Distributed authentication systems and intrusion detection systems.

Recommended Reading

1. Stallings, W. (2007): Network Security Essentials, Applications and Standards, 3rd Edition, Prentice Hall.

2. Kaufman, C., Perlman, R. & Speciner, M. (2002): Network Security: Private Communication in a Public World, 2nd Edition, Prentice Hall.

Course Code:	DS 306
Course Title:	Digital Signal Processing
Type of Course:	[OC-ES, OC-CSN]
Year of Study/ Semester:	3rd/ 6th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	G. Efthymoglou, Associate Professor

Objective

The students will be able to use the theory of linear systems to design analogue and digital filters according to design specifications.

Prerequisites: DS 307 – Signals and Systems.

Course Contents

Discrete time convolution. Z transform. Frequency response of discrete time signals and systems. Prototypes of analogue lowpass filters: Butterworth polynomials and Chebyshev polynomials. Frequency translation of normalized analogue filters. General algorithm for creating arbitrary analogue filters. Bilinear transformation. Design of digital infinite impulse response (IIR) filters using bilinear transformation. Frequency transformation of digital filters. Digital finite impulse response (FIR) filters with linear phase. FIR filter design using frequency sampling. Implementation issues and techniques for IIR and FIR filters.

Recommended Reading

1. Proakis, J. & Manolakis, D. (2007): Digital Signal Processing: Principles, Algorithms and Applications, 4th Edition, Prentice Hall.

2. Ingle, V. & Proakis, J. (2000): Digital Signal Processing Using Matlab, Brooks/Cole Publishing.

Course Code:	DS 707
Course Title:	Digital Media in Education
Type of Course:	[OC-ES]
Year of Study/ Semester:	3rd/ 6th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	D. Sampson, Professor

Objective

The goal of this course is to get students acquainted with the principles and techniques of using digital media to support web-based education and to help them develop a set of critical skills and competencies that will enable them to design and develop of Educational e-Content in general and in particular, Digital Learning Resources for System Users' Training (Experts or not) and Task Performance Improvement.

Prerequisites: DS 706 - Instructional Methods, DS 701 - Educational Digital Systems, DS 708 - Educational Psychology, DS 509 - Human - Computer Interaction, DS 510 - Web Programming.

Course Contents

Part A – Digital Media and Web Applications: Introduction to Digital Media. History. Information Architecture in Hypermedia Systems. Hypermedia Models. Web Applications. *Part B – Educational Use of Digital Media:* Factors that affect the use of Digital Media for Educational Purposes. Digital Media Characteristics: Technical, Functional based on the type of content (Decorative, Representational, Mnemonic, Organizational, Relational, Transformational, Interpretive). Functional based on the type of the Learning Activity. Learners' Characteristics. Learning Activity Characteristics. Examples of Educational Hypermedia.

Recommended Reading

1. Rosenfeld, L. & Morville, P. (2002): Information Architecture for the World Wide Web (2nd Edition). O'Reilly & Associates.

2. Clark, R., Nguyen F. & Sweller, J. (2006): Efficiency in Learning -Evidence-based Guidelines to manage Cognitive Load, Pfeiffer.

Course Code:	DS 720
Course Title:	e-Health Services
Type of Course:	[OC-ES]
Year of Study/ Semester:	3rd/ 6th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	F. Malamateniou, Associate Professor

Objective

The main objective of the course is to present the need for e-Health Services and the Information and Communication Technologies (ICTs) involved in the development of e-Health Services, to introduce Health Informatics basic concepts and to present state of play and action plan for e-Health Services, at national and international level.

Prerequisites: DS 512 - Information Systems, DS 511 - Workflow Systems, DS 507 - Software Engineering, DS 504 – Database Systems Design, DS 505 - Database Systems, DS 320 - Computer Networks I, DS 321 - Computer Networks II, DS 502 - Object-Oriented Programming.

Course Contents

Introduction to e-Health Services. Healthcare Organizations. Introduction to Healthcare Information Systems. Internet and Healthcare Delivery, Medical Coding and Standards. Pervasive & Ubiquitous Computing in Healthcare. e-Health Systems Development Methodologies. Ethics, Security and Protection of Healthcare Information Systems.

Recommended Reading

1. Tan, J. (2005): E-Health Care Information Systems: An Introduction for Students and Professionals, Wiley.
2. Bardram, J., Mihailidis, A. &Wan, D. (2006): Pervasive Computing in Healthcare, CRC.

Course Code:	DS 702
Course Title:	Didactics of Digital Technologies
Type of Course:	[OC-ES]
Year of Study/ Semester:	3rd/ 6th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	S. Retalis, Associate Professor

Objective

The aim of this course is to help learners acquire knowledge on curricula, recommendations and teaching strategies that can be applied to computer science courses at primary, secondary and higher education. It focuses on strategies for analysis, design, implementation and evaluation of lesson plans in programming courses.

Prerequisites: -

Course Contents

Demanding tuitional concepts concerning computer science courses, teaching guidelines about digital literacy, curricula and teaching recommendations for computer science courses at primary, secondary educational level. Educational tools like Jeroo, KarelRobot, Alice, Scrach. Design and development of educational games.

Recommended Reading

1. UNESCO & IFIP (2002): Information and Communication Technology in Secondary Education – A Curriculum for Schools, Edited by Tom van Weert. Paris: UNESCO, 2002.

2. Bennedsen, J., Caspersen, M.E. & Kölling, M. (2008): Reflections on the Teaching of Programming Methods and Implementations, Series: Lecture Notes in Computer Science, Vol. 4821.

Course Code:	DS 710
Course Title:	IT-Centric Professional Development
Type of Course:	[OC-ES]
Year of Study/ Semester:	3rd/ 6th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	F. Paraskeva, Assistant Professor

Objective

This course introduces students in consulting procedures for the personal and professional development in an IT context.

Prerequisites: DS 509 - Human - Computer Interaction, DS 701 - Educational Digital Systems, DS 708 - Educational Psychology.

Course Contents

Introduce students in basic principles of professional development in an IT environment: (Self)Management, Communication and Performance Skills (management skills, customer relations, communication skills through collaboration, developing trainee/employee/workers performance, personal performance skills, critical thinking and creative problem solving, making better decisions, training methods).

Recommended Reading

1. Robinson, D. & Robinson, J. (2008): Performance Consulting: A practical Guide for HR and Learning Professionals, Berrett-Koehler Publishers.

2. Rosenberg, M. (2001): E-Learning Strategies for Delivering Knowledge in the Digital Age, McGraw-Hill.

Course Code:	DS 807
Course Title:	Privacy Enhancing Technologies
Type of Course:	[OC-ES, OC-CSN]
Year of Study/ Semester:	3rd/ 6th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	K. Lambrinoudakis, Associate Professor

Objective

The aim of the course is to raise the privacy issues related to the personal or/and sensitive data exchanged, by various electronic services, over open public networks, like the internet. The currently available privacy enhancing technologies will be presented, highlighting the privacy problems that specific application domains are facing as well as the appropriate mechanisms for each case.

Prerequisites: DS 801 **-** Security Policies and Security Management.

Course Contents

Privacy Definitions, Legal Framework for the Protection of Personal Data, Attacks against Privacy, Subjectiveness on Evaluating the Impact of a Privacy Violation Incident. The Requirements of Anonymity, Unlinkability, Undetectability and Unobservability. Relations between these Requirements. Pseudo-Anonymity. Identity Management. Privacy Enhancing Technologies. Privacy Enhancing Technologies for Sensor Networks and Ubiquitous Environments (RFIDs, Location Monitoring etc). Privacy Issues in VoIP Telephony. Privacy Protection in Health Information Systems.

Recommended Reading

1. Acquisti, A., Gritzalis, S., Lambrinoudakis, C. & De Capitani di Vimercati, S. (2008): Digital Privacy, Theory Technologies and Practices, Auerbach Publications.

2. Fisher-Huebner, S. (2001): IT Security and Privacy, Design and Use of Privacy Enhancing Security Mechanisms, LNCS 1958, Springer.

Course Code:	DS 401
Course Title:	Intelligent Systems
Type of Course:	[OC-ES, OC-CSN]
Year of Study/ Semester:	3rd/ 6th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	N.-M. Sgouros, Professor

Objective

The course seeks to introduce the students to the basic features of intelligent systems and their implementations. It focuses on symbolic knowledge representation and inference methods.

Prerequisites: -

Course Contents

Definitions and features of intelligent systems. Knowledge representation models. Inference techniques. Programming environments. PROLOG.

Recommended Reading

1. Luger, G. (2009): Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Addison Wesley.

2. Russell, S. & Norvig, P. (2002): Artificial Intelligence: A Modern Approach (2nd Edition), Prentice Hall.

Course Code:	DS 325
Course Title:	Intelligent Networks
Type of Course:	[OC-ES, OC-CSN]
Year of Study/ Semester:	3rd / 6th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	A.Rouskas, Associate Professor

Objective

The course presents modern technologies for the implementation of intelligent services of contemporary telecommunication networks.

Prerequisites: -

Course Contents

Overview of basic networking protocols; stream control transmission protocol. Session initiation protocol (SIP). IMS platforms and services. Intelligent networks architecture. Functional layers. IN conceptual model. Common channel signalling No 7 (SS7). ISUP and BISUP. BINAP. Wireless intelligent network services.

Recommended Reading

- Poikselka M. (2006): The IMS: IP Multimedia Concepts and Services, Wiley.
- Russell T. (2006): Signaling System #7, 5th Edition, McGraw-Hill.

Course Code:	DS 901
Course Title:	Operations Research
Type of Course:	[OC-ES, OC-CSN]
Year of Study/ Semester:	3rd/ 6th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	Academic staff, Department of Business Administration

This course offered by the Department of *Business Administration* of University of Piraeus.

Objective

This course aims to teach optimization methods so that students are able to solve problems that are typically encountered in the field of modern technological systems such as networks and telecommunications.

Prerequisites: -

Course Contents

Linear programming; the Simplex method and variants that are computational efficient(such as the big M method); duality and sensitivity analysis; integer programming; transportation, transhipment and assignment problems; network optimization applications including shortest-route, minimal spanning tree and maximal flow; introduction to heuristic algorithms; multiple criteria analysis; nonlinear programming; overview of dynamic programming; decision analysis.

Recommended Reading

1. Hillier, F.S. & Lieberman, G.J. (2005): Introduction to Operations Research (8th Edition), McGraw-Hill Science.

Course Code:	DS 904
Course Title:	Total Quality Management
Type of Course:	[OC-ES, OC-CSN]
Year of Study/ Semester:	3rd/ 6th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	Academic staff, Department of Business Administration

This course offered by Department of *Business Administration* of University of Piraeus.

Course Code:	DS 911
Course Title:	Enterpreneurship I
Type of Course:	[OC-ES, OC-CSN]
Year of Study/ Semester:	3rd/ 6th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	Academic staff, Department of Economics

This course offered by Department of *Economics* of University of Piraeus.

Course Code:	DS 521
Course Title:	Information Retrieval
Type of Course:	[OC-ES, OC-CSN]
Year of Study/ Semester:	3rd/ 6th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	C. Doulkeridis, Lecturer

Objective

The aim of this course is learning the basic concepts of information retrieval systems. The contents of the course cover all phases of design and implementation of systems for collection, indexing, searching, as well as evaluation methods. In addition, recent trends in information retrieval will be covered, such as web information retrieval and XML retrieval.

Prerequisites:

Course Contents

Boolean retrieval. The term vocabulary & postings lists. Dictionaries and tolerant retrieval. Index construction. Index compression. Scoring, term weighting & the vector space model. Computing scores in a complete search system. Evaluation in information retrieval. Language models. XML information retrieval. Basic concepts of web search. Crawling. Architecture of search engines. Text classification.

Recommended Reading

1. Manning, C.D., Raghavan P., and Schütze H. (2008): Introduction to Information Retrieval. Cambridge University Press.

Course Code:	DS 405
Course Title:	Digital Image Processing
Type of Course:	[OC-ES, OC-CSN]
Year of Study/ Semester:	3^{rd}/ 6^{th}
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	I. Maglogiannis, Assistant Professor

Objective

Vision provides humans with extremely important information like no other of the human senses. This is clear in all aspects of human activities and in particular in those related to science. The recent advances of processing technology and optical sensors have enabled the establishment of image processing and computer vision among the prominent fiels of computer science. Digital image processing is used for two distinct purposes: (1) image enhancement, so as to facilitate interpretation by a human observer and (2) digital image analysis, so as to allow unsupervised recognition and interpretation of the image contents. The course aims to present the basic algorithms and methodologies for both purposes, both in the spatial and frequency domain.

Prerequisites:

Course Contents

Introduction to Digital Image Processing. 2-D Signals and Systems – Background Information. Sampling and Digitization Issues. Image Enhancement and Restoration. Binary Image Processing – Morphological Operators. Image Segmentation – Edge Detection. Image Transformations (Fourier, DCT, Hadamard, etc.).

Analysis in the frequency domain. Digital Image Compression. Digital Image Analysis – Computer Vision. Texture Analysis – Region of Interests. Other areas: eg Watermarking, Information Retrieval, etc.

Recommended Reading

1. Papamarkos N., (2010): Digital Image Processing and Analysis, Papamarkos Press.
2. Gonzales S., (2010): Digital Image Processing, 3rd Edition, Papasotiriou Press.

7th Semester

Course Code:	DS 902
Course Title:	Project Management
Type of Course:	[C]
Year of Study/ Semester:	4th/ 7th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	F. Malamateniou, Associate Professor

Objective

The main objective of the course is to introduce project management basic concepts and, in particular, management of Information and Communications Technology (ICT) projects, to study a widely accepted methodological framework of project management and to use it in the management of ICT projects. In addition, project management tools will be presented and used for students' laboratory exercise.

Prerequisites: -

Course Contents

The Project Management Framework. Project Life-cycle and Organization. The Standard for Project Management of a Project. The Project Management Knowledge Areas (Project Integration Management, Project Scope Management, Project Time Management, Project Cost Management, Project Quality Management, Project Human Resource Management, Project Communications Management, Project Risk Management, Project Procurement Management). Management of ICT projects.

Recommended Reading

1. Project Management Institute (2004): A Guide to the Project Management Body of Knowledge, 3rd Edition (PMBOK Guides), Project Management Institute.
2. Nicholas, J. (2004): Project Management for Business and Engineering: Principles and Practice, Elsevier.

Course Code:	DS 703
Course Title:	e-Learning Systems
Type of Course:	[CC-ES]

Year of Study/ Semester:	4th/ 7th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	D. Sampson, Professor

Objective

The goal of this course is to get students acquainted with the principles and techniques of web-based education and e-learning systems and to help them develop a set of critical skills and competencies that will enable them to design and develop e-Learning systems and courses.

Prerequisites: DS 706 - Instructional Methods, DS 701 - Educational Digital Systems, DS 510 - Web Programming, DS 707 – Digital Media in Education, DS 516 – Semantic Web - XML.

Course Contents

Web-based Education (definitions; history; advantages/disadvantages; typical examples of web-based education); A Conceptual Framework of Web-based Education; Tools for authoring and managing e-Learning Content (Case Study: Lectora); Tools for authoring and managing e-Learning Activities (Case Study: LAMS); e-Course Management Systems (Case Study: Moodle); Planning and Evaluating Web-based Educational Programmes; Quality Issues in Web-based Education.

Recommended Reading

1. Horton, W. (2006): E-Learning by Design, Pfeiffer Wiley.
2. Horton, W. & Horton, K. (2003): E-Learning Tools and Technologies, Wiley Publishing.

Course Code:	DS 513
Course Title:	Network Oriented Information Systems
Type of Course:	[CC-ES]
Year of Study/ Semester:	4th/ 7th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	G. Vassilacopoulos, Professor M. Themistocleous, Associate Professor

Objective

The aim of this course is the understanding of the nature of the Information Systems that are run and managed over a network.

Prerequisites: DS 512 – Information Systems, ΨΣ 516 – Semantic Web - XML.

Course Contents

Information Systems and Networks. Portals. Middleware. Integration. Enterprise Application Integration. Enterprise Service Bus. Web Services. Service Oriented Architectures. SOA Governance. Organizational

Change. The impact of Integrated net centric IS on organizations. Enterprise Resource Planning applications. Customer Relationship Management systems. Supply Chain Management solutions. e-business applications.

Recommended Reading

1. Papazoglou, M. P. (2008): Web Services: Principles and Technology, Pearson, Pentice Hall.
2. Josuttis, N. (2007): SOA in Practice, O'Reilly.

Course Code:	DS 309
Course Title:	Broadband Networks
Type of Course:	[CC-CSN]
Year of Study/ Semester:	4th/ 7th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	A. Alexiou, Assistant Professor

Objective

The aim of this course is to provide an introduction to broadband technologies and their applications and familiarize students with broadband networks and relevant protocols.

Prerequisites: DS 326 - Internet Protocols.

Course Contents

Introduction to broadband networks. Main concepts. Integrated services networks. Access networks. Core networks. Integrated services networks: integrated services digital networks (ISDN). Broadband integrated services digital networks (B-ISDN). Access networks/technologies: public switched telephone networks (PSTN). digital subscriber line (DSL). Wireless-access (broadcasting, mobile, fixed-wireless access–FWA). fiber to the curb/home (FTTX). Core networks/technologies: ATM. Ethernet. Ethernet wide area networks. Optical technologies. Synchronous optical networks (SONET). Wave division multiplexing (WDM). Passive optical networks (PONs). Wireless broadband technologies: WI-FI. Wimax. 3G (Long Term Evolution). Satellite.

Recommended Reading

1. Russell, T. (1997): Telecommunication Protocols (McGraw-Hill Education).
2. Cajetan M. Akujuobi, Matthew N.O. Sadiku, (1997): Introduction to Broadband Communication Systems, Chapman & Hall/CRC.

Course Code:	DS 303
Course Title:	Satellite Communications
Type of Course:	[CC-CSN]
Year of Study/ Semester:	4th/ 7th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	A. Kanatas, Professor

Objective

This course requires a well developed background on telecommunication systems, digital techniques and wireless links are required. In this course, Satellite links for diverse services are studied with an emphasis on performance evaluation and link availability.

Prerequisites: DS 320 – Computer Networks I, DS 305 – Digital Communications, DS 304 – Wireless Communications, DS 307 – Signals and Systems.

Course Contents

Satellite communication systems (characteristics, services, earth stations, organizations and standardization bodies). Orbit mechanics (Keplerian orbits, motion equations, orbit parameters, earth orbit, earth-satellite relative geometry, GEO, LEO, MEO, HEO satellites). Analysis and design of satellite communication links (antenna characteristic parameters, link budget for clear sky conditions and for rain conditions, noise effects, quality measures and figures of merit for satellite receivers, the transmission path, signal to noise ratio for an earth station to earth station link, satellite amplifiers and transfer characteristics, saturation and power gain at the satellite). Transmission techniques analysis (analogue and digital baseband transmission techniques and modulation for audio and video signals). Multiple access techniques (FDMA, TDMA, CDMA) for satellite networks. Single and multiple beam systems.

Recommended Reading

1. Pratt, T., Bostian, C. & Allnutt J., (2003): Satellite Communications, Wiley.
2. Maral, G. & Bousquet, M. (2002): Satellite Communications Systems, John Wiley and Sons Ltd.

Course Code:	DS 705
Course Title:	Instructional Design of Adult Learning Programs
Type of Course:	[OC-ES]
Year of Study/ Semester:	4^{th}/ 7^{th}
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	S. Retalis, Associate Professor

Objective

This course presents, in theory and practice, subjects concerning the education of adults. It explores continuing lifelong learning, which is developed through the evolution of traditional approaches in the education of adults. Students attending the course will be introduced to the institutions, financing and policies of continuing education, will learn, how to determine the needs and practices of teaching adults, the role of instructor of adults, the psychology of adults and how to develop programs of training using modern methods of teaching. More specifically, the course aims the acquisition of knowledge and dexterities for all stages of designing adult learning programs, creating materials (in printed and digital form) for educational purposes (from analysis to evaluation and maintenance) through practices, standardised methods and models. Furthermore it emphasizes in practical subjects and particular in the techniques and tools that are developed for virtual training communities of adults.

Prerequisites: DS 706 - Instructional Methods.

Course Contents

Topics on adult educational principles, role of instructor of adults, design of adult learning programs, lifelong learning and employment, greek policy in adult education, quality assurance of adult learning programmes, advanced technologies for adult education such as mobile learning, adaptive educational hypermedia learning and computer supported collaborative learning communities.

Recommended Reading

1. Knowles, M.S., Holton, E.F. & Swanson, R.A. (1998): The Adult Learner: The Definitive Classic in Adult Education and Human Resource Development, Gulf Professional Publishing.
2. Jarvis, P. (2006): The Theory and Practice of Teaching, Routledge

Course Code:	DS 514
Course Title:	e-Business
Type of Course:	[OC-ES]
Year of Study/ Semester:	4^{th}/ 7^{th}
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	M. Themistocleous, Associate Professor

Objective

This course presents baselines on digital economy. The focus is on the analysis and the understanding of the basic types of applications of e-business.

Prerequisites: -

Course Contents

E-business introduction. E-commerce presentation. Baselines on e-business micro-economy theory. Business requirements analysis for the design of e-commerce. Methodology for the design of successful web pages. Blogs. E-stores. Methodology for the design of e-stores. Design evaluation and faults detection through the use of web statistics applications. eGovernment. ebanking. ehealth. Business-to-business applications.

Recommended Reading

1. McGarvey, R. & Campanelli, M. (2005): Start Your own E-Business, Entrepreneur Press.
2. Chaffey, D. (2008): E-Business and E-Commerce Management (3^{rd} Edition), Prentice Hall.

Course Code:	DS 517
Course Title:	Web Applications Development
Type of Course:	[OC-ES, OC-CSN]
Year of Study/ Semester:	4^{th}/ 7^{th}
Theory/ Lab Sessions:	3 hours/ 2 hours

ECTS Credits:	5
Academic Personnel:	V.-A. Stavroulaki, Assistant Professor

Objective

This course focuses on the development of Web applications and services with current technologies such as Java, XML,.NET. More specifically, the aim of the course is to provide an introduction on fundamental principles and concepts relating to the design and implementation of applications and Web services. In terms of specific technologies, this course covers programming and markup languages, and application frameworks such as HTML, XML, JavaScript, JSP, SOAP, WSDL, UDDI,. NET framework, etc.

Prerequisites: DS 327 - Network Services, DS 501 - C Programming, DS 502 - Object-Oriented Programming.

Course Contents

Introduction to web application development: Overview of key concepts, Protocols and languages, HTML, XHTML, XML, TCP / IP. Applications development for the client side: AJAX = JavaScript + XML. Applications development for the server side: Web Servers (Apache HTTP Server, Tomcat), JSP, Servlets, PHP. Web Services (Web Services): SOAP, WSDL, UDDI, SOAP RPC, Developing Web Services Using Java Web Services and Apache Axis SOAP engine. Introduction to Web Applications development with the .NET framework (Microsoft). "Mashups: Combining content and / or functionality of existing services and Web sites to provide new services / applications: Use of APIs such as GoogleMaps, Amazon, del.icio.us, Flickr.

Recommended Reading

1. Deitel, H. & Deitel, P. (2007): Internet & World Wide Web How to Program (4th Edition), Prentice Hall.
2. Sharp, J. (2007): Microsoft Visual C# 2008 Step by Step, Microsoft Press.

Course Code:	DS 806
Course Title:	Cryptography
Type of Course:	[OC-ES, OC-CSN]
Year of Study/ Semester:	4th/ 7th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	C. Xenakis, Assistant Professor

Objective

The aim of this course is to support the students in learning the principles, concepts and applications of cryptography.

Prerequisites: -

Course Contents

Basic definitions and concepts. Information security. Symmetric cryptography. Digital signatures. Authentication. Public key cryptography. Hash functions. Integrity checking. Key management and random number generators.

Recommended Reading

1. Schneier, B. (1996): Applied Cryptography (2nd Edition), John Wiley & Sons.
2. Stallings, W. (2006): Cryptography and Network Security (4th Edition), Prentice Hall.

Course Code:	DS 310
Course Title:	Wireless Sensor Networks
Type of Course:	[OC-ES, OC-CSN]
Year of Study/ Semester:	4th/ 7th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	A. Alexiou, Assistant Professor

Objective

The objective of this course is to focus on short range communications with emphasis on adhoc networks, wireless sensor networks and applications.

