Technologies and Management of Information and Communication Systems

Postgraduate Program Guide
2014-2015
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The establishment of the University of the Aegean is the realization of an idea of the great Greek mathematician Constantine Caratheodory. The University of the Aegean was founded in 1984 and is one of the newest universities in Greece. Today, having completed the second phase of its development with sixteen (16) academic Departments, twenty eight (28) Postgraduate Programs and thirteen thousand (13,000) undergraduate and graduate students, the University of the Aegean ranks among the largest universities in the country. Administrative headquarters of the University is Mytilene, while various departments have been established in towns of the islands of Lesvos.
University of the Aegean (Mytilene), Chios (Chios), Samos (Karlovasi), Rhodes (Rhodes), Syros (Ermoupolis) and Lemnos (Myrina), forming a University-network covering both the administrative divisions of the Aegean (North and South Aegean).

The University of the Aegean, with its spatial dispersion, aims to provide modern scientific education and to promote high quality basic and applied research. Keeping a flexible, non bureaucratic, organizational structure, it has established high standards for the scientific level of both its graduates, and the research and teaching staff.

The main feature of the Departments of the University is the development of innovative disciplines, often interdisciplinary, which meet the needs of modern Greek and international society, as well as the demands and expectations of students for studies of high scientific value, combined with excellent prospects for career development.

The University of the Aegean is growing steadily and methodically, according to the Strategic Plans and the Five-Year Development Plans prepared. These plans reflect the experiences gained both from the operational difficulties of academic departments on border islands and the communication within a University-network, which operates under the particular conditions of the Greek Archipelago. These experiences led the University of the Aegean to be the first Greek University that fully integrates the information and communication technologies in everyday broad administrative practice, thereby creating the conditions of development of a Society of Information and Knowledge.
Currently the University of the Aegean comprises the following sixteen (16) Departments and Schools:

### School of Sciences (Samos)
- Dept. of Information and Communication Systems Engineering*
- Dept. of Mathematics
- Dept. of Product and Systems Design Engineering (Syros)*

### School of Social Sciences (Lesvos)
- Dept. of Social Anthropology and History
- Dept. of Geography
- Dept. of Sociology
- Dept. of Cultural Technology and Communication

### School of the Environment (Lesvos)
- Dept. of Environment
- Dept. of Marine Sciences
- Dept. of Food Sciences and Nutrition (Lemnos)

### School of Business (Chios)
- Dept. of Business Administration
- Dept. of Shipping, Trade and Transport
- Dept. of Financial and Management Engineering*

### School of Humanities (Rhodes)
- Dept. of Primary Education
- Dept. of Pre-School Education and Educational Design
- Dept. of Mediterranean Studies

* The Engineering Departments will constitute the “School of Engineering” of the University of the Aegean, the founding of which has been already decided by the Greek Council for Higher Education.
The University of the Aegean is managed by the Senate, the Rector and the Vice Rectors, who, for the academic year 2014-2015, are:

**Rector**  Professor Stefanos Gritzalis

**Vice Rectors**
- Professor Amalia Polydoropoulou  
  *Department of Shipping, Trade and Transport*
- Associate Professor Alexandra Bounia  
  *Department of Cultural Technology & Communication*
- Associate Professor Spyridon Syropoulos  
  *Department of Mediterranean Studies*

The administrative facilities of the University of the Aegean are located at the following places:

**Lesvos (University Headquarters - Rector’s Office)**

University Hill, Administration Building, Mytilene, Lesvos, GR 81100, Greece
Tel. +30-22510-36000
Fax: +30-22510-36009

**Samos**

Karlovasi, Samos, GR 83200, Greece

<table>
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<tr>
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<th>Tel: +30-22730-82015</th>
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<td></td>
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<td></td>
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<tr>
<td>Undergraduate Studies Secretariat</td>
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<td>+30-22730-82021</td>
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<td>Eirini Grammatikou</td>
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<td>Postgraduate Studies Secretariat</td>
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<td>Eirini Grammatikou</td>
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<tr>
<td>Student Support</td>
<td>Apostolos Galanopoulos</td>
<td>+30-22730-82028</td>
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<tr>
<td></td>
<td>Giorgos Mitatakis</td>
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<tr>
<td>Computing Center</td>
<td>Aggeliki Parianou</td>
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<td>Library</td>
<td>Vasiliki Gouvala</td>
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<td>Manto Katsiani</td>
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<td>Evina Vasmari</td>
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<td>Fotis Kyriakou</td>
<td>Nikos Zacharis</td>
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<td>Demokratias Avenue 1, Rhodes, GR-85100, Greece</td>
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<td>Tel. +30-22710-35000</td>
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<td>Mitropoli Ioakeim 2, Myrina, GR-81400, Greece</td>
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<td>Tel. +30-22810-97000</td>
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<tr>
<td>Tel. +30-210-6492000 • Fax: +30-210-6492299</td>
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For more information about the University of the Aegean please visit our website:

http://www.aegean.gr
Facilities

The islands of the Aegean possess an architectural wealth of significant historical value. The exploitation of this wealth by the University of the Aegean contributes to the preservation of our national heritage. The aim of the University is that its activities are housed –where possible– in traditional buildings on the islands.

On the island of Samos, the University of the Aegean utilizes the following buildings:

**Karlovasi**
- Emporiki Sholi Building (Classrooms, Helpdesk)
- Igemoneio (Faculty Offices of Mathematics Department, Secretariat)
- Chatzigianneio (Library)
- Liberis Building (School of Science Secretariat, Faculty Offices of the Department of Information and Communication Systems Engineering, Secretariat, Classroom, Laboratories)
- Vourlioti Building (Faculty Offices of the Department of Statistics and Actuarial-Financial Mathematics, Secretariat)
- Morali Building (Faculty Offices of the Department of Mathematics)
- Provatari Building (Classrooms, Faculty Offices)
- Tsobana Building (Multimedia center)
- Kalatzis Warehouses (under construction)
- “Former Papanikolaou” Building (Offices of Postgraduate Students)
- Middle Karlovasi School Group (Classrooms)
- Student Club – Projection Hall
- Student Residences of the University Unit of Samos
- “Former Katsika” Building (Technical Services)
- “Former Psatha” Building (offices)
- “Former Karagiannis” Building (warehouses)
- “Former Thrasyvoulou” Building (warehouses)
- “Former Pantazoni” Building (warehouses)

**Vathi**
- Maniakeio Institute (Seminar Room, Faculty Offices)
There are twenty eight (28) Postgraduate Programs in more than thirty (30) different fields of study in the University of the Aegean (www.aegean.gr).

