



**University of Macedonia  
School of Information Science  
Department of Applied Informatics**

# **Master of Science in Applied Informatics**

**Course Guide  
*Academic Year 2017-2018***

**Thessaloniki**

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## **1. Introduction**

The Graduate Program has been offered by the Department of Applied Informatics since 2003-2004, with initial funding from the Operational Program for Education and Initial Vocational Training of the Hellenic Ministry of National Education and Religious Affairs. Since 2005-2006 it has been a self-funded Program. The Specializations of the Master's Program were also offered at the Technical Educational Institution (TEI) of Western Macedonia, Kozani campus until the academic year 2013-14 in cooperation with the Departments of Business Administration and Electrical Engineering there.

Since the academic year 2014-2015 the Master's Program of the Department of Applied Informatics of the School of Information Science has been operating under a new curriculum entitled "M.Sc. in Applied Informatics".

The Graduate Program of the Department of Applied Informatics offers an M.Sc. degree in Applied Informatics in one of the following Specializations:

1. Computer Systems and Network Technologies
2. Computational Methods and Applications
3. Business Computing
4. E-Business and Innovation Technology

## **2. Aim - Fields of study**

The M.Sc. in Applied Informatics offers high quality graduate level education in Informatics and equips its graduates with a strong background, experience and know-how for the adoption of best practices in applying computing knowledge to meeting society's needs in economics, management and education.

The main goals of the M.Sc. in Applied Informatics are to:

- provide high quality graduate level studies
- offer state-of-the-art computing knowledge
- combine systems, methodology and software in problem-solving
- develop and manage processes for the management of digital economy
- train professionals with the necessary skills for a successful career in the private, public and academic sector.
- prepare students for doctoral studies

Field of study for each specialization:

### **1. Computer Systems and Network Technologies**

This specialization includes all those knowledge areas that deal with technologies of networked computer systems, ranging from the operating system and database management system, to application software, networking and good practices implementing large IT projects.

In this specialization are found the following knowledge areas of ACM Curriculum CS 2013 are included: AR (Architecture and Organization); IAS (Information Assurance and Security); IM (Information Management); NC (Networking and Communications); OS (Operating

Systems);

PBD (Platform-based Development); PD (Parallel and Distributed Computing); and SE (Software Engineering).

## **2. Computational Methods and Applications**

This specialization includes all those knowledge areas that deal with solving complex computational problems, by using abstract models (mathematics, data structures and algorithms) which will then be implemented as software that will be integrated into the core of integrated computing systems.

In this specialization are found the following knowledge areas of ACM Curriculum CS 2013) are included: AL (Algorithms and Complexity); CN (Computational Science); DS (Discrete Structures); GV (Graphics and Visual Computing); HCI (Human-Computer Interaction); IS (Intelligent Systems); and PL (Programming Languages).

## **3. Business Computing**

Offers expertise in Information Technology, Business Administration and Economics. It prepares students to cover the gap between business and technology and offers the best combination of technical, managerial and financial knowledge, shaping the identity of the modern business executive that meets the needs of both business and public administration in the Greek and international area.

## **4. E-Business and Innovation Technology**

The interdisciplinary character facilitates the acquisition of knowledge both in information technology (ICT) and information systems, as well as practices in e/m business and social media so as to provide participants with the necessary skills for the successful development of startups or the transformation of existing businesses.

All staff involved in the Graduate Program are committed to providing high quality services incorporating the latest teaching methods and the most up-to-date developments in the subject areas involved.

## **3. Duration**

The full-time M.Sc. degree requires three (3) academic semesters. The part-time M.Sc. degree requires five (5) academic semesters.

## **4. Program of studies**

One academic semester consists of thirteen (13) weeks. The course begins on the Monday of the first full week of October. All courses, comprising lectures and laboratories, are for three (3) hours a week.

The sum of all Graduate courses is equal to 90 ECTS credits, and particularly 30 ECTS credits per semester, that is 7.5 ECTS credits per course and 30 ECTS credits for the M.Sc. thesis. The directions of the M.Sc. program can vary depending on the decision of the General Assembly of Special Composition of the Department of Applied Informatics.

The courses include teaching, lab exercises and exams. Each graduate student has to attend and successfully complete eight (8) courses, four (4) during each of the first two semesters. During the third semester the student has to prepare and be examined on his/her M.Sc. thesis.

The Graduate Program offers students the student the possibility of attending additional courses. More specifically, students who choose to do an additional course will have the same rights but also the same obligations as other students. They will be required to: (i) pay the corresponding cost of the additional course on the dates appointed by the Secretariat, (ii) attend the course and sign the relevant attendance sheet, (iii) submit the required assignments, and (iv) take the set examinations for that course. The Secretariat of the Graduate Program is in a position to issue either certification of attendance to the additional course or an official detailed transcript stating attendance to the additional course. However, it should be noted that there will be a statement in the transcript to the effect that the student's cumulative grade point average does not include the grade of the additional course(s).

All courses are taught either in Greek or in English.

The syllabus of the full-time study for each specialization is the following:

## 4.1 Courses of the 1<sup>st</sup> specialization “Computer Systems and Network Technologies”

### 1st Semester (30 ECTS)

Students may choose: either 4 courses from Table 1.A., or 3 courses from Table 1.A. together with 1 elective course from some other stream of specialization.

Table 1.A	
	ECTS
Cryptography	7.5
Advanced Computer Architecture	7.5
Advanced Software Engineering	7.5
Advanced Computer Networks	7.5
Concurrent and Distributed Systems	7.5

### 2nd Semester (30 ECTS)

Students may choose: either 4 courses from Table 1.B., or 3 courses from Table 1.B. together with 1 elective course from some other specialization.

Table 1.B	
	ECTS
Web and Mobile Application Development	7.5
Information Security in the Internet Age	7.5
Ubiquitous Communications, Clouds, and Big Data	7.5
Topics in Database Technology	7.5
Practical Issues in Computer Networks and Internetworks	7.5
Serious Games Programming	7.5

### Third semester

	ECTS
Master/[OR]/Master’s thesis	30

## 4.2 Courses of the 2<sup>nd</sup> specialization “Computational Methods and Applications”

### 1st Semester (30 ECTS)

Students may choose: either 4 courses from Table 2.A., or 3 courses from Table 2.A. together with 1 elective course from some other specialization.

Table 2.A	
	ECTS
Optimization	7.5
Data Structures and Algorithms	7.5
Heuristic Methods	7.5
Simulation Methods	7.5
Advanced Artificial Intelligence	7.5

### 2nd Semester (30 ECTS)

Students may choose: either 4 courses from Table 2.B., or 3 courses from Table 2.B. together with 1 elective course from some other specialization.

Table 2.B	
	ECTS
Algorithmic Game Theory	7.5
Data Mining	7.5
Modeling and Decision Making	7.5
Parallel Computing	7.5
Agent Oriented Programming	7.5
Statistical Data Analysis	7.5

### Third semester

	ECTS
Master/[OR]/Master’s thesis	30

### 4.3 Courses of the 3<sup>rd</sup> specialization “Business Computing”

#### 1st Semester (30 ECTS)

All four courses of Table 3.A are compulsory.

Table 3.A – Compulsory courses	
	ECTS
Object-Oriented Software Development	7.5
Databases	7.5
Computer Systems and Networks	7.5
Financial Accounting Systems	7.5

#### 2nd Semester (30 ECTS)

Students may choose: either 4 courses from Table 3.B., or 3 courses from Table 3.B. together with 1 elective course from some other specialization.

Table 3.B	
	ECTS
Business Process Intelligence	7.5
Legal Issues of Informatics and e-Business	7.5
Simulation and Quality control of processes	7.5
Cost Accounting Systems	7.5
Information Systems in Financial Analysis and Management	7.5
Computational Estimation Techniques	7.5

#### Third semester

	ECTS
Master/[OR]/Master’s thesis	30



#### 4.4 Courses of the 4<sup>th</sup> specialization “E-Business & Innovation Technology”

##### 1st Semester (30 ECTS)

Students have to attend the 1st course quoted in Table 4.A.1 and can choose: either 3 courses from Table 4.A.2, or 2 courses from Table 4.A.2 and 1 elective course from some other specialization.

Table 4.A.1 - Compulsory	
	ECTS
IT Infrastructure	7.5

Table 4.A.2	
	ECTS
IS/ICT Management	7.5
Digital Business Strategy	7.5
Cloud Technologies and Web Analytics	7.5
Digital Economy and Business	7.5

##### 2nd Semester (30 ECTS)

Students have to attend: either 4 courses from Table 4.B, or 3 courses from Table 4.B and 1 elective course from some other specialization.

Table 4.B	
	ECTS
Start-up Entrepreneurship	7.5
Innovation Management in Digital Enterprises	7.5
Innovative e-Business Systems	7.5
m-Business & e-Commerce Technologies	7.5
Digital Marketing & Social Networking	7.5

##### Third semester

	ECTS
Master/[OR]/Master's thesis	30

The M.Sc. may also be supported by workshops.

Below are: the curriculum, the course content, and the teaching staff for the academic year 2017-18.

## 5. Curriculum for the academic year 2017-2018

### 5.1 1<sup>st</sup> Specialization: “Computer Systems and Network Technologies”

#### 1st Semester

##### Elective Courses

<b>α/α</b>	<b>Course</b>	<b>Teaching Staff</b>
[1]	Cryptography	<b>Petridou Sofia</b> , Lecturer, dpt. of Applied Informatics, UOM
[2]	Advanced Computer Architecture	<b>Roumeliotis Manos</b> , Professor, dpt. of Applied Informatics, UOM
[3]	Advanced Software Engineering	<b>Chatzigeorgiou Alexandros</b> , Professor, dpt. of Applied Informatics, UOM
[4]	Advanced Computer Networks	<b>Fouliras Panayotis</b> , Assistant Professor, dpt. of Applied Informatics, UOM
[5]	Concurrent and Distributed Systems	<b>Margaritis Konstantinos</b> , Professor, dpt. of Applied Informatics, UOM <b>Kaskalis Theodoros</b> , Associate Professor, dpt. of Applied Informatics, UOM

#### 2nd Semester

##### Elective Courses

<b>α/α</b>	<b>Course</b>	<b>Teaching Staff</b>
[1]	Web and Mobile Application Development	<b>Kaskalis Theodoros</b> , Associate Professor, dpt. of Applied Informatics, UOM
[2]	Information Security in the Internet Age	<b>Mavridis Ioannis</b> , Professor, dpt. of Applied Informatics, UOM
[3]	Ubiquitous Communications, Clouds, and Big Data	<b>Psannis Konstantinos</b> , Assistant Professor, dpt. of Applied Informatics, UOM
[4]	Topics in Database Technology	<b>Evangelidis Georgios</b> , Professor, dpt. of Applied Informatics, UOM <b>Koloniari Georgia</b> , Assistant Professor, dpt. of Applied Informatics, UOM
[5]	Practical Issues in Computer Networks and Internetworks	<b>Mamatas Eleftherios</b> , Assistant Professor, dpt. of Applied Informatics, UOM
[6]	Serious Games Programming	<b>Xinogalos Stylianos</b> , Assistant Professor, dpt. of Applied Informatics, UOM

## 5.2 2<sup>nd</sup> Specialization: “Computational Methods and Applications”

### 1st Semester

#### Elective Courses

<b>α/α</b>	<b>Course</b>	<b>Teaching Staff</b>
[1]	Optimization	<b>Samaras Nikolaos</b> , Professor, dpt. of Applied Informatics, UOM <b>Hristu- Varsakelis Dimitrios</b> , Associate Professor, dpt. of Applied Informatics, UOM
[2]	Data Structures and Algorithms	<b>Satratzemi Maya</b> , Professor, dpt. of Applied Informatics, UOM
[3]	Heuristic Methods	<b>Sifaleras Aggelos</b> , Assistant Professor, dpt. of Applied Informatics, UOM
[4]	Simulation Methods	<b>Souravlas Stavros</b> , Lecturer, dpt. of Applied Informatics, UOM
[5]	Advanced Artificial Intelligence	<b>Refanidis Ioannis</b> , Professor, dpt. of Applied Informatics, UOM <b>Sakellariou Ilias</b> , Assistant Professor, dpt. of Applied Informatics, UOM

### 2nd Semester

#### Elective Courses

<b>α/α</b>	<b>Course</b>	<b>Teaching Staff</b>
[1]	Algorithmic Game Theory	<b>Refanidis Ioannis</b> , Professor, dpt. of Applied Informatics, UOM
[2]	Data Mining	<b>Evangelidis Georgios</b> , Professor, dpt. of Applied Informatics, UOM <b>Koloniari Georgia</b> , Assistant Professor, dpt. of Applied Informatics, UOM
[3]	Modeling and Decision Making	<b>Samaras Nikolaos</b> , Professor, dpt. of Applied Informatics, UOM <b>Hristu-Varsakelis Dimitrios</b> , Associate Professor, dpt. of Applied Informatics, UOM
[4]	Parallel Computing	<b>Margaritis Konstantinos</b> , Professor, dpt. of Applied Informatics, UOM
[5]	Agent Oriented Programming	<b>Sakellariou Ilias</b> , Assistant Professor, dpt. of Applied Informatics, UOM
[6]	Statistical Data Analysis	<b>Papanastasiou Dimitrios</b> , Professor, dpt. of Applied Informatics, UOM

### 5.3 3<sup>rd</sup> Specialization: “Business Computing”

#### 1st Semester

##### Compulsory Courses

<b><math>\alpha/\alpha</math></b>	<b>Course</b>	<b>Teaching Staff</b>
[1]	Object-Oriented Software Development	<b>Chatzigeorgiou Alexandros</b> , Professor, dpt. of Applied Informatics, UOM <b>Xinogalos Stylianos</b> , Assistant Professor, dpt. of Applied Informatics, UOM
[2]	Databases	<b>Dervos Dimitrios</b> , Professor, dpt. of Computer Engineering, TEITHE <b>Evangelidis Georgios</b> , Professor, dpt. of Applied Informatics, UOM
[3]	Computer Systems and Networks	<b>Papadimitriou Panagiotis</b> , Lecturer, dpt. of Applied Informatics, UOM
[4]	Financial Accounting Systems	<b>Vazakidis Athanasios</b> , Professor, dpt. of Applied Informatics, UOM <b>Stavropoulos Antonios</b> , Associate Professor, dpt. of Applied Informatics, UOM

#### 2nd Semester

##### Elective Courses

<b><math>\alpha/\alpha</math></b>	<b>Course</b>	<b>Teaching Staff</b>
[1]	Business Process Intelligence	<b>Vergidis Konstantinos</b> , Assistant Professor, dpt. of Applied Informatics, UOM
[2]	Legal Issues of Informatics and e-Business	<b>Alexandropoulou Evgenia</b> , Professor, dpt. of Applied Informatics, UOM
[3]	Simulation and Quality Control of Processes	<b>Nikolaidis Yiannis</b> , Associate Professor, dpt. of Applied Informatics, UOM
[4]	Cost Accounting Systems	<b>Vazakidis Athanasios</b> , Professor, dpt. of Applied Informatics, UOM
[5]	Information Systems in Financial Analysis and Management	<b>Dasilas Apostolos</b> , Assistant Professor, dpt. of Applied Informatics, UOM
[6]	Computational Estimation Techniques	<b>Dritsakis Nikolaos</b> , Professor, dpt. of Applied Informatics, UOM

## 5.4 4<sup>th</sup> Specialization “E-Business & Innovation Technology”

### 1st Semester

#### Compulsory Course

<b>α/α</b>	<b>Course</b>	<b>Teaching Staff</b>
[1]	IT Infrastructure	<b>Psannis Konstantinos</b> , Assistant Professor, dpt. of Applied Informatics, UOM <b>Koloniari Georgia</b> , Assistant Professor, dpt. of Applied Informatics, UOM

#### Elective Courses

<b>α/α</b>	<b>Course</b>	<b>Teaching Staff</b>
[1]	IS/ICT Management	<b>Manthou Vasiliki</b> , Professor, dpt. of Applied Informatics, UOM
[2]	Digital Business Strategy	<b>Kitsios Fotios</b> , Assistant Professor, dpt. of Applied Informatics, UOM
[3]	Cloud Technologies and Web Analytics	<b>Georgiadis Christos</b> , Associate Professor, dpt. of Applied Informatics, UOM <b>Papadimitriou Panagiotis</b> , Lecturer, dpt. of Applied Informatics, UOM
[4]	Digital Economy and Business	<b>Stiakakis Emmanuel</b> , Associate Professor, dpt. of Applied Informatics, UOM

### 2nd Semester

#### Elective Courses

<b>α/α</b>	<b>Course</b>	<b>Teaching Staff</b>
[1]	Start-up Entrepreneurship	<b>Fouskas Kostantinos</b> , Assistant Professor, dpt. of Applied Informatics, UOM
[2]	Innovation Management in Digital Enterprises	<b>Kitsios Fotios</b> , Assistant Professor, dpt. of Applied Informatics, UOM <b>Stiakakis Emmanuel</b> , Associate Professor, dpt. of Applied Informatics, UOM
[3]	Innovative e-Business Systems	<b>Tambouris Efthimios</b> , Associate Professor, dpt. of Applied Informatics, UOM
[4]	m-Business & e-Commerce Technologies	<b>Georgiadis Christos</b> , Associate Professor, dpt. of Applied Informatics, UOM
[5]	Digital Marketing & Social Networking	<b>Vlachopoulou Maro</b> , Professor, dpt. of Applied Informatics, UOM