Prerequisites: DS 304 - Wireless Communications.

Course Contents

Short range communications: Personal Area Networks (PAN), Body Area Networks (BAN), Ultra Wide Band communications. AdHoc Networks: Physical layer and transceiver design, MAC layer design, connectivity, topologies and routing. Wireless Sensor Networks: Information-theoretic bounds on sensor network performance, detection and estimation, cooperative transmission, localization and positioning, energy efficiency. Applications: eCommerce, safety, digital home, eHealth.

Recommended Reading

1. Swami, A. (Ed.) (2007): Wireless Sensor Networks: Signal Processing and Communications, John Wiley and Sons.
2. Kraemer, R. & Katz, M. (2008): Short-range wireless communications: Emerging technologies and applications, Wiley.

Course Code:	DS 324
Course Title:	Design and Optimization of Telecommunication Systems and Networks
Type of Course:	[OC-CSN]
Year of Study/ Semester:	4th/ 7th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	A. Rouskas, Associate Professor

Objective

This is an introductory course on the design, evaluation and optimization of networks and services. At the end of the course the students will be able to understand and evaluate different design alternative options at the early stages of data networks design.

Prerequisites: DS 320 – Computer Networks I, DS 321 – Computer Networks II.

Course Contents

Introduction to the design and performance evaluation of networks and services. Modelling and topological design of communication networks. Modelling of network services traffic and work load. Top-down network design under service requirements and various constraints. Network optimization techniques and algorithms. Network reliability. Performance measures. Quality of service assurance. Theoretical exercises and network design projects.

Recommended Reading

1. Oppenheimer, P. (2004): Top-Down Network Design (2nd Edition), Cisco Press.
2. McCabe, J.D. (2003): Network Analysis, Architecture and Design, 2nd Edition, Morgan Kaufmann Publishers Inc.

Course Code:	DS 313
Course Title:	Development of Telecommunication Systems
Type of Course:	[OC-ES, OC-CSN]
Year of Study/ Semester:	4th/ 7th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	A.Meliones, Lecturer

Objective

The aim of this course is to familiarize students with best practices for the design and implementation of modern innovative telecom systems and applications. The main topics discussed include systematic multicriteria requirement analysis, transformation of user requirements to architectural specifications and system functionality, design optimization for high performance and QoS, installation and deployment procedures, as well as system validation against initial requirements and specifications. The presented methodologies derive analytically from real case studies of innovative telecommunication systems and applications with extremely high added value and impact. Students will further gain significant practical experience in the design and implementation of innovative telecommunication systems through exercise solving and development of small projects. Last but not least, the course presents an in-depth commercial feasibility analysis of the developed systems.

Prerequisites:

Course Contents

Exemplary Innovative telecommunication systems and applications with high added value and impact**.** Systematic multicriteria requirement analysis**.** Transformation of user requirements to architectural

specifications and system functionality. Design optimization for high performance and QoS. Installation procedures and relevant issues. System validation against initial requirements and specifications. Commercial feasibility analysis. Exercises and programming projects.

Recommended Reading

Course textbook under preparation (estimated time to market: early fall 2012)

Course Code:	DS 522
Course Title:	Data Management on the Web
Type of Course:	[OC-ES, OC-CSN]
Year of Study/ Semester:	4^{th}/ 7^{th}
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	C. Doulkeridis, Lecturer

Objective

The objective of this course is to become familiar with management techniques for semi-structured data, which is the type of data typically encountered on the Web. Strong emphasis is given in data representation using XML, which is the de-facto representation model used in the Web.

Prerequisites:

Course Contents

XML information management, structure of XML documents, querying XML documents, transformation of XML documents, XML programming, storage of XML documents, XML services, XML usage in e-commerce applications.

Recommended Reading

1. Holzner S., (2008): XML: A Beginner's Guide, McGraw-Hill.
2. Young M.J., (2002): XML Step by Step, Microsoft Press.

Course Code:	DS 408
Course Title:	Semantic Web and Ontologies
Type of Course:	[OC-ES, OC-CSN]
Year of Study/ Semester:	4^{th}/ 7^{th}
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	G. Vouros, Professor

Objective

This course aims at proving the necessary knowledge and skills for understanding semantic web technologies. The course focuses on understanding, engineering, and deploying ontologies for shaping and exploiting structured information.

Prerequisites: Optionally, students may have attended courses on Computational Logic and Databases.

Course Contents

Basic notions, motivations, architecture(s) and introduction to semantic web technologies for knowledge management. From structured XML documents to the description of resources using RDF and RDFS. Ontologies: The OWL family of languages. Ontology Engineering: Methodologies and tools. Managing and deploying ontologies to the semantic web: Storage and exploitation, alignment, learning and evolution. Case Studies.

Recommended Reading

1. Antoniou G., Van Harmelen F., (2004): A Semantic Web Primer, MIT Press.
2. Allemang J., Hendler J., (2008): Semantic Web for the Working Ontologist: Effective Modeling in RDFS and OWL, Elsevier & Morgan Kauffman Pub.

Course Code:	DS 523
Course Title:	Laboratory of Database Applications
Type of Course:	[OC-ES, OC-CSN]
Year of Study/ Semester:	4^{th}/ 7^{th}
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	M. Halkidi, Assistant Professor

Objective

This course aims to familiarize the students with the database application development technologies. We present the fundamental principles and concepts related to designing and implementing database applications through case studies.

Prerequisites: DS-504 Database Systems Design; DS-505 Database Systems; DS-502 Object-Oriented Programming

Course Contents

Introduction to the fundamental design and application development principles – requirement analysis. Design and implementation of database (Entity Associations Model, relational model). Application development technologies and database connection (ODBC, JDBC). Data management and retrieval methods from databases.

Recommended Reading

1. Lecture Notes

Course Code:	DS 903
Course Title:	Human Factor Management
Type of Course:	[OC-ES]
Year of Study/ Semester:	4th/ 7th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	Academic staff, Department of Business Administration

This course offered by Department of *Business Administration* of University of Piraeus.

Course Code:	DS 911
Course Title:	Entrepreneurship II
Type of Course:	[OC-ES, OC-CSN]
Year of Study/ Semester:	4th/ 7th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	Academic staff, Department of Economics

This course offered by Department of *Economics* of University of Piraeus.

Course Code:	DS 910
Course Title:	Business Policy and Strategic
Type of Course:	[OC-ES, OC-CSN]
Year of Study/ Semester:	4th/ 7th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	Academic staff, Department of Business Administration

This course offered by Department of *Business Administration* of University of Piraeus.

8th Semester

Course Code:	DS 323
Course Title:	Mobile and Personal Communication Networks
Type of Course:	[C]
Year of Study/ Semester:	4th/ 8th
Theory/ Lab Sessions:	3 hours/ 2 hours

ECTS Credits:	5
Academic Personnel:	A. Rouskas, Associate Professor

Objective

The course presents the architecture and functional characteristics of mobile communication networks. Emphasis is given on the networking entities, the fixed network infrastructure and mobile services.

Prerequisites: -

Course Contents

Overview of mobile communication networks with emphasis on 2nd generation GSM and 3rd generation UMTS systems. Network architecture (network subsystems, functional layers, physical architecture, radiocoverage, mobility). Radiolink management (functions and procedures for radio management, handover procedure, handover in multi-layer architecture). Mobility management (paging and location update procedures). Communication management (call control, call setup, call release, complementary services, message services). Systems and standards GSM, HSCSD, GPRS, UMTS. Signaling protocols (SS7). Location based services (architectures, methods).

Recommended Reading

1. Lin, Y.-B. & Chlamtac, I. (2000): Wireless and Mobile Network Architectures, Wiley.
2. Redl, S. (1995): An Introduction to GSM, Artech House.

Course Code:	DS 515
Course Title:	Information Systems Management
Type of Course:	[CC-ES]
Year of Study/ Semester:	4^{th}/ 8^{th}
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	M. Themistocleous, Associate Professor

Objective

The course seeks to analyse managerial issues in the area of Information Systems such as IS adoption, evaluation, organizational change etc.

Prerequisites: DS 513 – Network Oriented Information Systems.

Course Contents

Information systems evolution. Social and economic impact of IS. IS adoption. IS evaluation. IS success. IS failure. IS and organizational change. IS and business value. IS strategy. Resistance to change and change management. IS and innovation. Value innovation. Exemplar cases. ERP systems.

Recommended Reading

1. Brown, C., DeHayes, D., Hoffer, J. Martin, W. & Perkings, W. (2008): Managing Information Technology (6th Edition), Pearson, Prentice Hall.

2. Turban, E., Leinder, D., Mclean, E. & Wetherbe, J. (2007): Information Technology for Management: Transforming Organizations in the Digital Economy, Wiley.

Course Code:	DS 802
Course Title:	Information Systems Security
Type of Course:	[CC-ES]
Year of Study/ Semester:	4th/ 8th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	S. Katsikas, Professor

Objective

The acquaintance, familiarization and the acquisition of knowledge and application competencies by the students of techniques and methods used to protect the confidentiality, integrity and availability of information processed by IS and of the systems themselves.

Prerequisites: DS 801 - Security Policies and Security Management, DS 204 - Operating Systems I, DS 205 - Operating Systems II – UNIX, DS 512 - Information Systems, DS 806 - Cryptography.

Course Contents

Identification and Authentication: Authentication categories, Authentication data, Authentication systems, Biometric systems. Identity management: Examples, Technologies, Data protection. Access control: Access functions, Access matrices, Access control mechanisms. Policies and formal security methods: MAC, DAC, RBAC, Chinese wall, Formal descriptions. Operating systems security: Parameters, Mechanisms, Secure OS development, Case studies. Database systems security: Security requirements, Data integrity and system availability, Sensitive data security, Multi-level security, Oracle security. Malware: Categories, Types, Dealing with malware, Case studies.

Recommended Reading

1. Furnell, S., Katsikas, S., Lopez, J. & Patel A. (2008): Securing Information and Communication Systems. Principles, Technologies and Applications, Artech House.

2. Summers, R.C. (1997): Secure Computing: Threats and Safeguards, McGraw-Hill.

Course Code:	DS 302
Course Title:	Mobile Communication Systems
Type of Course:	[CC-CSN]
Year of Study/ Semester:	4th/ 8th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	A. Kanatas, Professor

Objective

The course provides the basic principles of cellular mobile communication systems. It also provides the methodologies of analysis and design of these systems. Emphasis is given on the physical layer and radio access techniques. The course covers the radio communications technologies used by existing and future mobile cellular systems.

Prerequisites: DS 301 – Introduction to Telecommunications, DS 320 – Computer Networks I, DS 305 – Digital Communications, DS 304 – Wireless Communications.

Course Contents

Mobile communication systems. Cellular network architecture. Channel access techniques. Teletraffic and system performance issues. Radio channel. Interference and noise. Interference and noise effects on system performance (C/I calculations for different cellular systems). Handoff and channel allocation techniques. Techniques for spectral efficiency improvement. Principles and design techniques for the physical layer. Mitigation techniques. GSM and UMTS architecture, technology and services is also provided.

Recommended Reading

1. Rappaport, T. (2002): Wireless Communications: Principles and Practice, Prentice Hall PTR.
2. Molisch, A. (2005): Wireless Communications, IEEE.

Course Code:	DS 322
Course Title:	Network Management
Type of Course:	[CC-CSN]
Year of Study/ Semester:	4^{th}/ 8^{th}
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	P. Demestichas, Professor

Objective

The course teaches the functionality of the Data Link Layer (DLL), Medium Access Control (MAC) and Logical Link Control (LLC) layers.

Prerequisites: DS 309 - Broadband Networks.

Course Contents

Management functions. Cfaps. Configuration. Fault. Accounting. Performance. Security management. Element management. Network management. Service management. Business management. Managers. Agents. Management information base (MIB). Simple network management protocol (SNMP). Web-based management. Policy based management. Telecommunications management network (TMN).

Recommended Reading

1. Kurose, J. & Ross, K. (2004): Computer Networking: A top-down approach featuring the Internet. Prentice Hall.

2. Stallings, W. (2002): Data and Computer Communications, Prentice Hall.

Course Code:	DS 704
Course Title:	Knowledge and Competence Management
Type of Course:	[OC-ES]
Year of Study/ Semester:	4^{th}/ 8^{th}
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	D. Sampson, Professor

Objective

The goal of this course is to get students acquainted with the principles and techniques of Knowledge and Competence Management within the framework of Organizational Learning and to help them develop a set of critical skills that will enable them to employ Knowledge and Competence Management Systems.

Prerequisites: DS 510 - Web Programming, DS 707 – Digital Media in Education, DS 703 – e-Learning Systems, DS 516 – Semantic Web - XML.

Course Contents

Part A – Knowledge Management: Introduction to Knowledge Management. The nature of Knowledge (what Knowledge is, different Types of Knowledge: procedural-declarative, tacit-explicit, general-specific). Issues related with Knowledge Management (Knowledge Discovery, Knowledge Capture and Acquisition, Knowledge Sharing, Knowledge Application). Knowledge Management Systems. *Part B* – Competence *Management*: Introduction to Competence Management. Competence Models. International Specifications for Competence Description. Competence Management Systems.

Recommended Reading

1. Becerra-Fernandez, I., Gonzalez, A. & Sabherwal, R. (2004). Knowledge Management: Challenges, Solutions and Technologies. Pearson Prentice Hall, New Jersey.

2. Cheetham, G. & Chivers, G. (2005). Professions, Competence and Informal Learning. Edward Elgar Publishing.

Course Code:	DS 709
Course Title:	Collaborative Learning Environments
Type of Course:	[OC-ES]
Year of Study/ Semester:	4^{th}/ 8^{th}
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	F. Paraskeva, Assistant Professor

Objective

This course introduces students in collaborative learning environments, social cognition and social constructivism as well as applications in digital learning/work environments (CSCL & CSCW).

Prerequisites: DS 706 - Instructional Methods, DS 509 - Human - Computer Interaction, DS 701 - Educational Digital Systems, DS 708 - Educational Psychology, DS 707 - Digital Media in Education, DS 703 - e-Learning Systems, DS 705 - Instructional Design of Adult Learning Programs.

Course Contents

CSCL in educational and working environment (ICTs) offers increasing possibilities for peer and collaborative learning. This is achieved by providing added value in the production of knowledge and constructive communication between teachers and learners, employers/employees, trainers/trainees etc. Socio-Cognitive approaches of learning, social constructivism models and collaborative learning environments. Collaboration and technology can facilitate sharing and distributing of knowledge and expertise among community members. The social & dialectical constructivism: Vygotskian Theory, Situative Learning, Cognitive Apprenticeship, Problem Based Learning, Communities of Practice. Evaluation of collaborative learning based on digital systems in schooling, training/vocational environments.

Recommended Reading

1. Dillenbourg, P., Fischer, F., Kollar, I., Mandl, H. & Haake, J.M. (2007). Scripting Computer-Supported Collaborative Learning, Springer.

2. Kobbe, L. (2006). Framework on multiple goal dimensions for computer-supported scripts, Kaleidoscope.

Course Code:	DS 804
Course Title:	Mobile and Wireless Communications Security
Type of Course:	[OC-CSN]
Year of Study/ Semester:	4^{th}/ 8^{th}
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	C. Xenakis, Assistant Professor

Objective

The aim of this course is to enhance students' learning in security architectures applied in mobile/wireless communications.

Prerequisites: -

Course Contents

Security parameters/threats that threaten the mobile/wireless networks. Security measures in mobile/wireless networks like: Wireless Local Area Network (WLAN), Personal Area Network (PAN), Radio-frequency identification (RFID), Global System for Mobile communications (GSM), General Packet Radio Services (GPRS), Universal Mobile Telecommunication System (UMTS), 4th Generation (4G) heterogeneous networks, ad hoc networks and sensor networks.

Recommended Reading

1. Zhang, Y., Zheng, J. & Ma, M. (2008): Handbook of Research on Wireless Security, Information Science Reference.

2. Butty, L. & Hubaux, J.-P. (2007): Security and Cooperation in Wireless Networks: Thwarting Malicious and Selfish Behavior in the Age of Ubiquitous Computing, Cambridge University Press.

Course Code:	DS 312
Course Title:	Advanced Topics in Wireless Communications
Type of Course:	[OC-CSN]
Year of Study/ Semester:	4^{th}/ 8^{th}
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	A. Alexiou, Assistant Professor

Objective

This course focuses on wide area wireless networks and addresses advanced topics in physical layer design, multi-carrier systems and wireless standards evolution.

Prerequisites: DS 302 - Mobile Communication Systems.

Course Contents

Advanced physical layer design topics; Multi-carrier systems: OFDM/OFDMA; Radio resource allocation: multi-user communications and scheduling, cross-layer optimization; Wireless standards: 3G evolution, IEEE 802.x, 4G.

Recommended Reading

1. Rappaport, T. (2002): Wireless Communications: Principles and Practice, Prentice Hall.

2. Tse, D. & Viswanath, P. (2005): Fundamentals of Wireless Communication, Cambridge University Press.

Course Code:	DS-520
Course Title:	Intelligent Agents and Multiagent Systems
Type of Course:	[OC-ES, OC-CSN]
Year of Study/ Semester:	4^{th}/ 8^{th}
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	G. Vouros, Professor

Objective

This course aims to introduce students one of the most vibrant and important areas of research and development to have emerged in information technology since 1990's An agent is a computer system that is capable of flexible and autonomous behaviour in dynamic, unpredictable and typically multi-agent domains. The course aims to delve into the theoretical underpinnings and practical issues concerning these systems;

provide a wide spectrum of agents technology, where agents serve as design metaphor for structuring complex computational systems, as a source of technologies (e.g. for electronic auctions, negotiations, learning etc), and as an emergent technology for simulating complex systems (e.g. social systems) and studying their emergent behaviours. The course is tailored towards major undergraduate and early graduate students who are ready to share the excitement.

Prerequisites:

Course Contents

Agents: Principles, architectures and application examples, Deliberation vs Reaction: Architectures, Mental attitudes, states and their representation, Multi-agent Systems: Interactions and dependencies, Multiagent organizations and communication, Cooperation and collaboration, Multi-Agent Learning

Recommended Reading

1. Michael Wooldridge, Introduction to MultiAgent Systems (In Greek), 2008.
2. N. Vlassis, A concise introduction to multiagent systems and distributed artificial intelligence, Morgan nd Claypool, 2007
3. Yoav Shoham, Kevin Leyton-Brown Multiagent Systems: Algorithmic, Game-Theoretic, and Logical Foundations, Cambridge University Press, 2009

Course Code:	DS 308
Course Title:	Performance Evaluation of Telecommunication Systems
Type of Course:	[OC-CSN]
Year of Study/ Semester:	4^{th}/ 8^{th}
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	G. Efthymoglou, Associate Professor

Objective

This course aims to evaluate the performance of various digital modulations in channels affected by noise and fading through the use of Monte Carlo simulation in the MATLAB software. Emphasis will be given in the evaluation of the performance of coded systems as well as the performance of digital systems that employ OFDM and CDMA techniques.

Prerequisites: DS 301 – Introduction to Telecommunications, DS 305 – Digital Communications.

Course Contents

Simulation in MATLAB software of algorithms at the transmitter and the receiver side that implement digital modulations such as: M-PSK, M-QAM, FSK, MSK, GMSK, and DPSK. Monte Carlo simulation for the evaluation of bit error rate (BER) and symbol error rate (SER) of these modulations in channels with Additive White Gaussian Noise (AWGN) and fading with Rayleigh statistics. Simulation of an Orthogonal Frequency Division Multiplexing (OFDM) system in MATLAB and analysis of its channel estimation algorithm. Simulation of a code division multiple access (CDMA) system in MATLAB and evaluation of its BER versus the number of users that simultaneously use the channel.

Recommended Reading

1. Proakis, J. & Salehi, M. (2001). Communication Systems Engineering (2nd Edition), Prentice Hall.

2. Harada, H. & Prasad, R. (2005): Simulation and Software Radio for Mobile Communications, Artech House Publishers.

Course Code:	DS 721
Course Title:	Healthcare Information Systems
Type of Course:	[OC-ES]
Year of Study/ Semester:	4th/ 8th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	F. Malamateniou, Associate Professor

Objective

The main objective of the course is to introduce basic concepts of Healthcare Information Systems (HIS), to describe the main types of HIS, to study HIS architectural designs, development methodologies and interoperability with other systems and to present HIS challenges and perspectives. In addition, software tools will be used for the development of HIS for students' laboratory exercise.

Prerequisites: DS 512 - Information Systems, DS 511 - Workflow Systems, DS 507 - Software Engineering, DS 504 – Database Systems Design, DS 505 - Database Systems, DS 320 - Computer Networks I, DS 321 - Computer Networks II, DS 502 - Object-Oriented Programming, DS 802 - Information Systems Security.

Course Contents

Introduction to Healthcare Information Systems. Data and Information in Healthcare. Healthcare Information Systems Evolution. Examples of Healthcare Information Systems. Types of Healthcare Information Systems (Administrative, Clinical, Nursing). Healthcare Information Systems Architectures and Integration (e.g. SOA, EAI, ESB). Healthcare Information Systems Design, Development and Security. Challenges and Perspectives.

Recommended Reading

1. Wager, K., Lee, F. & Glaser, J. (2005): Managing Health Care Information Systems: A Practical Approach for Health Care Executives, Jossey-Bass.

2. van Bemmel J.H. & Musen, M.A. (2002): Handbook of Medical Informatics, Springer.

Course Code:	DS 203
Course Title:	Embedded Systems
Type of Course:	[OC-ES, OC-CSN]
Year of Study/ Semester:	4th/ 8th
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	A. Meliones, Lecturer

Objective

The key objective of this class on Embedded Systems is to present a good understanding of embedded systems architecture as well as a detailed methodology for the multilayered design of embedded systems and their applications with emphasis on network embedded systems. Main topics of the class are the understanding of communication processors and system architecture, basic hardware design principles, Linux operating system porting on proprietary system architectures, as well as device driver programming. From this point on, system architecture is transparent to the development of embedded applications.

Prerequisites: DS 201 – Computer Architecture, DS 501 – C Programming, DS 320 – Computer Networks I.

Course Contents

Communication Processors (Architecture, integrated communication processor module, peripheral devices, memory map, I/O ports, peripheral device controllers and operation, interrupt handling). Hardware development tools (Schematic design, PCB design, BOM, lab equipment). Hardware System Architecture (Sample integrated access device (IAD) system architectures, modular design, EMI standards). Device drivers (Peripheral and network devices, device driver programming, performance analysis of network devices). Development and performance evaluation of an ATM network access device. Embedded applications (Network services, web-based management, video surveillance, telephony, Asterisk PBX, home automation and domotics, voice interaction). Lab projects.

Recommended Reading

1. K. Yaghmour, J. Masters, G. Ben-Yossef, P. Gherum, “Building Embedded Linux Systems”, O’Reily, 2008.
2. J. Peckol, “Embedded Systems: A Contemporary Design Tool”, Wiley, 2007.
3. J. Corbet, A. Rubini, G. Kroah-Hartman, Linux Device Drivers, 3rd Edition, O’Reilly, 2005.

Course Code:	DS 525
Course Title:	Laboratory of Information Processing Systems on the Web
Type of Course:	[OC-ES, OC-CSN]
Year of Study/ Semester:	4^{th}/ 8^{th}
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	C. Doulkeridis, Lecturer

Objective

This course aims to train students in the design and implementation of systems that manage large data volumes, such as the ones encountered in document collections and on the World Wide Web. Management of this type of content cannot be efficiently provided by traditional relational database management systems, therefore different architectures, representation models, and storage systems are necessary. In the context of this course, students will develop information management applications that access data originating from different data sources, including documents and other web content available on the Web. In this way, they will obtain practical

experience in systems development that cover everyday needs of today's companies and institutions.

Prerequisites: -

Course Contents

Data collection from the Web. Storage and indexing of web information and content. Data structures for in-memory indexing of large volumes of data. XML storage, management and querying. Document stores with efficient search mechanism. Development of integrated system for information management with Web content by combining subsystems and components.