The Postgraduate Program “Technologies and Management of Information and Communication Systems” operates in the Department of Information and Communication Systems Engineering, which is based on the island of Samos.
Emporiki Sholi Building (Classrooms, Helpdesk)
2.1 Orientation

Information and Communication Technologies (ICTs) constitute a very dynamic part of the economy. The rapid proliferation of these technologies led to the development of the “New Economy”. The term New Economy, as we move towards the Information Society, includes the redesign of the existing economic activities concurrently with the creation of new ones, as digital technology makes storage, processing, dissemination and utilization of information easier, faster, cheaper and more efficient. The huge amount of available electronic information changes significantly the way companies and markets work, leading to a redesign of their operational framework that aims at the creation of new added value by exploiting the available information.

In this New Economy, the efficiency and competitiveness of organizations, in both the public and the private sector, highly rely on the effective exploitation of ICTs.

In this context, both the Undergraduate and Postgraduate Programs of the Department of Information and Communication Systems Engineering (www.icsd.aegean.gr) aim at preparing highly educated and skilled engineers in the area of ICTs, who:

- will have sound fundamental, as well as specialized knowledge,
- will be distinguished for their analytic, synthetic, critical and creative spirit,
- will be able to work effectively in a collaborative environment,
- will be able to contribute from positions of responsibility to the effective exploitation of ICTs in companies and organizations of the public, private and social sector of the economy,
will be able to take action in a collaborative environment, generating new knowledge through their participation in activities of basic and applied research and development.

2.2 Faculty

Head of Department: Associate Professor Charalabos Skianis
Deputy Head of Department: Associate Professor Euripidis Loukis
Director of Postgraduate Studies: Associate Professor Charalabos Skianis

Professor Spiros Cotsakis, Degree in Mathematics, National and Kapodistrian University of Athens, M.Sc. in Astronomy, Ph.D. in Mathematical Physics and Cosmology, University of Sussex (Differential Geometry, Mathematical Relativity, Generalized Theories, Mathematical Cosmology).


Professor Agis Iliadis, Degree in Physics, Aristotle University of Thessaloniki, M.Sc. in Electrical Engineering and Electronics, Ph.D. in Electrical Engineering and Electronics, University of Manchester Institute of Science and Technology (UMIST) (Semiconductors, Basic and Composite Materials for Semiconductors Construction).


Associate Professor Lilian Mitrou, Degree in Law, National and Kapodistrian University of Athens, Ph.D. in Law, Goethe-Universitat, Frankfurt (Legal Aspects of Information Society, Information Law, Individual Rights in the Information Society, Personal Data Protection).

Associate Professor Charalampos Skianis, Degree in Physics, University of Patras, Ph.D. in Informatics, University of Bradford (Computer Networks, Modeling and Performance Evaluation of Wireless and Mobile Communication Networks).
Associate Professor **Efstathios Stamatatos**, Diploma in Electrical and Computer Technology Engineering, Ph.D. in Natural Language Processing, University of Patras (Natural Language Processing, Machine Learning and Computer Music).

Assistant Professor (tenured) **Yannis Charalabidis**, Diploma in Electrical and Computer Engineering, Ph.D. in Complex Software Systems, National Technical University of Athens (ICT enabled Collaborative Governance, Linked / Open Data, Social Participation Systems, Complex Societal Systems Modeling and Simulation, Enterprise Interoperability).

Assistant Professor (tenured) **Spyros Kokolakis**, Degree in Informatics, Ph.D. in Information Systems, Athens University of Economics and Business (Information Systems, Information Systems Security).

Assistant Professor (tenured) **Asimakis Leros**, Diploma in Electrical Engineering, University of Patras, M.Sc. in Electrical & Computer Engineering, University of Massachusetts at Amherst, Ph.D. in Computer Engineering and Informatics, University of Patras (Estimation Theory, Parallel Algorithms, Digital Signal Processing, Systems Modeling and Simulation).

Assistant Professor (tenured) **Theodoros Tzouramanis**, Diploma in Electrical and Computer Engineering, Ph.D. in Informatics, Aristotle University of Thessaloniki (Databases, Geographical Information Systems).

Assistant Professor (tenured) **Demosthenes Vouyioukas**, Diploma in Electrical and Computer Engineering, M.Sc. in Business Administration (MBA), Ph.D. in Wireless and Mobile Communications, National Technical University of Athens (Mobile and Satellite Communications, Digital Communication Systems, Propagation and Antennas, Broadband Networks).

Assistant Professor **Emmanouil Kalligeros**, Diploma in Computer Engineering and Informatics, M.Sc. in Computer Science and Technology, Ph.D. in Embedded Testing of Digital Circuits, University of Patras (VLSI Design and Test, Design for Testability, CAD Methodologies for VLSI Testing, Test-Data Compression and Built-In-Self-Test Architectures).


Assistant Professor **Alexis Kaporis**, Degree in Mathematics, Ph.D. in Threshold Phenomena in Combinatorial Problems, University of Patras (Algorithm Analysis, Probabilistic Techniques, Algorithmic Game Theory, Data Structures).

Assistant Professor **Ergina Kavallieratou**, Diploma in Electrical and Computer Technology Engineering, Ph.D. in Document Image Processing and Optical Character Recognition, University of Patras (Image Processing, Computer Vision, Pattern Recognition).

Assistant Professor **Elisavet Konstantinou**, Degree in Informatics, University of Ioannina, M.Sc. in Signal and Image Processing Systems, Ph.D. in Public Key Cryptography, University of Patras (Cryptography).