## 6. Course Content

### 6.1 1<sup>st</sup> Specialization: “Computer Systems and Network Technologies”

#### 1st Semester

#### Elective Courses

Title	<b>Cryptography</b>
Instructor(s)	Sofia Petridou
Objectives	To become familiar with the modern cryptosystems and protocols, which are required for secure communication and data security, and for privacy assurance.
Skills	Undergraduate background in Mathematics and Computer Science
Prerequisites	Abstract Algebra – Number Theory
Meeting the prerequisites	By personal study
Content	<ul style="list-style-type: none"> <li>• Stream Ciphers</li> <li>• Block Ciphers – AES</li> <li>• Public-key Cryptography – RSA, ElGamal, Rabin</li> <li>• Elliptic Curve Cryptography: elliptic curves (EC), EC cryptosystems (ElGamal, Diffie-Hellman key exchange, digital signature algorithm).</li> <li>• Identity Based Cryptography (IBE): encryption schemes with bilinear pairings and quadratic residues, comparison with other public-key encryption/decryption schemes.</li> <li>• Cryptographic Protocols: advanced cryptographic protocols, interactive proofs and zero-knowledge protocols, secure multi-party computation, secure e-voting systems.</li> <li>• Lattice Based Cryptography: mathematical background, GGH and NTRUEncrypt encryption schemes, GGH και NTRUSign digital signature schemes, advantages and post-quantum cryptography.</li> <li>• Homomorphic Encryption: Partially homomorphic cryptosystems (Unpadded RSA, ElGamal, Goldwasser-Micali, Benaloh, etc.), fully homomorphic cryptography (Gentry's scheme and variations).</li> </ul>
Textbooks	<ol style="list-style-type: none"> <li>1. Handbook of Applied Cryptography, A.J. Menezes, P.C. van Oorschot and S.A. Vanstone, <a href="http://cacr.uwaterloo.ca/hac/">http://cacr.uwaterloo.ca/hac/</a></li> <li>2. Introduction to Mathematical Cryptography, J. Hoffstein, J. Pipher, J.H. Silverman, Springer.</li> <li>3. N. Smart, Cryptography, An Introduction, <a href="http://www.cs.bris.ac.uk/~nigel/Crypto_Book/">http://www.cs.bris.ac.uk/~nigel/Crypto_Book/</a></li> </ol>
Assessment	2 Homework Assignments (group of exercises) (40%) & Final Exam (60%)
Website of the course	<a href="http://users.uom.gr/~steph/cryptodata.html">http://users.uom.gr/~steph/cryptodata.html</a>

Title	<b>Advanced Computer Architecture</b>
Instructor(s)	Manos Roumeliotis
Objectives	By the end of the course, students should have a comprehensive knowledge of computer science, from the hardware perspective (design and implementation)
Skills	Programming
Prerequisites	Programming, Logic Design
Meeting the prerequisites	Prerequisites can be met by either a corresponding course, or a corresponding undergraduate degree.
Content	Study and analysis of modern processor design techniques, like superscalar design, advanced pipeline, the use of Very Long Instruction Words, multilevel cache, etc. The course examines the out of order execution, instruction reordering buffers, the handling of execution exceptions, reservation tables, and branch prediction techniques. The material includes the analysis of design techniques and access to specialized memories for superscalar processors, the reordering of load/store instructions, etc. Finally, the course studies the performance evaluation of superscalar processors and multicore processors.
Textbooks	John P. Shen and Mikko Lipasti, "Modern Processor Design: Fundamentals of Superscalar Processors," McGraw Hill.
Assessment	2 Project reports 20%, Final Exam 80%.
Website of the course	<a href="http://compus.uom.gr/MINF184/">http://compus.uom.gr/MINF184/</a>

Title	<b>Advanced Software Engineering</b>
Instructor(s)	Alexander Chatzigeorgiou
Objectives	<p>The objective of this course is the study of principles, techniques and tools which are used for the development of large scale software projects with emphasis on the design of object-oriented systems.</p> <p>By employing programming languages such as C++ and Java as well as the Unified Modeling Language (UML) students will have the opportunity to investigate the application of the most established Design Principles, Design Patterns and Refactorings for the evaluation of design quality and the resolution of design/coding problems encountered in software industry. Students will participate in collaborative software development projects to simulate actual industrial (or open-source) processes and will also employ state-of-the-art Computer-Aided Software Engineering tools. In the context of this course references to the open research problems in the field of Software Engineering will be made.</p>
Skills	<p>Upon successful completion of this course students will be able to:</p> <ul style="list-style-type: none"> <li>- apply techniques and tools for the analysis, design and implementation of comprehensible, maintainable and reusable software systems</li> <li>- perform maintenance on software projects</li> <li>- evaluate the design quality of software systems</li> <li>- develop software projects collaboratively</li> </ul>
Prerequisites	<ul style="list-style-type: none"> <li>- familiarity with the algorithmic way of problem solving</li> <li>- knowledge of an object-oriented programming language</li> <li>- knowledge of basic data structures</li> </ul>
Meeting the prerequisites	<p>For students with insufficient background on the aforementioned fields, the parallel attendance of the undergraduate course "Procedural Programming" of the 1<sup>st</sup> semester or/and "Object-Oriented Programming" of the 3<sup>rd</sup> semester is suggested. Alternatively, personal study on the topics where students lack the corresponding background is suggested, employing bibliography provided by the instructor.</p> <p>In the context of the course, one lecture is devoted to reminding fundamental features of an object-oriented programming language.</p>
Content	<ul style="list-style-type: none"> <li>• Introduction to Software Engineering. Challenges in the development of large-scale software projects</li> <li>• Brief overview of object-oriented programming concepts: Java</li> <li>• Agile Software Development Methodologies</li> <li>• Overview of the Unified Modeling Language (UML)</li> <li>• Object-Oriented Analysis and Design (ICONIX Methodology)</li> <li>• Collaborative Software Development. Version Control Systems</li> <li>• Object-Oriented Design Principles</li> <li>• Design Patterns</li> <li>• Design Heuristics</li> <li>• Software Refactoring</li> <li>• Software Quality. Software Metrics.</li> <li>• Empirical Studies in Software Engineering</li> </ul>



	<ul style="list-style-type: none"><li>• Computer-Aided Software Engineering (CASE) tools</li></ul>
Textbooks	<p>Gamma, E., Helm R., Johnson, R., Vlissides, J. Design Patterns: Elements of Reusable Object-Oriented Software. Addison-Wesley, 1994.</p> <p>Fowler, M., Beck, K., Brant, J., Opdyke, W., Roberts, D., Refactoring: Improving the Design of Existing Code. Addison Wesley, 1999.</p> <p>Martin, R.C., Agile Software Development: Principles, Patterns and Practices. Prentice Hall, 2003.</p> <p>Rosenberg, D., Stephens, M., Use Case Driven Object Modeling with UML: Theory and Practice, Apress, 2007.</p>
Assessment	<p>50% final exams</p> <p>50% 2 Personal Assignments and 2 Team Projects</p>
Website of the course	<p><a href="http://compus.uom.gr/MINF111/">http://compus.uom.gr/MINF111/</a></p>

Title	<b>Advanced Computer Networks</b>
Instructor(s)	P. Fouliras
Objectives	The study of advanced issues in Computer Networks, so that students can better appreciate, simulate, evaluate, design new or modify existing infrastructure and services and prepare themselves for pursuing research in this field
Skills	(to be acquired): Computer Network and Protocol simulation, network infrastructure services programming
Prerequisites	Basic knowledge of Computer Networks, programming preferably in C++
Meeting the prerequisites	Undergraduate course in Computer Networks. Personal study in C++ programming.
Content	Wireless networks, routing protocols, VLAN, packet loss-congestion-appropriate mechanisms, P2P networks, protocols and real-time traffic, QoS, monitoring, performance analysis and evaluation, design, simulation. Internet of Things.
Textbooks	<ul style="list-style-type: none"> <li>• James F. Kurose, Keith W. Ross, "Computer Networking-A Top-down Approach," Pearson Addison-Wesley.</li> <li>• Deploying IP and MPLS QoS for Multiservice Networks: Theory &amp; Practice (The Morgan Kaufmann Series in Networking) by John William Evans and Clarence Filstis</li> <li>• John T. Moy, "OSPF-Anatomy of an Internet Routing Protocol", Addison Wesley.</li> </ul>
Assessment	60% written exams, 40% personal lab/programming assignments
Website of the course	<a href="http://compus.uom.gr/MINF170/">http://compus.uom.gr/MINF170/</a>

Title	<b>Concurrent and Distributed Systems</b>
Instructor(s)	K.G. Margaritis & T. Kaskalis
Objectives	The course covers aspects of design and programming of Concurrent and Distributed Systems and Applications. The course consists of the following main subject areas: (a) Operating and Distributed Systems: fundamental issues of inter-process communications (b) Inter-networking infrastructures and basic middleware (γ) Environments and techniques for concurrent and distributed programming (d) Current applications and case studies – World Wide Web and Computer Cloud.
Skills	Development of concurrent and distributed systems and applications
Prerequisites	Computer Programming, Operating Systems, Computer Networks
Meeting the prerequisites	Personal study, participation in undergraduate courses.
Content	<p>Operating systems and fundamental issues of inter-process communications: Processes, Threads, Inter-Process Communication, Basic Issues and Techniques (Mutual Exclusion, Locks, Semaphores, Monitors, Deadlocks, Starvation), Messages and Message Queues, Client-Server model in Operating Systems. Distributed Systems (Logical Time, Mutual Exclusion, Distributed Deadlocks, Leader Selection, Distributed File Systems, Distributed Name Services etc.) Virtual Machines and Virtualization.</p> <p>Inter-Networking and basic moddleware: Internet adn Distributed Systems, TCP/IP Stack – Services, Sockets and Client-Server Model, Basic Protocols and Services, 3-Tier Architecture, Remote Procedure Call, Distributed Objects, Heterogeneous Distributed Systems, Web Protocols, Web Applications and Services. Peer-to-peer Systems, Introduction to Computer Cloud.</p> <p>Languages, Environments and Programming Techniques: Programming Multithreaded Applications, Concurrent Data Structures, Higher Level Structures and Programming Models, Socket Programming, Distributed Objects Programming, Heterogeneous Distributed Programming, Peer-to-peer Application Programming, Web Applications and Services Programming, Map-Reduce Applications, Cloud Application Programming.</p>
Textbooks	<p>Distributed Systems: Concepts and Design (5th edition) George Coulouris, Jean Dollimore, Tim Kindberg and Gordon Blair Addisson Wesley, 2011, ISBN 0-13-214301-1</p> <p>Concurrency - State Models &amp; Java Programs, J. Magee, J. Kramer, Wiley, 1999, ISBN: 0471987107</p> <p>Distributed and Cloud Computing: From Parallel Processing to the Internet of Things Kai Hwang, Jack Dongarra and Geoffrey C. Fox. Morgan Kaufmann, 2011, ISBN 9780123858801</p> <p>Κατανεμημένα Συστήματα με Java, (3η εκδοση) Κάβουρας ΙΚ, κ.α Εκδ Κλειδαριθμος, 2011, ISBN 978-960-461-463-9</p> <p>Παράλληλα και Κατανεμημένα Συστήματα σε Java Μιχαηλίδης Π. Μαργαρίτης Κ. Πανεπιστημιακές Παραδόσεις, 2009</p>
Assessment	<p>50% 6 Laboratory exercises (1 per fortnight)</p> <p>50% Final written examination</p> <p>Students should achieve at least 'pass' grade in both Laboratory exercises and</p>

	Final written examination
Website of the course	<a href="http://compus.uom.gr/MINF188/">http://compus.uom.gr/MINF188/</a>

## 2nd Semester

### Elective Courses

Title	<b>Web and Mobile Application Development</b>
Instructor(s)	T. Kaskalis
Objectives	The subject focuses on: (1) modern web architecture principles, (2) the development of interactive web applications (mostly front-side but also back-side), (3) the functioning of asynchronously communicating web application processes, (4) the design and development of mobile devices' applications, based on web technologies, (5) semantic web elements and the respective data storage, search and exchange standards, (6) applying principles, practices and technologies oriented towards application development for heterogeneous platforms.
Skills	Utilization of web technologies on platforms with diverse underlying characteristics. Application development using semantic web standards and asynchronous communication. Assessment ability of web technologies' application development tools and environments. Distinction and management of operations, services and data in web architecture levels. Critical analysis of elements and architectural design of mobile applications. Fluent use and expansion of programming interfaces regarding web and mobile applications.
Prerequisites	Basic programming abilities.
Meeting the prerequisites	Pre-graduate introductory programming course (e.g. in C).
Content	Modern web content development technologies (HTML5, CSS3). Web application scripting languages (Javascript). Document Object Model, Application Programming Interfaces, multi-tier architecture. Web application and services asynchronous communication (AJAX, JSON). Scripting languages frameworks (libraries, frameworks). Mobile devices' application design and development with web technologies. Architecture and creation of mobile applications. Modern topics of ambient web services.
Textbooks	M. Pilgrim, <i>Dive Into HTML5</i> , <a href="http://diveintohtml5.info">http://diveintohtml5.info</a> <i>CSS Basics</i> , <a href="http://www.cssbasics.com">http://www.cssbasics.com</a> A. Rauschmayer, <i>Speaking JavaScript: An In-Depth Guide for Programmers</i> , O'Reilly Media, 2014, <a href="http://speakingjs.com/es5/">http://speakingjs.com/es5/</a> A. Rauschmayer, <i>Exploring ES6</i> , Leanpub, 2016, <a href="http://exploringjs.com/es6/">http://exploringjs.com/es6/</a> R. Braithwaite, <i>JavaScript Allongé, the "Six" Edition</i> , Leanpub, 2016, <a href="https://leanpub.com/javascriptallongesix/read">https://leanpub.com/javascriptallongesix/read</a> By Y. Fain, V. Rasputnis, A. Tartakovsky & V. Gamov, <i>Enterprise Web Development, Building HTML5 Applications: From Desktop to Mobile</i> , O'Reilly Media, 2014, <a href="http://enterprisewebbook.com/">http://enterprisewebbook.com/</a> <a href="http://jsbooks.revolunet.com/">http://jsbooks.revolunet.com/</a>
Assessment	During the course, students will carry out 3 or 4 homework assignments (50% of final grade). The rest 50% will come from a written final examination.
Website of the course	<a href="http://compus.uom.gr/MINF187/index.php">http://compus.uom.gr/MINF187/index.php</a>

Title	<b>Information Security in the Internet Age</b>
Instructor(s)	Ioannis Mavridis
Objectives	<ul style="list-style-type: none"> <li>• Understanding of information protection issues and techniques in the Internet.</li> <li>• Application of security mechanisms and attack scenarios.</li> <li>• Studying of Internet mal-use cases and implementation of defense methods.</li> <li>• Utilization of methodologies and response techniques for security incidents.</li> <li>• Studying of relevant issues and investigation of research directions in cyber-security.</li> </ul>
Skills	Linux, Windows
Prerequisites	Basic Knowledge and handling of Linux & Windows operating systems, being familiar with computer networks as well as with information security issues.
Meeting the prerequisites	Relevant courses and introductory lectures.
Content	<ul style="list-style-type: none"> <li>• Introduction – Internet threats and attacks</li> <li>• Applied cryptology and security mechanisms)</li> <li>• Network security systems &amp; protocols – Attack scenarios</li> <li>• Web application security – Attack scenarios</li> <li>• Access control enhancements – Attack scenarios</li> <li>• Cyber-crime protection</li> <li>• Incident response and digital forensics</li> <li>• Critical infrastructure protection, early warning systems, cyber-security.</li> </ul>
Textbooks	<p>Information Systems and Networks Security (in Greek) G.Pangalos &amp; I.Mavridis Publ. Anikoula, 2002 ISBN: 960-516-018-8</p> <p>Computer Network Security (in Greek) S. Gritzalis, S. Katsikas &amp; D. Gritzalis Publ. Papatotiriou 2003 ISBN: 960-7530-45-4</p> <p>Cryptography and Network Security W. Stallings, Prentice Hall (5e), ISBN-13: 978-0136097044</p>
Assessment	50% Written examination and 50% Written assignment orally examined
Website of the course	<a href="http://compus.uom.gr/MINF179/">http://compus.uom.gr/MINF179/</a>

Title	<b>Ubiquitous Communications, Clouds, and BIG Data</b>
Instructor(s)	Konstantinos Psannis <a href="http://users.uom.gr/~kpsannis/">http://users.uom.gr/~kpsannis/</a>
Objectives	By the end of the course, students should have a comprehensive knowledge of advanced communications systems and information technology in order to design ICT apps and services (ICT in Societal Challenges/Industrial Development/Product).
Skills	ICT-Application Development. Ability to understand the usefulness of the Convergence of Information Technology (IT) and advanced Communications Systems (CS).
Prerequisites	Knowledge of fundamental of Telecommunications Systems- Data and Communications Networks.
Meeting the prerequisites	Graduates with no Information Technology background can attend undergraduate courses (Communications Systems and Networks). <a href="http://opencourses.uom.gr/courses/efarmosmenhs-plhroforikhs/1102-thlepikoinonies-systhmata-epikoinonion">http://opencourses.uom.gr/courses/efarmosmenhs-plhroforikhs/1102-thlepikoinonies-systhmata-epikoinonion</a> Additional educational material (e-books, white papers: industry perspective of a problem/solution, patents) can be provided to students. Self-study of basic Communications Systems and Networks, attend webseminars/ web-conferences <a href="http://users.uom.gr/~kpsannis/">http://users.uom.gr/~kpsannis/</a> <a href="https://www.researchgate.net/profile/Kostas_Psannis">https://www.researchgate.net/profile/Kostas_Psannis</a> <a href="https://orcid.org/0000-0003-0020-6394">https://orcid.org/0000-0003-0020-6394</a>
Content	BIG Data Processing –Networking–Broadcasting and Communications. Internet of Things: Connects ALL Things- Things that THINK! Cloud-Based Communications Systems: Convergence of (mobile) Cloud Computing and Telecommunications Networks (wired/wireless).  4G LTE & DVB-T/M/S & WiMAX. Hybrid LTE -DVB channels, PHY-layer and Application-layer optimization). Network as a Service (Wired : GEANT-EU/GRNET-GR/SINET-JP/Internet2-USA high speed connectivity /Wireless: Network as a Service 4G LTE & DVB-T/M/S & WiMAX  Cloud-based unified communications systems, NIST’s definition of Cloud Computing, Enterprise Cloud (JAPAN-EU-USA), Co-location Interconnectivity, X-as-Service  Networking and Cloud: An Era of Change, Role of the Platform in Cloud Service Delivery , Building the Cloud-Ready Network, Transforming Telecoms Services with a Secure, Agile Private Cloud Environment, Cloud: Powered by the Network  3D/ HD/UHD Video- Audio - Haptic data, real time - multipoint communications, Avatars/Tele-robotics. .