Recommended Reading

1. Liskov B., Guttag J., (2000): Program Development in Java: Abstraction, Specification, and Object-Oriented Design. Addison-Wesley.
2. Hall M., Brown L., (2003): Core Servlets and Javaserver Pages: Core Technologies. Prentice Hall.

Course Code:	DS 722
Course Title:	Telemedicine
Type of Course:	[OC-ES, OC-CSN]
Year of Study/ Semester:	4^{th}/ 8^{th}
Theory/ Lab Sessions:	3 hours/ 2 hours
ECTS Credits:	5
Academic Personnel:	I. Maglogiannis, Assistant Professor

Objective

The course is introducing students in telemedicine systems and applications that improve the quality of life and provide remote electronic health services. The curicullum includes background knowledge in the areas of coding and processing of biomedical data, analyzes the design and implementation issues of telemedicine systems and discusses the the next generation telemedicine systems, which include context awareness and computational intelligence as additional features. During the course case studies will be presented and there will be project assigned to students.

Prerequisites: -

Course Contents

Introduction to Telemedicine. Biomedical Data Coding and Compression. Biomedical Data Processing for Telemedicine Applications. Video Communication for Telemedicine Applications. Telemedicine Networks. Home Care Systems. Context Aware Telemedicine Systems. Wireless Telemedicine and Ambient Asssisted Living. Wearable Systems. Clinical Applications of Telemedicine. Security in telemedicine systems. Case Studies – Project Assignements.

Recommended Reading

1. Pompidou A., Apostolakis A., A.,Ferrer - Roca Olga,Sosa - Iudicissa Marcelo,Allaert Francois,Della Mea Vincenzo, Kastania A. (2009): Handbook of Telemedicine, Papazisis Press
2. Pantelis Agelidis (2011): Medical Informatics, Volume A, Sofia Press.

2.5 Postgraduate Programmes

2.5.1 Postgraduate Programme in "Technology Education and Digital Systems"

Code	Title	Year of Study/ Semester	ECTS Credits
Major A. E – Learning			
ΨΣ-ΗΜ-501	Human - Computer Interaction	1st/ 1st	6
ΨΣ-ΗΜ-701	Educational Design in Technology-Enhanced Learning	1st/ 1st	6
ΨΣ-ΗΜ-502	Web Programming	1st/ 1st	6
ΨΣ-ΗΜ-702	Theories of Learning and Teaching Methodology	1st/ 1st	6
ΨΣ-ΗΜ-509	e-Learning Systems Analysis and Design	1st/ 1st	6
ΨΣ-ΗΜ-703	Learning Management Systems	1st/ 2nd	6
ΨΣ-ΗΜ-707	Social Context of E-Learning	1st/ 2nd	6
ΨΣ-ΗΜ-503	Semantic Web and Learning	1st/ 2nd	6
ΨΣ-ΗΜ-705	Lifelong Learning	1st/ 2nd	6
ΨΣ-ΗΜ-709	Learning Process Management	1st/ 2nd	6
ΨΣ-ΗΜ-777	Master Thesis	2nd /3rd	30
	Seminars	2nd / 3rd	-
Major B. Digital Communications and Networks			
ΨΣ-ΕΔ-303	Design of Wireless Networks	1st/ 1st	6
ΨΣ-ΕΔ-308	Broadband Communications	1st/ 1st	6
ΨΣ-ΕΔ-502	Distributed Systems and Network Programming	1st/ 1st	6
ΨΣ-ΕΔ-324	Web Technologies	1st/ 1st	6
ΨΣ-ΕΔ-504	Cloud Computing	1st/ 1st	6
ΨΣ-ΕΔ-301	Wireless and Satellite Communications	1st/ 2nd	6
ΨΣ-ΕΔ-320	Mobile Communication Networks	1st/ 2nd	6
ΨΣ-ΕΔ-201	Pervasive and Embedded Systems	1st/ 2nd	6
ΨΣ-ΕΔ-322	Computer Networks Design and Management	1st/ 2nd	6

Code	Title	Year of Study/ Semester	ECTS Credits
ΨΣ-ΕΔ-505	Development of Applications for Mobile Devices	1st/ 2nd	6
ΨΣ-ΕΔ-333	Master Thesis	2nd /3rd	30
	Seminars	2nd /3rd	-

Major C. Network Oriented Systems

ΨΣ-ΔΚ-513	Service Oriented Architectures	1st/ 1st	6
ΨΣ-ΔΚ-502	Advanced Information Systems	1st/ 1st	6
ΨΣ-ΔΚ-512	Digital Services and Web Applications	1st/ 1st	6
ΨΣ-ΔΚ-506	Network Programming	1st/ 1st	6
ΨΣ-ΔΚ-504	Data Management	1st/ 1st	6
ΨΣ-ΔΚ-505	Business Process Management	1st/ 2nd	6
ΨΣ-ΔΚ-513	Mobile Devices Programming	1st/ 2nd	6
ΨΣ-ΔΚ-302	Management of Computer Networks	1st/ 2nd	6
ΨΣ-ΔΚ-510	Cloud Computing	1st/ 2nd	6
ΨΣ-ΔΚ-515	Network-Oriented Systems Governance	1st/ 2nd	6
ΨΣ-ΔΚ-555	Master Thesis	2nd /3rd	30
	Seminars	2nd /3rd	-

2.5.2 Postgraduate Programme in "Technology Education and Digital Systems" - Individual Course Description

Major A. E – Learning

1st Semester

Course Code:	ΨΣ-ΗΜ-501
Course Title:	Human - Computer Interaction
Type of Course:	Compulsory

Year of Study/ Semester:	1st /1st
ECTS Credits:	6
Faculty:	S. Retalis, Associate Professor

Objective

This course provides an introduction to and overview of the field of human-computer interaction (HCI) spanning current theory and practice in interface specification, design and usability evaluation. HCI is an interdisciplinary field that integrates theories and methodologies from computer science, cognitive psychology, design, and many other areas. Students will gain knowledge in creative design, systematic development of innovative graphical user interfaces, software usability, interactive applications design, interactive systems evaluation and acquire dexterities in the designing, development and evaluation of multimodal applications.

Course Contents

Human as a computer user; cognitive models, visual coding, focus and memory, knowledge representation and management. Models of the mind, user conceptual models. Interaction technologies; input/output devices, graphical environments, direct manipulation, collaborative systems, virtual reality. Interactive systems design methods, user-centered design, usability requirements, task analysis. Dialogue and internet interfaces design. System design – Hierarchical task analysis. Prototyping of interactive systems. Usability evaluation methods and techniques. Design patterns. Special purpose interactive systems: computer-supported cooperative work, voice communication, assistive technologies, augmented reality

Recommended Reading

1. Dix, A., Finlay, J., Abowd, G., & Beale, R. (2004). Human-Computer Interaction, Prentice Hall.
2. Preece, J., Rogers, Y., & Sharp, H. (2011). Interaction Design: Beyond Human-Computer Interaction. New York: John Wiley & Sons, Inc.

Course Code:	ΨΣ-HM-701
Course Title:	Educational Design in Technology-Enhanced Learning
Type of Course:	Compulsory
Year of Study/ Semester:	1st /1st
ECTS Credits:	6
Faculty:	D. Sampson, Professor

Objective

The educational objectives of this course are: (a) to introduce the basic principles of Educational Design, (b) to present and discuss various Models of Teaching that implement these principles, (c) to demonstrate the design and implementation of Educational Scenarios supported by digital tools, and (d) to analyze and reflect on case studies from real-life examples.

Course Contents

Introduction: Presentation of course objectives, course activities and assessment methods. Demonstration of indicative previous students' achievements in this course. Discussion on students' expectations for this

course. Technology Enhanced Learning: Definition of Key Concepts in Technology Enhanced Learning. The need for re-thinking Educational Design for Technology Enhanced Learning. Educational Design and Models of Teaching: Definition of Educational Design. Different roles and functions in Educational Design. Overview of Instructional Design Models. Overview of Models of Teaching. A Methodology of Educational Design for Technology Enhanced Learning: The need for sharing and Reusing Educational Practices between Web-supported Educational Communities. A methodology of Educational Design for Technology Enhanced Learning. Educational Activities: Definition of Educational Activities as the fundamental component of Educational Design. The need for describing educational activities with common terms and vocabularies. The Dialog Plus Taxonomy. The Dialog Plus Nugget Developer Toolkit. Educational Design Tools: Presentation of widely used Educational Design and Management Tools: the Learning Activity Management System (LAMS) and the ASK Learning Design Toolkit (ASK-LDT). Design and Authoring of Educational Scenarios using LAMS and ASK-LDT. Case Study I: Design and Authoring of Educational Scenarios in Secondary School Education. Case Study II: Design and Authoring of Educational Scenarios in Lifelong Learning. Conclusions: Discussion on students' perspectives regarding their experiences from the course in relation to their anticipated expectations.

Recommended Reading

1. Beetham, H. and Rhona, S. (Eds.), Rethinking pedagogy for a digital age: designing and delivering e-learning, London: Routledge, 2007.
2. Oliver M. and Conole G. (Eds.), Contemporary Perspectives in E-learning Research: Themes, Methods and Impact on Practice, The Open and Flexible Learning Series, London: Routledge, 2006.
3. Charles Reigeluth (Editor), Instructional-Design Theories and Models: A New Paradigm of Instructional Theory, Vol. 2, Lawrence Erlbaum Associates, 1999.
4. Marsha Weil, Emily Calhoun, Bruce R. Joyce, Models of Teaching (6th Edition), Allyn & Bacon, 2000.
5. Walter Dick, Lou Carey, James O Carey, The Systematic Design of Instruction (6th Edition), Pearson/ Allyn & Bacon, 2001.

Course Code:	ΨΣ-HM-502
Course Title:	Web Programming
Type of Course:	Compulsory
Year of Study/ Semester:	1^{st} /1^{st}
ECTS Credits:	6
Faculty:	A. Prentza, Assistant Professor

Objective

The course seeks to familiarize students with the main technologies involved in the development of static and dynamic Internet applications HTML, CSS, PHP and XML. The course takes place in a lab setting. Teaching consists of the presentation of the programming techniques available for creating Internet applications illustrated through specific coding examples. Students must then extend/modify the given code.

Course Contents

Introduction to Internet technologies and application development: main technologies, basic characteristics, architectures. Content programming: Introduction to HTML – the first HTML document, basic syntax, links, examples of programming with HTML. Using HTML to create forms, Using CSS to format web pages, website development case study. Introduction to the development of dynamic web applications using PHP, Basic PHP syntax, structure of PHP (variables, data types, arrays, control structures, functions). Creating web applications using HTML forms, processing data using PHP, storing data in files and browsing directories. Introduction to XML, XML document structure, well-formed versus valid documents. Creating a DTD, Entities and Notations in DTD, Validation and Using DTDs, case study on creating a valid document from a well-formed document. XML with CSS: basic steps, properties, case study. XSL, Transformation with XSLT, case study. Case study – development of an e-learning web application.

Recommended Reading

1. Larry Ullman (2008), PHP for the World Wide Web, publisher Peachpit Press, 3rd Edition.
2. Julie Meloni (2008), Sams Teach Yourself PHP, MySQL and Apache All in One, publisher Sams, 4th Edition.
3. Luke Welling & Laura Thomson (2008), PHP & MySQL Web Development, publisher Addison-Wesley Professional, 4th Edition.
4. Young, M. (2002). XML Step-by-step, publisher Microsoft Press, 2nd Edition.
5. Harvey M. Deitel, Paul J. Deitel, Tem R. Nieto, Ted Lin, Praveen Sadhu (2000), XML How to Program, publisher Prentice Hall.

Course Code:	ΨΣ-HM-702
Course Title:	Theories of Learning and Teaching Methodologies
Type of Course:	Compulsory
Year of Study/ Semester:	1st /1st
ECTS Credits:	6
Faculty:	F. Paraskeva, Assistant Professor

Objective

This course is designed to promote a fundamental understanding of the theoretical and applied knowledge related to theories of learning and the applications to the educational environments with emphasis on e-learning, through design, development, implementation and evaluation of e-learning tools and environments. This course introduces to the theoretical overview of how human learning occurs according to the various learning theories and examines how instructional methodologies enriched by new technologies can accommodate the learning process correspondingly. In particular, by this course we attempt to interpret the phenomenon of learning through the examination of the principles, the methods (strategies and techniques) and the applications in digital learning environments, regarding the development of instructional methodologies for e-learning solutions. In the context of the course content, it is examined the behavioral and cognitive approach, the constructivist theories (cognitive and social) for e-learning solutions.

Course Contents

Introduction to Learning with Technology. Behaviorism (Pavlov's Classical Conditioning, Skinner's Operant Conditioning): principles, conditions, restrictions, applications to technology. Socio-cognitive Learning Models (Bandura's socio-cognitive learning theory, self regulated learning, self efficacy, self-directed learning): principles, conditions, restrictions, applications to technology. Cognitive learning theories and Constructivism (Piaget, Pappert, Bruner, Gagné): principles, conditions, restrictions, applications to technology. Neuroscience & Information Processing: information processing models, memory, perception, attention, mnemonic devices & strategies, chunking, metacognitive strategies, problem solving, critical thinking, hyperlearning, applications to technology. Social Constructivism (Vygotsky's Zone of Proximal Development, Lave's & Wenger's Theory of Situated Learning, Collins' Brown's & Newman's Theory of Cognitive Apprenticeship, Spiro's Cognitive Flexibility Theory): principles, conditions, restrictions, applications to technology. Learning Objectives: Bloom's Taxonomy, Revised Bloom's Taxonomy by Anderson, Gagné's Nine Events of Instruction, Educational Scenarios/Scripts, applications to technology.
Didactic Principles & Strategies: examples & applications to technology. Assessment of Learning and Assessment for Learning: types of assessment, diagnostic assessment, formative assessment, summative assessment, authentic assessment, applications to technology.

Recommended Reading

1. Elliott S, Kratochwill T, Littlefield-Cook J, Travers J. (2000). Educational Psychology: Effective Teaching, Effective Learning, Brown & Benchmark Pub.
2. Snowman, J. Biehler, R. (2008). Psychology Applied to Teaching, 12th Edition, Hougton & Mifflin.
3. Slavin R., E. (2008). Educational Psychology: Theory and Practice, 9th ed., Allyn & Bacon.
4. Woolfolk, A. (2010). Educational Psychology, 11th ed., Allyn & Bacon.
5. Newby, T., Stepich, D., Lehman, J., Russell, J. (2000), Instructional Technology for Teaching and Learning, 2nd ed., Merrill, New York
6. Roblyer M.D. (2009). Integrating Educational Technology into Teaching, 5th ed., Allyn & Bacon.
7. Mayer, R. C., Richard, E. (2007). e-Learning and the Science of Instruction: Proven Guidelines for Consumers and Designers of Multimedia Learning, Pfeiffer.
8. Reggie, K., Fox, R., Chan F. T. , Tsang P. (2008). Enhancing Learning Through Technology: Research on Emerging Technologies and Pedagogies. World Scientific
9. Tomei, L. (2008). Adapting Information & Communication Technologies for Effective Education, Information Science Publishing.
10. Beetham, H., Sharpe, R. (2007). Rethinking Pedagogy for a Digital Age: Designing and Delivering E-Learning, Routledge.
11. Sawyer, R. K. (2006). The Cambridge Handbook of the Learning Sciences, Cambridge University Press.

Course Code:	ΨΣ-HM-509
Course Title:	e-Learning Systems Analysis and Design
Type of Course:	Compulsory
Year of Study/ Semester:	1st /1st

ECTS Credits:	6
Faculty:	F.Malamateniou, Associate Professor G.Vassilacopoulos, Professor M.Poulymenopoulou

Objective

The main objective of the course is to enable students deepen into the modern human-centric methodologies of systems analysis and design with special reference to e-learning systems. Every learning process is approached as a human activity system and analyzed using the basic principles of systems theory. In this framework, the basic principles of soft systems methodology (SSM) and the Rational Unified Process (RUP) methodological framework, based on the Unified Modeling Language (UML), are presented. Students are expected to become familiar with best practices for e-learning software development, based on the above methodologies. In addition, laboratory exercises are conducted using well known systems modeling tools.

Course Contents

Principles of systems theory, systems formal characteristics, human activity systems, soft systems methodology (SSM), root definitions and conceptual model building, real world examples from learning environments. Case study on the implementation of SSM for modeling of learning processes that are supported by with digital technology-enhanced learning. Learning software development best practices (e.g. develop iteratively, model visually, verify quality, use component architecture, manage requirements, and control changes). Object-oriented technology principles (e.g. encapsulation, message passing, inheritance, polymorphism). Principles of systems modeling using UML. Class diagrams (e.g. how to draw, when to use, examples from e-learning systems modeling). Use case diagrams (e.g. how to draw, when to use, use-case documentation, and examples from e-learning systems modeling). Sequence, Collaboration and Activity Diagrams (e.g. how to draw, when to use, examples from e-learning systems modeling). RUP methodological framework. RUP structure and content (e.g. phases, cycles, iterations, core workflows, work products). UML diagrams incorporated in RUP Projects design using RUP. Case study: Modeling of a prototype e-learning system using UML. Laboratory exercises using IBM Rational software modeler. Laboratory exercises using IBM Rational software modeler.

Recommended Reading

1. Checkland P (1981): Systems Thinking, Systems Practice. Wiley.
2. Checkland P, Holwell S (1998): Information, Systems and Information Systems. Wiley.
3. Checkland P, Scholes J (1990): Soft Systems Methodology in Action. Wiley.
4. Ambler S (2004): The Object Primer: Agile Model-Driven Development with UML 2.0. Cambridge University Press.
5. Booch G, Jacobson I, Rumbaugh J (2005): The Unified Modeling Language User Guide. Addison-Wesley.
6. Fowler M (2003): UML Distilled: A Brief Guide to the Standard Object Modeling Language. Addison-Wesley.
7. Harmon P, Watson M (1998): Understanding UML: The Developer's Guide. Morgan Kaufmann Publishers.
8. Jacobson I, Booch G, Rumbaugh J (1999): The Unified Software Development Process. Addison-Wesley Professional.

9. Kruchten P (2003): The Rational Unified Process: An Introduction. Addison-Wesley Professional.
10. Stevens P (2006): Using UML: Software Engineering with Objects and Components. Addison Wesley.

2nd Semester

Course Code:	ΨΣ-HM-703
Course Title:	Learning Management Systems
Type of Course:	Compulsory
Year of Study/ Semester:	1st /2nd
ECTS Credits:	6
Faculty:	D. Sampson, Professor

Objective

The objectives of this course are to present the basic design principles of e-learning systems, the state-of-the-art international specifications and standards in Learning Technologies (with emphasis to IEEE Learning Object Metadata, SCORM, IMS Common Cartridge and IMS Learning Design) and case studies of e-Learning Systems from areas of selected applications such as Mobile Language Learning and e-Training for People with Disabilities.

Course Contents

Design Principles of e-Learning Systems. Overview of state-of-the-art International Specifications and Standards in Learning Technologies. Digital Educational Content and Learning Objects. Educational Metadata: the IEEE Learning Object Metadata (LOM) Specification and Tools. Web-based e-Courses: Sharable Content Object Reference Model (SCORM), IMS Global Learning Consortium Content Packaging (CP) and Simple Sequencing (SS) Specifications and Tools. Educational Modeling Languages: IMS Learning Design Specification and Tools. Case Study: e-Training for People with Disabilities (eAccess2Learn). Case Study: Mobile Language Learning.

Recommended Reading

1. Adelsberger, H.H., Kinshuk, Pawlowski, J.M. and Sampson, D.G. (2008). Handbook on Information Technologies for Education and Training. Springer. 466p, ISBN: 978-3-540-74154-1.
2. Garriso D. R. and Anderson T. (2003). E-Learning in the 21st Century: A Framework for Research and Practice. RoutledgeFalmer.
3. Laurilland, D. (1993). Rethinking University Teaching – A Framework for the Effective Use of Educational Technology. Routledge-Taylor and Francis Group.
4. McGreal R. (2004) Online Education Using Learning Objects. Falmer Press.
5. Koper R. and Tattersall C. (2005). Learning Design: A Handbook on Modelling and Delivering Networked Education and Training. Springer.

6. Kukulska-Hulme, A. and Traxler, J. (Eds.), Mobile Learning, RoutledgeFalmer-Taylor & Francis Group, 2005.

Course Code:	ΨΣ-ΗΜ-707
Course Title:	Social Context of eLearning
Type of Course:	Compulsory
Year of Study/ Semester:	1st /2nd
ECTS Credits:	6
Faculty:	F. Paraskeva, Assistant Professor

Objective

This course focuses on theory, research and practice, in relation to the factors that affect communication, behavior and performance in e-learning environments. For this reason, we emphasize on social and on psychological factors, as these are formed by the use of digital systems in the modern society (digital communication/collaboration/performance and tools, well designed technological artefacts, virtual performance, e-learning applications).

Course Contents

Introduction to the subject, defining concepts & interdisciplinary research areas. Types and means of communication (face to face/computer mediated, verbal/non verbal, synchronous/asynchronous), digital communication tools and types of interaction. Online collaboration, computer supported collaborative learning (CSCL/W), CSCL tools & applications. Communities of practice, communities of learning & social networks. Social and pedagogical agents, avatars, Second Life. Theories of motivation, intrinsic/extrinsic motivation, locus of control, instruments to measure motivation in digital environments. Maslow's hierarchy of needs in e-learning contexts. Computer self-efficacy (self-perceptions: self-concept, computer/self-efficacy believes, self-esteem, self-management, self-regulation, locus of control). Personalized learning, individual differences (cognitive & learning styles, multiple intelligence).

Recommended Reading

1. Wood, A.F. & Smith, M.J. (2005): Online Communication: Linking Technology, Identity, and Culture, Lawrence Erlbaum Associates Publishers.
2. Dweck C.S. (2000): Self Theories: their role on Motivation, personality and Development, Taylor and Francis [ISBN 1-84169-024-4].
3. Bandura, A. (2003): Self Efficacy: the Exercise of Control, Freeman and Company, NY.
4. Bandura, A. (2002): Self-Efficacy in Changing Societies, Cambridge University Press.
5. Dai, D.Y. & Stenberg, R. (2004). Motivation, Emotion and Cognition, LEA, NY.
6. Daniels, H, Edward A. (2004): Psychology of Education, Routledge Falmer, Taylor & Francis Group, London.
7. Kaluzniacky, E. (2004). Managing Psychological factor in Information Systems Work, Information Science Publishing.
8. Kimble, C. & Hildreth, P. & Bourdon, I. (2008). Communities of Practice, IAP.

9. Gibson, D. & Aldich, C. & Prencky, M. (2007). Gamew and Simulations in Online Learning, Information Science Development, London.
10. Griffin, E. (2003): A First Look at Communication Theory, McGraw-Hill.
11. Sunck, D. & Zimmerman, B. (2008). Motivation and Self-Regulated Learning, Taylor and Francis, NY.

Course Code:	ΨΣ-HM-503
Course Title:	Semantic Web and Learning
Type of Course:	Compulsory
Year of Study/ Semester:	1^{st} /2^{nd}
ECTS Credits:	6
Faculty:	G. Vouros, Professor

Objective

This course aims at proving the necessary knowledge and skills for using semantic web technologies for the purposes of teaching and learning over the web. The course focuses on understanding, engineering, and deploying ontologies for organizing and exploiting learning/teaching material and learning objects during the educational process.

Course Contents

Basic notions, motivations, architecture(s) and introduction to semantic web technologies for information and knowledge management. XML documents. DTDs, XMLS, XPath. Description of resources using RDF. RDFs. RDF/RDFs semantics via Inference rules and SPARQL Querying. Constructing my first Ontology: Basic methodology and Tools. Basics of OWL. OWL DL. More on Ontology Engineering: Methodologies and Tools.