Assistant Professor **Georgios Kormentzas**, Diploma in Electrical and Computer Engineering, Ph.D. in Traffic Control and Management of Broadband Networks using Abstract Information Models and Distributed Object Architectures, National Technical University of Athens (Computer Networks, Wireless Communications, Service Quality, Traffic Modeling and Analysis).

Assistant Professor **Manolis Maragoudakis**, Degree in Computer Science, University of Crete, Ph.D. in Artificial Intelligence, University of Patras (Data Mining, Privacy Preserving Data Mining, Machine Learning, User Modeling, Semantic Web, Databases, Bayesian Networks, Knowledge Engineering).


Lecturer **Dimitrios Drosos**, Degree in Computer Science, University of Crete, MBA International (specialization e-commerce), Ph.D. in Mobile Advertising Effectiveness, Athens University of Economics and Business (e-Business, Wireless Technologies for Business Applications).

Lecturer **Christos Goumopoulos**, Diploma in Computer Engineering and Informatics, Ph.D. in Distributed Software Systems, University of Patras (Parallel and Distributed Computing).

Lecturer **Georgios Kofinas**, Degree in Physics, National and Kapodistrian University of Athens, M.Sc. in Theoretical Physics, University of Alberta, Ph.D. in Physics, National and Kapodistrian University of Athens (Relativistic Classical and Quantum Cosmology, Gravity in Higher Dimensions, Generalized Theories).

Dr. Ifigenia Klaoudatou, Degree in Mathematics, National and Kapodistrian University of Athens, M.Phil. in Astronomy, Cardiff University, Ph.D. in Applied Mathematics and Mathematical Physics, University of the Aegean (Mathematical Relativity and Cosmology).

2.3 Technical Laboratory Personnel

Dr. Dimitrios N. Skoutas, Diploma in Electrical and Computer Technology Engineering, University of Patras, Ph.D. in Communication Networks, University of the Aegean.

Christina Theocharopoulou, Degree in Mathematics, University of the Aegean.

2.4 Research Activities

Basic and applied research is in the core of the transformation process of modern society into a society of knowledge. Basic research produces the knowledge, which will lead to the innovations of the future. Applied research is the answer to the constantly increasing demands for economic growth and progress, based on innovation for the benefit of the society and development of the country. The acceleration of social, economic and technological development created the need for rapid interaction between basic and applied research, particularly in the rapidly developing field of information technology and telecommunications.

Research requires robust planning, infrastructure supported by continuous investment, and, most of all, researchers with high expertise, broad and valuable knowledge base, inclination for participation in the research process and high-level collaborative view, practice and effectiveness. As a system of knowledge production, research is closely linked with education and technology.

In this context, investment in research is a primary objective and a key in the development of the Department of Information and Communication Systems Engineering. The Department invests in pioneering and important areas of basic and applied research, such as:
The Department of Information and Communication Systems Engineering have extensive experience in designing and carrying out competitive research and development projects. Such projects have been funded by the European Commission and the European Committee for Standardization, through programs such as: FP7, FP6-STREP, FP6-IST, TEN / TELECOM, ISIS, Leonardo, ACTS, INFOSEC ETS II, ESPRIT / ESSI, Telematics Applications, ACTION 2, INFOSEC, ESPRIT LTR, BRITE EURAM, INNOVATION, RACE, VALUE II, LRE, ESPRIT, EURET / EURATN, AIM, etc.

The Department’s faculty has similar experience in designing and carrying out national competitive research and development projects. Funders of such projects
are: the Ministries of Interior, Foreign Affairs, Justice, Transparency and Human Rights, Finance, Education and Religious Affairs, Culture and Sports, Health, Public Order and Citizen Protection, Labor, Social Insurance and Welfare, Marine and the Aegean, as well and the General Secretariat for Research and Technology, General Secretariat for Greeks Abroad, the National Centre for Vocational Orientation, the National Organization for Medicines, the Social Insurance Institute, the Greek State Scholarship Foundation, the Information Society SA, and many private organizations and enterprises.

Also, by taking advantage of the European Union financing capabilities through the ERASMUS / SOCRATES programs, the Department has developed and maintains educational and research collaborations with several European universities, including, among others, the following: Royal Holloway and Bedford New College (University of London), University of Plymouth, University College Dublin, Aston University, Kingston University, Trinity College Dublin, University of Stockholm, University of Lund, Chalmers Institute of Technology, Karlstad University, University of Hamburg, University of Essen, University of Regensburg, Catholic University of Leuven, University of Vienna, Technical University of Graz, University of Oulu, University of Rome “La Sapienza”, University of Milano, Deusto University, University of Malaga, Polytechnic University of Catalunya, and Copenhagen Business School.

Student residences, Karlovasi
3.1 Objective

The objective of the Postgraduate Program of the Department of Information and Communication Systems Engineering is to provide high-level education and promote basic and applied research in the area of Information and Communication Systems.

3.2 Degrees that can be obtained through the Postgraduate Program

The Postgraduate Program of the Department of Information and Communication Systems Engineering leads to the following Degrees:

- Master’s Degree (M.Sc.) in “Technologies and Management of Information and Communication Systems”
- Doctor of Philosophy (Ph.D.) Degree
4 Master’s Degree Program (M.Sc.)

4.1 Scope

The scope of the Master’s Degree Program in “Technologies and Management of Information and Communication Systems” is to provide high quality education for University graduates in the area of Information and Communication Systems.

4.2 Purpose

The purpose of the Master’s Degree program, apart from providing high-level education and promoting basic and applied research in the area of Information and Communication Systems, is also to study and exploit methodologies and tools in this vital area.