	<p>Digital Media over Cloud (synnefo.it.uom.gr Okeanos.GRnet Google Cloud, DropBox Amazon Simple Storage Service Box Microsoft Apple icloud), Multipoint /Avatars/Tele-Robotics /Olfactory/Haptic Senses. Experiments on International Connections (E-ICONS)-Green Data streams over TEIN3 (Pan-Asian), Science Information Network (SINET, Japan), GRNET (Greece)-Okeanos Cloud, and GEANT (European Union) dedicated high capacity connectivity. Next Generation Mobile Networks (5G): Building a virtual zero latency gigabit experience, Three key development areas in 5G, Bridging the spectrum gap with 5G, Cloud Technologies for Flexible 5G Radio Access Networks.</p> <p>Internet of Things (IoT): Sensor networks-Platforms for connected smart Objects. Internet of Things: integration of several technologies and communications solutions. Telecoms Technologies: (a) RFID systems(RFID), (b) Wireless Sensor Networks (WSN), and RFID sensor networks (RSN). Apps/Services: (a) Transportation and logistics domain (b) Healthcare domain (c) Smart environment (home, office, plant) domain and (d) Personal and social domain.</p> <p>Big data over advanced integrated cloud and network infrastructure (OKEANOS -GRNET's cloud service). Network as a Service : IoT – clouds, mobile cloud computing- converged network design-converged infrastructure) . Algorithms for high-quality global data network services/apps</p> <p>ICT in the Societal Challenges, ICT-Industrial Leadership/Development/Product. Seamless ICT: Globally integrated ICT environments, Low-cost, flexible and on-demand ICT environments, Safe ICT environments. BIG DATA, Cloud-based unified Communications systems and Internet of Things. ICT environment OPTIMIZATION through seamless ICT</p>
Textbooks	<p>Hakima Chaouchi, The Internet of Things: Connecting Objects, 288 pages, Wiley, May 2010.</p> <p>William Stallings, Wireless Communications &amp; Networks: Pearson New International Edition, 2nd Edition Nov 2013.</p> <p>Ricardo Puttini, Thomas Erl, Zaigham Mahmood, Cloud Computing: Concepts, Technology &amp; Architecture, 2015.</p> <p>Zeng, Deze, Gu, Lin, Guo, Song ,m Cloud Networking for Big Data, 1st ed. Edition, Kindle Edition , Springer, 2015</p> <p>Michael P. Fitz, Fundamentals of Communications Systems, McGraw-Hill 2012.</p>



	<p>Frank H. P. Fitzek, Marcos D. Katz, Mobile Clouds: Exploiting Distributed Resources in Wireless, Mobile and Social Networks, Wiley, February 2014</p> <p>e-books, Patents (<a href="http://patft.uspto.gov/">http://patft.uspto.gov/</a>) , e-White papers industry perspective of a problem/solution (Compus)</p> <p><a href="https://www.researchgate.net/profile/Kostas_Psannis">https://www.researchgate.net/profile/Kostas_Psannis</a></p>
Assessment	<p>(i) Personal Assignment and Team Project (presentation of a technical paper)(50%)</p> <p>(ii) Final Exams (50%)</p>
Website of the course	<p><a href="http://users.uom.gr/~kpsannis/">http://users.uom.gr/~kpsannis/</a></p> <p><a href="http://compus.uom.gr/MINF193/">http://compus.uom.gr/MINF193/</a></p>

Title	Topics in Database Technology
Instructor(s)	Georgios Evangelidis & Georgia Koloniari
Objectives	(a) To study in detail fundamental and advanced issues on database design and implementation (transaction management, views, recursive SQL, stored procedures, database tuning). (b) To study modern trends in data models and database applications (data warehouses, post-relational databases, XML databases).
Skills	Acquire knowledge in terms of theory and practice on database development issues. Get to know and use modern models and applications of databases.
Prerequisites	Undergraduate course in Databases (entity-relationship model, relational model, normalization, relational algebra, SQL).
Meeting the prerequisites	Requirements will be met due to the profile of the applicants.
Content	Database Transactions and Concurrency Control Technologies (Multi-granular locking CC, Multi-versioning CC, Optimistic CC), case studies on IBM DB2, Oracle, MySQL, Postgresql. Indexes and Query Processing cost. Partitioning, Replication and Clustering. Recursive SQL. SQL Stored Procedures. Data Warehousing and OLAP. XML Databases. NoSQL Databases. Graph Databases. Linked Data.
Textbooks	Database Management Systems (3rd edition), by Raghu Ramakrishnan and Johannes Gehrke, McGraw-Hill, 2002.  Database Systems: The Complete Book (2nd Edition), by Hector Garcia-Molina, Jeffrey D. Ullman, and Jennifer Widom, Prentice Hall, 2008.  Readings in Database Systems (4th edition), by J. M. Hellerstein and M. Stonebraker (eds.), Morgan Kaufmann Publishers, 2005.
Assessment	Three (3) Homework Assignments (50%) Final Written Examination (50%)
Website of the course	<a href="http://compus.uom.gr/MINF177/">http://compus.uom.gr/MINF177/</a>

Title	<b>Practical Issues in Computer Networks and Internetworks</b>
Instructor(s)	E. Mamatas
Objectives	<p>With the successful completion of the course the student should:</p> <ul style="list-style-type: none"> <li>• know how to design and configure networks in order to study and solve performance issues under constraints, e.g., design an protocol taking into account the energy consumption of battery-limited devices in a wireless environment</li> <li>• be able to distinguish the different technologies needed in less traditional network environments, e.g., delay-tolerant networking (networks operating in mobile or extreme terrestrial environments, or planned networks in space)</li> <li>• learn and describe the key benefits of new networking technologies, such as Software-Defined Networking (SDN), Network Functions Virtualization (NFV) and clouds</li> <li>• familiarize with the networks simulation and emulation in order to study and explain operation and performance issues</li> </ul> <p>be able to use modeling techniques for queue management as well as probabilistic model checking as a means of formal verification of communication protocols</p>
Skills	Hands-on experience, networks simulation, network components' configuration and management
Prerequisites	Computer Networks
Meeting the prerequisites	A corresponding undergraduate degree
Content	The main objective of this course is the practical issues related to the implementation of networking systems, from the local area view to the wide area internetworks. Emphasis is given to familiarize students with the metrics evaluating the networks' performance, the widely used networking protocols and mechanisms, the routing algorithms, the queue management models, the reliability issues of the different network layers, the flow/congestion control mechanism of TCP as well as the management of networking equipment (e.g., router). To get a deeper understanding of these issues we evaluate and compare different mechanisms and protocols through simulation. Finally, to get hands-on experience the course contains a set of lab assignments and a project.
Textbooks	<ul style="list-style-type: none"> <li>• V. Tsaoussidis, L. Mamatas, I. Psaras, S. Kosmidis, «Εργαστηριακά Μαθήματα στα Δίκτυα Υπολογιστών», Klidarithmos Press, 2010</li> <li>• Larry L. Peterson and Bruce S. Davie, Computer Networks, A Systems Approach, 5th ed., Morgan Kaufmann Publishers Inc., 2001</li> <li>• Tsaoussidis, «Διαδικτυακά Πρωτόκολλα», Klidarithmos Press, 2004</li> </ul>
Assessment	1 Homework assignment (40%) Written Final examination (60%)
Website of the course	<a href="http://compus.uom.gr/MINF203">http://compus.uom.gr/MINF203</a>

Title	<b>Serious Games Programming</b>
Instructor(s)	S. Xinogalos
Objectives	The aim of the course is for students to acquire: (a) basic knowledge of the role, the types and the features of serious games, as well as the whole process of devising a serious game, (b) capabilities of designing and implementing serious games using contemporary tools, interfaces and programming languages, (c) knowledge and capabilities of using/devising evaluation metrics of serious games based on the aims defined during its design.
Skills	Upon successful completion of this course students will be able to: <ul style="list-style-type: none"> <li>- evaluate the design quality of serious games and the degree they fulfill the initial goals</li> <li>- design serious games taking into account various factors/design principles</li> <li>- implement simple serious games using the object-oriented programming technique and game libraries\engines</li> </ul>
Prerequisites	Knowledge of object-oriented programming
Meeting the prerequisites	Attending relevant undergraduate courses. Material for study will be provided.
Content	<p>The <i>role</i> of serious games as tools for educating, skills acquisition and simulation in various sectors, such as education, health and business processes. <i>Types</i> and <i>features</i> of serious games. Review of representative examples of serious games.</p> <p><i>Designing</i> a serious game: the world, the characters (players and bots) and their actions, the levels of the game. Design principles and methodologies. Presentation of relevant concepts through designing a simple educational game in an educational programming environment, such as Greenfoot, Alice and GameMaker. Evaluating the quality of existing serious games. <i>Tools, engines and programming interfaces</i> for serious games. Designing a game with libraries that are language and platform independent, such as OpenGL.</p> <p><i>Programming</i> serious games: the loop of the game, architecture of the game, graphical user interface, interaction and event handling, text, 2D graphics and animation, arrays and object collections.</p> <p>Designing a serious game using contemporary game engines/libraries and implementing it in C#, C++ or Java.</p>
Textbooks	<ol style="list-style-type: none"> <li>1. Ernest Adams, Fundamentals of Game Design, New Riders, 2009.</li> <li>2. David Michael, Serious Games: Games That Educate, Train, and Inform, Cengage Learning PTR, 2005.</li> <li>3. Clark Aldrich, The Complete Guide to Simulations and Serious Games: How the Most Valuable Content Will be Created in the Age Beyond Gutenberg to Google, Pfeiffer, 2009.</li> <li>4. Daniel Schuller, C# Game Programming: For Serious Game Creation, Cengage Learning PTR, 2010.</li> <li>5. Arjan Egges, Learning C# by Programming Games, Springer, 2013.</li> <li>6. Andrew Davison, Killer Game Programming in Java, O'Reilly Media, 2005.</li> <li>7. David Brackeen, Bret Barker, Lawrence Vanhelsuwe, Developing Games in Java, New Riders, 2003.</li> <li>8. OpenGL Programming Guide: The Official Guide to Learning OpenGL (ISBN-13: 978-0321552624) by Dave Shreiner</li> </ol>
Assessment	<p>60% final exams (computer-based)</p> <p>40% personal assignments: three (3) assignments on evaluating existing serious games using special frameworks and criteria, designing and implementing</p>

	serious games.
Website of the course	<a href="http://compus.uom.gr/MINF172/">http://compus.uom.gr/MINF172/</a>

## 6.2 2nd Specialization: “Computational Methods and Applications”

### 1st Semester

#### Elective Courses

Title	<b>Optimization</b>
Instructor(s)	Nikolaos Samaras & Dimitrios Hristu-Varsakelis
Objectives	The course aims to introduce students to algorithms used for the solution of optimization problems, as well as their applications in Informatics and scientific decision making, in the context of complex economic and management decisions.
Skills	Upon successful completion of the course, students will be able to a) model optimization problems and b) select and apply the appropriate algorithms and solution techniques.
Prerequisites	Linear Algebra, Analysis, Analysis of Algorithms at the undergraduate level.
Meeting the prerequisites	Individual study, for those who have not taken the corresponding undergraduate courses.
Teaching methods	Lectures
Content	Historical review, Definitions and concepts of Optimization, Ellipsoid Algorithm, Scaling Techniques, Interior Point Methods (path following, barrier methods, affine scaling), Exterior Point Algorithms, Presolve Techniques, Advanced Optimization Techniques in dynamic decision problems, Differential equations with inputs, Calculus of Variations, Euler-Lagrange equations, Linear-quadratic regulators, the Maximum Principle, Hamilton-Jacobi-Bellman equation.
Textbooks	<ol style="list-style-type: none"> <li>1. Bazaraa, M., Jarvis, J., Sherali, H. (2005). “Linear Programming and Network Flows”, 3<sup>rd</sup> edition, Wiley-Interscience</li> <li>2. Griva, I., Nash, S., Sofer, A. (2009). “Linear and Nonlinear Optimization”, 2<sup>nd</sup> edition, SIAM</li> <li>3. Papadimitriou, H.C., Steiglitz, K. (1982). “Combinatorial Optimization: Algorithms and Complexity”, Prentice-Hall, Inc., Englewood Cliffs, N.J.</li> </ol>
Assessment	Written Final examination 60% Coursework 40% (2 assignments)
Website of the course	<a href="http://compus.uom.gr/MINF175/">http://compus.uom.gr/MINF175/</a>

Title	<b>Data Structures and Algorithms</b>
Instructor(s)	Maya Satratzemi
Objectives	This course surveys the most important algorithms and data structures in use on computers today. Particular emphasis is given to algorithms for sorting, searching, and string processing as well as graph algorithms. The course will concentrate on developing implementations, understanding their performance characteristics, and estimating their potential effectiveness in applications.
Skills	Ability to analyze the performance of advanced data structures and algorithms. Ability to implement advanced data structures with Java an Object Oriented language. Ability to understand the usefulness of a data structure for a particular problem. Ability to adapt a data structure according to the requirements of a problem. Ability to combine data structures.
Prerequisites	Graduates with IT background. Knowledge of fundamental data structures and Java programming language.
Meeting the prerequisites	For Science graduates (except Informatics): Self-study of basic data structures. Additional educational material on the Java programming language can be provided to students. Graduates with no IT background can attend and successfully pass the undergraduate course Object Oriented Programming in Java.
Content	<p>The Data Structures and Algorithms is one of the most important and historic disciplines of Computer Science, with continuous development providing solutions to fundamental problems of sorting, organizing, managing and searching information. While recent years have seen tremendous growth of the Internet to support a wide range of activities. The internet is promoted as a universal means support human activities. The provision and distribution of information on the Internet has led to the development of Networked Information Systems. Is of the utmost importance to effectively search this information and therefore the search algorithms for locating data in a large volume of information is fundamental. Also, graph algorithms allow us to address many of the difficult and important problems: Communication, circuit, mechanical, financial stock, transportation, internet, game, social relationship, neural network, protein, chemical compound. Finally, string algorithms face the problem of text matching, as the cases of: text editors, search word(s) in the contents of a website or a DNA sequence.</p> <p><i>Contents</i></p> <p>Fundamentals: Basic Programming Model, Data Abstraction, Bags, Queues, and Stacks, Case Study: Union-Find</p> <p>Sorting: Elementary Sorts, Mergesort, Quicksort, (implementations, improvements, duplicate keys, 3-way partitioning, Bentley-McIlroy quicksort, Dual-pivot quicksort), system sort in Java, Priority Queues, Sorting various types of data (immutable keys, Alternate orderings, Items with multiple keys, Priority queues with comparators), Applications</p> <p>Symbol Tables Elementary symbol tables (sets, dictionary clients, indexing clients). Binary Search Trees. Balanced Search Trees. AVL. 2-3 trees, Red-Black Trees. B-Trees, Hash tables.</p> <p>Strings: Sorting Strings (key-indexed counting, LSD string sort, MSD string sort, 3-way string quicksort, suffix arrays), String Symbol Tables, Substring Search (brute force, Knuth-Morris-Pratt, Boyer-Moore, Rabin-Karp), Data compression, applications.</p> <p>Graphs. Graph API. Components of a graph. Graph traversal (DFS, BFS),</p>

	applications (Facebook, Kevin Bacon numbers, Fewest number of hops in a communication network).. Directed graphs (transportation, web, food, WordNet, scheduling, financial stock, cell phone, infectious disease, game, citation, object graph, inheritance, control flow).
Textbooks	<ol style="list-style-type: none"> <li>1. Robert Sedgewick, Kevin Wayne, <i>Algorithms, 4th Edition</i>, Addison-Wesley, 2011</li> <li>2. T. Cormen, C. Leiserson, R. Rivest, and C. Stein, <i>Introduction to Algorithms</i>, MIT Press.</li> <li>3. J. Kleinberg and E. Tardos, <i>Algorithm Design</i>, Pearson, 2014.</li> <li>4. Michael T. Goodrich and Roberto Tamassia, <i>Data Structures and Algorithms in Java</i>, Wiley</li> <li>5. Mark Allen Weiss, <i>Data Structures and Problem Solving Using Java (Fourth Edition)</i>, Addison-Wesley, 2010</li> <li>6. Mark Allen Weiss, <i>Data Structures and Algorithm Analysis in Java (Third Edition)</i>, Addison-Wesley, 2012</li> <li>7. Kurt Mehlhorn, Peter Sanders, <i>Algorithms and Data Structures: The Basic Toolbox</i>, Springer Verlag, 2008</li> <li>8. Selected papers on: Searching, Graphs, Strings algorithms</li> </ol>
Assessment	<p>(50%) Homework assignments : (5) Programming exercises &amp; (1) study &amp; written presentation of a paper (1 assignment every 2 weeks)</p> <p>(50%) Written Final examination</p>
Website of the course	<a href="http://compus.uom.gr/MINF168/">http://compus.uom.gr/MINF168/</a>