Recommended Reading

1. Y.Sure "A Short Tutorial on Semantic Web", http://videolectures.net/training06_sure_stsw/, 2006.
2. E. Motta "Semantic Web Applications", http://videolectures.net/iswc07_motta_swa/, 2007.
3. Klyne, J.Caroll, "Resource Description Framework (RDF): Concepts and Abstract Syntax", http://www3.org/TR/rdf-concepts/, 2004.
4. D. Brickley, R.V.Guha, "RDF Vocabulary Description Language 1.0: RDF Schema", http://www3.org/TR/rdf-schema/, 2004.
5. P. Hayes "RDF Semantics", http://www3.org/TR/rdf-mt/, 2004.
6. E. Prud'hommeaux, A.Seaborne, "SPARQL Query Language for RDF", http://www3.org/TR/rdf-sparql-query/, 2007.
7. D. McGuiness, F.van Harmelen, "OWL Web Ontology Language Overview", http://www3.org/TR/owl-features/, 2004.
8. S. Bechhofer, F.van Harmelen, J.Hendler, I.Horrocks, D.McGuinness, P.Patel-Schneider. L.Stein, "OWL Web Ontology Language Reference", http://www3.org/TR/owl-ref/, 2004.
9. S. Smith, C.Welty, D.McGuinness "OWL Web Ontology Language: Guide", http://www3.org/TR/owl-guide/, 2004.
10. N. Noy, D.McGuinness, "Ontology Development 101: A Guide to Creating Your First

Ontology", http://ksl.stanford.edu/people/dlm/papers/ontology-tutorial-noy-mcguinness-abstract.html.

11. 10 S.Bechhofer, "An introduction to OWL", http://videolectures.net/iswc07_bechhofer_iowl/, 2007.
12. M. Bergman, "A Brief Survey of Ontology Development Methodologies", http://www.mkbergman.com/906/a-brief-survey-of-ontology-development-methodologies/, 2010.
13. Gomez Perez, "Ontological Engineering", http://videolectures.net/iswc07_perez_oem/, 2007.
14. J. Allemang, J.Hendler, "Semantic Web for the Working Ontologist: Effective Modeling in RDFS and OWL", Elsevier & Morgan Kauffman Pub., 2008.

Course Code:	ΨΣ-HM-705
Course Title:	Lifelong Learning
Type of Course:	Compulsory
Year of Study/ Semester:	1st /2nd
ECTS Credits:	6
Faculty:	S. Retalis, Associate Professor

Objective

This course presents, in theory and practice, the way to design and implement learning programs for adults which follow the EU and national policies for lifelong learning. It aims at helping students acquire knowledge and skills about how to creatively design (in groups or alone) adult learning programs based on modern teaching methods and networked technologies as well as developing stimulating learning resources that comply with learning technologies standards (e.g. IEEE LOM) and specifications (e.g. SCORM, IMS LD). They will also gain knowledge and skills in evaluating the quality of lifelong learning programs.

Course Contents

Historical and Social Issues in lifelong learning. Principles of teaching adults. Program Planning in lifelong learning. Role of instructor/tutor of lifelong learning programs. Design of educational material for lifelong learning programs. Greek policies & opportunities in lifelong learning. Quality evaluation in lifelong learning. Collaborative learning – learning communities. E-portfolios. Advanced technologies for lifelong learning programs (I): M-learning, Adaptive Learning, Games for Social Change.

Recommended Reading

1. Knowles, M. S, Holton, E. F. & Swanson, R. A. (2011). The adult learner: The definitive classic in adult education and human resource development – 7th ed., London: Elsevier, 2011
2. Cambridge, D. (2010). Eportfolios for Lifelong Learning and Assessment, Jossey-Bass, 2010
3. Jarvis, P. (2010). Adult education and lifelong learning : theory and practice, New York: Routledge,2010
4. Knowles, Malcolm; Holton, E. F., Swanson, R. A. (2005). The adult learner: The definitive classic in adult education and human resource development, 6th ed., Burlington, MA: Elsevier, 2005

Course Code:	ΨΣ-ΗΜ-709
Course Title:	Learning Process Management
Type of Course:	Compulsory
Year of Study/ Semester:	1st /2nd
ECTS Credits:	6
Faculty:	F. Malamateniou, Associate Professor M. Poulymenopoulou

Objective

Business process management (BPM) is a holistic management approach focusing on aligning all aspects of an organization with needs and desires of clients. It promotes business effectiveness and efficiency while striving for innovation, flexibility and integration with technology. BPM attempts to improve processes continuously. It can therefore be described as a "process optimization process." It is argued that BPM enables organizations to be more efficient, more effective and more capable of change than a functionally focused, traditional hierarchical management approach. In this context, the main objective of this course is to enable students apply the basic principles of BPM to learning processes or learning-oriented organizations under study. To this end students are taught how to discover, define, design, model, execute, monitor, optimize and improve (or re-engineer) learning processes. In addition, the enabler of business (learning) processes automation, namely workflow technology, is presented along with its usage in the context of e-learning systems. Within the course, students are expected to perform laboratory exercises using well known BPM tools.

Course Contents

Principles of BPM and their application to learning processes (learning process definition and design, intra-organizational and inter-organizational learning processes, workflows). Workflow-based systems in educational environments (correspondence of educational environments to workflow dimensions, course structure as workflows, flexible learning paths definition, learning activities and roles definition). Workflow management systems (WfMS) and their application in implementing learning workflows, metamodels, buildtime and runtime environment of learning workflows, learning processes and activities life cycles, interaction between learning workflow participants). Workflow management systems standards, generic structure of a WfMS, learning workflow reference models. Syntactical rules of processes, course titles presentations (sequential, parallel routing, union, separation, iteration). Workflow-based e-learning systems, flexible e-learning environments, workflow technology incorporation in e-learning environments, pedagogical issues. Examples of workflow-based e-learning systems derived from the international bibliography. Elaboration of a case study and laboratory exercises using Oracle BPM Studio.

Recommended Reading

1. Leymann F, Roller D (2000): Production Workflow: Concepts and Techniques, Prentice Hall.
2. Van der Aalst, W.M.P. & Van Hee K.M. (2002): Workflow Management: Models, Methods and Systems, MIT Press.

3. Smith H, Fingar P (2003): Business Process Management (BPM): The Third Wave, Meghan-Kiffer Press.
4. Fischer L (2009): 2009 BPM and Workflow Handbook: Spotlight on Government, Future Strategies Inc.
5. Weske M (2010): Business Process Management: Concepts, Languages, Architectures, Springer.
6. Kock N (2007): Encyclopedia of E-Collaboration, IGI Global.
7. Khan B (2005): Managing E-Learning Strategies: Design, Delivery, Implementation and Evaluation, Information Science Publishing.

Major B. Digital Communications and Networks

1st Semester

Course Code:	ΨΣ-ΕΔ-303
Course Title:	Design of Wireless Networks
Type of Course:	Compulsory
Year of Study/ Semester:	1st/1st
ECTS Credits:	6
Faculty:	A. Kanatas, Associate Professor

Objective

The course aims at a comprehensive presentation of the analysis and design of existing and new wireless communication networks. The area of wireless communication is one of the most dynamic areas in the communication field. The course covers the wireless channel characteristics and the transmission and reception techniques developed to cope with the channel impairments. Next, the design techniques of wireless systems are discussed and case studies are examined. Indeed, the characteristics and the fundamentals of existing systems (2G, 3G and 4G) are provided and a flavor of open research topics is given.

Course Contents

Categories of wireless communications networks. Coverage, services and performance requirements of wireless networks. Network examples. Duplexing techniques, multiple access techniques and random access. Fundamentals of cellular network design.

Propagation environment, mechanisms and propagation phenomena. Fading, types of fading, delay spread and intersymbol interference. Doppler spread and time variance.

Analytic and empirical propagation channel models for outdoor and indoor environments. Shadowing and lognormal distribution. Calculation of coverage range and percentage. Empirical calculation of model parameters.

Wideband channel characteristics. Flat, frequency selective and WSSUS channels. Characterization parameters (coherence bandwidth, coherence time, etc.). Fading mitigation techniques (diversity, OFDM, interleaving).

Narrowband channels and characterization parameters. Scattering models and Rayleigh or Ricean fading.

Diversity techniques (space and time). From SISO to SIMO and MISO systems. The advantages for the next generation systems.

Spatial multiplexing techniques. From SISO to MIMO systems. Capacity and performance gains. The advantages for the next generation systems.

Noise and interference. Calculation of transmitted power based on SNR, and of reuse distance based on CIR. Adjacent channel interference. Spectral efficiency and techniques for improving the metrics (cell sectoring, cell splitting and channel assignment).

Case study: Design of a cellular mobile communications system step-by-step.

Structure, architecture and functionalities of existing wireless communication systems (examples from GSM, GPRS, UMTS, HSPA, LTE and WiMAX). Multiuser techniques.

Recommended Reading

1. A. Kanatas, P. Constantinou and G. Pantos, “Mobile Communication Systems”, in Greek, Papasotiriou S.A., 2008.
2. T. Rappaport, “Wireless Communications”, 2nd edition, Prentice Hall, 2002.
3. Holma and Toskala (Editors), “WCDMA for UMTS: HSPA Evolution and LTE”, Fifth Edition, Wiley, 2010.
4. J.D. Parsons, “The Mobile Radio Propagation Channel”, 2nd Edition, Pentech Press, 2000.
5. A. Molisch, “Wireless Communications”, Wiley, 2005.
6. D. Tse, P. Viswanath, “Fundamentals of Wireless Communications”, Cambridge University Press, 2005.

Course Code:	ΨΣ-ΕΔ-308
Course Title:	Broadband Communications
Type of Course:	Compulsory
Year of Study/ Semester:	$1^{st}/1^{st}$
ECTS Credits:	6
Faculty:	A. Alexiou, Assistant Professor

Objective

The objective of this course is to study broadband network architectures, focusing on the most recent developments in the evolution of communication and computer networks to the next generation and key enabling technologies. The first part of the course addresses the requirements, technological advances and limitations in the design of broadband networks and the implementation of broadband applications and services. Wireline and optical broadband networks are analyzed in the second part of the course, with emphasis placed on transmission and baseband processing, multiple access and network architecture issues.

Finally, in the last part, recent technological advances and associated research topics are discussed, including wireless and wireline convergence.

Course Contents

Broadband access: Quality of Service requirements, technological trends and challenges and critical applications and services.

Fundamental broadband transmission principles: Information Theoretic criteria, performance impairments, modulation, coding, multiplexing and multiple access techniques.

Efficient spectrum utilization techniques for broadband access: Spread Spectrum, Multi-carrier modulation, Orthogonal Frequency Division Multiplexing.

Digital Subscriber Line: Physical layer, MAC and network architecture for ADSL, ADSL2, ADSL2+, VDSL. Advanced DSL techniques, including Dynamic Spectrum Managements and MIMO processing.

Next generation Ethernet: Fast Ethernet, Gigabit Ethernet and 10Gigabit Ethernet. Novel Ethernet architecture for Broadband services (e.g. Ethernet in the First Mile).

Optical transmission: Optical fibre, optical transmission fundamentals, modulation, optical receiver design, Wavelength Division Multiplexing.

Optical networks design and architecture: Optical networks evolution, optical layer and client layers, optical infrastructure elements, optical networks design and optimization principles.

Passive Optical Networks (PONs): optical networks deployment considerations, Fiber to the Home/Curb/Neighbourhood/.. (FTTx), Passive Optical Networks architectures and next generations PONs.

Recent technological advances: Broadband access in metropolitan areas and broadband short range communications.

Wireless, wireline and optical networks convergence: converged access and backhaul network solutions, fiberwireless networks, multi-point to multi-point microwave links, next generation Ethernet PONs.

Recommended Reading

1. Behrouz A. Forouzan, “Data Communications and Networking”, Fourth edition, McGraw-Hill (2007).
2. W Stallings, “Wireless Communications and Networks”, Prentice Hall (2004).
3. D. Tse, P. Viswanath, “Fundamentals of Wireless Communication”, Cambridge University Press (2005).
4. Bernhard H. Walke, Stefan Mangold, Lars Berlemann, “IEEE 802 Wireless Systems: Protocols, Multi-Hop Mesh/Relaying, Performance and Spectrum Coexistence”, Wiley (2006).
5. Rajiv Sivarajan, Kumar N. Ramaswami, “Optical Networks: A Practical Perspective (Morgan Kaufmann Series in Networking)”, Morgan Kaufmann, 2nd edition (2001).

Course Code:	ΨΣ-ΕΔ-502
Course Title:	Distributed Systems and Network Programming
Type of Course:	Compulsory
Year of Study/ Semester:	1st /1st
ECTS Credits:	6

Faculty:	N.-M. Sgouros, Professor A. Meliones, Lecturer

Objective

The objective of this course is to familiarize students with the main principles and concepts of Distributed Systems and Network Programming. The course will comprise lab exercises. The first part of the course focuses on Distributed Systems and aims to combine fundamental knowledge and basic principles of distributed systems with the practical (hands-on) experience of developing distributed applications with new development tools. The second part of the course focuses on Network Programming. This part addresses programming techniques for the implementation of network applications with the use of Java. The students must then work on programming projects.

Course Contents

Introduction to Distributed Systems: architecture, transparencies, scalability, hardware, operating systems, middleware, communication models, data representation, distributed programming models.

Synchronization and classical distributed systems theory: clock synchronization, logical clocks, broadcasting, global state, distributed mutual exclusion, election, distributed transactions.

Fault tolerance, reliable client-server communication, reliable group communication, distributed commitment, recovery, consistency, replication.

Development of object-oriented distributed applications: (i) Design and implementation of a whiteboard distributed application. (ii) Design and implementation of a distributed processing middleware and application examples (e.g. 3D rendering).

Cloud computing and the software development ecosystem: introduction to cloud computing, cloud architecture, cloud computing models and classification, software development ecosystem, writing code for cloud, Amazon EC2, Eucalyptus, OpenNebula, Google App Engine, migration to cloud.

Introduction to networking, Java Programming concepts.

Java Sockets: Basic internet networking, IP addresses, network ports, Data Communication Protocols.

I/O Programming Concepts – Java Threads.

User Interface Concepts – Server-Client Programming.

Developing Clients for common services.

Recommended Reading

1. G. Coulouris, J. Dollimore, T. Kindberg, "Distributed Systems: Concepts and Design, 4th Edition, Addison Wesley, 2005.
2. A. Tanenbaum, M. Steen, “Distributed Systems: Principles and Paradigms”, Prentice Hall, 2007.
3. P. Verissimo, L. Rodrigues, “Distributed Systems for System Architects”, Kluwer Academic Publishers, 2001
4. W. Emmerich, “Engineering Distributed Objects”, Willey, 2000
5. M. Henning, C. Vinoski, “Advanced CORBA Programming with C++”, Addison Wesley, 1999
6. N. Lynch, “Distributed Algorithms”, Morgan Kaufmann, 1997
7. P. Jalote, “Fault Tolerance in Distributed Systems”, Prentice Hall, 1994
8. Li, Ze-Nian, Drew, Mark S., Fundamentals of Multimedia, Prentice Hall 2004

9. Roads Curtis, The Computer Music Tutorial, MIT Press 1996
10. McClellan, J. H. et al., DSP First: A Multimedia Approach, Prentice Hall 1998
11. Salomon D., Data Compression – The Complete Reference, Springer 2004
12. Watt. A. et al., The Computer Image, Addison Wesley, 1998

Course Code:	ΨΣ-ΕΔ-504
Course Title:	Cloud Computing
Type of Course:	Compulsory
Year of Study/ Semester:	1^{st} /1^{st}
ECTS Credits:	6
Faculty:	D. Kiriazis

Objective

RAID (Redundant Array of Independent Disks) has been presented in 1987, enabling multiple disks to be "combined" in one logical unit. In 2002 the emergence of Hypervisors (as a virtualization technique) enabled the "combination" of multiple computing systems in the same physical resource. In 2008 cloud computing enables service provisioning based on dynamic user and application requirements. In 2012, it became "the phrase du jour" according to the Gartner senior analyst Ben Pring, leading to the "Post-PC" era.

The main objective of this course is to present both architecture- and implementation- related topics in the domain of cloud computing, as well as their relation to other distributed computing infrastructures. Representative characteristics, such as resource virtualization, scalability, elasticity and quality of service, will be discussed and analysed during the semester. The course will provide the necessary theoretical background for cloud environments, while aiming to ensure that participants get familiar with functional cloud technologies as well as with topics related to the implementation and execution of cloud applications (through the corresponding laboratory seminars). Approaches and methodologies across all infrastructure layers will be addressed, emphasizing in emerging cloud architectures (computing, storage, event-based, etc) and their differences comparing to similar technologies (e.g. grid computing, utility computing), as well as the main building blocks in cloud environments (resource types, service categories, service and event level agreements, multi-level workflow management). Approaches for provisioning of quality of service guarantees in different layer and real-time cloud technologies will also be discussed. What is more, emphasis will be put upon technologies for resource management based on service parameters, interacting virtual resources on the same physical host, and application service components interdependencies that affect its elasticity, and programming models for cloud environments (e.g. MapReduce, Hadoop, bigTable). Open-source middlewares for the development of cloud infrastructures (i.e. OpenStack, OpenNebula) will be analysed and exploited in the laboratory sessions. Furthermore, the course will focus on storage clouds, and their fundamental concepts such as computational storage and access to storage objects based on their content. Modern techniques and business approaches will be introduced as the basis for interoperability and federation of cloud environments. Moreover, methodologies for modelling and development of cloud applications as well as protocols and standards will be discussed (e.g. Web Service Description Language - WSDL, Web Service-Addressing, Web Service-Security, Web Service Resource Framework - WSRF, Unified Data & Compute Resource Model). Finally, the course will demonstrate modern cloud applications (e.g. data-driven journalism, smart city services) and the emerging challenges for cloud computing.

Course Contents

Cloud Architectures: Objectives, challenges, application domains, service level agreements, service lifecycle.

Software-Platform-Infrastructure (SPI) cloud service model, interoperability, properties, interfaces and interconnection of different layers.

Cloud deployment models: private, public, hybrid, federated, multi.

Service oriented architectures (*aaS offerings), event-driven architectures.

Architectures for the provision of specific services enabling management of trust, risk, eco-efficiency and cost (TREC: trust, risk, eco, cost), programming models for distributed applications, architectures for data-intensive services, for semantic interoperability and for multi-layer applications, real-time cloud architectures.

Software as a Service / Platform as a Service Layer:

Modelling components (atomic services) and applications (composite services / workflows): OASIS SOA Reference Model, Service oriented architecture Modelling Language (SoaML), Modelling and Analysis of Real-Time and Embedded Systems (MARTE), Real-Time Software Components (RTSC), Quality Of Service and Fault Tolerance Characteristics And Mechanisms (QoSFTC), Tools: Papyrus, Enterprise Architect, Magic Draw, Modelio, Eclipse Modelling Framework.

Performance estimation through analytical models and artificial neural networks.

Application classification based on stereotypes and development of wrappers for control, monitoring, and configuration of the applications.

Service level agreements: Schemas and protocols (WS-Agreement, Web Service Level Agreement – WSLA, SLA Notification Generation – SLAng, Service Negotiation and Allocation Protocol – SNAP, Class of Grid Service Language – CGSL, NextGRID SLA primitives), Enforcement mechanisms (CQEF, A Grid Resource SLA-based Broker - GRUBER/DI-GRUBER, Open Computing Center Software - openCCS).

Service catalogues / registries and query mechanisms: Universal Description, Discovery and Integration (UDDI), UDDI Business Registry (UBR), Electronic Business using eXtensible Markup Language (ebXML), Sun Service Registry, IBM WebSphere Registry.

Resource selection and reservation: deterministic approaches, multi-constraint optimization algorithms, advance reservation or policy-based resource reservation.

Application and infrastructure monitoring: Nagios, Ganglia, Monitoring Agents using a Large Integrated Services Architecture (MonALISA), CloudStatus.

Workflow management: Workflow description languages (XML Process Definition Language - XPDL, WS-BPEL, QoS-aware Grid workflows - QoWL), Workflow orchestration and enactment (Kepler, Taverna, Pegasus).

Accounting and billing (Distributed Grid Accounting System – DGAS, Gratia, Verizon, RESERVOIR).

Infrastructure as a Service Layer:

Virtualization: Development and provisioning of virtual machines, virtualization categories (native, hardware, OS-level, application-level), Hypervisors (Kernel-based Virtual Machine - KVM, Xen).

Network resources management: Integrated Services - IntServ, Resource Reservation Protocol - RSVP, Differentiated Services - DiffServ.

Virtual network resources (VINI), Layer 2 virtualization (VLAN stacking, Overlay Transport Virtualization - OTV, Open VirtualiZation - OpenVZ, vNetwork, SUNCrossbow), Layer 3 virtualization 3.

Fault detection and handling: redundancy and migration approaches.

Cloud computing environments (Google App Engine, Amazon AWS, Microsoft Azure), programming models (e.g. MapReduce, Hadoop, bigTable).

Quality of Service and Real-time Clouds:

Classification of parameters and requirements.

Fault-tolerance approaches: replication, repetition, alternative resource, control/restart point, approaches ASKALON and ProActive.

Proactive fault detection and handling: monitoring parameters potential relationships, repetitive patterns in the monitoring data.

Real-time clouds: 2 phases approach (offline / online), Control loops in Software, Platform and Infrastructure layers.

Events management for application, infrastructure, or service level agreements, and triggering of corrective actions.

Monitoring and analysis techniques: Multi-layer, adaptive, management on platform layer and sensing on virtual infrastructures.

Resource Management Technologies:

Management based on ontologies, queues, genetic algorithms, performance estimation.

Interaction of concurrently executed services (processing, memory, network, virtualization layers) based on application classification, quality parameters, processor architectures, virtualization type, and number of virtual machines.

Behavioural estimation of applications for different hardware profiles (i.e. scheduling approaches, effect of application architecture, time series analysis, usage patterns).

Elasticity techniques for transactional and batch applications based on graph approaches, parallelization layers and rules.

Middleware for the Development of Cloud Environments (OpenNebula)

Installation of OpenNebula modules for the management and monitoring of virtual resources, computing and storage resources.

Middleware customization for the management of user groups and the provision of resources based on different policies and service level agreements parameters.

Implementation and execution of applications using REST or SOAP.

Middleware for the Development of Cloud Environments (OpenStack)

Educational visit at GRNET, for the introduction of OKEANOS that offers cloud services as well as for the subsystems Cyclades (management and provisioning of computing and networking resources) and Pithos+ (management and provisioning of storage resources).

Implementation and customization of OpenStack –compute, image and object storage services.

Interoperability and Federation of Cloud Environments:

Resource interconnection and aggregation (Aneka Coordinator, CometCloud), identity (Amazon Web Services Identity and Access Management), multiple layers (3 phase model: search, selection and certification, Haizea lease manager).

Connection layers (based on services, resources, or performance criteria) and service level agreements (cost and penalties splitting).

Connection based on business rules and objectives, or based on quality of service parameters (using models and theories: Fuzzy Preference Programming, Analytical Hierarchy Process, Multiple Attribute Utility).

Storage and Data Management Technologies:

Architectures addressing various issues (e.g. scalability, data integrity, namespace management, replication) in distributed object data management approaches: EMC Atmos, Rackspace Cloud Files, Windows Azure Storage, Google Storage, Amazon S3.

Computational storage tackling computational and data issues, as well as execution constraints, triggering conditions and interactivity with other data or services.

Content-centric access to data: Metadata annotation and content network implementation techniques (based on content linking), storage objects access mechanisms.

Elasticity approaches in storage clouds (e.g. BASE).

Data management technologies for big data (Amazon SimpleDB, Google BigTable, SimpleDB, Tokyo Cabinet/Tyrant, HBase, Amazon Dynamo, Apache Cassandra, Dynomite, Voldemort).

Cloud Applications, Cloud Computing Platforms, Open Research Topics, Industrial Focus:

Virtual and augmented reality applications, data-driven journalism services, smart city applications.

Protocols and standards (Web Service Resource Framework - WSRF, Web Service-Resource Transfer, Web Service-Addressing, Web Service-Security, Unified Data & Compute Resource Model).

Mainstream cloud computing platforms (architecture, services and comparison of platforms).

Challenges, open research topics and industrial focus:

IBM: storage clouds and resource management based on information from social media.

ATOS Origin: techniques for the migration of legacy applications in clouds.

Alcatel-Lucent: methods for the development of media clouds (optimization of data streams in network level, on-the-fly stream composition).

VMWare: technologies (e.g. Cloud Foundry) for the implementation of cloud application on the Software as a Service layer.

Telefonica: approaches for the trading of cloud computing services (eMarketplace).