4.3 Objective

The objective of the Master’s Degree program is to train University graduates so as to provide scientists with advanced knowledge, skills and specialization, thus being able to:

- promote science through their participation in basic and applied research and development activities in the area of Information and Communication Systems,
- meet the needs of companies and organizations of the public, private and social sectors of the economy for specialized personnel in the areas of analysis, design, implementation, management and evaluation of Information and Communication Systems.
The Master’s Program in “Technologies and Management of Information and Communication Systems” of the Department of Information and Communication Systems Engineering consists of the following six Streams:

<table>
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<td>Stream III</td>
<td>Intelligent Information Systems</td>
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<td>Stream IV</td>
<td>Communication and Computer Networking Technologies</td>
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<td>Stream V</td>
<td>Information and Communication Systems</td>
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<td>Stream VI</td>
<td>Digital Innovation and Entrepreneurship</td>
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5.1 Stream I

Information and Communication Systems Security

5.1.1 Scope and Objectives

The aim of the “Information and Communication Systems Security” Stream is to educate the postgraduate students on all aspects pertaining to the development, management and evaluation of a secure Information and Communication System. In particular, this Stream will offer all the knowledge and skills required for:

- analyzing, designing, developing, managing and evaluating the security level of an Information and Communication System, in close analogy to the “real” operational environment of a typical organization,
- creating new knowledge, by participating in research and development activities in the area of Information and Communication Systems Security.

5.1.2 Courses per Semester

The "Information and Communication Systems Security" Stream offers eight (8) courses. The titles as well as the distribution of the courses per semester are presented below. All eight courses of this Stream are compulsory and students are expected to successfully attend all of them.

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## 3rd SEMESTER

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### 5.1.3 Courses Syllabus and Learning Outcomes

For each course, syllabus is shown first and learning outcomes follow.

#### 5.1.3.1. Computer and Communication Networks Security

This course focuses on advanced topics of network security. The learning objectives of this course are as follows: To understand how network security is perceived and materialized; to understand the various ways in which networks can be attacked and realize the tradeoffs in protecting networks; to provide students with a deep understanding of the architecture, risks, vulnerabilities and penetration testing techniques in both single and multi-domain networks; to articulate informed opinion about security by design vs. security as afterthought. The structure of the module follows the OSI/ISO architecture of network security and more specifically that of the Internet model. Case studies and student projects are an important component of the course. Their aim is to provide students with the knowledge and skills necessary to design and support network security, meaning to design and implement secure networks that streamline accessibility while minimising exposure or susceptibility to security risks. The aforementioned objectives are accomplished through course lectures, paper readings, and extensive laboratory exercises.

5.1.3.2. Cryptography
Introduction to number theory, prime numbers, finite fields, modular arithmetic, Chinese remainder theorem, one-way functions, historical cryptographic algorithms, one-time pad, public key cryptography (RSA, Rabin, ElGamal, elliptic curves), key management, Diffie-Hellman key agreement, stream ciphers, block ciphers, hash functions, digital signatures with appendix, digital signatures with message recovery.

Deep knowledge of the basic elements of number theory and familiarity with the most well known cryptographic algorithms.

5.1.3.3. Database Systems Security
Discretionary and mandatory access control; security and privacy protection using capabilities of the SQL language; role-based access control; multilevel secure database management system architectures. Digital watermarking and fingerprinting in relational databases. Surviving information warfare attacks on databases, intrusion detection, data corruption and database recovery. Database models, architectures, mechanisms and policies that ensure data security, privacy preservation, confidentiality protection, integrity and availability. Translucent and encrypted databases, retrieval of encrypted data. Security in statistical, object-oriented, distributed and medical databases. Big data security. Data security and privacy protection in online social networks. Case studies: Oracle Database, Microsoft SQL Server, IBM DB2, MySQL, etc.
In this course, the students learn about challenges and threats, in their most serious form, against data security and privacy in modern database systems, and about the most effective countermeasures developed to protect data and ensure that legitimate and authorized users retain safe access to these data for processing.

5.1.3.4. Future Internet Security and Privacy

Learning of advanced design and development technology topics for the protection of privacy and the achievement of safety in the Future Internet.

5.1.3.5. Advanced topics in Cryptography and Security

Learning of advanced design and development technology topics used in applied cryptography.

5.1.3.6. Information Law
The aim of this course is to offer to the students of the Postgraduate Program the opportunity and the possibility to gain an overview of the legal and institutional issues, which pertain to the Information and Communication Technologies (ICTs) in their socio-economic environment. The knowledge and understanding of the regulatory context of ICTs and of the main legal rules and principles allow the students to integrate their technical knowledge in a wider social, economical and institutional context. The knowledge and the understanding of these issues, the requirements of the socio-economic environment and the regulatory system are of major importance, as on the one side they enhance the inter-disciplinary knowledge and approach, and on the other side they provide the students with a wider range of skills, which prove to be useful for their professional course.

5.1.3.7. Information Systems Security Management


5.1.3.8. Wireless and Mobile Networks Security


The current course addresses advanced security and privacy issues in wireless systems, including cellular and wireless LAN and MAN networks. More specifically, the
topics under the focus of this module include confidentiality, integrity, availability, privacy, and control of fraudulent usage of mobile and wireless networks. The main learning objectives of the course at hand are: To impart state-of-the-art technologies and protocols of wireless network security; to identify and investigate in-depth both early and contemporary threats to mobile and wireless networks security; to apply proactive and defensive measures to deter and repel potential threats, attacks and intrusions; to develop an understanding of security issues towards 4G architectures (as those posed by SAE/LTE network). This contributes into developing a clear view of integrated security environments consisting of both similar and diverse wireless access technologies and security architectures (horizontal and vertical), and obtaining an understanding of cross-layer security issues encountered by these networks. Particular emphasis is put on security problems of MAC and upper layers. A limited number of demanding case studies and student projects is also an important component of the course. The aforementioned objectives are accomplished through face-to-face course lectures, paper readings, and laboratory exercises.