Title	<b>Heuristic Methods</b>
Instructor(s)	Angelos Sifaleras
Objectives	This course aims to an introduction to modern metaheuristic methods in real-world large-scale problem solving, where a compromise between the solution quality and the computational time is required.
Skills	By successfully attending this course, graduate students will develop skills related to i) modeling of complex practical problems and ii) the algorithmic solution in a short computational time.
Prerequisites	Very good knowledge of operational research methods. Good knowledge of programming. Good knowledge of data structures.
Meeting the prerequisites	Personal study and/or completion of a related undergraduate module. Some introductory concepts in optimization and scientific programming will be provided during the course. Additional educational material on optimization problems and the Fortran programming language will be provided to students.
Content	<p>In solving optimization problems various exact mathematical programming algorithms are usually applied. However, such conventional methods are not usually efficient with combinatorial or global optimization problems, especially when the problem has a large and complex search space. The majority of these computational problems belong to the NP-hard class and thus, a solution in polynomial time is not possible (unless <math>P = NP</math>).</p> <p>In order to efficiently solve such problems several heuristic methods have also been studied in an attempt to find a compromise sub-optimal solution in a short computation time. Heuristic search methods are usually produced using simple intuitive and creative thinking, and are often useful in local search to quickly find good solutions in a small search area. Metaheuristic methods are higher level methods, which systematically coordinate the whole search process by the heuristic methods. Although, metaheuristic algorithms cannot guarantee finding a global optimal solution, they often provide very good results in several practical problems.</p> <p>The following topics will be studied in this module:</p> <p>Introduction to computationally hard combinatorial and global optimization problems and also to exhaustive search methods. Basic concepts such as solution representation, local search, neighborhoods, and local optimal. Introduction to variable neighborhood search, genetic algorithms, nature inspired algorithms, (e.g., swarm intelligence), tabu search, simulated annealing. Applications of metaheuristic algorithms in routing and inventory problems. Statistical analysis of computational experiments of heuristics.</p>
Textbooks	<p>Μαρινάκης Ι., Μαρινάκη Μ., Ματσατσίνης Ν. Φ., Ζοπουνίδης Κ., (2011). Μεθευρετικοί και Εξελικτικοί Αλγόριθμοι σε Προβλήματα Διοικητικής Επιστήμης, Εκδόσεις Κλειδάριθμος</p> <p>Zbigniew Michalewicz, David B. Fogel, (2004). How to Solve It: Modern Heuristics, 2nd ed., Springer.</p>
Assessment	The written exam is worth 50% of the final mark and the coursework for the course is worth the remaining 50% of the final mark. Each student is required to submit: i) a literature review report and ii) a programming deliverable, worth 25.0% each (i.e., 50% in total). These two assignments are due on the tenth teaching week and on the date of the course written examination, respectively

Website of the course	<a href="http://compus.uom.gr/MINF199/">http://compus.uom.gr/MINF199/</a>
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Title	<b>Simulation Methods</b>
Instructor(s)	S. Souravlas
Objectives	In the end of this course, the students should be able to <input type="checkbox"/> Effectively develop their computing skills on simulation. <input type="checkbox"/> Apply the appropriate mathematical and statistical methods to design models and process simulations <input type="checkbox"/> Use the most sophisticated tools for simulating processes from a variety of scientific areas.
Skills	Programming
Prerequisites	Statistics and Basic Knowledge on Programming
Meeting the prerequisites	Partially from the course and from previous studies
Content	Systems study, continuous systems (construction of analytical models and sensitivity analysis), discrete systems (activities and events), Petri nets, process modeling with Petri nets, Simulation Timing Mechanisms, Simulation Languages (GPSS, MATLAB, SIMULINK) and development of simulation models for a variety of scientific fields, Randomness controls, Analysis of simulation results, deterministic systems simulation, queue models.
Textbooks	Manos Roumeliotis and Stavros I. Souravlas «Simulation Techniques-Theory and Applications», 2 <sup>nd</sup> Edition, 2015, Tziolas Publications.  As supportive material, the following textbooks could be usedQ <ol style="list-style-type: none"> <li>1. D. Maki, M. Thompson, Mathematical Modeling and Computer Simulation, Brooks/Cole, 2006.</li> <li>2. G. S. Fishman, Discrete-Event Simulation, Springer, 2001.</li> </ol> <p>Moreover, any paper or reference found from any electronic source.</p> <p>The following packages could be used as application software: GPSS, MATLAB.</p>
Assessment	During the course, the students will work on two small projects (10% of the final grade for each one) and on a big project assigned to them in the middle of the semester (30% of the final grade). The remaining 50% of the final grade is taken from the final exam.
Website of the course	<a href="http://compus.uom.gr/MINF205/index.php">http://compus.uom.gr/MINF205/index.php</a>

Title	<b>Advanced Artificial Intelligence</b>
Instructor(s)	Ioannis Refanidis & Ilias Sakellariou
Objectives	The course presents both the theory of Artificial Intelligence, as well as its applications and more specifically modeling and solving interesting combinatorial problems using constraint satisfaction techniques and taking decisions under uncertainty. It also presents the modern view of intelligent systems, with probabilistic knowledge representations and reasoning with exact and approximate (through sampling) methods.
Skills	<p>Upon the successful completion of the course, students will be able to:</p> <ul style="list-style-type: none"> <li>• model simple combinatorial problems as constraint satisfaction problems (CSP), and select the appropriate global constraints for solving such problems efficiently,</li> <li>• solve scheduling problems using the most suitable representation and apply algorithms to find the optimal solution,</li> <li>• implement CSP solutions in a constraint programming platform,</li> <li>• model probabilistic decision problems using Bayesian networks,</li> <li>• compute probabilistic distributions analytically and by sampling,</li> </ul> <p>apply probabilistic reasoning in real world problems, such as target tracking and localisation.</p>
Prerequisites	<p>It is recommended, that the student has the undergraduate course in Artificial Intelligence. The classes of this undergraduate course have been recorded (Spring semester of academic year 2013-14) and are available online through the Open Courses program of University of Macedonia.</p> <p>The student is also expected to have a basic understanding of probabilities and statistics. Finally, the student is also expected to have good programming skills (e.g., know at least one programming language (such as Python)).</p>
Meeting the prerequisites	During the semester, 2 weeks (out of 12 weeks) are devoted in reviewing the fundamentals of Artificial Intelligence, such as basic search algorithms, logic, constraint programming and basic notions of probabilities.
Content	<ul style="list-style-type: none"> <li>• Uninformed &amp; heuristic search algorithms: Depth first search, breadth first search, best first search, A*.</li> <li>• Constraint satisfaction problems and constraint modeling. Solving constraint satisfaction problems. Consistency algorithms and arc consistency. Consistency algorithms' degree and efficiency. Combining search and constraint propagation.</li> <li>• Introduction to constraint programming platforms. Solving simple problems. Enforcing consistency and solution search.</li> <li>• Heuristics in constraint satisfaction problems. Global constraints. The all-different constraint. Resource allocation and the element constraint.</li> <li>• Optimization and the branch and bound algorithm in satisfaction problems.</li> <li>• Modeling scheduling problems. Global constraint that target scheduling. Scheduling under resource constraints.</li> <li>• Acting under uncertainty. Rational decisions. A decision theory agent. Basic notations of probabilities. Probability axioms. Reasoning with complete</li> </ul>

	<p>joint probability distributions. Independence. Conditional independence.</p> <ul style="list-style-type: none"> <li>• Probabilistic reasoning. Bayesian networks. Markov blanket. Continuous variables. Exact reasoning in Bayesian networks. Reasoning through enumeration. Approximate reasoning. Direct sampling. Rejection sampling. Likelihood weighing. Monte Carlo Markov chain.</li> <li>• Temporal probabilistic reasoning. Stationary processes. Markov hypothesis. Reasoning in temporal models: Filtering, Prediction, Smoothing. Finding the most likely explanation. Viterbi algorithm. Dynamic Bayesian networks. Particle filtering.</li> <li>• Making simple decisions. Maximum expected utility. Axioms of utility theory. Utility functions. Risk aversion, risk neutral. Multicriteria utility functions. Decision networks. Value of information. Expert systems of decision theory.</li> <li>• Sequential decision making problems. Markov decision processes (MDPs). Value iteration. Policy iteration. Partially observable Markov decision processes.</li> </ul>
Textbooks	<ul style="list-style-type: none"> <li>• Stuart Russell &amp; Peter Norvig, <b>Artificial Intelligence, A Modern Approach</b> (3<sup>rd</sup> edition), Prentice Hall, 2009. ISBN: 0136042597.</li> <li>• Mausam and Andrey Kolobov, <b>Planning with Markov Decision Processes</b>, an AI perspective. Morgan and Claypool, 2012.</li> <li>• Judy Pearl, <b>Probabilistic Reasoning in Intelligent Systems</b>. Morgan Kaufmann, 1988.</li> <li>• Stefan Edelkamp and Stefan Schroedl, <b>Heuristic Search, theory and applications</b>. Morgan Kaufmann, 2012.</li> <li>• K.R. Apt, Principles of Constraint Programming, Cambridge University Press, 2003.</li> <li>• Francesca Rossi, Peter van Beek, and Toby Walsh, (editors), <b>Handbook of Constraint Programming</b>, Elsevier Science, 2006</li> <li>• Kim Marriott and Peter J. Stuckey, <b>A MiniZinc Tutorial</b>, <a href="http://www.minizinc.org/resources.html">http://www.minizinc.org/resources.html</a></li> </ul>
Assessment	<p>Students will be expected to complete two smaller programming assignments (25% of the final mark) and one assignment that contributes 25% to the final mark. The final written examination, will contribute 50% of the final mark.</p>
Website of the course	<p><a href="http://compus.uom.gr/MINF117/">http://compus.uom.gr/MINF117/</a></p>

## 2nd Semester

### Elective Courses

Title	<b>Algorithmic Game Theory</b>
Instructor(s)	Ioannis Refanidis
Objectives	Over the last few years there has been explosive growth in the research done at the interface of computer science, game theory and economic theory, largely motivated by the emergence of internet. This course treats algorithms for equilibria in games and markets, computational auctions and mechanism design, the “price of anarchy”, as well as applications in networks, peer-to-peer systems, security, information markets and more.
Skills	With the successful attention of the class, the student is expected to be able to: <ul style="list-style-type: none"> <li>• recognize algorithmic problems of game theory,</li> <li>• model them, and</li> </ul> employ suitable algorithms to solve them
Prerequisites	It is good for the undergraduate student to have attended the undergraduate course on Game Theory. The basic notion of Nash equilibrium, in its various forms (concurrent actions, extended games, repeated games, probabilistic games) will be presented also through this course.
Meeting the prerequisites	The student can (but it is not necessary) to attend the undergraduate course on Game Theory, which is taught during the Fall semester. The lectures of this course have been recorded (during the Fall semester of academic year 2013-14) and are available (in Greek) through the Open Courses program of University of Macedonia.
Content	<ul style="list-style-type: none"> <li>• Basic solution concepts and computational issues <ul style="list-style-type: none"> <li>○ Complexity of finding Nash equilibria in two player games, in strategic and extended forms. Combinatorial algorithms.</li> </ul> </li> <li>• Algorithmic mechanism design <ul style="list-style-type: none"> <li>○ Mechanism design without money. Combinatorial auctions. Profit maximization. Distributed algorithms. Cost sharing. Online mechanisms</li> </ul> </li> <li>• Quantifying the inefficiency of equilibria <ul style="list-style-type: none"> <li>○ Routing games. Selfish load balancing. The price of anarchy.</li> </ul> </li> <li>• Applications <ul style="list-style-type: none"> <li>○ Communication networks. Peer-to-peer systems. Cascading behavior in networks. Information security. Prediction markets. Manipulation-resistant reputation systems. Sponsored search auctions.</li> </ul> </li> </ul>
Textbooks	<ol style="list-style-type: none"> <li>1. N. Nisan, N. Roughgarden, E. Tardos and V.V.Vazirani, <b>Algorithmic Game Theory</b>. Cambridge University Press 2007.</li> <li>2. David Easley and Jon Kleinberg, <b>Networks, Crowds, and Markets: Reasoning About a Highly Connected World</b>, Cambridge University Press, 2010.</li> </ol>
Assessment	<ul style="list-style-type: none"> <li>• 50% written exams</li> <li>• 50% projects (3 distinct projects)</li> </ul>

Website of the course	<a href="http://compus.uom.gr/MINF200/">http://compus.uom.gr/MINF200/</a>
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<b>Title</b>	<b>Data Mining</b>
Instructor(s)	Georgios Evangelidis & Georgia Koloniari
Objectives	The course presents methods for mining and analyzing data. Emphasis is given on web mining. The course also focuses on the application of the presented mining techniques in real problems with the use of appropriate tools.
Skills	Students will acquire knowledge and practical experience on issues around data analysis through the use of tools that support knowledge discovery algorithms from data.
Prerequisites	-
Meeting the prerequisites	-
Content	<p>Introduction to knowledge discovery in databases (KDD), statistical methods, classification, association rules, frequent itemsets, clustering.</p> <p>Case studies of applying and using mining techniques in environments of both commercial and open source tools that support the process of knowledge discovery in databases (e.g. Oracle Data Miner, WEKA).</p> <p>Recent research developments in the field such as time series mining and text mining.</p> <p>Particular emphasis on mining knowledge from the web (web mining): techniques such as graph mining, link analysis and recommendation systems.</p>
Textbooks	<p>P.-N. Tan, M. Steinbach and V. Kumar, "Introduction to Data Mining" Addison Wesley, 2006.</p> <p>M. H. Dunham, "Data Mining: Introductory And Advanced Topics". Pearson Education, 2006.</p> <p>B. Liu, "Web Data Mining – Exploring Hyperlinks, Contents, and Usage Data", Second Edition, Springer, 2011.</p> <p>A. Rajaraman, J. Leskovec, J. D. Ullman, "Mining of Massive Datasets", Cambridge University Press, 2010.</p>
Assessment	<p>Four (4) Homework Assignments (50%)</p> <p>Final Written Examination (50%)</p>
Website of the course	<a href="http://compus.uom.gr/MINF201/">http://compus.uom.gr/MINF201/</a>