Recommended Reading

1. Greg Schulz, “Cloud and Virtual Data Storage Networking”, August 2011
2. David S. Linthicum, “Cloud Computing and SOA Convergence in Your Enterprise: A Step-by-Step Guide”, October 2009
3. Barrie Sosinsky, “Cloud Computing Bible”, January 2011
4. John Rhoton, “Cloud Computing Explained: Implementation Handbook for Enterprises”, November 2009
5. George Reese, “Cloud Application Architectures: Building Applications and Infrastructure in the Cloud”, April 2009
6. John Rhoton, Risto Haukioja, “Cloud Computing Architected: Solution Design Handbook”, May 2011
7. “IBM System x Private Cloud Offering: Solution and Component Guide”, IBM RedBook, August 2011

2nd Semester

Course Code:	ΨΣ-ΕΔ-301
Course Title:	Wireless and Satellite Communications
Type of Course:	Compulsory
Year of Study/ Semester:	1st /2nd
ECTS Credits:	6
Faculty:	A. Kanatas, Professor

Objective

The objective of the course is a comprehensive presentation of the analysis and design techniques of wireless and satellite communication links. The course includes two sections. In the first section we attempt a review of fundamental concepts of antenna technology and electromagnetic propagation. An analytic description of propagation aspects in current wireless communication systems is given for the mostly used frequency bands. Propagation mechanisms and prediction models are provided for successful design of fixed wireless access systems. We analyze international standards and recommendations (ITU-R) for the efficient design of wireless links providing the critical metrics and quality parameters. The section closes with the analysis of antenna arrays, the methods used for array signal processing and typical applications of optimum beam formers. The second section deals with the review of Satellite communications networks technology providing the current state of structural blocks of these networks, discussing the multiple access techniques and network topologies used. Typical examples are given for VSAT networks and the design of satellite links.

Course Contents

Electromagnetic waves and wave polarization. Antennas as radiators and several antenna types. Antenna parameters, radiation patterns, directive gain, power gain, effective aperture, effective length.

Electromagnetic wave propagation mechanisms: Reflection and refraction, propagation in the troposphere.

Electromagnetic wave propagation mechanisms: Scattering, diffraction, propagation models. Quality parameters for effective link design.

Analysis of antenna arrays. Types, topologies, geometry of arrays. Fundamental parameters for antenna array system representation. Narrowband assumption. Basic structures for beamforming.

Array signal processing. Uniform linear arrays. Visible region, antenna array weighting-feeding. Radiation patterns parameters and beamsteering.

Statistical antenna array signal processing. Narrowband processing, conventional beam former, null steering beam former. Wiener filters and digital beamforming techniques for optimum beam formers.

The development of satellite communication networks. Review of services. Geometrical parameters and orbits (GEO, LEO, MEO, HEO). Satellite transponders and basic structures. Antennas on board the satellite.

Noise in satellite communications (antennas and receivers). Receiver architectures. Non-linearities in satellite high power amplifiers. Quality parameters and performance evaluation criteria for clear sky and under rain conditions.

Transmission techniques and satellite link design. Design examples for fixed as well as mobile communication systems.

Multiple access techniques for satellite communication networks (TDMA, FDMA, CDMA). VSAT Networks, topologies and architectures.

Recommended Reading

1. A. Kanatas, P. Constantinou, and G. Pantos, “Wireless Communications”, in Greek, 2010.
2. T. Pratt, C.W. Bostian, J.E. Allnutt, “Satellite Communications”, 2nd Edition, John Wiley & Sons, 2002.
3. G. Maral, M. Bousquet, “Satellite Communications Systems”, John Wiley & Sons, 4th Edition, 2002.
4. C. Balanis, "Antenna Theory Analysis and Design", 2nd Edition, John Wiley & Sons, 2005.
5. T. Rappaport, “Wireless Communications”, 2nd edition, Prentice Hall, 2002.
6. Les Barclay, "Propagation of Radiowaves", 2nd Edition, IEE, 2002.

Course Code:	ΨΣ-ΕΔ-320
Course Title:	Mobile Communication Networks
Type of Course:	Compulsory
Year of Study/ Semester:	1st / 2nd
ECTS Credits:	6
Faculty:	A. Rouskas, Associate Professor

Objective

The objective of the course is the presentation of modern mobile communication networks architecture and technologies. At the end of the course, the students will be able to analyze and evaluate main principles and planning design options for mobile communication networks. The students will work on a small project in a relative subject of mobile communication networks.

Course Contents

Overview of mobile communication networks (1G, 2G, 2.5G, 3G, 3.5G), functional model, architecture and components. Wireless communications, multiple access techniques.

Call traffic analysis and modeling, wireless network dimensioning. Examples and exercises.

Radio resource planning and management, handover management, communication management, mobility management in circuit switched mobile networks. Examples and exercises.

Introduction in packet scheduling. Packet Scheduling in wireless links: problems and proposed solution techniques. Examples of packet scheduling algorithms in UMTS and LTE systems.

Mobility management in wireless packet networks. Mobility provisioning in different network layers (data link, IP, transport, application). Macro- and micro- mobility protocols (mobile, hierarchical, cellular IP). Examples of IP mobility management in GPRS and UMTS.

TCP protocol in wireless links: problems and proposed solution techniques. Link-layer mechanisms, split connection approach, TCP-Aware link layer, TCP-Unaware approximation of TCP-aware link layer.

Technologies and Architectures for mobile terminal location discovery. Mobile terminal location-based services and applications.

4G/IMT-advanced technologies: 3GPP LTE-Advanced, IEEE WirelessMAN.

IP Multimedia Subsystem architecture, protocols and services. Multimedia calls setup and management in the lab using an open IMS platform.

Recommended Reading

1. Holma and Toskala, “WCDMA for UMTS: Radio Access for Third Generation Mobile Communications”, Wiley, 2004.
2. Holma and Toskala, “HSDPA/HSUPA for UMTS: High Speed Radio Access for Mobile Communications”, Wiley, 2006.
3. Poikselka and Mayer, “The IMS: IP Multimedia Concepts and Services”, Wiley, 2009.
4. Garg, “Wireless Communications and Networks”, Morgan Kaufmann 2007.
5. Glisic, “Advanced Wireless Networks:4G Technologies”, Wiley 2006.
6. Schwartz, “Mobile Wireless Communications”, Cambridge University Press, 2005.
7. Mark and Zhuang, “Wireless Communications and Networking”, Prentice Hall, 2003.

8. Eberspacher, Vogel and Bettstetter, “GSM Switching Services and Protocols”, Wiley, 2001.

Course Code:	ΨΣ-ΕΔ-701
Course Title:	Pervasive and Embedded Systems
Type of Course:	Compulsory
Year of Study/ Semester:	1st / 2nd
ECTS Credits:	6
Faculty:	A.Meliones, Lecturer

Objective

The key objective of this course is to present a good understanding of embedded systems architecture as well as a detailed methodology for the multilayered design of embedded systems and their applications, with main emphasis on network embedded systems and pervasive applications. Main topics covered are the understanding of communication processors and system architecture, basic system design principles, Linux operating system porting on proprietary system architectures, network device driver programming, and performance analysis and evaluation of network embedded systems. From this point on, system architecture is transparent to the development of embedded applications which resembles the desktop development paradigms. Last but not least, the course attempts to illustrate an advanced application of embedded systems in the modern scientific area of pervasive systems.

Course Contents

Communication Processors: Architecture, integrated communication processor module, memory map, I/O ports and dedicated network functionality, network device controllers and operation (TDM, serial, ATM, fast Ethernet, HDLC, multiple channels), interrupt handling.

Network Embedded Systems Architecture and System Design: Sample integrated system architectures with emphasis on IADs (Integrated Access Devices), schematic modular design.

Embedded system software and processes: GNU cross-development tool chain, basic system initialization (JTAG), bootloader configuration, kernel architecture, kernel configuration and porting, cross compiling, debian packages, embedded file system.

Network Device Drivers: Network device driver programming principles, development of a complex ATM network access device driver, Linux API for network subsystems.

Performance Analysis and Evaluation of Network Embedded Systems: Performance analysis of high performance network devices, performance optimization, interrupt moderation.

Network Embedded System Applications I: Network services (NAT, DHCP, routing, IP QoS, VLAN, VPN κλπ), web-based management, telephony, Asterisk PBX, home automation and domotics, spoken dialogue interface.

Network Embedded Systems Applications II: Development of an embedded video surveillance service.

Pervasive Systems: Advanced SOA architectures for adaptive pervasive systems, NGAIEs (Next Generation Ambient Intelligent Environments), ambient/symbiotic ecologies, pervasive adaptation (semantic, structure, interaction, behavior, network), ontologies, planning.

Embedded System Applications in Pervasive Systems: NGAIE network, network adaptation, device and service representation/adaptation, task execution manager, unified network access, UPnP middleware, UPnP virtualization, OSGi.

Pervasive applications and prototype systems: End user requirements and goals, example activity spheres, component development tools, prototype system development, lessons learned.

Recommended Reading

1. A. Meliones, «Network Embedded Systems», University Press.
2. Next Generation Intelligent Environments: Ambient Adaptive Systems, Springer book, 2011, Chapter 2: Adaptive Networking (A. Meliones, I. Liverezas, D. Economou).

Course Code:	ΨΣ-ΕΔ-322
Course Title:	Computer Networks Design and Management
Type of Course:	Compulsory
Year of Study/ Semester:	1st / 2nd
ECTS Credits:	6
Faculty:	P. Demestichas, Professor K. Tsagkaris

Objective

The course “Design and Management of Computer Networks” aims at teaching the contemporary methodologies and technologies in the areas of design and management of computer networks. In this context, network design problems are presented and properly formulated, whereas algorithms for their solution are presented, developed and validated using commercial software packages. Furthermore, the fundaments of computer network management, with respect to functional, information and communication models, are presented, thoroughly discussed and validated. The course is in general comprised of both theoretical lectures and specialised laboratory and programming exercises and platform demonstrations.

Course Contents

Introduction: Course overview. Overview of computer networks. Modern computer networks. Wireless and wired access. Core networks. General presentation of computer network design, control and management problems.

Wireline network design problems. Packet switching, circuit switching. IP access via DSL, LAN, optical systems. Core network design problems, Ethernet WANs, optical technologies.

Wireless access network design problems. The cases of TDMA, CDMA and OFDMA for 2G, 3G, LTE, Femtocells, IEEE 802.x technologies, heterogeneous infrastructures. Radio resource management. Spectrum and power management. Network element topology problems. Interconnection with backhaul/core networks.

Methods and Algorithms for solving computer network design problems: local search, greedy, (meta-)heuristics, simulated annealing, genetic algorithms, taboo search, neural networks, other bio-inspired and learning techniques. Application to the above network design problems. Programming exercises.

Introduction to network management. CFAPS functionalities. Network Management levels. Manager, Agents. Management Information Base (MIB). Management of IP-based networks. SNMP protocol. SMI, ASN.1.

MIB design and realization for network elements. Management based on the SNMP Protocol. MIBs content processing. Laboratory exercises.

MIB design and realization for network elements. Management based on the SNMP Protocol. MIBs content processing. Laboratory exercises.

Design and Implementation of management applications based on the SNMP Protocol. MIBs content processing. Laboratory exercises.

Management platform and tools. Demonstration and use of platforms and tools used today for monitoring, management and control of computer networks: HP Openview, SNMPc, MRTG.

Modern methodologies and trends in computer network management: Self-*, Self-management, autonomic management, cognitive management, web-based management, policy based management, network governance.

Recommended Reading

1. Professors' notes / Lectures' slidesets.
2. Computer Network Management, A.Miliou, P.Nikopolitidis, A.Pomportsis, 2007, ISBN: 9789604181339, in Greek.
3. Telecommunication Network Management, L.Oikonomou, 2001, ISBN: 960-91680-0-0, in Greek.
4. Integrated Management of Networked Systems: Concepts, Architectures, and Their Operational Application (The Morgan Kaufmann Series in Networking), Heinz-Gerd Hegering, Sebastian Abeck, and Bernhard Neumair, 1999.
5. LANs TO WANs: The Complete Management Guide, Nathan Muller, Artech House Books, 2003.
6. Stallings W., SNMP, SNMPv2 and CMIP: The practical guide to network management standards, Addison-Wesley Inc.
7. Mani Subramanian Network Management - principles and practice, Addison-Wesley 2000, ISBN 0-201-35742-9.
8. Leinwand, K. Fang, "Network management a practical perspective", Addison-Wesley Inc.
9. D. R. Mauro and K. J. Schmidt, Essential SNMP, O'Reilly, 2nd Edition, September 2005.
10. SNMP RFCs, available at http://www.snmp.com/protocol/snmp_rfcs.shtml.
11. Integrated Management of Networked Systems: Concepts, Architectures, and Their Operational Application (The Morgan Kaufmann Series in Networking), Heinz-Gerd Hegering, Sebastian Abeck, and Bernhard Neumair, 1999.
12. D. Bertsekas, "Network Optimization: Continuous and Discrete Models", Athena Scientific, 1998.
13. D. Bertsekas, "Dynamic Programming and Optimal Control", Vols. I and II, Athena Scientific, 1995, (3rd Edition Vol. I, 2005, 2nd Edition Vol. II, 2001).
14. D. Bertsekas, R. Gallagher, "Data Networks ", Prentice-Hall, 1987 (2nd Ed. 1991),
15. D. Bertsekas, "Linear Network Optimisation, Algorithms and Codes", MIT Press, 1991
16. Andrew Tanenbaum, "Computer Networks".
17. James Kurose, Keith Ross, "Computer Networking: A Top-Down Approach Featuring the Internet".

18. Jean Walrand, “High Speed Networks”.
19. Jean Walrand, “Computer Networks: A First Course”.
20. Travis Russell, “Telecommunications Protocols”.

Course Code:	ΨΣ-ΕΔ-505
Course Title:	Development of Applications for Mobile Devices
Type of Course:	Compulsory
Year of Study/ Semester:	1st / 2nd
ECTS Credits:	6
Faculty:	V.-A.Stavroulaki, Assistant Professor A.Meliones, Lecturer

Objective

The Android technology is being used in the latest smart mobile devices. The goal of this lab/course is for the students to understand the android computing platform and develop applications for mobile devices using the latest Android Software Development Kit (SDK). Working with Android applications, the students will gain experience with an interesting technology in the fast moving market segment of Internet-enabled phones.

Course Contents

Download/configure the Android SDK. Introduction to Android development tools for application development. Getting familiar with the Android emulator (Ref [1] chapters 2 and 3, Ref [2] chapters 1 and 2, Ref [3] chapter 2).

Creating User Interfaces: using XML-based layouts (comparison with java powered layouts), basic widgets (labels, check boxes, buttons, input boxes, etc), containers (widget collections), input method framework, drop-down menus, fonts, etc. Introduction to different layout methods (Ref [1] chapters 4 to 7, Ref [3] chapter 4).

Design examples using Android SDK and Eclipse framework.

Specifications of course «projects».

The Webkit browser: creating applications with the browser. Introduction to mobile browsing and webkit engine. Markup languages, CCS, and javascript. Embedding the webkit browser (Ref [1] chapter 13, and Ref [2] chapter 17).

Using resources: string resources, layout resources, etc, working with arbitrary XML Resource files, working with Assets, etc (Ref [2] chapter 3 and Ref [1] chapter 20).

Content Providers: using and building a content provider (Ref [2], chapters 25 to 27).

Creating intent filters (Ref [2], chapter 17, Ref [3] chapter 5).

Location based services, creating map-based activities, audio, video and using the camera (Ref [3], chapters 8 and 11).

Dealing with real devices, handling multiple screen sizes and resolutions, etc (Ref. [2] chapter 19, and Ref [1] chapters 36, 37, 38).

Recommended Reading

1. Mark L. Murphy, Beginning Android 2: Begin the journey toward your own successful Android 2 applications, Apress 2010.
2. Sayed Y. Hashimi, Satya Komatineni, Dave MacLean: Pro Android 2: Covers Google's Android 2 Platform including advanced topics such as OpenGL, Widgets, Text to Speech, Multi-Touch, and Titanium Mobile, Apress 2010.
3. Reto Meier, Professional Android 2 Application Development, Wrox Programmer to Programmer, Wiley Publishing, 2010.
4. F. Ableson, C. Collins, R. Sen, "Unlocking Android: A Developer's Guide", Manning Publications, 2009.
5. E. Burnette, "Hello, Android (3rd edition): Introducing Google's Mobile Development Platform", Pragmatic Bookshelf, 2010.
6. M. L. Murphy, "Android Programming Tutorials", 3rd Edition, CommonsWare, 2010.
7. J. Steele, N. To, "The Android Developer's Cookbook: Building Applications with the Android SDK", Addison-Wesley Professional, 2010
8. P.J. Deitel, H. M. Deitel, A. Deitel, M. Morgano "Android for Programmers: An App-Driven Approach", Prentice Hall, July 2011.

Major C. Network Oriented Systems

1st Semester

Course Code:	ΨΣ-ΔΚ-513
Course Title:	Service Oriented Architectures
Type of Course:	Compulsory
Year of Study/ Semester:	1st/1st
ECTS Credits:	6
Faculty:	M. Themistocleous, Associate Professor V.-A. Stavroulaki, Assistant Professor C. Doulkeridis, Lecturer

Objective

In the past, organizations have adopted computer applications to improve and automate their business processes. These applications have not been implemented according to a strategic plan or based on a common integrated IT infrastructure. Instead, it was based on the needs of each individual department of the company and always according to current technologies. Thus, most organizations have developed information infrastructures consisting of a set of autonomous and in many cases heterogeneous systems. As a result, the need for automated and integrated business processes has increased over the years but organizations were unable to build an integrated IT infrastructure as heterogeneous applications have had several connection problems. In recent years Service Oriented Architectures (SOA) and technologies are widely used to help organizations overcome these problems. In this context, the objective of this course is to

study SOA model and it emphases on the analysis, design and development of SOA based applications. Upon completion this course, students will be able to implement service oriented systems and architectures.

Course Contents

Service Oriented Architectures (SOA): The integration problem and the need for flexible and efficient integrated IT infrastructures, Service Oriented Architectures, architectural principles, architectural model, SOA rules, best practices, building blocks.

Designing service oriented architectures: SOA applications' lifecycle, techniques and SOA development methodologies, top down methodology, bottom up methodology, middle out methodology, comparison and evaluation of SOA development methodologies, best practices, examples.

Web services: Definitions, roles, functions, characteristics and attributes, web services types, service hierarchies, examples and exercises.

Lab 1 – XML: Structure of XML documents, valid XML documents, introduction to schema languages, document type definition (DTD), structure of DTD, presentation of XML schema, querying XML documents, the XPath language, XPath axes, XPath query formulation, examples of XPath querying, the XQuery language, XQuery syntax, XQuery examples.

Lab 2 – XML: Development of dynamically transformed web pages with XSL, the XSLT language, XSLT processing, XML web application development using XML data management systems, XML storage in relational databases, XML storage in native XML databases.

SOAP, REST, WSDL and UDDI: SOAP message structure, SOAP bindings, REST message structure, REST Vs SOAP, WSDL, types, WSDL message, WSDL functionality, ports, ports types, bindings, UDDI, data definition, data types, interfaces, application development, SOAP and UDDI, WSDL and UDDI.

Quality of service (QoS): Definition of QoS, service requirements, user requirements specification, domain independent, domain depended services, service providers and QoS, security requirements, selection and matching of web service depending on the quality requirements of the client application, factors affecting QoS, pricing and QoS.

Lab 3 – web services programming: Hands on training on Microsoft Visual Studio .Net, building web services and service oriented architectures with C#, service interfaces, user interfaces, connecting web services with databases and external systems or services, examples, exercises.

Orchestration and choreography: Basic principles and definitions, orchestration, choreography, differences between choreography and orchestration, BPEL structure, message flow, control flow, data flow, data handling, fault management, activities, examples and exercises.

SOA security: Risks and threads, confidentiality, authentication, integrity, security services, WS-Security, security policies, firewalls, message-level security, security as a service, standards of service security, SOAP related security, web services security framework.

Recommended Reading

1. Michael Papazoglou (2008): Web Services: Principles and Technology', Pearson, Prentice Hall, New York, ISBN: 0321155556.
2. Thomas Erl (2009): SOA Design Patterns, The Prentice Hall Service-Oriented Computing Series, Prentice Hall, London, ISBN: 0136135161.
3. David Linthicum, (2009), "Cloud Computing and SOA Convergence in Your Enterprise: A Step-by-Step Guide", Addison-Wesley Professional, New York, ISBN 0136009220.

4. Sanjiva Weerawarana, Francisco Curbera, Frank Leymann and Tony Storey (2005): Web Services Platform Architecture: SOAP, WSDL, WS-Policy, WS-Addressing, WS-BPEL, WS-Reliable Messaging, and More, Prentice Hall, New York, ISBN: 0131488740.

Course Code:	ΨΣ-ΔΚ-502
Course Title:	Advanced Information Systems
Type of Course:	Compulsory
Year of Study/ Semester:	1st/1st
ECTS Credits:	6
Faculty:	G.Vassilacopoulos, Professor

Objective

Human beings have the distinct ability to attach meaning to whatever they perceive. The data translation to information and attempt, in an organized manner, to provide information for action, constitute the basis of the principle “information system”. In this course, the notion of an information system in the context of an organization is defined and particular emphasis is placed on the fact that an information system is essentially a kind of system that supports business processes and distributes information to the appropriate receivers using a digital technology as a tool. Professionals in the field of information systems basically work on: a) information generation with the goal to aid the organization define and achieve its goals, and b) the realization or improvement of processes of the organization with the use of appropriate digital technology. Hence, these professionals play an important role in determining the requirements for an information system of the organization and they participate actively in its specification, design and realization. Therefore, they must have deep knowledge of state-of-the-art digital technologies and must be acquainted with the organizational principles and practices so that they contribute decisively in provisioning the systems and information that organization needs for supporting its operations. Furthermore these professionals determine the processes of evolution of information systems in order to achieve novel comparative assets to the organization through interoperability of existing systems and the capitalization from modern digital technology while maintaining existing investments. In this context, the course places particular emphasis to real world case studies on the development of information systems by creating modern web-based and service-oriented architectures.

Course Contents

Principles of systems analysis, human activity systems, systems thinking, system approach to information systems, high level analysis methodologies, information systems types.

The organization as system, organizational framework of information systems, the organization concept in information systems, information systems leverage to re-organization.

Information systems development methodologies, code-and-fix, structured systems analysis and design, evolutionary/rapid application development, agile systems development, teamwork methodologies, end-user development.

Information systems life cycle, advantages and disadvantages, structure lifecycle phases, user participation, documentation, structured information systems development, data flow diagrams, requirements engineering.

Human-oriented and participative information systems development, requirements elicitation, the prototyping approach.

Object-oriented systems development, RUP methodology, general principles of the methodology, unified model language (UML) diagrams.

Information systems evolution, types of systems evolution, architectural transformation, systems development by reuse, evolution to process-oriented information systems.

Network-oriented (web-based) systems development, process-oriented architectures, workflow management, web services and workflows, workflow security, service-oriented architectures (SOA).

Information systems organization and architectures, centralized and distributed processing and storage, on-line and batch processing, cloud-based information systems.

Information systems security, security policies, security enforcement mechanisms, role-based security, authorization administration.

Recommended Reading

1. Vassilacopoulos G. (2010). Information Systems (in Greek).
2. Checkland P. and Holwell S. (2002). Information, Systems and Information Systems – Making sense of the field. Wiley.
3. Arthur M. Langer (2010). Analysis and Design of Information Systems. Springer.
4. Avison D. E. (2006). Information Systems Development: Methodologies, Techniques & Tools. McGraw-Hill.
5. Vidgen R., Avison D., Wood B. and Wood-Harper T. (2004). Developing Web Information Systems: From Strategy to Implementation. Butterworth-Heinemann Information Systems Series.