5.1.4 Research Activities

The research areas of interest of the faculty members and the collaborating researchers of the Laboratory of Information and Communication Systems Security (Info-Sec-Lab), which supports the “Information and Communication Systems Security” postgraduate Stream, include, among others:

- Security and Protection of Privacy in Mobile, Wireless and Sensor Networks
- Technical and Legal Issues of Secure e-Government
- Technical and Legal Issues of Secure e-Voting
- Secure e-Commerce and e-Business
- Secure e-Learning
- Health Information Systems Security
- Applied Cryptography
- Formal Methods in Security and Protection of Privacy
- Privacy Enhancing Technologies
- Theory and Development Practices of Public Key Infrastructure
- Information Systems Risk Assessment Methodologies
- Information Systems Security Policies
- Legal and Regulatory Issues of Personal Data Security and Privacy
- Security and Privacy Preservation Economics
- Information Law
- Intrusion Detection Systems
- Security on the Grid
- Technology and Applications of Smart Cards

The Info-Sec-Lab members have participated in numerous research and development competitive projects supported by EU programs (e.g., IST, CRAFT, Telematics for Administrations, ESPRIT, European Trusted Services ETS I & ETS II, ISIS, INFOSEC, Healthcare Telematics, RACE, ACTS, AIM, VALUE, STAR, ORA, Socrates / Erasmus, etc.), by the European Standardization Committee (CEN), or by the Greek Government (GSRT, ministries, public organizations, etc.).

In the framework of these projects, collaboration has been developed with more than 150 organizations, universities, research centers, private companies and public institutions from Greece, country members of the European Union and the USA. Doctoral and postgraduate students of the “Information and Communication Systems Security” postgraduate Stream perform high quality research by participating in the research and development activities of national and international competitive programs.

Members of the Info-Sec-Lab have participated as authors of books or book chapters, book editors or editors of conference proceedings, authors of invited journal papers, and authors of scientific journal or international conference articles, in more than 500 publications on Information and Communication Systems Security and Privacy Protection.

Furthermore, members of the Info-Sec-Lab have served more than 700 times as Conference General Chairs, Program Chairs, Program Committee Members, Members of Organizing Committees, referees in scientific journals and international conferences, in the area of Information and Communication Systems Security and Privacy Protection.

The number of citations (from non co-authors) to the scientific work of the Info-Sec-Lab members exceeds 1,500.

Also, more than 60 international scientific conferences have been organized in the last fifteen years, many of them at Samos, under the scientific and organizing supervision of Info-Sec-Lab members. Among them are the following: [1996]: IFIP/SEC-1996. [1997]: IFIP/CMS-1997. [1999]: IPICS European Summer School 1999. [2000]: ACM/
5.1.5 Honors - Graduates’ Impressions

All doctoral and a significant number of postgraduate students of the “Information and Communication Systems Security” postgraduate Stream have presented original papers in scientific journals and international conferences in Europe and the USA. Detailed information about these publications is available at the webpage of Info-Sec-Lab.

In addition, groups of students of this specific Stream, in collaboration with faculty members and other teaching staff, have implemented high quality software for the academic community, such as the MILC (http://milc.samos.aegean.gr/) and Pandora (http://pandora.samos.aegean.gr/) services. Specialized software applications implemented during the courses have been awarded in important contests. Such an example is the EARTH application, which received the second prize in the National Contest of HTC Hellas for the development of applications in the Android platform. Also, students of the “Information and Communication Systems Security” postgraduate Stream participate in prestigious international contests in the area of information systems security (see http://www.appsecresearch.org/uni-challenge/).
Furthermore, many graduates of the “Information and Communication Systems Security” Stream, immediately after their graduation, have been employed by leading companies in Informatics and Telecommunications, working mainly on information systems’ and network security issues.

Finally, note the possibility for postgraduate students to stay for four months in one of the several collaborating European Universities through the Erasmus / Socrates program, in order to work on their M.Sc. Thesis.

**Hara Vassileiadou, Channel Manager Greece and Cyprus, Check Point Software Technologies (M.Sc.)**

The specialized scientific knowledge gained upon successful completion of the “Information and Communication Systems Security” Stream of the Master’s Program of the Information and Communication Systems Engineering Department, University of the Aegean, Samos, created the conditions for me to be hired immediately after my graduation, in one of the largest IT and Telecommunication companies in Greece, working as a security consultant. Today, I am employed at Check Point Software Technologies, one of the most important companies in the domain of integrated information systems security solutions.

**Dimitris Geneiatakis, Researcher, EU Joint Research Center (M.Sc., Ph.D.)**

Completing my postgraduate studies (M.Sc., Ph.D.) at the Information and Communication Systems Engineering Department, University of the Aegean, I acquired the basic knowledge and skill development for my professional and academic career. The direct contact with my professors helped me to understand the theoretical and applied research problems in the field of Information Systems Security. Today, I am employed at the Joint Research Center of the European Union and I have also been appointed as Lecturer at the Aristotle University of Thessaloniki.
5.2 Stream II

e-Government

5.2.1 Scope and Objectives

Information and Communication Technologies (ICT) offer enormous potential for improving the function of Public Services, reducing costs, improving citizen service and generally offered value to society, and also help achieve better and closer communication and cooperation between the Government and citizens with transparency. However, previous experience in our country, but also internationally, shows that the use of such opportunities is a difficult task that requires close collaboration between different scientific fields (technical and administrative) from both the internal environment of the public sector and from the external (IT companies, advisory services, etc.). The needs that arise in this area are significant, as are the markets opened for related business.

The “e-Government” Stream offers a unique opportunity for participants to develop a high level of knowledge and skills in this critical area of digital government on a variety of forms of Information Systems that can be developed in the public sector (e.g. Information Systems of internal support, providing electronic information to citizens, electronic trading between citizens and the state, e-democracy, participation and consultation, utilizing social networks (social media), open government data, interoperability, etc.). This will enable creative and meaningful participation in development projects for various forms of Information Systems in public sector with various roles.

The “e-Government” Stream is based upon the vast experience of our department in numerous national and international R&D projects for various forms of Information Systems in the public sector and the large network of partnerships with major European universities, research centers and multinational companies. Specialized, experienced executives from the above institutions will participate as invited speakers in courses, as well as supervisors in projects and dissertations.

This Stream is aiming at a wide range of graduates (universities and technological institutes), both of technological background (e.g. ICT, school of engineering / science), and non-technological background (e.g. financial, administrative), and graduates of the National School of Public Administration, who are already involved or interested in participating in future e-Government development, and development
projects on various forms of Information Systems in public sector, with various roles (from the side of the public or the private sector).