Title	<b>Modeling and Decision Making</b>
Instructor(s)	Nikolaos Samaras & Dimitrios Hristu-Varsakelis
Objectives	The course aims to introduce the students to advanced topics in mathematical modeling and decision making through case studies and selected papers from the current literature. We will examine problems (and their solutions) from a series of scientific fields such as bioinformatics, image processing, social networks, auctions, tax policy optimization and others.
Skills	Upon successful completion of the course, students will have gained experience in transitioning from a “verbal” to a mathematical description of a decision problem, so that appropriate optimization/solution techniques may be applied.
Prerequisites	Any undergraduate operations research course which includes nonlinear programming.
Meeting the prerequisites	Individual study, for those who have not taken the corresponding undergraduate courses.
Content	<p>Topics will vary each year, drawing on articles from the current literature. Examples include:</p> <ul style="list-style-type: none"> <li>• Online ad auctions (Decision Support Systems)</li> <li>• Trust and electronic word-of-mouth modeling (DSS)</li> <li>• Structure and function of complex networks (SIAM Review)</li> <li>• Mathematics of Infectious Diseases (SIAM Review)</li> <li>• Modeling Growth in Biological Materials (SIAM Review)</li> <li>• Modeling Basketball Free Throws (SIAM Review)</li> </ul>
Textbooks	<p>1. Evans, R.J. (2012). Statistics, Data Analysis, and Decision Modeling (5th Edition), Pearson, ISBN-13: 978-0132744287</p> <p>2. Hillier and Lieberman (2001). Introduction to Operations Research (7th ed.), McGraw-Hill.</p> <p>3. Decision Support Systems (Elsevier)  <a href="http://www.journals.elsevier.com/decision-support-systems/">http://www.journals.elsevier.com/decision-support-systems/</a></p> <p>4. SIAM Review (SIAM), <a href="http://epubs.siam.org/journal/siread">http://epubs.siam.org/journal/siread</a></p>
Assessment	<p>Written Final examination 50%</p> <p>2 Homework Assignments 50%</p>
Website of the course	<a href="http://compus.uom.gr/MINF202/">http://compus.uom.gr/MINF202/</a>

Title	<b>Parallel Computing</b>
Instructor(s)	K.G. Margaritis
Objectives	The course covers aspects of Parallel Computing organized in the following subject-areas: (a) parallel computer systems: computer architecture and operating systems (b) parallel computing models, programming languages and environments (c) parallel algorithm design and parallel programming techniques (d) performance metrics and experimental measurements.
Skills	Parallel algorithm design and software development
Prerequisites	Algorithms, Computer Programming (C/C++)
Meeting the prerequisites	Personal study, participation in undergraduate courses.
Content	<p>Parallel Computer Systems: Flynn's Taxonomy, Shared and Distributed Memory Systems, Current Multi-core Processors and Multiprocessors, General Purpose Graphical Processing Units, Memory Hierarchy, Interconnection Networks, Networking-Clustering Infrastructure, Trends of High Performance Computer Systems.</p> <p>Multi-core and Multiprocessor Operating Systems, Computer Cluster Operating Systems, Network Computations software, Computational Grid and Big Data Infrastructure.</p> <p>Parallel Computing Models, Parallel Programming Environments and Techniques: Programming Multithreaded Applications Message Passing Interface Programming, General Purpose Graphical Processing Units Programming, Languages, Libraries, Standards, Programming Environments. Heterogeneous Parallel Computing. Platform-based Computations (Map-Reduce, Hadoop). Alternative-Emerging Models and Languages for Parallel Computing.</p> <p>Parallel Algorithms Design: Partitioning, Communication, Agglomeration, Mapping. Data Parallelism, Master-Worker, Task-graph model (Task Parallelism), Pipelining - Task / Data Flow, Pool of Tasks, Map-Reduce model.</p> <p>Performance metrics and experimental measurements of parallel computing applications.</p>

Textbooks	<p>Introduction to Parallel Computing (2nd edition) Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar Pearson Education, 2003, ISBN 0-201-64865-2</p> <p>Parallel and Distributed Computation D.Bertsekas and J.Tsitsiklis Prentice Hall, 1989, ISBN 0-13-648700-9</p> <p>Parallel Programming in C withMPI and OpenMP Michael Quinn McGraw Hill 2004, ISBN 007-282256-2</p> <p>Parallel Programming (2nd edition) B.Wilkinson, M.Allen Prentice Hall 2005, ISBN 0-13-140563-2</p> <p>An Introduction to Parallel Programming P.Pacheco Morgan Kaufman 2011, ISBN 978-0-12-374260-5</p> <p>Programming Massively Parallel Processors, Second Edition D.Kirk, W.Hwu Morgan Kaufman 2013, ISBN 978-0-12-415992-1</p>
Assessment	<p>50% 6 Laboratory exercises (1 per fortnight) 50% Final written examination Students should achieve at least 'pass' grade in both Laboratory exercises and Final written examination Homework Assignments 50%</p>
Website of the course	<p><a href="http://compus.uom.gr/MINF189/">http://compus.uom.gr/MINF189/</a></p>

Title	<b>Agent Oriented Programming</b>
Instructor(s)	Ilias Sakellariou
Objectives	<p>The term <i>agent</i> refers to a software entity that acts autonomously to achieve its goals. During the recent years, agents have attracted significant interest and the applications of the relevant technology range from industrial production control systems, energy production and distribution systems to air traffic control. The course aims to:</p> <ul style="list-style-type: none"> <li>• provide an in depth introduction to the notions of intelligent agents by presenting the various abstract architectures, their strengths and limitations,</li> <li>• analyse issues involved in agent communication and interaction and present the main protocols for cooperation/coordination of multi-agent systems,</li> <li>• familiarise students with technologies for multi agent systems simulation,</li> <li>• familiarise students with agent oriented development platforms, especially those that concern BDI agents.</li> </ul>
Skills	<p>At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> <li>• understand the basic notions of agent systems and be able to explain the difference between agents and other conventional approaches to complex systems,</li> <li>• synthesize solutions to complex problems, using intelligent agent notions and be able to choose appropriate interaction protocols for the specific problem,</li> <li>• develop multi-agent simulations in order to assess design and modeling choices of MAS,</li> <li>• implement multi-agent systems, using well established BDI agent development platforms.</li> </ul>
Prerequisites	Knowledge of procedural, object oriented and logic programming
Meeting the prerequisites	Personal study / completion of a corresponding undergraduate course. Material covering introductory concepts in Logic programming will be provided during the course.
Content	Introductory Notions. Software Agent Definition. Weak and Strong Notions of Agency. Logic Based Agents. Reactive Agents. Belief-Desire-Intention Agents (BDI). Hybrid agents. Agent Communication Languages. Speech Acts Theory. Communication Protocols/Interaction Protocols. The contract Net Protocol, Negotiation Protocols. Auctions. NetLogo Agent Simulation Platform. Agent Development in Jason, Jadex and 2APL. Jade Platform. Agent Theories and Programming Languages. Biology inspired Agent systems.
Textbooks	<p>M. Wooldridge, <i>“Εισαγωγή στα πολυπρακτορικά συστήματα”</i>, Κλειδάριθμος, ISBN: 9604611259, ISBN13: 9789604611256, Απρίλιος 2008 (in Greek)</p> <p>Michael Wooldridge, <i>“An Introduction to MultiAgent Systems - Second Edition”</i>, John Wiley &amp; Sons, ISBN: 978-0470519462, May 2009.</p> <p>Rafael H. Bordini, Jomi Fred Hübner, Michael Wooldridge, <i>“Programming Multi-agent Systems in AgentSpeak Using Jason”</i>, (Wiley Series in Agent Technology) Wiley-Blackwell ISBN-10: 0470029005 ISBN-13: 978-0470029008, 2007</p>
Assessment	During the course, students are expected to complete coursework that consists of two individual programming assignments, contributing 40% to the final mark.

	Final written examination will contribute 60% to the final mark.
Website of the course	<a href="http://compus.uom.gr/MINF173/">http://compus.uom.gr/MINF173/</a>

Title	<b>Statistical Data Analysis</b>
Instructor(s)	D Papanastassiou
Objectives	The aim of the course is to train students to be able to make decisions by analyzing properly the statistical data in hand, using the free source software R. Through examples they are introduced to basic statistical methods, like statistical hypothesis testing, regression analysis (linear and non linear), predictions, multivariate data analysis (classification and clustering).
Skills	To implement properly basic statistical methods. To be able to interpret and present their results.
Prerequisites	It is not absolutely necessary, but it is of help if someone already had a first introductory course in statistics, data mining or something similar. It is far more important the students to be handy with the use of the software, so that the lecture concentrates on the statistical notions.
Meeting the prerequisites	Personal study, under instructor's advice.
Content	Statistical data (introduction to R, data entry and presentation, exploratory data analysis) Assignment 1: case study Statistical hypothesis testing (normal distribution, sample vs population, point estimates, hypothesis testing and confidence intervals for means, proportions variances, ANOVA, $\chi^2$ -tests) Assignment 2: case study Regression Analysis I: (fundamental concepts for linear regression, diagnostic checking, model selection, prediction, non-linear regression) Assignment 3: case study Regression Analysis II: (logit and probit models, GLM, classification) Assignment 4: case study Topics in multivariate data analysis-machine learning
Textbooks	Statistical Analysis and Data Display, An Intermediate Course with Examples in S-Plus, R, and SAS R. M. Heiberger, B. Holland Springer, New York, 2004, ISBN: 0-387-40270-5  Data mining and business analytics with R J. Ledolter John Wiley & Sons, Inc, Hoboken, New Jersey, 2013, ISBN 978-1-118-44714-7  Data Mining with R: Learning with Case Studies L. Torgo Chapman & Hall, 2011, ISBN: 978-1-4398-1019-4  Στοιχεία Υπολογιστικής Στατιστικής J. E. Gentle, Επιμέλεια Χ. Μωυσιάδης Εκδόσεις Πανεπιστημίου Μακεδονίας, Θεσσαλονίκη, 2009, ISBN: 978-960-8396-49-4
Assessment	Four (4) assignments during the teaching period (50% of the total assessment) and an open book final examination (50% of the total assessment)
Website of the course	<a href="http://compus.uom.gr/MINF180/">http://compus.uom.gr/MINF180/</a>

## 6.3 3<sup>rd</sup> Specialization: “Business Computing”

### 1st Semester

#### Compulsory Courses

Title	<b>Object-Oriented Software Development</b>
Instructor(s)	Alexander Chatzigeorgiou & Stelios Xinogalos
Objectives	The development of large scale information systems entails significant challenges both in terms of technology and management of the involved activities and resources. The objective of this course is the introduction to the object-oriented approach for the analysis, design and implementation of software, which constitutes the most widely adopted approach for the development of contemporary systems. The Java programming language is employed in order to illustrate systematic methods for confronting the complexity of large-scale projects. The course covers introductory and advanced concepts of object-oriented programming as well as the specification and decomposition of a problem (analysis) and its solution by means of software (design). Computer-Aided Software Engineering (CASE) tools will be employed during various phases of the development process.
Skills	Upon successful completion of this course students will be able to: <ul style="list-style-type: none"> <li>- specify the various phases in the development of a large-scale software project and identify the related challenges</li> <li>- apply object-oriented analysis and design techniques for the development of a software system</li> <li>- implement object-oriented software</li> </ul>
Prerequisites	
Meeting the prerequisites	
Content	<ul style="list-style-type: none"> <li>• Introduction into the object-oriented way of thinking</li> <li>• Definition of classes, Construction of Objects</li> <li>• Relations among classes, Exchange of messages among objects</li> <li>• Usage of Library Classes</li> <li>• Improvement of object-oriented system structure by means of Inheritance</li> <li>• Object-Oriented Design Principles. Use of Abstraction</li> <li>• Development of Graphical User Interfaces</li> <li>• Event Handling</li> <li>• Modern Integrated Development Environments</li> <li>• Introduction to Software Engineering. Challenges in the development of large-scale software systems</li> <li>• Overview of the Unified Modeling Language (UML)</li> <li>• Object-Oriented Analysis: Domain model, requirements specification, use cases</li> <li>• Object-Oriented Design: Object interaction, allocation of responsibilities, sequence diagrams, class diagrams</li> </ul>

Textbooks	<p>David J. Barnes, Michael Kolling, Αντικειμενοστρεφής προγραμματισμός σε Java, (Pearson 3rd edition), Κλειδάριθμος, 2008.</p> <p>H. M. Deitel and P. J. Deitel, Java: How to Program, Prentice Hall, 2009.</p> <p>C. Larman, Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development, Prentice Hall, 2004.</p> <p>D. Rosenberg, M. Stephens, Use Case Driven Object Modelling with UML: Theory and Practice, Apress, 2007.</p>
Assessment	<p>60% final exams</p> <p>40% 5 Personal Programming Assignments</p>
Website of the course	<p><a href="http://compus.uom.gr/MINF167/">http://compus.uom.gr/MINF167/</a></p>



Title	<b>Databases</b>
Instructor(s)	Georgios Evangelidis & Dimitrios Dervos
Objectives	(a) Design a database for an information system based on certain (given) business rules, (b) Implement the database on a Relational Database Management System (RDBMS), (c) Master SQL to manage the contents of a relational database, (d) Perform OLAP analysis on Data Warehouses.
Skills	Acquire theoretical knowledge and practical skills on the design, implementation and management of relational databases.
Prerequisites	-
Meeting the prerequisites	-
Content	Entity-Relationship model, Relational model, CASE tools for database synchronization and reverse engineering, SQL, normalization, database management, OLAP.
Textbooks	Database Management Systems (3rd edition), by Raghu Ramakrishnan and Johannes Gehrke, McGraw-Hill, 2002.  Database Systems: The Complete Book (2nd Edition), by Hector Garcia-Molina, Jeffrey D. Ullman, and Jennifer Widom, Prentice Hall, 2008.
Assessment	Four (4) Homework Assignments (50%) Final Written Examination (50%)
Website of the course	<a href="http://compus.uom.gr/MINF176/">http://compus.uom.gr/MINF176/</a>

Title	<b>Computer Systems and Networks</b>
Instructor(s)	Panagiotis Papadimitriou
Objectives	<p>This course provides an introduction to IT infrastructure issues and covers topics related to both computer and systems architecture and communication networks, with an overall focus on the services and capabilities that IT infrastructure solutions enable in an organizational context. It gives the students the knowledge and skills that they need for communicating effectively with professionals whose special focus is on hardware and systems software technology and for designing organizational processes and software solutions that require in-depth understanding of the IT infrastructure capabilities and limitations.</p> <ul style="list-style-type: none"> <li>• Understand the principles underlying layered systems architectures and their application to both computers and networks.</li> <li>• Understand the differences and similarities between the core elements of an IT infrastructure solution, such as clients, servers, network devices, wired and wireless network links, systems software, and specialized security devices.</li> <li>• Understand how IT infrastructure components are organized into infrastructure solutions in different organizational environments.</li> <li>• Configure an IT infrastructure solution for a small organization, including a network based on standard technology components, servers, security devices, and several different types of computing clients.</li> <li>• Understand the role and structure of the Internet as an IT infrastructure component and design simple infrastructure solutions based on the use of the Internet.</li> </ul>
Skills	Hands-on laboratory work and practical exercises to teach the complex concepts that are often too abstract to grasp without practical examples.
Prerequisites	-
Meeting the prerequisites	-
Content	<ul style="list-style-type: none"> <li>• Core computing system organizing structures</li> <li>• Core technical components of computer-based systems</li> <li>• Role of IT infrastructure in a modern organization</li> <li>• Core operating systems functionality</li> <li>• Networking</li> <li>• Organizing storage on organizational networks</li> </ul>
Textbooks	<p>- Σύγχρονα Λειτουργικά Συστήματα, Α. Tanenbaum, Εκδόσεις Κλειδάριθμος</p> <p>- Δικτύωση Υπολογιστών, Προσέγγιση από πάνω προς τα κάτω, J. Kurose, K. Ross, Εκδόσεις Γκούρδιας</p> <p>- Computer Networking: Principles, Protocols and Practice, O. Bonaventure</p>
Assessment	<p>1 Homework assignment (30%)</p> <p>Written Final examination (70%)</p>
Website of the course	<a href="http://compus.uom.gr/MINF204">http://compus.uom.gr/MINF204</a>

Title	<b>Financial Accounting Systems</b>
Instructor(s)	Vazakidis Athanasios & Stavropoulos Antonios
Objectives	The course of "Financial Accounting Systems" aims to provide knowledge of Financial Accounting, of understanding the content and mode of the Greek Charts of Accounts (groups 1-8), of the Double-entry book-keeping using Accounting Information Systems, of the Opening and Closing the books, of handling special issues as K.E.P.Y.O, V.A.T. (Value Added Tax), I.K.A. (Social Security Organisation) and various taxes, of creating Companies Balance Sheet and Table of Results of Operations, of guidance on determining the fair value of companies, according to relevant Greek Legislation and analysis of Accounting Data. Based on the knowledge offered by this course, future managers are prepared to be more effective in their working environment.
Skills	General Skills of Computing and basic knowledge of the Greek Chart of Accounts (Groups 1-8 of G.Ch.A.).
Prerequisites	The approach will be initiated by the student and teacher guidance.
Meeting the prerequisites	The course will take the form of 12 three hour Lectures.
Content	<p>Deepening in Accounting Standardisation.</p> <p>Description and analysis of the Greek Chart of Accounts (groups 1-8).</p> <p>Proper Use of Accounts such as customer, suppliers, securities, sales, purchases and expenses.</p> <p>Accounting errors (prevention, search, correction).</p> <p>Determination of V.A.T. (Value Added Tax), I.K.A. (Social Security Organisation), other taxes.</p> <p>Connect to TAXISNET (Greek Tax-Office System) of all the Accounts where possible.</p> <p>Organizing warehouse data.</p> <p>Prints, projections, changes, modifications, temporary and permanent movements of accounting records.</p> <p>Implementing Exercises in Accounting Information Systems.</p> <p>Double-entry book-keeping using Accounting Information Systems.</p> <p>Creating Balance Sheet and Table of Results of Operation.</p> <p>Financial Statements.</p> <p>Implementing Accounting Exercises using modern Accounting Information Systems in the PC Lab.</p> <p>Determining the fair value of a business (Individual, O.E., E.E., Ltd, SA) based on the relevant Greek Legislation.</p> <p>In depth studies in specialized cases (case studies) in order for the students to understand the importance of analyzing the accounting records and information of the companies to both internal and external stakeholders.</p>
Textbooks	<p>1) Accounting Plan-Computerized Accounting (Vazakidis A, Stavropoulos A, Chatzis A), in Greek, 2nd edition, 2010, Thessaloniki.</p> <p>2) Financial Accounting - Accounting Plan (Stavropoulos A, Vazakidis A, Tsopoglou S), 2nd edition, 2010, Thessaloniki.</p>