Course Code:	ΨΣ-ΔΚ-512
Course Title:	Digital Services and Web Applications
Type of Course:	Compulsory
Year of Study/ Semester:	1st / 1st
ECTS Credits:	6
Faculty:	M.Themistocleous, Associate Professor A.Prentza, Assistant Professor F.Malamateniou, Associate Professor

Objective

In an attempt to discover a quick and cheap way to reproduce the bible, Gutenberg invented the printing in 1438. Although it was not his intension, Gutenberg helped in the rapid dissemination of knowledge, which in turn led to the industrial revolution. If Gutenberg's discovery has so significant impact on science and entrepreneurship, what can one say about the Internet and its innovative opportunities for searching, tracking and managing information, trade development and organizations restructuring? In late 2010, the Internet reached 2 billion users, when 10 years earlier its users were only 361 million. Approximately 300 million users visit YouTube and Facebook each month where 8 years before these applications did not exist. In Google 140 billion searches are made per month, while 82% of Internet users gather information about products and services. The spread of Internet and digital economy is rapid. Just to think that radio reached a critical mass of 50 million users in 38 years, while TV needed 13 years, Internet 4 and Facebook only 2 years!

In 2011, Internet data traffic increased tenfold compared to that in 2006 and the Internet links surpassed 1 billion in 2009 from only 1000 connections in 1984. Undoubtedly, the Internet revolution cannot be ignored and it is therefore the intension of this course to explore advanced topics related to the digital economy and services. In doing so, the course studies the areas of electronic services, e-business, e-government, e-health and social networks. Also, it concentrates on methodologies, technologies and techniques for developing Web applications.

Course Contents

Social networks: Definitions, social networks' characteristics, types, advantages, disadvantages and challenges of social networks, sensitive issues, privacy, social networking as a means of understanding consumers' needs, collaboration among business and clients to create or improve products, changing roles and involved parties, the impact of social networking, policies and business strategies, examples, case studies.

Virtual Organisations: Definitions and characteristics of virtual enterprises, advantages and disadvantages, comparison between traditional and virtual enterprises, innovation, strategies adopted by virtual enterprises, digital product, advanced techniques for marketing and pricing of digital products, digital products and knowledge, digital supply chain, examples, case studies.

Digital services' interoperability: Principles, definitions, benefits, approaches, requirements, organizational interoperability, semantic interoperability, technical interoperability, international standards and initiatives, European Interoperability Framework, design methodology of interoperable digital services.

Electronic business: types and models, electronic business and its basic constructs, architectures, communications channels, virtual organizations, competitive advantage, challenges and strategies, examples and case studies.

Electronic governance: the importance and the advantages of e-government for citizens and the state, analysis of e-government applications, architecture, standards, characteristics, entities, roles, main types of applications, examples and case studies, social networks and their role, social networks and business models, the role of the users in shaping and leading changes in business environments, exemplar cases.

Electronic procurement: Definition and basic principles, phases of electronic procurement value chain, benefits, regulatory framework for electronic procurement in national and European level, state-of-the-art and future developments, best-practices, eProcurement applications, design and implementation of information systems supporting electronic procurement.

Electronic invoicing: Definitions, market validation and benefits, electronic Invoicing processes and models, interoperability requirements, data representation and data transport standards for eInvoicing, issues of data security and integrity in electronic invoices.

Electronic health: Healthcare systems, the need for healthcare services, digital systems and quality improvement, healthcare information systems, trends and architectures, best practices, e-health systems and security.

Electronic health: Electronic healthcare record (EHR), requirements, structure and content, EHR, architectures, EHR standards, medical information and security, cost, performance and benefits, international practices, electronic patient record, architectures, data types, security issues, benefits, common practices, technical and semantics interoperability.

Electronic health: e-health applications' portfolio, international practices, exemplar e-health applications, characteristics, functions, home care and hospital at home, e-prescribing, e-referral, examples.

Recommended Reading

1. Lynie Arden (2009): Start Your Own E-Business, Entrepreneur Press, New York, ISBN: 1599181924.
2. Vishanth Weerakkody (2012): Technology Enabled Transformation of the Public Sector: Advances in E-government, Great Taste Publications, London, ISBN: 1466617764.
3. Jeff Jarvis, (2009): What Would Google Do?: Reverse-Engineering the Fastest Growing Company in the History of the World, Harper Business, New York, ISBN: 0061709697.
4. Joseph Tan (2005): E-health Care Information Systems: An Introduction for Students and Professionals, John Wiley & Sons, New York, ISBN: 0787966185.
5. Ilias Iakovidis, Petra Wilson and Jean Healy (2004): E-Health: Current Situation and Examples of Implemented and Beneficial E-Health Applications, IOS Press, Amsterdam, ISBN: 1586034480.

Course Code:	ΨΣ-ΔΚ-506
Course Title:	Network Programming
Type of Course:	Compulsory
Year of Study/ Semester:	1st / 1st
ECTS Credits:	6
Faculty:	N.-M. Sgouros, Professor

Objective

In recent years network programming has grown from a specialized programming form to a central component of any programming tool. The catalyst for this development proved to be the appearance of the Java programming language which was designed from the start to provide capabilities for the easy and generally safe transmission and reception of data via computer networks. These specific capabilities were critical for the establishment of Java as a lingua franca for the development of complex networking applications. This stems from the use of Java as the development language in basic network software environments such as the Android operating system for mobile devices. Consequently knowledge of the Java language and the network programming tools that it offers is a basic requirement for coding modern net-centric systems.

The goal of this course is to familiarize students with the basic principles of programming network systems using the Java programming language. The course consists of laboratory sessions. More specifically, the course presents the basic programming techniques for the implementation of various network applications while describing the main features of programming code that implements the specific applications. The students must then work on extending/upgrading/modifying the given code. Furthermore, the students are required to develop during the semester complex programming assignments chosen from a list of available topics that is handed to them at the start of the semester. After the successful completion of this course the students will have mastered the programming philosophy of network systems. In addition, they will be able to program with ease complex network applications in Java.

Course Contents

Complex & Polymorphic Data Types : generic data types, collections.

Event-driven Programming: listener interfaces, development of simple GUIs using the AWT library.

User Interface Development using the Java Swing library: development of complex GUIs.

Thread Programming: thread lifecycle, thread synchronization, timing applications.

I/O streams: primary and complex data types I/O, data serializability.

Socket programming: sockets lifecycle, socket types, socket management, development of communication protocols.

Client/Server implementation: building blocks for programming client/server systems, development examples for server and clients that use threads for data I/O.

Non-Blocking I/O: development examples for server and clients using the no-threads NIO library.

Multimedia Network Programming: management of multimedia sources, audio streaming example, overview of video streaming.

Graphics Network Programming: graphics programming principles, development of animation applications, development of multiplayer games.

Recommended Reading

1. Course Notes.
2. Java Tutorials (http://download.oracle.com/javase/tutorial/).

Course Code:	ΨΣ-ΔΚ-504
Course Title:	Data management
Type of Course:	Compulsory
Year of Study/ Semester:	1st / 1st
ECTS Credits:	6
Faculty:	G. Vassilacopoulos, Professor M. Halkidi, Assistant Professor C. Doulkeridis, Lecturer

Objective

The main objective of this course is to present students contemporary issues and best practices in the area of Data Management. In this context, the course covers advanced topics in database design and query processing as well as new architectures of database management systems. These topics are interrelated with issues regardind the development of network-oriented systems and services. The course also presents the main concepts of knowledge discovery and data mining for voluminous data collections.

Course Contents

Conceptual database design: Entity-relationship model, class model.

Logical database design: Relational data model, integrity constraints over relations, database normalization, transformation of entity-relationship and class models into relational models.

Database Security: Authentication, access control, security policies, users roles (model RBAC).

Spatial data management: basic concepts of physical organization, data types of spatial data, indexing and query processing of spatial data, multidimensional data, problems of many dimensions (“the curse of dimensionality”, “the empty space phenomenon”), dimensionality reduction techniques.

Advanced rank-aware query processing: Top-k query processing, rank-join (top-k join) query processing, algorithms for rank-aware query processing, skyline queries, algorithms for processing skyline queries.

Parallel data management: Fundamental concepts and architecture of parallel databases, parallel query processing, introduction to data management in the cloud, the MapReduce programming model, the Hadoop implementation, HDFS, the language Hive.

Distributed data management Basic concepts, problems, architectures, distributed query processing, peer-to-peer data management systems, unstructured and structured peer-to-peer networks.

Data warehouse: Multidimensional data model, architecture of data warehouses, OLAP operations, business intelligence and tools for business intelligence.

Unsupervised and supervised learning: Clustering algorithms (divisive, hierarchical, density-based, clustering applications), classification algorithms (decision trees, naive bayes classifier, support vector machines).

Web mining: Link analysis, web search, page ranking algorithms.

Recommended Reading

1. Teorey T. J., Lightstone S. S., Nadeau T. and Jagadish H.V. (2011). Database Modeling and Design, Fifth Edition: Logical Design. Morgan Kaufmann.
2. Teorey T. J. (1998). Database Modeling & Design: The Fundamental Principles. Morgan Kaufmann.
3. Siau K. (2007). Contemporary Issues in Database Design and Information Systems Development. IGI Publishing.

2nd Semester

Course Code:	ΨΣ-ΔΚ-505
Course Title:	Business Process Management
Type of Course:	Compulsory
Year of Study/ Semester:	1st / 2nd
ECTS Credits:	6
Faculty:	M. Themistocleous, Associate Professor

Objective

Business process management (BPM) is the set of concepts, methods and tools that help organizations define, implement, measure and improve their end-to-end processes. BPM is a combination of mature organizational transformation concepts (business process reengineering, lean six sigma, total quality management) and supporting technologies such as workflow management, process analytics process mining and service-oriented systems. BPM technology helps organizations become more efficient by coordinating activities, automatically allocating tasks to process participants and integrating services and applications into the process. Demand for BPM is fueled by opportunities related to ongoing performance improvement, process outsourcing/off-shoring and the interest in process standards such as ITIL and SCOR. Global analysts such as the Gartner Group have identified the improvements of business processes as the number one

priority of CIOs for a number of years. In this context, the course addresses the needs of public and private organizations with BPM initiatives. It covers topics relevant for students that plan to become business or systems analysts that participate in BPM projects, but covers concepts that are useful for functional/line of business positions as well. The course is also suitable for students interested in joining IT organizations with BPM tool offerings and provides business-level education for future sales-force personnel, technical staff, and consultants. The course makes use of real-world case studies to illustrate specific aspects of process mapping, automation and evaluation and to test student comprehension of the material. During the course, various methods for process modelling are explored, techniques for process improvement, reengineering and management are studied and issues related to Service-Oriented Architectures and BPM are analysed. In addition to this, the course aims to provide hands on training on relevant software solutions.

Course Contents

Enterprise business processes: business process definition, intra- and inter-organizational processes, process-oriented organizational approach, custom business processes for competitive advantage, beyond best practice, on to excellence, business process automation, business process alignment, process-oriented and service-oriented systems.

Business process modeling: process modeling requirements, tailoring requirements, process meta-models, process meta-model views, the process mapping process, process mapping metrics, Methods and process modeling techniques, IDEF0, IDEF3, DFD.

Process-centered organizations: models for process-centered organizations, the social organization of work, computer supported cooperative work, dynamics of cooperative networks, Business Strategy, Business Process Management and stakeholders' management (rules, restrictions, exceptions, business logic, fault handling).

Business process management lifecycle: discover, analyze, model, monitor, map, simulate, deploy. Business process reengineering methodology. Critical success factors and tips for avoiding failure.

Business process change: business process analysis, improvement, redesign, reengineering, innovation, management.

BPM Six Sigma methodology: defining, measuring, analyzing, improving, controlling business processes. Examples, exercises and case studies.

Implementing BPM: Learning to become a process-managed enterprise, the process portfolio, the critical success factors, the core competency, mastering BPM, case study: an organizational initiative in reengineering.

Workflow management technology: plans and procedures in process automation, workflow management, functional requirements for workflow management, workflow specification and execution languages.

Workflow security: workflow security requirements, authentication, authorization, and access control, security implementation issues.

BPM and service oriented architectures: business process orchestration and choreography, business process execution language, case study.

Recommended Reading

1. John Jeston and Johan Nelis (2008): Business Process Management, Second Edition: Practical Guidelines to Successful Implementations, Butterworth-Heinemann, Boston, ISBN: 0750669217.
2. Marc Fiammante (2009): Dynamic SOA and BPM: Best Practices for Business Process Management and SOA Agility, IBM Press, New York, ISBN: 0137018916.

3. Robert Damelio (2011): The Basics of Process Mapping, 2nd Edition, Productivity Press, Boca Raton, ISBN: 1563273764.

4. Susan Page (2010): The Power of Business Process Improvement: 10 Simple Steps to Increase Effectiveness, Efficiency, and Adaptability, AMACOM, Atlanta, ISBN: 0814414788.

5. Mark McDonald, (2010): Improving Business Processes, Harvard Business Review Press, Boston, ISBN: 142212973.

Course Code:	ΨΣ-ΔΚ-513
Course Title:	Mobile Devices Programming
Type of Course:	Compulsory
Year of Study/ Semester:	1st / 2nd
ECTS Credits:	6
Faculty:	A.Rouskas, Associate Professor V.-A. Stavroulaki, Assistant Professor

Objective

The proliferation of mobile devices in all sectors of human activity is spectacular. Todays' mobile devices comprise several applications and capabilities, as well as access to the Internet thus tend to replace computers, as well as a variety of other devices such as cameras, MP3 players, etc. This has made mobile devices extremely popular while the widespread use of mobile devices and the rapid development of corresponding applications help accelerate business innovation. The objective of this course is to provide basic knowledge of technologies that will allow students to capitalize upon the opportunities offered by mobile application development industry. More specifically, the course presents network technologies for mobile and wireless communications. Moreover, the course presents location discovery techniques that can be exploited for location-based services for mobile devices. In addition the course provides an overview of requirements and functionalities for "smart" devices. An overview of the main platforms for mobile devices is also provided, such as iPhone, Android, Windows Mobile, Symbian, RIM. The design and development of applications for mobile devices is addressed. Finally the course aims to familiarize students with main concepts of developing Android mobile applications.

Course Contents

Mobile and wireless communication networks: Wireless access technologies and networks, characteristics of wireless personal area networks (WPANs), local area networks (WLANs), metropolitan area networks (WMANs) and wide area cellular networks (WWANs). Multimode terminals and wireless access selection.

Conversational applications, data applications and web browsing via wireless packet access networks, effects of wireless environment and mobility on network/transport layer and applications, mobility management protocols and TCP adaptation in wireless packet networks

Location discovery technologies and location based services, IP multimedia subsystem wireless internet support technologies, architecture, layering and services.

Overview of "smart" devices: Requirements for "smart" mobile devices: Personalization, context awareness, always best connectivity, ubiquitous service provision, seamless mobility. Functionalities: Acquiring user

information, acquiring context information, policies, selection of optimal device configuration. Advantages – drawbacks, potential business benefits.

Mobile device platforms: Overview of main mobile device platforms: iPhone, Android, Windows Mobile, Symbian, RIM, iPhone, overview of iPhone Operating System (IOS), main concepts of Objective C, tools for developing IOS applications, Xcode.

Android SDK: Main concepts, Android application model, introduction to the Android platform, platform architecture, application building blocks, activities, services, content providers, broadcast receivers, intents, development tools.

Android Lab 1: Development of applications with Android Software Development Kit (SDK) and the Eclipse framework, design and implementation of Graphical User Interface (GUI), use of XML layouts, main widgets (labels, check boxes, buttons, input boxes, etc), containers (widget collections), input method framework, drop-down menus, fonts. Examples and lab exercises.

Android Lab 2: Data management in Android applications. Shared Preferences, local files, SQLite data bases, table creation, insert and modification of records, queries, use of ContentProvider for the exchange of information between applications.

Android Lab 3: Access to device location information, Android classes and interfaces for management of location information in applications, use of Google Maps, MapViews, Geocoding, examples and lab exercises.

Security for mobile devices and applications: Threads and security risks, principles, concerns, best practices and critical success factors, Mobile devices' security policy.

Recommended Reading

1. E. Burnette (2010): Hello, Android: Introducing Google's Mobile Development Platform, Pragmatic Bookshelf, ISBN: 9781934356562.
2. P.J. Deitel, H. M. Deitel, A. Deitel, M. Morgano (2011): Android for Programmers: An App-Driven Approach, Prentice Hall, ISBN: 978-0132121361.
3. M. L. Murphy (2010): Android Programming Tutorials, 3rd Edition, CommonsWare, ISBN: 978-0981678047.
4. J. Steele, N. To (2010): The Android Developer's Cookbook: Building Applications with the Android SDK, Addison-Wesley Professional, ISBN: 978-0321741233.
5. F. Ableson, C. Collins, R. Sen (2012): Unlocking Android: A Developer's Guide, Manning Publications, ISBN: 9781933988672.

Course Code:	ΨΣ-ΔΚ-302
Course Title:	Management of Computer Networks
Type of Course:	Compulsory
Year of Study/ Semester:	1st / 2nd
ECTS Credits:	6
Faculty:	A.Rouskas, Associate Professor P. Demestichas, Professor K. Tsagkaris

Objective

The course "Management of Computer Networks" aims at teaching the contemporary methodologies and technologies in the area of management and design of computer networks. In this context, the course covers modern computer networks including wireless /wired access and core networks. Moreover, the course aims at teaching aspects related to the top down network design, in terms of topology, addressing, routing and performance monitoring. Furthermore, the fundaments of computer network management, with respect to functional, information and communication models, are presented, thoroughly discussed and validated. The course is in general comprised of both theoretical lectures and specialized laboratory and programming exercises and platform demonstrations.

Course Contents

Computer networks: Modern computer networks, wireless and wired access, core networks, packet switching, circuit switching, IP access via Digital Subscriber Line (DSL), Local Area Networks (LAN), Fiber-to-the-x (FTTx)-optical systems, Ethernet Wide Area Networks (WANs), optical technologies, Wireless 2G, 3G, Long Term Evolution LTE, Femtocells, IEEE 802,x technologies, heterogeneous infrastructures, radio resource management, spectrum and power management, network element topology problems, interconnection with backhaul/core networks.

Top-Down network design: Business and technical goals, requirements and constraints, network monitoring and performance evaluation, traffic characterization, topological design, comparison of hierarchical and flat network design, three-layer network hierarchy, core, distribution and access layers.

Design: Addressing design, hierarchical addressing, classless addressing, supernetting, switching protocols selection, spanning tree protocol, Virtual LAN (VLAN), routing protocols selection, path-update distance-vector and link-state protocols, autonomous systems, example protocols Routing Information Protocol (RIP), Open Shortest Path First (OSPF), Border Gateway Protocol (BGP).

Network management: CFAPS functions, configuration management, fault management, accounting management, performance management, security management, management layers (element, network, service, business), manager(s), agents, management architectures and standards. IP-based management, Simple Network Management Protocol (SNMP), Management Information Base (MIB), Structure of Management Information (SMI)/Abstract Syntax Notation.1 (ASN.1) languages.

MIB design and elaboration I: MIB reading and elaboration. Getting started with MIB-II (RFC 1213), focus on groups, system, interfaces, IP and TCP, monitoring and setting of parameters based on SNMP for configuration, performance and fault management, application into lab network infrastructure (servers, host PCs, switches etc) using NET-SNMP tool, performance of lab exercises and analysis of results.

MIB design and elaboration II: Getting started with HOST-RESOURCES-MIB (RFC 2790), monitoring and setting of parameters based on SNMP for configuration, performance and fault management, derivation, elaboration and analysis of trap messages and alarms, application into lab network infrastructure (servers, host PCs, switches etc) using NET-SNMP tool, performance of lab exercises and analysis of results.

Implementation of management applications: Design and implementation of network management applications based on SNMP, focus on configuration, performance and fault management, use of scripts and high level programming languages as well as NET-SNMP (C/C++) and NET-SNMPJ/SNMP4J (Java) software libraries, programming and laboratory exercises, derivation and analysis of results.

Management platforms and tools: Demonstration and use of platforms and tools used today for monitoring, management and control of computer networks, HP Openview, SNMPc, MRTG/PRTG, Nagios, OpenNMS.

Network Security Design: Identifying network assets, analyzing security risks, developing a security plan and policy, security procedures, security mechanisms, physical security, authentication, authorization, data encryption, public/private key encryption, packet filters, firewalls, intrusion detection and prevention systems, securing internet connections, securing servers, securing remote-access and VPNs.

Modern methodologies and trends in computer network management: Self-*, Self-management, autonomic management, cognitive management, business level and service management (enhanced Telecom Operations Map – eTOM), policy based management, network governance, LTE Self-Organizing Networks (SON), management of cloud network infrastructures, SNMP/MIBs and extensions for cloud management, architectures, open interfaces and standards.

Recommended Reading

1. Priscilla Oppenheimer (2011): Top-Down Network Design, 3rd Edition, 2011, Cisco Systems, ISBN: 9781587202834.
2. W. Stallings (2006): SNMP, SNMPv2 and CMIP: The practical guide to network management standards, Addison-Wesley Inc. ISBN: 0201633310.
3. D. R. Mauro and K. J. Schmidt (2005): Essential SNMP, O'Reilly, 2nd Edition, ISBN: 0596000200.

Course Code:	ΨΣ-ΔΚ-510
Course Title:	Cloud Computing
Type of Course:	Compulsory
Year of Study/ Semester:	1st / 2nd
ECTS Credits:	6
Faculty:	M. Themistocleous, Associate Professor, D. Kyriazis, Adjunct Lecturer

Objective

Cloud computing introduces a new way of sharing computing resources and it is the next stage in the evolution of Internet and digital technologies. In recent years, the applications and the importance of cloud computing have been rapidly increased with experts estimating that in the next few years personal clouds will replace personal computers. Furthermore, cloud computing creates a range of new skills and jobs. It is estimated that 14 million jobs worldwide will be created in the area of cloud computing by 2015, while the size of this market will reach 1.1 trillion dollars per year. The importance of cloud computing becomes more pronounced when one considers that this area is still in its infancy. Cloud computing introduces a series of new principles, ways to manage, access, and use of computing resources and services. This course aims at understanding the theoretical underpinnings of cloud computing and helping students to comprehend issues related to the deployment and management of computational clouds as well as services that run over cloud computing environments. In doing so, the course covers topics related to the theoretical background, architectures, standards, building blocks, modeling approaches and programming models of clouds. Besides the lectures, laboratory exercises allow students to gain hands-on experience with regard to installation and customization of cloud middleware as well as modeling and execution of application service components. Finally and given that cloud computing emerged in the last years, cutting edge research outcomes are reviewed, challenges are highlighted and open research topics are explored.

Course Contents

Cloud computing: definitions, goals, challenges, application areas, service level agreements, service phases, distinct layers based on the Service-Platform-Infrastructure (SPI) model, architectural design, open grid service architecture, service oriented architecture, next generation architecture / internet of services, virtualization types (native, hardware, OS-level, application), hypervisors (Kernel-based Virtual Machine – KVM, Xen), service level agreements, performance and monitoring of physical and virtual resources.

Platform as a Service and Software as a Service layers: service level agreements negotiation, service registry (UDDI, UBR, ebXML) and discovery, service selection, execution, monitoring, evaluation, accounting and billing, workflow management, wrappers for control, monitoring and configuration of application service components, methodology for developing, modeling and deploying applications, SLAs.

Lab 1 – SaaS: Development, customization and execution of an application on Google AppEngine, installation and customization (e.g. service selection mechanism) of cloud middlewares (OpenStack, GRIA).

Lab 2 – PaaS: Development of cloud environment as cloud providers (including certificates requests and generation, resource managers, endpoints configuration, etc), customization of wrappers for the execution of applications.

Lab 3 – SLA: Cloud environment development, service level agreements specification, customization and execution of application service components in a cloud environment, user groups and user access management, service selection mechanisms

Infrastructure as a service: Cloud network infrastructure management, power management, performance management, connectivity, routing, traffic engineering, security policies and cloud monitoring systems, use cases, examples using Nagios, SNMP/MIBs and extensions for cloud management for extensions MIBs for management through SNMP, Oceanos, Cloud Radio Access Networks. Architectures, open interfaces and standards (DMTF/OCSI, OCCI), network as a service (NaaS), software defined networking (SDN) and Openflow technologies.

Cloud data storage: Distributed File Systems (DFS), comparison with parallel database systems, advantages and disadvantages, reading and writing data, examples of applications on top of Hadoop Distributed File System.

Distributed data storage architectures in datacenters: Overview of architectures adopted by the major cloud providers (Amazon, Microsoft, Google) with particular focus on data storage and management, comparative study, relationship between cloud data storage and key features of cloud computing (scaling and fault-tolerance).