Graduates of the “e-Government” Stream would gain significant and substantive knowledge and skills for a career, whether in the public or private sector, in the area of technological support projects and services in public administration and local government, as well as in communication and collaboration with citizens. Distinguished graduates will have the opportunity to discuss possible collaboration with affiliated companies and organizations in Greece and abroad.

5.2.2 Courses per Semester

The titles as well as the distribution of the courses per semester for this Stream are the following:

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<thead>
<tr>
<th>1st SEMESTER</th>
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<td><strong>CODE</strong></td>
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<tr>
<td>323-210100</td>
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<tr>
<td>323-610700</td>
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</table>
* Students are expected to choose and successfully attend one (1) of the above optional courses.

<table>
<thead>
<tr>
<th>CODE</th>
<th>OPTIONAL COURSES*</th>
<th>ECTS</th>
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</thead>
<tbody>
<tr>
<td>323-210200</td>
<td>Research Methods and Current Research Topics</td>
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</tr>
<tr>
<td>323-610100</td>
<td>Digital Services and Technologies</td>
<td>7,5</td>
</tr>
<tr>
<td>323-610200</td>
<td>Enterprise Resource Planning (ERP) Systems</td>
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### 3rd SEMESTER

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<tr>
<td>323-000000</td>
<td>M.Sc. Thesis</td>
<td>30</td>
</tr>
</tbody>
</table>

### 5.2.3 Courses Syllabus and Learning Outcomes

For each course, syllabus is shown first and learning outcomes follow.

#### 5.2.3.1. e-Government I: Services and Infrastructure


The acquaintance of knowledge on the principles, the processes and the tools of governance, with the support of information and communication technologies.

#### 5.2.3.2. Information Systems

Introduction to Information Systems (IS), Organisational Strategy and IS, Data and Knowledge Management, Telecommunications and networking, Decision Making and Business Intelligence Applications, Social Computing, E-Business and E-commerce ap-

Comprehension of IS’ role in organizations-businesses. Knowledge of the characteristics and operation modes of various ISs. Ability of recording and replanning of business processes by using applications. Knowledge of IS acquisition and management processes.

5.2.3.3. Information Systems Security and Privacy Enhancing Technologies


Learning of security concepts and technologies. Ability of risk analysis and composition of policies and technologies in the context of an integrated IS security plan.

5.2.3.4. Digital Business Management

See subsection 5.6.3.3.

5.2.3.5. Information Law

See subsection 5.1.3.6.

5.2.3.6. e-Government II: Open and Collaborative Government

5.2.3.7. Greek Interoperability Framework
See subsection 5.6.3.12.

5.2.3.8. Research Methods and Current Research Topics
Principles of epistemology. Literature review and research questions formulation. Categories of research methodologies. Qualitative research methodologies: Case study, action research, ethnographic, etc. Collection and analysis of qualitative data. Quantitative research methodologies. Collection of quantitative data, design of questionnaires. Quantitative data analysis (descriptive statistics, correlation analysis, X2 tests, t-tests, analysis of variance (ANOVA), regression). Organization of research projects. Writing research proposals, papers and dissertations. Comprehension of research methodologies. Research projects planning and implementation skills development. Quantitative and qualitative research performing skills development. Scientific papers and thesis writing skills development.

5.2.3.9. Digital Services and Technologies
See subsection 5.6.3.5.

5.2.3.10. Enterprise Resource Planning (ERP) Systems
See subsection 5.6.3.6.

5.2.4 Research Activities
The effective integration and utilization of information and communication technologies in a modern enterprise, their rational administration/management, security policies planning, the redesign of processes and organizational structures based on the capabilities offered by the information and communication technologies, and, ultimately, the production of the highest possible value from them, are now critical issues for all enterprises. The faculty members and instructors of the "e-Government" postgraduate Stream, in collaboration with postgraduate students, conduct high level scientific research in this specific cognitive field, combining elements (perspectives, models, variables, etc.) from computer science, as well as the management, social and economic sciences, a fact that makes such research especially interesting and creative. The main axes of this research activity include the generation of Value Flow Models,
which depict the entire mechanism of creating value from information systems, the administration/management of information systems security in organizations, Information Systems Investment, their impact on business performance and their synergies with complementary actions, as far as it regards organizational changes, innovation, human resources, etc., Enterprise Resource Planning (ERP) Systems, e-Government, e-Democracy, and e-Participation. Specifically, the instructors of this postgraduate Stream have been active in the following research areas:

- Enterprise Information Systems
- Information Systems Evaluation
- Value Flow Models
- Information Systems Security Management
- Information Systems Management
- Enterprise Resource Planning (ERP) Systems
- Information Systems Investment
- Information Systems Strategy
- Medical Decision Support Systems
- e-Government, e-Governance
- e-Democracy, e-Participation
- e-Business
- e-Learning


Furthermore, significant research collaborations have been developed with high-level organizations such as the European Commission, the Greek General Secretariat for Research and Technology, the Swiss Federal Institute of Technology (ETH) Zurich,
the Darmouth College, USA, University of Leuven, Belgium, University of Koblenz, Germany, the National Technical University of Athens, University of Patras, Greece, the Athens University of Economics and Business, ICAP SA (Greece), European Dynamics SA (Greece), Athens Technology Center (ATC), and more. Moreover, the instructors of the "e-Government" postgraduate Stream have significant experience of successful participation in international research projects such as the following:

- PADGETS (“Policy Gadgets Mashing Underlying Group Knowledge in Web 2.0 Media”), Framework Programme 7, European Commission
- ENGAGE (“An Infrastructure for Open, Linked Governmental Data Provision towards Research Communities and Citizens”), Framework Programme 7, European Commission
- NOMAD (“Policy Formulation through non moderated crowdsourcing”), Framework Programme 7, European Commission
- Affiliated institution in “DEMO-net”, Network of Excellence in e-Participation, project IST FP6-2004-27219, European Commission
- “Factors increasing the productivity of IT and Communication expenses of Greek enterprises – international comparisons”, PENED 2003, Greek General Secretariat for Research and Technology, Ministry of Development
- “i-Learn: Research and development of optimized methodology, procedures and specifications of an integrated software platform for high-standard education and training through the Internet”, PAVET Program - NE 2004, Greek General Secretariat for Research and Technology, Ministry of Development

Detailed information about all the above issues is available at the webpage of Information Systems Lab (http://www.icsd.aegean.gr/is-lab/).
5.2.5 Honors – Graduates’ Impressions

All doctoral and a significant number of postgraduate students of the "e-Government" postgraduate Stream have presented original papers in peer-reviewed scientific journals and international conferences. Detailed information about these publications is available at the webpage of Information Systems Lab (students’ names in italics):


After completing my undergraduate studies in the Department of Informatics in the Athens University of Economics and Business, I was looking for the continuation of my studies with basic criteria to get specialization and deepen my scientific knowledge. With the aim to develop further and combine the theoretical background I had already acquired in Informatics with a more practical dimension focusing on computer applications in management and governance, I made the choice of the Master’s Degree Program “e-Government”.