	<p>3) Accounting Information Systems - Computerized Accounting, in Greek, (Ginoglou D, Tachinakis P, Protogeros N), 1st edition, 2004, Athens.</p> <p>4) Examples of implementation and analysis of the general plan of accounts in practice, in Greek, (Karagiannis D, Karagiannis I, Karagianni A) 8th edition, 2011, Thessaloniki.</p> <p>5) General Financial Accounting, in Greek, (Ginoglou D, Tachinakis P, Moese S), 2005, Athens, Editor: Rosili</p> <p>6) Accounting - the basis for business decisions (Meigs, W. Meigs, R), 7th edition, 1998, Athens.</p> <p>7) Financial &amp; Managerial Accounting (Needles B, Powers M, Crosson S), 2008</p> <p>8) Financial Accounting (Stickney, Clyde and Weil Roman), 10th edition Thomson South Western, 2004.</p> <p>9) Extensive material of notes and analytic case studies will be delivered at the end of each lecture.</p>
Assessment	Written examination
Website of the course	<a href="http://compus.uom.gr/MINF185/">http://compus.uom.gr/MINF185/</a>

## 2nd Semester

### Elective Courses

Title	<b>Business Process Intelligence</b>
Instructor(s)	Vergidis Konstantinos
Objectives	<p>The course has a three objectives:</p> <ol style="list-style-type: none"> <li>to familiarize the students with concepts related to Business Process Management (modelling, analysis, redesign/re-engineering)</li> <li>to provide in-depth training in computational methods and algorithms (process mining, genetic algorithms, heuristics, other optimization methods), and</li> <li>to combine the above in order to produce optimal and adaptive business process models.</li> </ol>
Skills	<p>By successful completion of the course, the students will:</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> have a solid understanding of the various stages of Business Process Management,</li> <li><input type="checkbox"/> be able to identify, document and break-down the core business processes of an organization or enterprise,</li> <li><input type="checkbox"/> employ a series of business process modelling techniques (e.g. EPC, IDEF, BPMN) along with business process analysis and optimisation methods.</li> <li><input type="checkbox"/> be familiar with techniques such as: process mining, simulation, machine learning, genetic algorithms, natural language processing. be able to combine BPM approaches and computational methods in order to achieve quantifiable and optimal results for the organization.</li> </ul>
Prerequisites	there are no prerequisites for this course
Meeting the prerequisites	-
Content	<p>Business process management is usually treated from two different perspectives: business administration and computer science (Weske, 2012). The life-cycle of a business process entails a series of stages: identification, modelling, analysis, optimisation, re-design/re-engineering and automation (Dumas et al., 2013).</p> <p>The course focuses on initial identification and modelling of a business process utilizing formal modelling techniques and also in optimisation / re-design employing quantifiable criteria and optimisation algorithms. The course main areas of focus are: business process modelling techniques and formal languages, re-design approaches and methodologies utilizing techniques such as process mining, simulation, machine learning, genetic algorithms, natural language processing.</p>
Textbooks	<ol style="list-style-type: none"> <li>Linden, M., Felder, C. and Chamoni P. (2011), <i>Dimensions of Business Process Intelligence</i>, Springer.</li> <li>Weske, M. (2012), <i>Business Process Management: Concepts, Languages, Architectures</i>, Springer (2<sup>nd</sup> edition), New York.</li> <li>Dumas, M., La Rosa, M., Mendling, J., Reijers, H.A. (2013), <i>Fundamentals of Business Process Management</i>, Springer, London.</li> </ol>

	4. Cummings, F. (2002), <i>Enterprise Integration: An Architecture for Enterprise Application and Systems Integration</i> , John Wiley & Sons, Toronto.
Assessment	<input type="checkbox"/> 20% weekly exercises (10) <input type="checkbox"/> 30% project <input type="checkbox"/> 50% exams
Website of the course	<a href="http://compus.uom.gr/MINF206/">http://compus.uom.gr/MINF206/</a>

Title	<b>Legal Issues of Informatics and e-Business</b>
Instructor(s)	Eugenia Alexandropoulou, Professor of I.T. Law
Objectives	The lesson aims to deal with important legal issues related to the use of Information Technology with emphasis in the regulatory framework of the Internet. It concerns the e-processing of personal data in business and communications, the protection of privacy in social networks, the intellectual rights, the e-crime, the specific protection of minors using the internet, as well as the legal framework of e-commerce.
Skills	The students are familiarized with the rights and obligations of the internet user and the issues of compliance to the legal rules governing the use of the I.T. and the Internet, in various sectors.
Prerequisites	-
Meeting the prerequisites	-
Content	<ul style="list-style-type: none"> <li>• Introduction to the I.T. Law and its various issues</li> <li>• Electronic Processing of Personal Data: Legal rules of the processing, the obligations of the data controller and the rights of the data subject</li> <li>• E-processing of personal data in business (customers, consumers, employees) with emphasis in banking</li> <li>• Legal framework of electronic communications</li> <li>• E-communication's confidentiality (telecommunications-Internet) and its legal protection</li> <li>• Use of new technologies and privacy legal protection. The example of the Radiofrequency Identification (RFID)</li> <li>• Monitoring (e-Surveillance) and Privacy</li> <li>• Copyright and Information Technology/ Software Legal Protection</li> <li>• Intellectual property rights in the Internet</li> <li>• E-crime and relative legal regulation</li> <li>• Legal protection of minors using the Internet</li> <li>• Legal framework of e-commerce</li> </ul>
Textbooks	<p>Alexandropoulou,E., Legal aspects of IT, ed. Ant.N.Sakkoula, Athens 2002 (in greek)</p> <p>Alexandropoulou, E., Copyright and Information Technology, ed. Themis-N.A. Sakkoula, Athens 2012 (in greek)</p> <p>Alexandropoulou, E., Personal data (e-processing), ed. Ant.N.Sakkoula, Athens 2007</p> <p>Christodoulou, K., Personal Data Law, ed. Nomiki Bibliothiki, Athens - Thessaloniki 2013 (in greek)</p> <p>Iglezakis,I., Law of the Information Technology, ed. Sakkoula, Thessaloniki-Athens 2013</p> <p>Karakostas, I., Law and Internet, 3<sup>rd</sup> ed., ed. P.N.Sakkoula, Athens 2009 (in greek)</p> <p>Sidiropoulos, Th., The Law of the Internet, 2<sup>nd</sup> ed., ed. Sakkoula, Thessaloniki 2008 (in greek)</p> <p>Reed Chr., Internet Law, 2<sup>nd</sup> ed., Cambridge University Press 2004</p> <p>Lucas, A., Devèze, J., Frayssinet, J., Droit de l' Informatique et de l' Internet, P.U.F., Paris 2001</p> <p>Dudley,A.-Braman,J.-Vincenti,G. Investigating Cyber Law and Cyber Ethics:</p>

	Issues, Impacts and Practices, Towson University, USA, IGI 2012. <a href="http://www.itlaw.uom.gr">www.itlaw.uom.gr</a> www.ethemis.gr <a href="http://www.tiresias.gr">www.tiresias.gr</a>
Assessment	Written final exams 50%. E-Presentation of a short-essay 50%.
Website of the course	<a href="http://compus.uom.gr/MINF171/">http://compus.uom.gr/MINF171/</a>



Title	<b>Simulation and Quality Control of Processes</b>
Instructor(s)	Yiannis Nikolaidis
Objectives	The purpose of this course is for the students to get to know and familiarize themselves with a number of special chapters of Applied Statistics, such as Simulation of Processes and Statistical Process Control. This will be achieved through the use of PCs and simple or advanced software (like Excel and Crystal Ball, and Minitab respectively). The students are introduced to this wide research area partly through theory and partly through working on case studies, using PCs. Finally, their knowledge is broadened through analyzing applied case studies.
Skills	To model and use adequately the relevant software for simple simulation and quality control applications.
Prerequisites	- Quite good knowledge of basics in Statistics - Quite good knowledge of basics in Excel
Meeting the prerequisites	Through the respective undergraduate courses as far as Statistics is concerned. However, for both teaching issues we are going to repeat the main points during the courses
Content	1. Introduction in Statistics: Discrete and Continuous distributions, Sampling distributions, Central limit theorem, Testing for goodness of fit.. 2. Introductory elements of Excel, Crystal Ball 3. Simulation of production processes: Simulation sampling, Statistical analysis of simulation results. Case studies on problems of organization and operational research. 4. Introductory elements of MINITAB 5. Acceptance Sampling for attributes and by variables, control charts for attributes or variables and design of a control chart.
Textbooks	a) "Simulation Techniques – Theory and Applications" M. Roumeliotis – S. Souravlas and b) "Statistical Quality Control" G. Tagaras
Assessment	60% for the final written exam and 40% for the (5-five) design projects.
Website of the course	<a href="http://compus.uom.gr/MINF186/index.php">http://compus.uom.gr/MINF186/index.php</a>

Title	<b>Cost Accounting Systems</b>
Instructor(s)	Vazakidis Athanasios
Objectives	<p>The purpose of this course is the knowledge, experience and understanding of accounting systems within the group 9 of the Greek Chart of Accounts with the use of information systems.</p> <p>The course, based on Estimate and Historic Costing method (analysis of costs to cost centers of business), examines the Cost of Products, Services, Merchandised Goods of Multifunctional Companies (both manufacturing, trading and of services).</p> <p>Then, students are taught modern costing methods such as Activity-Based Costing.</p> <p>The course seeks to deepen the analysis and costing accounting and tries to answer the following questions:</p> <ul style="list-style-type: none"> <li>• Which costing method is best, depending on the different forms of companies?</li> <li>• Can this costing method be easily applied?</li> <li>• Can this costing method provide better information regarding the cost of products to management?</li> </ul> <p>Students will have to work with written or oral tasks in order to be prepared to face the complexity of costing accounting.</p>
Skills	General Skills of Computing and basic knowledge of the group 9 of the Greek Chart of Accounts.
Prerequisites	The approach will be initiated by the student and teacher guidance.
Meeting the prerequisites	The course will take the form of lectures and hands-on in PC lab.
Content	<p>Arguments in Cost Accounting Systems.</p> <p>Basic concepts of Costing Accounting.</p> <p>Methods of costing products, merchandised goods and services.</p> <p>Analysis and operation of the group 9 of the Greek Chart of Accounts.</p> <p>Cost to Cost Centers Allocation.</p> <p>Case studies of product costing in annual or monthly base, as well as batch costing.</p> <p>Connection between Costing Accounting and Financial Accounting regarding the Greek Chart of Accounts.</p> <p>Analysis of Activity-based Costing.</p> <p>Case study of product costing with the use of group 9 of Greek Chart of Accounts interrelated with Cost Accounting Information Systems.</p> <p>All studies are solved in the PC Laboratory using modern Cost Accounting Information Systems.</p> <p>Advantages and disadvantages between Costing Accounting Methods.</p>
Textbooks	<ol style="list-style-type: none"> <li>1. Horngren, Ch., Srikant M., et al., "Cost Accounting and Student CD Package", 11th Edition, 2002, Prentice Hall, USA.</li> <li>2. Barfield J., Raiborn C. and Kinney M., "Cost Accounting: Traditions &amp; Innovations", 5th Edition 2002, South-Western College Pub, USA.</li> </ol>

	<p>3. Bagranoff Nancy A., Simkin Mark G. and Norman Carolyn Strand, "Core Concepts of Accounting Information Systems", John Wiley &amp; Sons; 11th Edition (18 Dec 2009).</p> <p>4. Simkin Mark G., Strand Norman Carolyn A., "Accounting Information Systems", John Wiley &amp; Sons; 12th Edition International Student Version edition (21 Feb 2012).</p> <p>5. Cost accounting with group 9 of the General Plan of Accounts - Monthly Cost Accounting - Annual Cost Accounting &amp; Warehouse handling in practice, in Greek, (Karagiannis D, Karagiannis I, Karagianni A), 4th edition, 2009, Thessaloniki.</p> <p>6. Management Accounting (Garrison R, Noreen E), 11th edition, 2006, Athens</p> <p>7. Extensive material of notes and analytic case studies will be delivered at the end of each lecture.</p>
Assessment	Written examination
Website of the course	<a href="http://compus.uom.gr/MINF166/">http://compus.uom.gr/MINF166/</a>

Title	<b>Information Systems in Financial Analysis and Management</b>
Instructor(s)	Apostolos Dasilas
Objectives	1. Introduction to the basic concepts and tools of Financial Analysis 2. Presentation and use of ERP software in general and with emphasis to its financial components.
Skills	
Prerequisites	Introduction to Business Accounting
Meeting the prerequisites	
Content	1. Basic concepts of Financial Analysis and sources of Financial Data. (Financial Statements, Financial Ratios, Hellastat Data Base) 2. Methodology of an ERP company presentation (Business activity, Product, Financial Structure, Financial Performance) 3. Financial Analysis Models
Textbooks	1. Γιάννης Α. Πολλάλης, Αθανάσιος Π. Βοζίκης, Πληροφοριακά συστήματα διαχείρισης επιχειρησιακών πόρων: Στρατηγικές και εφαρμογές ERP, Utopia, 2009, Αθήνα, ISBN 978-960-98123-3-7 2. Ολοκληρωμένα Συστήματα Διαχείρισης Επιχειρηματικών Πόρων, Γ. Ιωάννου, Εκδόσεις Σταμούλη ΑΕ, 2006. 3. Πληροφοριακά συστήματα διαχείρισης επιχειρησιακών πόρων Στρατηγικές και εφαρμογές ERP, Γιάννης Α. Πολλάλης, Αθανάσιος Π. Βοζίκης, Εκδόσεις UTOPIA, 2009. 4. Εγχειρίδια Χρήσης «Entersoft ERP»
Assessment	Assignments 15% Mid-term assignment / Presentation (ERP company) 20% Final exams - Assignment I (Compulsory: Financial Management Subsystem) 30% Final exams - Assignment II (Selecting a different Subsystem) 30% Participation 5% TOTAL 100%
Website of the course	<a href="http://compus.uom.gr/MINF102/">http://compus.uom.gr/MINF102/</a>

Title	<b>Computational Estimation Techniques</b>
Instructor(s)	Nikolaos Dritsakis
Objectives	Learning outcomes: Theory testing or empirical verification Exercise of economic policy Forecasting future values in economic variables
Skills	Use of econometric software E-Views
Prerequisites	Statistics - Econometrics
Meeting the prerequisites	Successful examination in the undergraduate module as prerequisite or extensive introductory lessons
Content	<p><b>Time-series analysis</b> [Introduction, Basic definitions, Spurious Regressions, Stationarity of time-series, Stationarity testing, Unit root, Unit root testing, (Augmented Dickey-Fuller, Dickey Fuller GLS (ERS), Phillips-Perron, Kwiatkowski-Phillips-Schmidt-Shin (KPSS), Elliot-Rothenberg-Stock Point Optimal Ng-Perron), Unit root test with structural breaks (Zivot-Andrews, Lumsdaine and Papelli)]</p> <p><b>Cointegration</b> (Definitions and meanings, Cointegration testing, Engel – Granger Testing, Johansen Testing, Phillips- Quliaris Testing, Park added variables, Hansen stability, Cointegration testing with structural breaks, Gregory – Hansen testing)</p> <p><b>Error correction model</b> (Error correction model with cointegration test F-test)</p> <p><b>Causality</b> (Definitions, Granger testing)</p> <p><b>Panel Data testing</b></p> <p><b>Unit Root tests</b> (Levin-Lin-Chu, Breitung, Im-Pesaran-Shin, Fisher Hadri)</p> <p><b>Cointegration tests</b> (Pedroni, Kao, Maddala and Wu)</p>
Textbooks	<p>Δημέλη. Σ. (2002). Σύγχρονες Μέθοδοι Ανάλυσης Χρονολογικών Σειρών, Αθήνα, Κριτική.</p> <p>Συριόπουλος, Κ, Φίλιππας, Δ. (2010). Οικονομετρικά. Υποδείγματα, Εκδόσεις Αντικύλα, Θεσσαλονίκη</p> <p>Baltagi, Badi (2008). Econometric Analysis of Panel Data, John Wiley &amp; Sons, U.K.</p> <p>Ben Voglvang (2005). Econometrics Theory and Applications with E-Views, Pearson Education Limited, England.</p>
Assessment	50% Written examination and 50% Written assignment
Website of the course	<a href="http://compus.uom.gr/MINF108/">http://compus.uom.gr/MINF108/</a>