Real-time clouds: Priorities, time constraints, real-time cloud architectures, service composition models, heterogeneity, scaling, workflow mapping mechanisms, quality of service guarantees in clouds, classification of parameters and requirements, fault tolerance techniques, SNAP model, approaches VAS – GARA.

Cloud security: Cloud security levels, network security, host security, application security, storage security, data security, data provider security, security management and standards, identity management, security management for IaaS, PaaS, SaaS, storage as a service, security as a service, data lifecycle security.

Recommended Reading

1. David Linthicum, (2009): Cloud Computing and SOA Convergence in Your Enterprise: A Step-by-Step Guide, Addison-Wesley Professional, New York, ISBN 0136009220.
2. John Rhoton, (2010): Cloud Computing Explained: Implementation Handbook for Enterprises, Recursive Press, London, ISBN 9780956355607.

3. George Reese, (2009): Cloud Application Architectures: Building Applications and Infrastructure in the Cloud. O'Reily, Cambridge, UK, ISBN 0596156367.
4. Tom White, (2010): Hadoop: The Definitive Guide, 2nd Edition. O'Reilly Media/Yahoo Press, ISBN: 9781449389734.

Course Code:	ΨΣ-ΔΚ-515
Course Title:	Network-Oriented Systems Governance
Type of Course:	Compulsory
Year of Study/ Semester:	1st / 2nd
ECTS Credits:	6
Faculty:	G. Vassilacopoulos, Professor M. Themistocleous, Associate Professor

Objective

Despite the vast sums of money spent on the development of software applications, failure rates remain extremely high. According to the Standish Group, 84% of Information Systems (IS) fail as they cost more in time and money, they are out of scope or they are of bad quality, usability or functionality. The literature reveals that the 31% of information systems is canceled before its completion, where another 51% costs more in time and money. Furthermore, change management and risk management failure is also high (63% and 57% respectively). Clearly, it is of high importance for organisations to govern their information communication infrastructures. Network oriented systems governance deals with a series of important decisions that are taken before (pre-implementation), during (implementation) and after (post-implementation) the delivery of information systems. Among others, governance refers to decisions related to techno-economic study, evaluation, development, operation, maintenance and expansion of network oriented information systems. These decisions are so important that can lead an organization to success or failure. An exemplar case of this is the American pharmaceutical giant FoxMeyer that went bankrupt due to poor governance. To grasp the magnitude of failure, FoxMeyer's sales totaled $ 5.1 billion a year before the bankruptcy, indicating that poor IT governance can lead any kind and size of organisation to bankruptcy. In this context, the main objective of this course is to present and analyse key issues related to network oriented systems' governance. Upon completion this course, students should be able to understand the techniques, tools and practices to be adopted for a successful IS implementation. Particular emphasis is placed on the analysis of real cases studies.

Course Contents

Network-oriented systems' governance: Definitions and principles of governance, components of governance, people, processes, organization, technology, structure and levels of governance, policies, plans, projects, priorities, key deliverables of IS governance, governance and strategy, governance and organizations, governance and architecture, governance and project life cycle, the impact of governance on organizations, the framework control objectives for information and related technology – COBIT, examples of COBIT.

Network-oriented systems project management: Portfolio management, project scheduling, resource management, project development framework.

Sourcing and outsourcing: Advantages and disadvantages for ICT, software development and acquisition, appropriateness of outsourcing, outsourcing criteria, service level agreements, risk management.

Network-oriented systems costing and return-on-investment: Costing procedures, Technical, economic and financial feasibility, costing factors, cost estimation methods, return-on-investment estimation methods, case study.

Network-oriented systems strategy: Strategy for business value, linking network-oriented systems to business metrics, managing perceptions of network-oriented systems, creating and evolving a systems roadmap.

Network-oriented systems evaluation: Successful evaluation framework, goal-oriented evaluation, goal-free evaluation, criteria-based evaluation, evaluation results, evaluation process and cost.

Network-oriented systems acceptance: Technology acceptance models (TAM model), influential factors, success and failure, exemplar case study.

Change management and organizational framework: Despair, denial, anger, anxiety, acceptance, practice, relief and motivation. Establish sense of urgency, create coalition develop a vision, share the vision, clear obstacles, secure short time wins, consolidate and keep moving.

Risk management: Risk identification, analysis, planning and monitoring, techniques, exercises, examples and exercises.

Service-oriented architectures governance: Governance and lack of governance, different types of SOA governance, SOA governance models, governance policies, stakeholders and roles, SOA governance lifecycle.

Recommended Reading

1. Gad Selig and Jayne Wilkinson (2008): Implementing IT Governance: A Practical Guide to Global Best Practices in IT Management, Van Haren Publishing, Amersfoort, ISBN: 9087531192.
2. Peter Weill, Jeanne Ross, (2004): IT Governance: How Top Performers Manage IT Decision Rights for Superior Results, Harvard Business School Press, Boston, ISBN: 1591392535.
3. Thomas Coleman, (2011): A Practical Guide to Risk Management, The Research Foundation of CFA Institute, ISBN: 1934667412.
4. T. Gilling, (2009): Beginner's COBIT Companion, Troubador Publishing Ltd, ISBN: 1848763085.
5. Harold Kerzner, (2009): Project Management: A Systems Approach to Planning, Scheduling, and Controlling, Wiley, New York, ISBN: 0470278706.
6. James Lewis, (2010): Project Planning, Scheduling, and Control: The Ultimate Hands-On Guide to Bringing Projects in On Time and On Budget, McGraw-Hill, ISBN: 0071746528.

2.5.3 Postgraduate Programme in "Techno-economics Management and Digital Systems Security"

No.	Title	Year of Study/ Semester	ECTS Credits
Major A.	**Techno-economics Management**		
ΨΣ-ΤΔ-901	Business, Regulatory and Legal Framework of Telecommunication Networks and Services	1st/ 1st	6
ΨΣ-ΤΔ-902	Managerial Accounting	1st/ 1st	6
ΨΣ-ΤΔ-320	Advanced Telecommunication Technologies	1st/ 1st	6
ΨΣ-ΤΔ-501	Network-Centric Systems and Services	1st/ 1st	6
ΨΣ-ΤΔ-913	Technoeconomic Analysis	1st/ 1st	6
ΨΣ-ΤΔ-909	Strategic Management of Digital Companies	1st / 2nd	6
ΨΣ-ΤΔ-502	Advanced Information Systems	1st / 2nd	6
ΨΣ-ΤΔ-914	Network-Oriented Informational Systems' Governance	1st / 2nd	6
ΨΣ-ΤΔ-905	Managerial Finance	1st / 2nd	6
ΨΣ-ΤΔ-911	Marketing of Digital Products and Services	1st / 2nd	6
ΨΣ-ΤΔ-999	Master Thesis	2nd / 3rd	30
Major B.	**Digital Systems Security**		
ΨΣ-ΑΦ-801	Security Principles and Foundations	1st/ 1st	6
ΨΣ-ΑΦ-813	Internet and Web Applications Security	1st/ 1st	6
ΨΣ-ΑΦ-804	Cryptography	1st/ 1st	6
ΨΣ-ΑΦ-814	Computer Security and Information Integrity	1st/ 1st	6
ΨΣ-ΑΦ-817	Best Security Practicies and Privacy Protection	1st/ 1st	6
ΨΣ-ΑΦ-815	Network Oriented Systems Security, Privacy and Trust	1st/ 2nd	6
ΨΣ-ΑΦ-816	Mobile Internet Security	1st/ 2nd	6
ΨΣ-ΑΦ-819	Secure Software Development in Service Oriented Architectures	1st/ 2nd	6
ΨΣ-ΑΦ-818	Security Services and Technologies for Electronic Transactions	1st/ 2nd	6
ΨΣ-ΑΦ-810	Socio-Economical Aspects of Security	1st/ 2nd	6

No.	Title	Year of Study/ Semester	ECTS Credits
ΨΣ-ΑΦ-888	Master Thesis	2nd /3rd	30

2.5.4 Postgraduate Programme in "Techno-economics Management and Digital Systems Security" - Individual Course Description

Major A. Techno-economics Management

1st Semester

Course Code:	ΨΣ-ΤΔ-901
Course Title:	Business, Regulatory and Legal Framework of Telecommunication Networks and Services
Type of Course:	Compulsory
Year of Study/ Semester:	1st / 1st
ECTS Credits:	6
Faculty:	A. Kanellos

Objective

The course aims at providing a thorough practical understanding of the business, operational, economic regulatory and legal environment of the electronic communications market in view of increasing employment possibilities of graduates in this dynamic sector.

Course Contents

Greek and European regulatory framework of the electronic communications (brief presentation of the applicable basic Greek and EU legislation, sector policies and assessment of their impact on the info-communications market, including access rules, interconnection, numbering, termination rates etc).

Business models applied by network operators and service providers (brief presentation of market players at competitive market, analysis of incumbent's and alternative operators' pricing policies, cost models of voice and data traffic, product placement methods, bundles, regulatory approvals).

Installation and operation of broadband infrastructures, such as fiber networks (FTT x), mobile networks, wired and satellite (licensing, rights of way, installation of base stations, collocation, resale of network capacity).

Basic organizational principles of modern telecom operators (corporate structure, financing instruments, staffing of technical and commercial departments, regulatory compliance).

Transition to the digital terrestrial television, radio spectrum policies, digital dividend (European experience, deadlines, procedures and deadlines, frequency allocation to television and mobile broadband, international coordination riules).

Introduction to European, corporate and labor law applicable on the electronic communications sector (EU policy instruments, corporate forms, corporate liability, labor law principles).

Roles of regulatory authorities and standardization bodies (role of independent regulatory authorities for telecoms and postal services, audiovisual, privacy protection, standards' bodies, ELOT, ETSI, CEN, alternative dispute resolution).

Industrial and intellectual property, e-commerce, electronic signatures, trademarks, domain names (Greek and EU copyright rules, patents, domain name management, dispute resolution mechanisms , internet governance, role of ICANN).

Legal protection of information, computer software, databases (management of digital rights, protection criteria, duration, composite and collective works, employees' works, court protection of right holders).

Privacy and personal data protection. Electronic criminality, Computer crime (Basic regulations on remote contracts, electronic transactions, criminal liability for illicit and harmful content, privacy protection in blogs and social media) .

Recommended Reading

1. www.eett.gr
2. Law and Internet – legal issues of the Web, Karakostas Ioannis, ISBN 960 -420 -199 -9.
3. The legal framework of telecommunications,Xiros Athanasiosm,Sakkoulas Ed,2003,ISBN: 960-301-763-9.

Course Code:	ΨΣ-ΤΔ-902
Course Title:	Managerial Accounting
Type of Course:	Compulsory
Year of Study/ Semester:	1^{st} /1^{st}
ECTS Credits:	6
Faculty:	G. Artikis

Objective

The course aims to provide information to assist all levels of management in decision making, planning and control business activities.

Course Contents

Accounting statements. Presentation of Balance Sheet and Profit and Loss Account used to determine the net worth and the profit or loss of a firm respectively.

Accounts. Accounts are classified according to their aim. These accounts are then used to prepare the Balance Sheet, and the Profit and Loss Account of a firm.

Company analysis: Ratio analysis. Company analysis using ratios of profitability, profit margin, assets turnover, liquidity, leverage, fixed assets over current assets etc.

Company analysis: Cash flows. Company analysis using sources and uses of capital tables to estimate the cash inflows and outflows produced in an accounting year.

Industry analysis. Analysis of the industry in which the firm operates that is used as an indication of the firm's environment.

Economy analysis. Analysis of the economy in which the firm operates that is used as an indication of the industry and firm's environment.

Financing principles. Determination of the appropriate sources of capital used to finance the fixed and current assets of a firm.

Investment cost. Initial cash outflows required to undertake an investment in fixed assets.

Cash flows. Cash inflows a firm expects to realize from undertaking an investment in fixed assets and which together with investment cost determine the feasibility of the investment.

Capital budgeting methods. Methods used to appraise an investment in fixed assets: Accounting rate of return, payback period, net present value, internal rate of return, profitability index.

Recommended Reading

1. Financial Management, Investment Decisions, G. Artikis, Interbooks, 2010.
2. Financial Management, Analysis and Planning, G. Artikis, Interbooks, 2010.
3. Managerial Accounting, Garrison & Noreen, Irwin McGraw-Hill, 11th Edition, 2006.

Course Code:	ΨΣ-ΤΔ-320
Course Title:	Advanced Telecommunication Technologies
Type of Course:	Compulsory
Year of Study/ Semester:	1st / 1st
ECTS Credits:	6
Faculty:	P. Demestichas, Professor A. Rouskas, Associate Professor K. Tsagkaris, Adjunct Lecturer

Objective

The course “Advanced Telecommunication Technologies” is about going into the structure and principles of the modern telecommunication technologies. It covers wired and wireless access and core network technologies, and paves the way in better comprehending the evolution towards Future Networks.

Course Contents

Introduction to Advanced Telecommunication Technologies. Introductory course on the most pioneer telecommunication technologies, presentation of the terms and current issues.

Wireless access systems, physical layer. The characteristics and functionalities of the system, as well as the role and functionality of the physical layer are presented in this session.

Mobile Networks technologies, 2G/ 2.5G/ 3G/ 3.5G/ 4G. The characteristics, functionalities and differences between the technologies are presented in this session.

Wireless access systems, WLAN, WMAN, WPAN. The characteristics, functionalities and differences between the technologies are presented in this session.

Wireless access networks, IMT-advanced technologies. The characteristics, functionalities and differences between the technologies are presented in this session.

Wireless access networks, 3G technologies. The characteristics and functionalities of the 3G technologies are presented in this session.

Core technologies, traffic engineering. Presentation of the core technologies and traffic engineering methodologies.

Wired access technologies (DSL, LAN, FTTx). The characteristics, functionalities and differences between the technologies are presented in this session.

Wireless internet technologies (Mobility and Transport Protocols). The characteristics and the functionalities of the wireless internet technologies, as well as the transport protocols and the term of mobility is presented in this session.

Future Internet – Advanced management techniques. The most current trend of the research activities is presented in this session, along with the most advanced management techniques.

Recommended Reading

1. Andrew Tanenbaum, "Computer Networks".
2. James Kurose, Keith Ross, "Computer Networking: A Top-Down Approach Featuring the Internet.
3. Jean Walrand, "High Speed Networks".
4. Jean Walrand, "Computer Networks: A First Course".
5. Travis Russell, "Telecommunications Protocols". Jean Walrand, “High Speed Networks”.
6. Jean Walrand, “Computer Networks: A First Course”.
7. Travis Russell, “Telecommunications Protocols”.

Course Code:	ΨΣ-ΤΔ-501
Course Title:	Network-Oriented Systems and Services
Type of Course:	Compulsory
Year of Study/ Semester:	1st / 1st
ECTS Credits:	6
Faculty:	G. Vassilacopoulos, Professor C. Doulkeridis, Lecturer

Objective

The objective of this course is to provide an overview of issues and technical challenges in the area of net-centric systems and services in which a lot of research effort is being devoted. The course introduces students to the basic concepts of net-centric systems and services and places particular emphasis on their techno-economic aspects. In this context, cost-benefit analysis and relevant project portfolio investment criteria are addressed and analyzed. Among the technologies addressed the following are included: business process management (BPM), service-oriented architectures, pervasive and ubiquitous computing, context-aware computing, smart places, ERP systems and cloud computing. Several applications of net-centric systems and services, emphasizing these technologies, in areas of current international interest such as e-government, e-business and e-health are also presented.

Course Contents

Basic concepts, advantages & disadvantages of net-centric systems and services, criteria for the investment in relevant technologies, acceptance management, change management.

E-services focusing on e-procurement, e-government, e-health, e-prescribing.

Business process management, service-oriented architectures, web-services.

Ubiquitous, pervasive systems (1): Main concepts, advantages-disadvantages, evaluation.

Ubiquitous, pervasive systems (2): Relevant technologies and benefits, context-awareness, smart phones, sensor networks.

Ubiquitous, pervasive systems (3): Applications on smart spaces, smart homes, smart offices.

ERP Systems (1): Introduction, objectives, operations, services provision, benefits.

ERP Systems (2): Case studies, example applications

Cloud computing (1): Basic concepts, new service provisioning model, pay-per-use.

Cloud computing (2): Software-as-a-Service (SaaS), Hardware-as-a-Service (HaaS), Platform-as-a-Service (PaaS).

Recommended Reading

1. M. Weiser, "The Computer for the 21st Century", Scientific American, Sept. 1991.
2. M. Satyanarayanan, "Pervasive Computing: Vision and Challenges", IEEE Personal Communications, 1991, p.p. 10-17, http://www-2.cs.cmu.edu/~aura/docdir/pcs01.pdf.
3. IEEE Pervasive Computing http://www.computer.org/portal/web/pervasive/.
4. Sachin G., Pervasive Computing Reading List http://www.cs.utah.edu/~sgoyal/pervasive/.
5. IBM Research Autonomic Computing, http://www.research.ibm.com/autonomic/.
6. Thomas H.Davenport, "Putting the Enterprise into the Enterprise System", Harvard Business Review, Vol.76, Issue 4, 1998.
7. IEEE Data Engineering Bulletin, Data Management on Cloud Computing Platforms, Volume 32, Number 1, March 2009.
8. Linthicum D.S. Cloud Computing and SOA Convergence in Your Enterprise, Addison-Wesley, 2010.
9. Holt J. A Pragmatic Guide to Business Process Management. 2nd Edition, BCS, 2009.

Course Code:	ΨΣ-ΤΔ-913
Course Title:	Technoeconomic Analysis
Type of Course:	Compulsory
Year of Study/ Semester:	1st / 1st
ECTS Credits:	6
Faculty:	D. Georgakellos

Objective

The main objective of this course is to introduce and familiarize the students with the techno-economic value analysis of new products or services. This will give them the skills to support the very important decision-making process within a company or organization.

Course Contents

Basic concepts in techno-economic analysis and technology management. Introduction to the main terms and purpose of the techno-economic analysis.

Innovations and business development. Product life cycle model development and presentation of the current situation in business development.

Techno-economic analysis at product business level and multi-technology analysis at corporate level. Presentation of different perspectives of techno-economic issues, both on product and corporate level.

Technology strategies, techno-economic systems framework, growth and diffusion. Presentation of the way a techno-economic system works and the way it can be diffused in the context of an organization.

Methodologies technology/ product planning. The methodologies, the factors that influence which technology will be chosen in each technoeconomic analysis are presented, as well as the way the results of the analysis influence the product planning.

Tools for technology/ product planning. Soft ware tools that can facilitate the process of the techno-economic analysis.

Value analysis based on techno-economic evaluation measures. Analysis of the results of different techno-economic analyses and evaluation procedures.

Technoeconomic analysis factors and examples.

Technoeconomic analysis case studies and discussions.

Technoeconomic analysis case studies and discussions.

Recommended Reading

1. G. Barbiroli "The Dynamics of Technology: A Methodological Framework for Techno-Economic Analyses (Theory and Decision Library A:)", Springer, 2010
2. Nagy K. Hanna "Enabling Enterprise Transformation: Business and Grassroots Innovation for the Knowledge Economy (Innovation, Technology, and Knowledge Management)", Springer, 2009

2nd Semester

Course Code:	ΨΣ-ΤΔ-909
Course Title:	Strategic Management of Digital Companies
Type of Course:	Compulsory
Year of Study/ Semester:	1st /2nd
ECTS Credits:	6
Faculty:	N. Georgopoulos

Objective

Methods for making techno-economical decisions in telecommunication enterprises and organisms.

Course contents

The course is concerned with the management of the organisation-the formulation and the implementation of corporate, business and functional strategies through the organisation's structure and processes. The course will consist of the following parts:

Strategic Analysis of the environment, industry, competition, stakeholder and pressure groups, and of the corporate capability. This analysis will be developed within the context of the increased complexity of change faced by tourism organisations and within the growing globalisation of business.

Strategic Decisions focuses upon the company's ability to identify the opportunities and threats inherent in environmental changes and to develop strategies to deal with these changes. An important consideration will be the benefits and implications of current methods used in developing strategies.

Strategic Action -the implementation of a strategy within the organisation's capabilities and its values- the concern here is with the creation of appropriate organisational structures, systems and cultures, and the role of the executive leadership in this process.

Selected Issues will include strategic alternatives open to Greek firms.

Recommended readings

1. Wheelen T., D. Hunger, (2010) 'Strategic Management & Business Policy', Pearson, 2010.
2. Johnson M, Scholes K and Whittington R., 'Exploring Corporate Strategy', Prentice Hall, 8th edition, 2010.
3. Barney Jay, Hesterly William, 'Strategic Management and Competitive Advantage: Concepts and Cases', Prentice Hall,3rd edition, 2010.
4. Lynch Richard, 'Corporate Strategy, Prentice Hall, 5th edition, 2009.
5. Ghemawat Pankaj, 'Strategy and the Business Landscape', Prentice Hall, 3rd edition, 2010.
6. Mintzberg H, Lambel J, Quinn J, Ghoshal S, 'The Strategy Process', 4th edition, 2003.
7. Hunger D and Wheelen T, 'Essentials of Strategic Management', Prentice Hall, 5th edition, 2011.
8. David F, 'Strategic Management Concepts', Prentice Hall, 12th edition 2009.
9. Carpenter Mason, Sanders Gerry, 'Strategic Management: A Dynamic Perspective' Prentice Hall, 2nd edition 2009.
10. Porter M, 'Competitive Strategy', Free Press, 1980.
11. Porter M, 'Competitive Advantage', Free Press 1985.

Course Code:	ΨΣ-ΤΔ-502
Course Title:	Advanced Information Systems
Type of Course:	Compulsory
Year of Study/ Semester:	1st / 2nd
ECTS Credits:	6
Faculty:	G. Vassilacopoulos, Professor

Objective

Human beings have the distinct ability to attach meaning to whatever they perceive. The data translation to information and attempt, in an organized manner to provide information so as to getting action, constitute the basis of the principle "information system". In this course, the notion of an information system in the context of an organisation is defined and particular emphasis is placed on the fact that an information system is essentially a special type of system which produces processes and distributes information to the appropriate receivers using a digital technology as a tool. Professionals in the field of information systems basically work on a) information generation from computers with the goal to aid the organization to define and achieve its goals, and b) the realization or improvement of processes of the organization with the use of appropriate digital technology. Thus, professionals in the field of information systems should be able to understand both the technological and the organizational factors, and must be able to help organization to determine how information and automated entrepreneurial processes can provide comparative advantages. These professionals play important role in determining the requirements for an information system of the organization and they participate actively in its specification, design and realization. Therefore, they must have deep knowledge of state-of-the-art digital technologies and must be acquainted with the

organizational principles and practices so that they contribute decisively in provisioning the systems and information that organization needs for supporting its operations. Furthermore these professionals determine the processes of evolution of information systems in order for novel comparative assets to be achieved for the organization through interoperability of existing systems themselves and the capitalization from the use state-of-the art digital technology, with parallel assurance of its earlier investments. In the context of the class particular emphasis will be given to the development of information systems for simulated realistic environments with the creation of state-of-the-art architectures that are based on the World Wide Web. In particular there will be developments of systems with the use of state-of-the-art process-oriented and service-oriented technologies.

Course Contents

Principles of systems analysis: Human activity systems, systems thinking, system approach to information systems, high level analysis methodologies, information systems types.

The organization as a system: Organizational framework of information systems, the organization concept in information systems, information systems leverage to re-organization.

Network-oriented systems strategy: Strategy for business value, linking network-oriented systems to business metrics, managing perceptions of network-oriented systems, creating and evolving a systems roadmap.

Sourcing and outsourcing: Advantages and disadvantages for ICT, software development and acquisition, appropriateness of outsourcing, outsourcing criteria, service level agreements, risk management.

Network-oriented systems costing and return-on-investment: Costing procedures, Technical, economic and financial feasibility, costing factors, cost estimation methods, return-on-investment estimation methods, case study.

Network-oriented systems evaluation: Successful evaluation framework, goal-oriented evaluation, goal-free evaluation, criteria-based evaluation, evaluation results, evaluation process and cost, systems evolution, evolution to process-oriented systems.

Network-oriented systems acceptance: Technology acceptance models (TAM model), influential factors (benefits, barriers, costs, pressures, support, IT infrastructure), exemplar case study.