The high level in the teaching personnel but also in the students, and the regional nature of the department, paved the conditions for a very creative and constructive experience, in which contributed the direct and continuous contact and support from the highly qualified and active in research faculty.

The curriculum was comprehensive and multifaceted, combining a wide range of disciplines such as marketing, accounting, business management and e-business. The most important asset for me though was the integration of courses in the field of e-Government, a cognitive area with increasing specialized needs, in which the MSc was among the pioneers in Greece.

During my graduate studies I had the opportunity to meet research projects, to come into contact with companies and other research institutions from Europe and renowned scientists from around the world. Finally, it gave me the impetus to engage actively and deeper with the research in the field of e-Government by continuing my studies as a PhD candidate at the University of the Aegean. I believe that my experience at the University of the Aegean has and will continue to have a key role in my future career path and my evolution as a scientist and citizen.

After graduating from the department of Computer Science and Technology in the University of Peloponnese, I chose to continue my studies in the pioneering field of e-Government at the University of the Aegean. The Master Program paved the way and setup the bases of my knowledge evolution through an aptly designed course and the appropriate instructors who effectively combine the scientific with the business component and the recognized international research experience. During my postgraduate studies I had the opportunity to get involved in international and national research programs (e.g., ENGAGE, PADGETS, NOMAD, PLUG-IN) in the field of e-Government and to work further with leading domain experts and researchers from around the globe. Furthermore, I had the chance to participate in national and international competitions in the fields of entrepreneurship and e-governance towards the fulfillment of my degree requirements. My participation and the continued support of my professors...
resulted in excellence awards at “E-gov Awards” and “e-nnovation” competitions. Moreover, I was able to deal with issues such as, open data management, policy modeling and support and semantic interoperability, as well as, with different methods and techniques addressing these issues. The latter issues, which underpin the domain of e-Government, contributed significantly to my research involvement in the domain. Finally, I believe that the knowledge and skills gained during my postgraduate studies will remarkably conduce to my future personal and career development.
5.3 Stream III

Intelligent Information Systems

5.3.1 Scope and Objectives

In the present-day knowledge society the ability to manage information and knowledge is a prerequisite for any private or public corporation. The needs that have already arisen are particularly compelling, due to the rapid development of the Web and the availability of ubiquitous and abundant information and knowledge of large volume in complex and dynamic environments.

The “Intelligent Information Systems” postgraduate Stream aims at studying advanced systems that can interact with their environment and act accordingly to achieve complicated tasks demonstrating an intelligent behavior. A fundamental property of intelligent systems is their ability to handle existing knowledge and acquire new knowledge through learning processes so that they can better fit to their dynamic environment and users. This ability makes them suitable for tasks such as information management on the Web, Semantic Web services, machine vision, and robotics, areas which are emphasized by the Stream.

The Stream is addressed to graduates of computer science, electrical and computer engineering and it provides postgraduate students with fundamental knowledge and skills to design and implement advanced systems that are able to:

- Assist humans in achieving difficult tasks in complex and dynamic environments.
- Take advantage of and integrate information coming from heterogeneous sources.
- Extract knowledge from large volumes of data and make appropriate use of this knowledge.

Graduates of this postgraduate Stream have a wide open horizon of professional options, with career opportunities in a constantly-increasing number of private and public organizations that apply intelligent systems to complicated problems as well as in companies that design and implement commercial advanced information systems. At the same time, students have acquired the necessary knowledge so that to be able to continue their studies for obtaining a Ph.D. in a definitely cutting-edge field.
### 5.3.2 Courses per Semester

The titles as well as the distribution of the courses per semester for this Stream are the following:

#### 1st SEMESTER

<table>
<thead>
<tr>
<th>CODE</th>
<th>COMPULSORY COURSES</th>
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<tbody>
<tr>
<td>323-300100</td>
<td>Combinatorial Optimization and Modern Financial Applications</td>
<td>7,5</td>
</tr>
<tr>
<td>323-300200</td>
<td>Machine Learning</td>
<td>7,5</td>
</tr>
<tr>
<td>323-300300</td>
<td>Semantic Web</td>
<td>7,5</td>
</tr>
<tr>
<td>CODE</td>
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<tr>
<td>323-100400</td>
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</tr>
<tr>
<td>323-300400</td>
<td>Distributed Systems and Web Services</td>
<td>7,5</td>
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</tbody>
</table>

* Students are expected to choose and successfully attend one (1) of the above optional courses.

#### 2nd SEMESTER

<table>
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<th>CODE</th>
<th>COMPULSORY COURSES</th>
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<tbody>
<tr>
<td>323-310100</td>
<td>Data Mining in the Web</td>
<td>7,5</td>
</tr>
<tr>
<td>323-310200</td>
<td>Image Processing and Robotic Vision</td>
<td>7,5</td>
</tr>
<tr>
<td>CODE</td>
<td>OPTIONAL COURSES*</td>
<td></td>
</tr>
<tr>
<td>323-310300</td>
<td>Business Intelligence and Big Data</td>
<td>7,5</td>
</tr>
<tr>
<td>323-310400</td>
<td>Databases for Multidimensional Data and Web Applications</td>
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<tr>
<td>323-310500</td>
<td>Research Methods and Current Research Topics</td>
<td>7,5</td>
</tr>
<tr>
<td>323-410200</td>
<td>Pervasive Computing Systems</td>
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* Students are expected to choose and successfully attend two (2) of the above optional courses.
### 3rd SEMESTER

<table>
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<tr>
<td>323-000000</td>
<td>M.Sc. Thesis</td>
<td>30</td>
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</tbody>
</table>

#### 5.3.3 Courses Syllabus and Learning Outcomes

For each course, syllabus is shown first and learning outcomes follow.