## 6.4 4<sup>th</sup> Specialization “E-Business & Innovation Technology”

### 1st Semester

#### Compulsory Course

Title	<b>IT Infrastructure</b>
Instructor(s)	Konstantinos Psannis & Georgia Koloniari
Objectives	<p>The subject introduces managerial-level technical knowledge and terminology on matters concerning communications and computer networks in order to qualify managers to effectively interact with telecommunication technicians. Students are expected to comprehend and apply the notions of data communications in business environments. Another course objective is to provide the students with an understanding of database technologies and the application of such technologies in data management.</p> <p>a) Familiarization with innovative information technology infrastructures for the support of business activities, b) Computer network services and technology study, c) Design techniques and processes utilization, network management and evaluation oriented towards business applications, d) Database design based on the requirements analysis of an application, e) database implementation in some relational DBMS f) management of the contents of a database with SQL and g) OLAP-like processing.</p>
Skills	Students will acquire knowledge and practical experience on issues regarding the basic principles of telecommunications (concepts, models, architectures, services and management of digital networks) as well as on issues such as the design, implementation and use of relational databases. Ability to effectively interact with technically oriented human resources. Fluency in decision making on platforms, services and architectures of information technology infrastructures.
Prerequisites	-
Meeting the prerequisites	-
Content	<p>The following subjects will be covered:</p> <ul style="list-style-type: none"> <li>• Networks and Internet – Reference models.</li> <li>• Communication networks' functional analysis.</li> <li>• Network infrastructure unification.</li> <li>• Computer networking technologies and services.</li> <li>• Alternative routing protocols in business environments.</li> <li>• Development of special infrastructure for the provision and transmission of data.</li> <li>• Network services cost estimation and management.</li> <li>• Infrastructure as a services – Internet services.</li> <li>• ER Model, relational model, CASE tools for database synchronization and reverse engineering, SQL, OLAP</li> </ul>
Textbooks	<ul style="list-style-type: none"> <li>• Business Data Communications and Networking, Jerry FitzGerald, Wiley</li> <li>• Business Data Communications, 6/E, William Stallings, Prentice Hall</li> </ul>

	<ul style="list-style-type: none"><li>• Database Management Systems (3rd edition), by Raghu Ramakrishnan and Johannes Gehrke, McGraw-Hill, 2002.</li><li>• Database Systems: The Complete Book (2nd Edition), by Hector Garcia-Molina, Jeffrey D. Ullman, and Jennifer Widom, Prentice Hall, 2008.</li></ul>
Assessment	(4) Homework Assignments (50%) Final Written Examination (50%)
Website of the course	<a href="http://compus.uom.gr/MINF190/">http://compus.uom.gr/MINF190/</a>

## 1st Semester

### Elective Courses

Title	<b>Information Systems/Information Communications Technology Management</b>
Instructor(s)	Vicky Manthou
Objectives	The purpose of this course is to present the Information Systems , Information Technologies and the Internet, as modern vehicles of information management (collection, processing, analysis , conducting and sharing , evaluation : data / information , knowledge), as well as, the way entrepreneurs will use and administer information technologies to revitalize business processes , improve decision making and gain competitive advantage. Emphasis will be given to the importance of information systems in creating business value and to the presentation of the most important applications and technologies used to achieve digital integration and enhancement of the organization's performance
Skills	Management of information and innovative web technologies in business applications
Prerequisites	General knowledge background on web environment and applications
Meeting the prerequisites	There are no prerequisites
Content	<p>Management of digital business</p> <p>Information systems in business</p> <p>The role of information in business, knowledge management</p> <p>Information systems , organizations, management and strategy (categorization capabilities of IS)</p> <p>Strategy for Information Technology - Strategic Alignment - Maturity criteria for strategic alignment</p> <p>Infrastructure of information technology</p> <p>Information management technologies</p> <p>Integration of enterprise applications and business processes (ERP, CRM, PRM, GIS, interoperable IS)</p> <p>IS and cloud computing</p> <p>Business intelligence and business performance management</p> <p>Strategic IS for innovation and competitive advantage</p> <p>Business applications of information systems</p>
Textbooks	<p>Laudon, K.C., and Laudon, J.P., 2014, Management Information Systems-Managing the Digital Firm, 13th ed. Prentice Hall</p> <p>Laudon, Kenneth C. and Guercio Traver, Carol, 2011, Management Information Systems 12th Edition, Prentice Hall</p> <p>Laudon, K.C., and Laudon, J.P., 2009, Management Information Systems-Managing the Digital Firm, 10th ed. Prentice Hall</p> <p>Turban, Leidner, McLean, Wetherbe, 2006, Information Technology for Management: Transforming Organizations in the Digital Economy, 5th edition, John Wiley and Sons</p>
Assessment	50% final exam



	25% team project 10% presentation of a case study 15% study and analysis of papers and case studies
Website of the course	<a href="http://compus.uom.gr/MINF174/">http://compus.uom.gr/MINF174/</a>

Title	<b>Digital business Strategy</b>
Instructor(s)	Fotios Kitsios Invited speakers
Objectives	The aim of the course is to highlight the importance of strategic management in the digital business environment. To prepare future managers to leverage technologies, applications and skills in adoption and change management of business ideas, opportunities and strategies that organizations need to manage in order to plan and lead digital business initiatives.
Skills	<ul style="list-style-type: none"> <li>• Understand the importance of digital business strategy</li> <li>• Align information technology with new organizational forms of electronic business</li> <li>• Develop effective strategies in digital business environment</li> </ul>
Prerequisites	-
Meeting the prerequisites	-
Content	<ol style="list-style-type: none"> <li>1. Introduction to e-business</li> <li>2. The markets for electronic commerce</li> <li>3. The economics of digital business</li> <li>4. Analysing the industry impacts of digital business</li> <li>5. Formulation a digital business strategy</li> <li>6. Developing a digital business strategy</li> <li>7. Implementing a digital business strategy</li> <li>8. Evaluation a digital business strategy</li> <li>9. Managing digital business change</li> <li>10. Case studies</li> </ol>
Textbooks	<ul style="list-style-type: none"> <li>• Dave Chaffey: "Digital Business &amp; E-Commerce Management, 6th ed. Strategy Implementation &amp; Practice 6th Revised ed. Edition, Prentice Hall, 2015. ISBN-13: 978-0273786542 (712 pp)</li> <li>• Chen Stephen: "Strategic Management of E-Business", John Wiley &amp; Sons, Inc. New York, NY, USA, 2004. ISBN:0471496332 (386pp)</li> <li>• Dave Chaffey: "E-business and E-commerce Management: Strategy, Implementation and Practice," fourth edition, Prentice Hall, 2009. ISBN 9780273719601 (735 pp)</li> <li>• Tawfik Jelassi, Albrecht Enders, "Strategies for E-business: Creating Value through Electronic and Mobile Commerce", Prentice Hall (2004)</li> <li>• Colin Combe, "Introduction to E-business: Management and strategy, 2006, Elsevier, ISBN-13: 978-0-7506-6731-9</li> <li>• Mohini Singh, Dianne Waddell, "E-Business Innovation and Change Management", Irm Press (2003)</li> <li>• In Lee, "Emergent Strategies for E-Business Processes, Services and Implications: Advancing Corporate Frameworks", Information Science Reference (2008)</li> <li>• Petter Gottschalk, "E-business strategy, sourcing, and governance", ISBN 1-59904-004-2, Idea Group Inc (2006)</li> </ul> <p>Papers</p> <ul style="list-style-type: none"> <li>• Porter, M.E. (2001) Strategy and the Internet, Harvard Business Review,</li> <li>• Amit, R.and Zott, C. (2001) Value creation in E-Business, Strategic Management Journal, 22, pp 493-520.</li> <li>• Combe, C.A. (2002) The management of e-commerce strategies for gaining and sustaining competitive advantage in the online bookselling industry: The case of Amazon.com, International Journal of e-Business Strategy Management, Vol.4, No.2, November/December, pp 153-165.</li> <li>• Combe, C.A. (2004) Assessing customer relationship management strategies for creating competitive advantage in electronic business,</li> </ul>

	Journal of Knowledge Management Practice, Vol.5, August, pp 4-14.
Assessment	50% final written examination 50% team assignment
Website of the course	<a href="http://compus.uom.gr/MINF192/">http://compus.uom.gr/MINF192/</a>

Title	<b>Cloud Technologies and Web Analytics</b>
Instructor(s)	Christos Georgiadis – Panagiotis Papadimitriou
Objectives	The main objective of the course is the theoretical and practical training in order to familiarize students with Web systems and technologies (mainly semantic Web) for creating new services and analyzing Web data.
Skills	By the end of the course, students will be able to: - understand cloud computing concepts, services and technologies, and datacenters - develop skills and knowledge in issues such as Web data analysis and management, using appropriate software.
Prerequisites	-
Meeting the prerequisites	-
Content	The course includes the following: <ul style="list-style-type: none"> <li>• Web Analytics - Introductory concepts</li> <li>• Web Analytics Software: Open Source solutions (e.g. Piwik) and SaaS solutions (e.g. Google Analytics)</li> <li>• Advanced monitoring methods and implementation techniques in Web Analytics (using either Piwik or Google Analytics)</li> <li>• Web Search - Optimizing search results</li> <li>• Cloud characteristics, cloud deployment models</li> <li>• Roles and cloud services for enterprises</li> <li>• Server and network virtualization</li> <li>• Datacenters</li> </ul>
Textbooks	For cloud technologies: <ul style="list-style-type: none"> <li>• Cloud computing: Αρχές, τεχνολογία και αρχιτεκτονική, T. Erl, Z. Mahmoud and R. Puttini, Γκιούρδας 2015.</li> <li>• Cloud computing: Μια πρακτική προσέγγιση, A. E. Velte, T. Velte and R. Elsenpeter, Γκιούρδας 2010.</li> </ul> For Web Analytics: <ul style="list-style-type: none"> <li>• Practical Web Analytics for User Experience, M. Beasley, Elsevier, 2013</li> <li>• Piwik Web Analytics Essentials, S. Miller, Packt, 2012</li> <li>• Τεχνολογίες Παγκόσμιου Ιστού και Ηλεκτρονικού Εμπορίου, Χ. ΓΕΩΡΓΙΑΔΗΣ, Εκδόσεις Κάλλιπος 2015, <a href="https://repository.kallipos.gr/handle/11419/2288">https://repository.kallipos.gr/handle/11419/2288</a>, <a href="http://repfiles.kallipos.gr/html_books/9536/">http://repfiles.kallipos.gr/html_books/9536/</a></li> <li>• Piwik (<a href="http://www.piwik.org">http://www.piwik.org</a>)</li> </ul>
Assessment	4 Assignments (50%) Final Exam (50%)
Website of the course	<a href="http://compus.uom.gr/MINF197/index.php">http://compus.uom.gr/MINF197/index.php</a>

Title	<b>Digital Economy and Business</b>
Instructor(s)	Emmanouil Stiakakis
Objectives	The course aims to investigate the ways and the extent that the Internet and the other Information and Communications Technologies (ICTs) contribute to the modern economy. It also aims to examine the characteristics of the digital economy and the similarities - differences from the traditional economy. A final objective of the course is to examine the characteristics of the digital business, especially those that can provide a competitive advantage in the modern business environment.
Skills	Upon successful completion of the course, postgraduate students will be able to: <ul style="list-style-type: none"> <li>• understand the important role of ICTs and the Internet for the economy</li> <li>• perceive the enormous opportunities that the creation of a digital enterprise provides nowadays</li> <li>• obtain adequate knowledge upon crucial business and economic issues, such as digital currency, electronic waste, software piracy etc.</li> </ul>
Prerequisites	---
Meeting the prerequisites	---
Content	<ul style="list-style-type: none"> <li>• Introduction to digital economy – similarities and differences from traditional economy</li> <li>• Digital divide and digital inequalities</li> <li>• Productivity and efficiency measurement in the digital economy</li> <li>• The productivity paradox – use of productivity measurement tools in the digital economy</li> <li>• Pricing policies in the Internet</li> <li>• Digital goods distribution</li> <li>• Economic implications of e-waste on the environment</li> <li>• The positive aspect of Information and Communications Technologies for the solution of environmental issues</li> <li>• Economic changes due to free software – open source software</li> <li>• Economic implications of software piracy</li> <li>• The business and the economic dimension of the digital currency</li> <li>• Measurement of digital economy parameters in Greece and other countries</li> </ul>
Textbooks	<ol style="list-style-type: none"> <li>1. Goldfarb, A., Greenstein, S.M. and Tucker, C.E. (2015) <b><i>Economic Analysis of the Digital Economy</i></b>. National Bureau of Economic Research, The University of Chicago Press, USA.</li> <li>2. Brousseau, E. and Curien, N. (2007) <b><i>Internet and Digital Economics: Principles, Methods and Applications</i></b>. Cambridge University Press, Cambridge, UK.</li> <li>3. Turban, E., Leidner, D., McLean, E. and Wetherbe, J. (2008) <b><i>Information Technology for Management: Transforming Organizations in the Digital Economy</i></b>. John Wiley &amp; Sons, Hoboken, NJ.</li> <li>4. McKenzie, R.B. (2003) <b><i>Digital Economics: How Information Technology</i></b></li> </ol>

	<p><b>has Transformed Business Thinking.</b> Praeger Publishers, Westport, CT.</p> <p>5. Στειακάκης, Ε. (2013) <b>Ψηφιακή Οικονομική.</b> Εκδόσεις Ανικούλα, Θεσσαλονίκη.</p>
Assessment	50% final written examination / 50% one (1) individual assignment
Website of the course	<a href="http://compus.uom.gr/MINF121/index.php">http://compus.uom.gr/MINF121/index.php</a>

## 2nd Semester

### Elective Courses

Title	<b>Start-up Entrepreneurship</b>
Instructor(s)	Fouskas Konstantinos
Objectives	<p>The aim of the course is to provide a systematic understanding of the integrated approach to entrepreneurship and new business establishment. It provides an overview of basic business steps and components that can become the introduction of students to the field of entrepreneurship with innovative approaches. In each course will analyze important elements of entrepreneurship that will present topics related to the genre selection business , targeting and positioning in the market , analyzing customer segments - developing business value , costing and pricing , business development and team recruitment , seeking financing and business launch .</p> <p>All these steps will be accompanied by a business analysis tools such as the Business Model Canvas, analysis of case studies of successful and non- successful business and presentation of scientific studies show that reveal the factors that help or hinder the success of an entrepreneurial effort.</p> <p>Moreover, we will analyze specific issues related to the development of entrepreneurship in specific environments, such as e-business and entrepreneurship to exploit new technologies in traditional sectors..</p>
Skills	<ul style="list-style-type: none"> <li>• To understand and evaluate the process of entrepreneurship</li> <li>• To compare and understand the use of scientific knowledge in the development of start-ups by applying appropriate business tools</li> <li>• To analyze and evaluate the strategic options available to entrepreneurial activity</li> <li>• To create added value to the business environment with the use of innovation</li> </ul>
Prerequisites	-
How to fulfill the prerequisites	-
Course Contents	<ul style="list-style-type: none"> <li>• Introduction to the course and examples</li> <li>• Entrepreneurial thinking and motivation</li> <li>• Seeing Entrepreneurially – I Seeking a business idea</li> <li>• Seeing Entrepreneurially– II ‘Get out of the building approach’</li> <li>• Design and pivoting of business idea</li> <li>• Business model canvas</li> <li>• Business model – Special issues (freemium,</li> <li>• Team development and management</li> <li>• Business model canvas evaluation and scenarios</li> <li>• Global challenges on entrepreneurship</li> <li>• Ethical issues on entrepreneurship</li> <li>• Financial issues and fund rising</li> <li>• Final presentation of Business plan (exams)</li> </ul>
Textbooks	<ul style="list-style-type: none"> <li>• Blamk, S., &amp; Dorf, B. (2012). The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company. K&amp;S Ranch.</li> <li>• Bosma, N., &amp; Schutjens, V. (2011). Understanding regional variation in entrepreneurial activity and entrepreneurial attitude in Europe. The Annals of Regional Science, 47(3), 711-742.</li> <li>• Chichester. Treleaven, P. (2000) eBusiness Start-Up, Kogan Page, London.</li> <li>• Combe, C.A. (2005) e-Business adoption trajectories of SME's in Scotland, Current Issues in E-Business Research, June, pp 29-40.</li> </ul>