Change management: Despair, denial, anger, anxiety, acceptance, practice, relief and motivation, sense of urgency, create coalition develop a vision, share the vision, clear obstacles, secure short time wins, consolidate and keep moving.

Risk management: Risk identification, analysis, planning and monitoring, examples and exercises.

Network-oriented systems governance: Governance and lack of governance, different types of SOA governance, SOA governance models, governance policies, stakeholders and roles, SOA governance lifecycle.

Recommended Reading

1. Vassilacopoulos G. (2011): Information Systems (in Greek).
2. Checkland P. and Holwell S. Information, Systems and Information Systems – Making sense of the field. Wiley, 2002.
3. Laudon K.C. and Laudon J.P. Management Information Systems – Managing the digital firm. Pearson, 2006.
4. O' Brien J.A. Management Information Systems – Managing information technology in the business enterprise. McGraw-Hill, 2004.

Course Code:	ΨΣ-ΤΔ-914
Course Title:	Network-Oriented Informational Systems' Governance
Type of Course:	Compulsory
Year of Study/ Semester:	1st / 2nd
ECTS Credits:	6
Faculty:	G. Artikis

Objective

The main objectives of the course are to introduce the main concepts of digital systems governance and project management and to study best practices in the area of project management such as the Project Management Body of Knowledge (PMBOK) of Project Management Institute (PMI) and PRINCE2, and to use such practices in project management and governance of digital systems.

Course Contents

Digital systems' governance and project management. Project definition, projects typology, triple constraint concept, a systems approach to project management, organizational influences.

Project information systems and services life cycles.

Project Management methodologies – Project Management Body of Knowledge (PMBOK)

Business cases of information technology projects (e.g. Measurable organizational value, feasibility study, Return on Investment, Cost Benefit Analysis).

Development of project charters and project plans. (COCOMO)

Managing projects using the Prince2 methodology (Starting up a project, Initiating a project, Directing a project, controlling a stage, Managing stage boundaries, Managing product delivery, closing a project). Comparison between Prince2 and PMBOK.

Risk Management and risk management methodology. Risk identification, analysis, planning and monitoring.

Change management and change management methodologies. Despair, denial, anger, anxiety, acceptance, practice, relief, motivation. Establish sense of urgency, create coalition develop a vision, share the vision, clear obstacles, secure short time wins, consolidate and keep moving.

Resource and Roles management (Project Sponsor, Project Manager, Team Members, Internal Stakeholders Vs External Stakeholders, Customers, Customer Representatives). Decisions related to implementation: Insourcing and outsourcing – Case study.

Governance and lack of governance, different types of governance, SOA governance models, governance policies, stakeholders and roles, SOA governance lifecycle.

Recommended Reading

1. Reed J, (2008): Project Management with PRINCE2 Best Practice Handbook: Building, Running and Managing Effective Project Management – Ready to use supporting documents bringing PRINCE2 Theory into Practice.
2. PMI Corporate authors, 2008, A Guide to the Project Management Body of Knowledge: (PMBOK Guide).
3. Project Management Institute (2004): A Guide to the Project Management Body of Knowledge, Third Edition (PMBOK Guides), Project Management Institute.

4. Nicholas J (2004): Project Management for Business and Engineering: Principles and Practice, Elsevier.

5. Phillips J (2004): IT Project Management: On Track From Start to Finish, McGraw-Hill.

6. Schwalbe K (2005): Information Technology Project Management, Thomson.

7. B. Maizlish and R. Handler (2005): IT Portfolio Management Step-by-Step: Unlocking the Business Value of Technology, Wiley.

8. J. Marchewka (2006): Information Technology Project Management: Providing Measurable Organizational Value, Wiley.

Course Code:	ΨΣ-ΤΔ-905
Course Title:	Managerial Finance
Type of Course:	Compulsory
Year of Study/ Semester:	1st / 2nd
ECTS Credits:	6
Faculty:	G. Artikis

Objective

The course aims to analyze how firms can finance capital expenditures, how financial managers estimate the cost of this financing and how analysts valuate firms using fundamental valuation methods.

Course Contents

Stock capital. Stock capital is the capital offered by shareholders. Stock capital can be raised by initial public offering, capitalization of good will, earnings or reserves.

Dividend policy. Dividend policy, which is the decision to pay out earnings as dividends or to retain and reinvest them in the firm, has three elements. First, what fraction of earnings should be paid out over time? Second, should the firm attempt to maintain a steady, stable dividend growth rate? Third, what amount should the firm pay in current dividends?

Leasing. One way of obtaining facilities and equipment is to buy them, but an alternative is to lease them. Today it is possible to lease virtually any kind of fixed asset. Leasing in some cases has advantages compared with other ways of financing.

Bond loans. Bond loan is another source of long term financing which a firm can use. In this case the loan is issued by the firm needed the capital, and therefore the firm has the opportunity to adapt the loan to its needs as opposed to bank loans that are issue by banks according to their interest.

Weighted average cost of capital. A firm's cost of capital, weighted average cost of capital, is critically important for three reasons. First, maximizing the value of the firm requires that the cost of all inputs, including capital, be minimizes. Second, capital budgeting decisions require an estimate of the cost of capital. Third, many other types of decision, like leasing, bonds etc, require estimates of cost of capital.

Cost of loans. In developing the firm's cost of capital, we first identify capital components, in turn determine the cost of each capital components, and finally we combine the component costs to form the weighted average cost of capital. Bond loans are one these capital components.

Cost of preferred stocks. The second capital component is preferred capital that is offered by investors who hold preferred stocks.

Cost of stocks. The third capital component is equity capital that is offered by investors who hold common stocks.

Cost of reverses. The fourth capital component is reserves that are earnings retained in the firm and not distributed as dividends to the investors who hold either preferred or common stocks.

Fundamental valuation. Valuation based on information other than that generating in stock markets is called fundamental valuation. This valuation is compared with stock market valuation to decide if the firm is over or under valuated.

Recommended Reading

1. Financial Management, Financing Decisions, G. Artikis, Interbooks, 2010.

Course Code:	ΨΣ-ΤΔ-911
Course Title:	Marketing of Digital Products and Services
Type of Course:	Compulsory
Year of Study/ Semester:	1st / 2nd
ECTS Credits:	6
Faculty:	A.Kouremenos

Objective

State-of-the-art practices for the promotion of products (technologies) and services in competitive environments.

Course Contents

Introduction to Marketing. Concept of Price, Product, Place and Promotion. Sales Administration.

Communication strategy. Case studies in Communication enterprises and organizations. Project assignment to groups of students: Cost accounting and Promotion of Telecommunication products and services in simulated markets based on marketing strategies. Theory, Exercises, Projects.

Recommended Reading

1. On the Move to Meaningful Internet Systems 2008, 2008, Springer-Verlag Berlin and Heidelberg GmbH & Co. KG, ISBN: 3540888705.

Major B. Digital Systems Security

1st Semester

Course Code:	ΨΣ-ΑΦ-801
Course Title:	Security Principles and Foundations
Type of Course:	Compulsory
Year of Study/ Semester:	1st / 1st
ECTS Credits:	6
Faculty:	K. Lambrinoudakis, Associate Professor S. Katsikas, Professor

Objective

The main objective of the course is the familiarization of the students with the terminology and main principles of the Information Systems Security area, thus ensuring a common understanding among the students. Methodologies for analyzing and managing in a systematic way the risk of an information system will be presented in detail, while the main principles for specifying the security policy of an organization will be also discussed.

Course Contents

Information and Communication Systems Security Terminology: Definitions and Principles.

Methodologies for the elicitation of Security and Privacy Requirements.

Need and scientific foundation of 'Risk Analysis'. Presentation of alternative approaches.

Best practices for Risk Management and for the identification of the appropriate security measures.

Detailed presentation of the CRAMM Risk Analysis and Management Method.

Legal Framework for the protection of personal and sensitive data.

Security Policies: Principles, Alternative Approaches, Required Characteristics.

Case Study: Presenting privacy enhancing techniques in a VoIP environment.

Security and Privacy Requirements in Service Oriented Systems and specifically in Health Information Systems, Electronic Government Systems and the Financial sector.

Recommended Reading

1. "Securing Information and Communication Systems: Principles, Technologies and Applications", S. Furnell, S. Katsikas, J. Lopez and A. Patel (Eds.), Artech House, 2008.
2. S. Furnell, S. Katsikas, J. Lopez, A. Patel, (2008): Securing Information and Communications Systems, Principles Technologies and Applications, Artech House.
3. J. Vacca (2009): Computer and Information Security Handbook, Morgan Kaufmann.
4. W. Stallings (2000): Network Security Essentials: Applications and Standards, Prentice Hall.
5. R. Oppliger (2002)Q: Internet and Intranet Security, Artech House.
6. W. Ford (1994): Computer Communication Security, Prentice Hall.

Course Code:	ΨΣ-ΑΦ-813
Course Title:	Internet and Web Applications Security
Type of Course:	Compulsory
Year of Study/ Semester:	1st / 1st
ECTS Credits:	6
Faculty:	C. Xenakis, Assistant Professor

Objective

The main objective of this lesson is to study and analyze the security issues encountered in computer networks and services. It focuses on wired networks, which are based on the Internet technology, that provide computer communications and networked services. More specifically, we present and analyze the security requirements (both from user and network point of view) as well as the particular technologies, mechanisms and protocols that protect them. Finally, we pinpoint the open issues that constitute subjects of the current research.

Course Contents

Introduction to network security, security requirements, attacks that target the network operation and the provided services, basic security services and mechanisms. Basic tools that protect networks, confidentiality, and applications of conventional cryptography. Applications of asymmetric cryptography, public key infrastructure, and introduction to the concept of trust. Authentication mechanisms, trust management mechanisms and reputation management models. Security mechanisms at the application layer, Pretty Good Privacy. Security mechanisms at the network layer, IPsec. Security at world wide web, SSL, SSH, SET . Network attacks and protection using firewalls. Malicious Software and malicious behaviors. Intrusion attacks and Intrusion Detection Systems

Recommended Reading

1. William Stallings, (2007): Network Security Essentials: Applications and Standards, 3/E, Publisher: Prentice Hall.
2. John R. Vacca, (2009): Computer and Information Security Handbook, Publisher: Morgan Kaufmann Publishers, Elsevier.

Course Code:	ΨΣ-ΑΦ-804
Course Title:	Cryptography
Type of Course:	Compulsory
Year of Study/ Semester:	1st / 1st
ECTS Credits:	6
Faculty:	D. Lekkas P. Rizomiliotis

Objective

The main objective of this lesson is to study and analyze the fundamental issues of the theory of cryptography, as well as the applications of cryptography on computer science and networks.

Course Contents

Basic concepts of security and cryptography. Historical review and presentation of the basic cryptographic systems. Mono-alphabetic substitution, poly-alphabetic substitution, permutation algorithms, modular arithmetic. Symmetric cipher algorithm, block ciphering, stream ciphering, feistel structure, DES and 3DES algorithms. Asymmetric cipher algorithms, principles and basic operations, the RSA algorithm. Modular Exponentiation, Diffie-Hellman key exchange, hybrid cryptography. Hash functions, Birthday attack, Collisions, the function SHA-1, Steganography. Digital signatures, public key infrastructure, digital certificates, application of asymmetric cryptography. Certification services, hierarchical schemes, cross certification, architectures of trust, value added services. Applications of cryptography, electronic passport, electronic vote, electronic payments.

Recommended Reading

1. B. Schneier (1996): Applied Cryptography. John Wiley & Sons, Inc., 2nd edition.
2. Menezes, Oorschot, Vanstone (2001): Handbook of Applied Cryptography, CRC Press.
3. N. Ferguson, B. Schneier (2003): Practical Cryptography. Wiley
4. Mao, W. (2003): Modern Cryptography : Theory and Practice. Prentice Hall
5. Stinson, D. (2005): Cryptography: Theory and Practice. Third Edition, CRC Press
6. John Hershey (2003): Cryptography Demystified, McGraw-Hill Professional
7. David Kahn (1996): The Codebreakers. Scribner
8. Simon Singh (1999): The Code Book, The secret history of Codes and Code-Breaking

Course Code:	ΨΣ-ΑΦ-814
Course Title:	Computer Security and Information Integrity
Type of Course:	Compulsory
Year of Study/ Semester:	1st / 1st
ECTS Credits:	6
Faculty:	S. Katsikas, Professor D .Gritzalis

Objective

The objective of the course is the detail presentation and study of various information security management techniques, methods and policies. The students will gain specialized knowledge and skills for their application.

Course Contents

Information Security Management: Definition and General Principles of Information Security Management Systems (ISMSs). Information Security Management and related International Standards (ISO 2700x family of standards). Information Security Approaches. Organizational Security Policies and Codes of Conduct.

Information Security Policies and Techniques: Access Control Policies,Formal Policies and Models,Authorization Policies,Authorization Policies in Information Workflows. Information Security Assurance and Evaluation of systems and products: Aim, Assurance Issues and Methods, Evaluation Criteria and Schemes (i.e. ITSEC, TCSEC, Common Criteria). Business Continuity: Categories of Plans, Phases and Steps for the Design and Implementation, Contents. Information Security Awareness – Training – Education. Critical Infrastructures Information Security. Information Security Auditing.

Recommended Reading

1. Furnell, S., Katsikas, S., Lopez, J. & Patel A. (2008): Securing Information and Communication Systems. Principles, Technologies and Applications, Artech House.
2. Acquisti, A., Gritzalis, S., Lambrinoudakis, C., De Capitani di Vimercati S. (2008): Digital Privacy, Theory Technologies and Practices, Auerbach Publications.
3. Summers, R.C. (1997): Secure Computing: Threats and Safeguards, McGraw-Hill.
4. Peltier, T. (1999): Information Security, Policy and Procedures: a Practitioner's Reference, CRC Press LLC.
5. ENISA (2008). A new Users' Guide: How to Raise Information Security Awareness. European Network and Information Security Agency. Available at: http://www.enisa.europa.eu/doc/pdf/deliverables/new_ar_users_guide.pdf.

Course Code:	ΨΣ-ΑΦ-817
Course Title:	Best Security Practicies and Privacy Protection
Type of Course:	Compulsory
Year of Study/ Semester:	1st / 1st
ECTS Credits:	6
Faculty:	C. Xenakis, Assistant Professor C. Ntantogian

Objective

This course provides hands-on experience in configuring and experimenting with commodity networked systems and security software in a live laboratory environment, with the purpose of understanding real-world security threats in various networking scenarios (e.g., operating systems, wireless networks, Internet, etc.). This course will take both offensive and defensive approaches and expose students to a variety of real-world attacks.

Course Contents

Exploitation techniques and buffer overflows. Non-privileged user access methods to remote networks and workstations. Footprinting and social engineering. Password breaking and packet sniffing/data leakage. Attacks in websites and web services. Countermeasures and protection. Network Vulnerability scanning and evaluation of the results. Network Penetration testing and evaluation of the results. Firewalls and virtual private networks configuration. Deployment of Intrusion detection systems. Evaluation and testing of various WLAN security mechanisms. Evaluation and testing of system authorization mechanisms. Application and evaluation of digital certificates/signatures security schemes.

Recommended Reading

1. Chris Anley, John Heasman, Felix Lindner and Gerardo Richarte: The Shellcoder's Handbook: Discovering and Exploiting Security Holes, Wiley, Aug 2007.
2. Jon Erickson: Hacking: The Art of Exploitation, 2nd Edition, No Starch Press Jan 2008.
3. Justin Clarke: SQL Injection Attacks and Defense, Syngress, May 2009.

4. Dafydd Stuttard and Marcus Pinto: The Web Application Hacker's Handbook: Discovering and Exploiting Security Flaws, Wiley, Oct 2007.
5. Lecturer's Notes.

2nd Semester

Course Code:	ΨΣ-ΑΦ-815
Course Title:	Network Oriented Information Systems Security, Privacy and Trust
Type of Course:	Compulsory
Year of Study/ Semester:	1st / 2nd
ECTS Credits:	6
Faculty:	K. Lambrinoudakis, Associate Professor S. Katsikas, Professor

Objective

This course enables students to become familiar with the technological, procedural and organizational methods followed for the provision of the basic security characteristics and privacy protection at an information system.

Course Contents

Best Practices for addressing Information Systems security and privacy protection.

Alternative methods for the identification and elicitation of security and privacy Requirements.

Operating System Security parameters and mechanisms. Main principles for the design and development of secure operating systems.

Alternative techniques for identification and authentication: Authentication Categories, Authentication Data, Authentication Systems, Biometric Systems.

Presentation of the Access Control Mechanisms, focussing on Access Matrix, Access Control Lists, Capabilities Lists and protection rings.

Presentation of the access control mechanisms in Unix and Windows.

Policy description languages and techniques for their enforcement (XML, XACML, Web Services).

Hardware security and presentation of the (fabrication and operational) characteristics of smartcards.

Database security services with emphasis on access control and authorization as well as on various types of Role Based access control.

Analysis of the security issues in object-oriented, distributed and federated databases. Furthermore the potential security and privacy violation problems in data mining systems will be addressed.

Security Economics: Techniques for estimating the optimal security investment amount as well as for exploiting the feasibility to transfer risks to an insurance company.

Recommended Reading

1. A. Acquisti, S. Gritzalis, C. Lambrinoudakis, S. de Capitani di Vimercati (2008) : Digital Privacy : Theory, Technologies and Practices, Artech House.
2. S. Furnell, S. Katsikas, J. Lopez, A. Patel, (2008): Securing Information and Communications Systems, Principles Technologies and Applications, Artech House.

3. S. Gritzalis, T. Karygiannis and C. Skiannis, (2009): Security and Privacy in Wireless and Mobile Networking, Troubador Publishing.

4. J. Lopez and J. Zhou (Eds.) (2008): Wireless Sensor Network Security, IOS Press

5. J. Vacca (2009): Computer and Information Security Handbook, Morgan Kaufmann.

6. Scientific papers, notes and/or books that will be recommended.

Course Code:	ΨΣ-ΑΦ-816
Course Title:	Mobile Internet Security
Type of Course:	Compulsory
Year of Study/ Semester:	1st / 2nd
ECTS Credits:	6
Faculty:	C. Xenakis, Assistant Professor

Objective

The main objective of this lesson is to study and analyze the security issues encountered in next generation mobile and wireless networks. These networks integrate heterogeneous technologies providing a wide range of multimedia applications and services to mobile users, independently of their location. Moreover, they realize the concept of Mobile Internet.

Course Contents

Introduction to mobile/wireless network security, mobile internet, security requirements and challenges. Security in Wireless Local Area Networks (WLANs), security vulnerabilities and possible attacks. The IEEE 802.11i standard, the included security mechanisms and the provided security services Evaluation of the security mechanisms of IEEE 802.11i that provide confidentiality, authentication and key management. Security in mobile ad hoc networks and the Internet of Things. Security in the Global System for Mobile Communication (GSM) and the General Packet Radio Services (GPRS) . Security in the Universal Mobile Telecommunication System (UMTS) . Security in the Worldwide Interoperability for Microwave Access (WiMAX) . Security in wireless community networks and MESH networks. Security in heterogeneous 4th generation integrated networks.

Recommended Reading

1. Stefanos Gritzalis, Tom Karygiannis and Charalabos Skianis (editors) (2009): Security and Privacy in Mobile and Wireless Networking, Troubador Publishing Ltd, February 2009.

2. Yan Zhang, Jun Zheng and Miao Ma, (editors): Handbook of Research on Wireless Security, Information Science Reference, February 2008.

Course Code:	ΨΣ-ΑΦ-819
Course Title:	Secure Software Development in Service Oriented Architectures
Type of Course:	Compulsory
Year of Study/ Semester:	1st / 2nd
ECTS Credits:	6
Faculty:	C. Xenakis, Assistant Professor C. Ntantogian

Objective

The objective of this course is the study and analysis of secure programming and application development methods for the provision of secure services in service oriented architectures. The students will gain the essential background knowledge and specialized skills in order to develop and materialize advanced services that support high level security and are robust to an array of attacks.

Course Contents

Presentation and analysis of secure software development practices. Definition of critical parameters and metrics for the evaluation of software from security viewpoint. Presentation and analysis of virus programming code. Worms' propagation techniques. Identification and detection of malware software. Antivirus software analysis. Presentation, analysis and application of intrusion detection engines. Presentation, analysis and application of content and data protection mechanisms. Presentation, analysis and application of security mechanism in databases. Presentation, analysis and application of secure development of dynamic web pages.

Presentation, analysis and application of security mechanisms for service oriented architectures.

Presentation, analysis and application of security mechanisms for cloud computing.

Recommended Reading

Diomidis Spinellis and Georgios Gousios, editors. Beautiful Architecture: Leading Thinkers Reveal the Hidden Beauty in Software Design. O'Reilly, 2009. ISBN 9780596517984.

Course Code:	ΨΣ-ΑΦ-818
Course Title:	Security Services and Technologies for Electronic Transactions
Type of Course:	Compulsory
Year of Study/ Semester:	1st / 2nd
ECTS Credits:	6
Faculty:	S. Katsikas, Professor S. Gritzalis P. Rizomiliotis

Objective

The course comprises a series of lectures by known researchers of Greek and European Universities and aims at exposing the students to the latest developments in the field of Information and Communication Systems Security, as well as in the field of Privacy Protection. Emphasis is given on new technologies and means to address security and privacy issues and on current research activities. The learning objective of the course is to make the students aware of current issues of research interest in the fields of Information and Communication Systems Security and Privacy and to familiarize them with the latest developments on solutions to these issues.

Course Contents

The exact contents of the course change every time the course is given, according to the subjects that the lecturers choose to cover, in co-operation with the course coordinator, so that overlaps are avoided.

Access control or usage control?. XML Security. RFID Security & Privacy. Privacy in emerging scenarios of the Information Society. Design and implementation of trusted electronic voting systems. Security issues and

recommendations for online social networks. Best practices in applying cryptographic techniques. Authenticated Key Establishment in Modern Telecommunication Systems. The impact of new technologies on privacy protection. Digital Forensics methodologies.

Recommended Reading

1. Acquisti, S. Gritzalis, C. Lambrinoudakis, S. de Capitani di Vimercati (2008) : Digital Privacy : Theory, Technologies and Practices, Artech House.
2. S. Furnell, S. Katsikas, J. Lopez, A. Patel, (2008): Securing Information and Communications Systems, Principles Technologies and Applications, Artech House.
3. S. Gritzalis, T. Karygiannis and C. Skiannis, (2009): Security and Privacy in Wireless and Mobile Networking, Troubador Publishing.
4. J. Vacca (2009): Computer and Information Security Handbook, Morgan Kaufmann.
5. Scientific papers, notes and/or books that are recommended by each lecturer.

Course Code:	ΨΣ-ΑΦ-810
Course Title:	Socio-Economical Aspects of Security
Type of Course:	Compulsory
Year of Study/ Semester:	1st / 2nd
ECTS Credits:	6
Faculty:	L. Mitrou

Objective

The objective of the course is to offer to the students an overview of the social, economical and institutional issues which pertain to the ICTs and especially to security. The knowledge of the regulatory context of ICTs and of the main legal rules and principles allows the students to integrate their technical knowledge in a wider social, economical and institutional context. Understanding the requirements of the socio-economic environment and the regulatory system is of major importance, since it enhances the inter-disciplinary knowledge and approach and also provides the students with a wider range of skills which prove to be useful for their professional carrier.

Course Contents

Specific issues of data security and data protection: conflict and harmonisation of security and data protection requirements (especially in the case of employees' monitoring), privacy protection in the Web (search engines, social networking etc), medical data in Hospital information systems and communications secrecy. Economic aspects of data security and data protection. Intellectual property in the Information Society: software and database protection, open source, licences, issues relating to peer to peer. Freedom of speech, rights and powers in the Information Society – Blogs –Forums, filtering and censorship. Cybercrime and Computer crime: ethical, social, legal and economical aspects. Penal law and Information and Communications Technologies. Legal issues in the framework of Computer/Internet Forensics.

2.6 Ph.D. Programme

This is a research programme leading to a Ph.D. degree in «Digital Systems» with research focusing namely the following areas:

- Network Oriented Systems and Services
- Digital Health Services
- Telecommunication Networks and Integrated Services
- Security Systems
- Intelligent Systems and Multimedia Technologies
- Telecommunication Systems
- Technology – enhanced Learning

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