	<ul style="list-style-type: none"> <li>• Creswell, J. W. (2014). Qualitative, Quantitative, and Mixed Methods Approaches. Fourth Edition. Sage Publ.</li> <li>• Eric Ries, (2011), The Lean Startup: How Constant Innovation Creates Radically Successful Businesses</li> <li>• Green, J. V. (2013). The Opportunity Analysis Canvas. Venture Artisans Press.</li> <li>• Harvard Business Review on Entrepreneurship, Harvard Business School Press</li> <li>• Hisrich R., &amp; Peters M. (2002). Entrepreneurship, 5th Edition, McGraw Hill.</li> <li>• Keeley, L., Pikkell, R., Quinn, B., &amp; Walters, H. (2013). Ten Types of Innovation. Wiley Inc.</li> <li>• Kuratko, D., &amp; Hodgetts, R. (2004). Entrepreneurship: Theory, Process, Practice, 6th ed., Thomson South-Western.</li> <li>• March. Wickramasekera, R. and Matthews, S. (2007) Wotif.com: An Online Success Story, International Journal of e-Business Management, Vol. 1, Issue 1, December, pp 50-52.</li> <li>• Osterwalder, A. &amp; Pigneur, Y. (2010). Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers. John Wiley &amp; Sons, Inc.</li> <li>• Pavic, S., Koh, S.C.L., Simpson, M. and Padmore, J. (2007) Could e-business create a competitive advantage in UK SME's?, Benchmarking: An International Journal, Vol. 14, No. 3, pp 320-351.</li> <li>• Peter F. Drucker Page (2007), Innovation and Entrepreneurship, Routledge; 2Rev Ed edition</li> <li>• Putsis, W. (2014). Compete Smarter, Not Harder: A Process for Developing the Right Priorities Through Strategic Thinking. Wiley Inc.</li> <li>• Ries, E. (2011).The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses. Crown Business.</li> <li>• Scarborough, N. M. (2013). Essentials of Entrepreneurship and Small Business Management . Prentice Hall.</li> <li>• Scase, R. (2002). Living in the corporate zoo, life and work in 2010, Oxford, Capstone Publishing Ltd: UK.</li> <li>• Stam, E., &amp; Schutjens, V. (2005). The fragile success of team start-ups (No. 1705). Papers on entrepreneurship, growth and public policy.</li> <li>• Stam, E., Bosma, N., Van Witteloostuijn, A., De Jong, J., Bogaert, S., Edwards, N., &amp; Jaspers, F. (2012). Ambitious entrepreneurship. A review of the academic literature and new directions for public policy, AWT report, 41.</li> <li>• Strauss, S. D. (2003). The Business Start-Up Kit. Dearborn Trade.</li> <li>• Van Gelderen, M., Thurik, R., &amp; Bosma, N. (2005). Success and risk factors in the pre-startup phase. Small Business Economics, 24(4), 365-380.</li> <li>• Warner, M. and Witzel, M. (2004) Managing in Virtual Organizations, Thomson, London.</li> <li>• William D. Bygrave, Andrew Zacharakis (February 2014), Entrepreneurship, 3rd Edition, Wiley</li> <li>• Yang, K., &amp; El-Haik, B.S. (2003). Design for Six Sigma: A Roadmap for Product Development, Second Edition. McGraw Hill.</li> <li>• Γεωργαντά, Ζ. (2003) Επιχειρηματικότητα και Καινοτομίες: Το management της επιχειρηματικής καινοτομίας, Αννικούλα, Θεσσαλονίκη.</li> <li>• Λαμπρόπουλος, Π. (2005). Εγχειρίδιο επιχειρηματικότητας. Οργάνωση, διαχείριση ατο- μικρών και μικρών επιχειρήσεων, Δ' Έκδοση, Εκδόσεις Προπομπός.</li> <li>• Σαμαρά Ε. &amp; Βάλβη Θ. (2010).Καινοτομία Επιχειρηματικότητα Θεωρία –</li> </ul>
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	<p>Πράξη, Εκδόσεις Σοφία</p> <ul style="list-style-type: none"><li>• Σκουλάς, Ν. (2002) Το Εγχειρίδιο του Μικρού και Μεσαίου Επιχειρηματία: Πρακτικός οδηγός για μια κερδοφόρα μικρή και μεσαία επιχείρηση, Ελληνικά Γράμματα, Αθήνα.</li><li>• Χατζηκωνσταντίνου Γ. &amp; Γωνιάδης Η. (2009). Επιχειρηματικότητα και καινοτομία. Από την ίδρυση στη διοίκηση και την επιβίωση της νέας επιχείρησης, Εκδόσεις Gutenberg</li></ul>
Assessment	<ol style="list-style-type: none"><li>1. Team assignment &amp; assignment presentation - 50% of final grade</li><li>2. Final exams - 50% of final grade</li></ol>
Website of the course	<a href="http://compus.uom.gr/MINF194/">http://compus.uom.gr/MINF194/</a>

Title	<b>Innovation Management in Digital Enterprises</b>
Instructor(s)	Fotios Kitsios & Emmanouil Stiakakis
Objectives	The objective of this course is to provide students with a detailed analysis of the key issues of innovation management in the digital business, its impact on business, competitiveness and economic development in an international context. At the same time, students will learn innovative digital business models that will help them categorize and make their thoughts for engaging in digital entrepreneurship.
Skills	<ul style="list-style-type: none"> <li>• Understand the processes of innovation and management of the e-business</li> <li>• Recognize the characteristics of innovation systems</li> <li>• Leverage innovation as a key development strategy</li> </ul>
Prerequisites	-
Meeting the prerequisites	-
Content	<ol style="list-style-type: none"> <li>1. Definitions of innovation and innovation in e-business</li> <li>2. Innovation as an interactive process</li> <li>3. Development and survival in the changing technological environment , the need for innovation</li> <li>4. Knowledge management and technology strategy, technological capabilities, innovation and patent diversification</li> <li>5. Models of innovation and innovative products and services</li> <li>6. The development and management of innovation within existing enterprises</li> <li>7. Collaborative / open innovation</li> <li>8. Presentation of digital business models by students</li> </ol>
Textbooks	<ul style="list-style-type: none"> <li>• Tidd, J. and Bessant, J. (2009), Managing Innovation: integrating technological, market and organizational change, 4th Edition, Chichester: John Wiley and Sons</li> <li>• Fagerberg, J., Mowery D.C. and Nelson, R.R. (eds.) (2006), The Oxford Handbook of Innovation, Oxford: Oxford University Press</li> <li>• Utterback, James M. (1996), Mastering the Dynamics of Innovation (Cambridge, Mass., Harvard Business School Press)</li> </ul>
Assessment	<p>50% final written examination</p> <p>50% team assignment</p>
	Students will develop with the help of a Business Model Canvas a business model for digital entrepreneurship whether based on their own ideas, or digital variation of existing business models that will be proposed
Website of the course	<a href="http://compus.uom.gr/MINF182/">http://compus.uom.gr/MINF182/</a>

Title	<b>Innovative e-Business Systems</b>
Instructor(s)	Efthimios Tambouris
Objectives	The main objective of this course is to familiarise students with innovative e-business systems with an emphasis on exploiting open data (e.g. visualization, analytics, development of innovative applications).
Skills	Upon successful completion of this course students will be able to: * visualize and analyze open data to support business decisions * publish data as linked open data * develop value-added applications using open data
Prerequisites	None
Meeting the prerequisites	
Content	Introduction on Open Data (incl. Open Government Data, Social Media Data etc.) Benefits and Challenges of open data Visualization and Analysis of Open Data (using Tableau and RapidMiner) Publishing of Linked Open Data (RDF, Turtle, OpenRefine) Querying Linked Open Data (SPARQL) Development of value-added Applications (π.χ. connection with R, using JavaScript etc) Multidimensional Open Data (OLAP)
Textbooks	Στεφανιδάκης, Μ., Ανδρόνικος, Θ., Παπαδάκης, Ι., 2015. Ανοικτά συνδεδεμένα δεδομένα και εφαρμογές. [ηλεκτρ. βιβλ.] Αθήνα: Σύνδεσμος Ελληνικών Ακαδημαϊκών Βιβλιοθηκών. Διαθέσιμο στο: <a href="http://hdl.handle.net/11419/1338">http://hdl.handle.net/11419/1338</a> (in Greek) Tom Heath , Christian Bizer , 2011. Linked Data: Evolving the Web into a Global Data Space. Διαθέσιμο στο: <a href="http://linkeddatatbook.com/">http://linkeddatatbook.com/</a> Grigoris Antoniou και Frank van Harmelen, Εισαγωγή στον Σημασιολογικό Ιστό, 2η έκδοση, 2009, Εκδ. Κλειδάριθμος (Ελληνική Έκδοση) (in Greek or using the original English edition)
Assessment	50% One Team Project 50% Final Exams
Website of the course	<a href="http://compus.uom.gr/MINF191/">http://compus.uom.gr/MINF191/</a>

Title	<b>m-Business &amp; e-Commerce Technologies</b>
Instructor(s)	Christos K. Georgiadis
Objectives	The purpose of this course is the study of important concepts, techniques and challenges in the area of mobile business applications and e-commerce technologies. The course covers a wide range of issues and introduces students to recent technological advances and developments. Furthermore, it addresses the application of new technologies that support the design and development of business software applications for mobile users (such as mobile native apps and mobile Web apps) and the appropriate use and adaptation of e-commerce technologies for mobile environments. Moreover, emphasis is given on interoperability issues regarding enterprise applications which have in many cases to combine mobile services and web content using service-based approaches.
Skills	Using basic programming tools, associated with the development of mobile applications and the use of electronic commerce technologies in the area of mobile business.
Prerequisites	-
Meeting the prerequisites	-
Content	<p><b>Lectures :</b></p> <ul style="list-style-type: none"> <li>- Challenges of exploiting new opportunities in a mobile environment - mobility, personal networks and business applications</li> <li>- Mobile devices, smart devices, tablets and mobile platform constraints</li> <li>- Mobile user behavior - factors affecting the adoption of mobile business services</li> <li>- Emerging technologies - Human Computer Interaction in the mobile environment (mobile HCI)</li> <li>- Location-aware mobile applications and context awareness.</li> <li>- Personalization approaches and recommendations - Mobile recommender systems.</li> <li>- Privacy and trust in mobile and electronic commerce environments. Concerns regarding the management of mobile security and smartphone security.</li> <li>- Mobile payment systems.</li> <li>- Interoperability between m-commerce and e-commerce applications. Business data exchange using mobile Web Services: Service-Oriented Architecture (SOA), XML Web Services, Quality of Web Services, Classic and Business Transactions.</li> </ul> <p><b>Lab:</b></p> <ul style="list-style-type: none"> <li>- Introduction to mobile programming (Native apps, Android)</li> <li>- Introduction to mobile Web application development (HTML5, CSS3)</li> <li>- Introduction to hybrid app development</li> <li>- Creation and composition of Web Services - BPEL (Business Process Execution Language)</li> </ul>
Textbooks	<ul style="list-style-type: none"> <li>- Shah M., "Mobile Working: Technologies and Business Strategies" (Routledge Series in Information Systems), Routledge, 2013</li> <li>- Laudon K.C., Traver C.G., "E-Commerce: Business. Technology. Society", Pearson Education, 10th Edition, 2014.</li> <li>- Skeldon P., "M-Commerce", Crimson Publishing, ISBN-10: 1854586750, 2011</li> <li>- Weerawarana S. et al.: "Αρχιτεκτονική Πλατφόρμας Υπηρεσιών Ιστού", επιστ. επιμέλεια ελλ. έκδοσης Χ. Γεωργιάδης, Κλειδάριθμος, 2008</li> <li>- J. Annuzzi Jr., L. Darcey S. Conder, "Introduction to Android Application</li> </ul>

	<p>Development”, 4th edition, Addison-Wesley, 2014</p> <p>- M. Firtman, “Programming the Mobile Web”, 2nd edition, O’ Reilly, 2013.</p> <p>- Χ. Γεωργιάδης, «Τεχνολογίες Παγκόσμιου Ιστού και Ηλεκτρονικού Εμπορίου: Σύγχρονες τάσεις και προκλήσεις», ΣΕΑΒ, ISBN 978-960-603-125-0, 2016: <a href="http://repository.kallipos.gr/handle/11419/2288">http://repository.kallipos.gr/handle/11419/2288</a></p>
Assessment	<p>Final written examination 50%</p> <p>2 Projects 50%</p>
Website of the course	<p><a href="http://compus.uom.gr/MINF196/">http://compus.uom.gr/MINF196/</a></p>

Title	<b>Digital Marketing and Social Networking</b>
Instructor(s)	Maro Vlachopoulou Invited speaker(s)
Objectives	<p>The main objective of this course is to present and analyze the strategy and implementation of Electronic Marketing &amp; Social Media Marketing based on innovative web technologies, mobile devices / tools, innovative e/m-business models &amp; social media marketing models.</p> <p>The scope of this course is to familiarize the participants on planning, development, implementation and evaluation of innovative web technologies, tools and models in the digital environment.</p> <p>Specific goals for the participating students are:</p> <ul style="list-style-type: none"> <li>• To understand the conceptual framework and the strategy of electronic / mobile &amp; social media marketing,</li> <li>• To learn about the innovative technologies, infrastructure and resources requirements,</li> <li>• To plan, analyze and design e- marketing και social media marketing models,</li> <li>• To describe and discuss the challenges, and the penetration of e / m/ social media-marketing in specific decisions and business sectors (online promotion, distribution, the use of social networks for brand awareness, etc.),</li> <li>• To understand and develop an Internet marketing plan and to identify the additional requirements towards mobile or social media applications. Moreover, to determine the detailed steps of an e/m-marketing plan regarding specific applications,</li> <li>• To understand and analyze innovative marketing models and their constructs in several industrial sectors between the involved parties (collaborative and viral marketing, community models, affiliate marketing, social networking, etc.),</li> <li>• To choose and implement web &amp; social media metrics/ analytics and tracking systems in order to identify and measure the effectiveness of online marketing actions and campaigns (web metrics / analyzing, SEO &amp; SEM search engine optimization / marketing, on line advertising measurement, web site evaluation, social media metrics, etc.),</li> <li>• To investigate, analyze and present case studies and best practices in various business sectors.</li> </ul>
Skills	Upon successful completion of the course, postgraduate students will be able to plan, develop and manage an integrated electronic & social media marketing strategy.
Prerequisites	General knowledge background on Information Systems Management and e-Business.
Meeting the prerequisites	(If necessary) additional basic bibliography will be provided
Content	<b>Definition approaches &amp; conceptual framework:</b> E -marketing, Internet marketing, mobile marketing, online Marketing, digital/ web marketing, social media

	<p>marketing, applications areas.</p> <p><b>Typology and use of Marketing Information Systems:</b> Customer Relationship Management (CRM), Partners Relationship Management (PRM) and Business Intelligence (BI). Geographic Information Systems in marketing (GIS). Electronic identification and data collection systems (bar codes, EPOS, RFID, QR codes, NFC, smart cards, etc.). Cloud computing, Social &amp; mobile CRM.</p> <p><b>E- Internet marketing plan, electronic/mobile - marketing mix &amp; strategy:</b> Marketing research based on innovative tools and web technologies, electronic / online customers' behavior, segmentation, targeting and positioning strategy in a digital environment, behavioral targeting based on web &amp; social media analytics. Online pricing and selling. Online advertising &amp; promotion, online distribution and multichannel policy, mobile devices and apps.</p> <p><b>Innovative electronic – mobile – social media marketing models:</b> viral marketing, affiliate μάρκετινγκ, consumer generated marketing and content, e –mail marketing, online – mobile advertising – promotion, adver-gaming marketing, augmented reality, mobile apps, social media marketing models (blogs, networks, microblogs, videos, Facebook, Twitter, LinkedIn, YouTube), e.t.c..</p> <p><b>Search Engine Optimization Marketing SEO /SEM, Paid Search (Google Adwords, Adsense).</b></p> <p><b>Web &amp; social media metrics / analytics – Key Performance Indicators</b></p> <p><b>Case studies and best practices in various business sectors</b> (government, health, smart cities, education, environment, retailing, tourism, logistics)</p>
Textbooks	<ul style="list-style-type: none"> <li>• Strauss, J. and R. Frost (2013). E-Marketing (7th edition), Prentice Hall.</li> <li>• <u>Tracy L. Tuten</u> (Author), <u>Michael R. Solomon</u> (Author), Social Media Marketing, The Horizontal Revolution, Pearson Education 2014.</li> <li>• The Social Media Marketing Book, by Dan Zarrella, Copyright © 2010 Dan Zarrella. Printed in Canada, Published by O'Reilly Media, Inc., 1005 Gravenstein Highway North, Sebastopol, CA 95472.</li> <li>• M.Vlachopoulou , S.Dimitriades (2014), «E- Business &amp; Marketing – Innovative models in the digital environment”, ISBN: 978-960-7745-32-3, Code Evdoxos 32997535 , edition Rosili, Business Books, Athens.</li> <li>• M.Vlachopoulou (2003), «e- Marketing – Internet Marketing”, ISBN960-7745-04-3, edition Rosili, Athens.</li> </ul>
Assessment	<p>50% final written examination</p> <p>50% personal assignment and team project</p>
Website of the course	<a href="http://compus.uom.gr/MINF195/">http://compus.uom.gr/MINF195/</a>