**5.3.3.1. Combinatorial Optimization and Modern Financial Applications**

Combinatorial Optimization (CO) studies algorithms that compute the optimum solution amongst the feasible solutions of a combinatorial problem. A milestone of the theory was the understanding of the linear/convex problems. The combinatorial problems capture the intrinsic complexity of the most important problems for the computers. Due to this, in the last 50 years CO has played central role to explore the power and limitations of the computers. But, during this decade, due to the power of computers and the explosion of the Internet, modern problems have arisen. These concern the independent, rational interplay of a large number of computers in the Internet, which are motivated by greedy objectives, or coordinated play. These problems lie within an interdisciplinary area of research, such as CO, Computer Science, Game Theory and Economic Theory. An important subject is the study of bimatrix games, because these essentially capture the selfish behavior of atomic players. Also, important is the study of selfish network flows in large scale networks and the computation of their steady states. It is obvious that in many situations the selfish behavior of the users can lead to a suboptimal state the Internet/System. This manifests Mechanism Design as a key area to study.

Learning of advanced topics on modeling and resolution of modern combinational problems related to the selfish use of Internet/System resources. Specialized knowledge in modeling and resolution programs development on such problems.

**5.3.3.2. Machine Learning**

vector machines (linearly and non-linearly separable problems, kernel methods). En-
semble learning methods (bagging, boosting). Genetic algorithms and genetic pro-
gramming. Semi-supervised learning methods. Reinforcement learning (Q-learning,
temporal difference learning). Experimental evaluation of classification methods (ROC
curves, cost curves). Application examples.
Understanding of the basic types of learning: supervised learning, unsupervised learn-
ing, and reinforcement learning. Understanding of classification algorithms and rele-
vant evaluation methods. Familiarity with the use of machine learning toolkits. Under-
standing of the process of applying machine learning techniques to applications ac-
cing to their properties.

5.3.3.3. Semantic Web
Introduction to knowledge representation and the semantic web. Basic Logics (Propo-
sitional logic and Predicate logic). Logical entailment, Inference rules, Resolution
method. Description Logic. Structured Web documents (XML). Ontologies and Seman-
tic Web languages (RDF, RDFS, OWL). Querying ontologies (SPARQL). Rules and reason-
ing in the Semantic Web. Ontology engineering (tools, methodologies). Ontology
learning and Ontology mapping. Development of ontologies and knowledge bases.
Understanding of basic principles of knowledge representation and the Semantic
Web. Familiarity with Propositional Logic, Predicate Logic, Description Logics and
reasoning methods. Understanding and use of structured documents in the WWW.
Use of ontology description languages. Understanding and use of ontology queries.
Familiarity with rule systems and reasoning mechanisms on the Semantic Web. Fa-
miliarity with ontology engineering and relevant applications. Ability to develop on-
tologies and knowledge bases.

5.3.3.4. Future Internet Security and Privacy
See subsection 5.1.3.4.

5.3.3.5. Distributed Systems and Web Services
Characterization and Challenges of Distributed Systems. System Models (Physical, Ar-
citectural, Interaction, Failure, Security Models). Networking and internetworking. In-
terprocess communication. Remote Invocation (Remote Procedure Call, Remote Meth-
od Invocation, Java RMI). Operating system support (Resource Protection, Processes
and Threads, Communication and Invocation). Distributed objects and components
Upon successful completion of this course, the students should be able to: a) Explain what is a distributed system, why we develop such systems and what are the possible problems that must be addressed; b) Describe basic architectural models (client/server, peer-to-peer) and explain the role of middleware in distributed application development; c) Distinguish the differences between distributed applications programming models (RPC, RMI, Publish/Subscribe, Web Services); d) Perceive the necessity of clock synchronization and group communication in distributed systems and explain why these constitute fundamental services; e) Perceive the significance of scalability in distributed systems and describe basic techniques that are used for achieving scalable services; f) Apply acquired theoretical knowledge for the development of composite distributed systems using Java RMI and Web Services technologies.

5.3.3.6. Data Mining in the Web


The course intends to give an insight into data mining techniques applied to Internet related data, and what they can be used for. After successful completion of the course, the students should be able to: a) identify and differentiate among application areas for web content mining, web structure mining and web usage mining, b) describe key concepts such as deep web, surface web, semantic web, web log, hypertext, social network, information synthesis, corpora and evaluation measures such as precision and recall, c) discuss the use of methods and techniques such as word frequency and co-occurrence statistics, normalization of data, machine learning, clustering, vector space models and lexical semantics, d) explain in detail the architecture and main al-
algorithms commonly used by web mining applications, e) appropriately select between different approaches and techniques of web mining for, e.g., sentiment analysis, targeted marketing, linguistic forensics, topic/trend-detection-tracking and multi-document summarization (information aggregation), f) apply human language technology tools such as tokenizers, stemmers, part-of-speech taggers, noun phrase chunkers and shallow parsers on different types of web content gathered, for instance, from e-commerce sites, and perform analysis of linguistically processed data using a suitable statistical classifier, g) set requirements, compare and assess the quality of existing web mining tools, h) analyze and explain what web mining problems are satisfiably solved, what is worked upon at the research frontier and what still lies beyond the current state-of-the-art, and i) independently solve a well-defined practical web mining problem using tools and techniques introduced in the course, or analyze it through theoretical studies seeking information beyond the course literature.

5.3.3.7. Image Processing and Robotic Vision

The human vision is a natural function that processes the visual information effortlessly. It is able to detect, locate and identify objects. A human perceives and understands the 3D world and uses 3D information to perform complex tasks. However, the imitation of the human visual system is difficult and often impossible. The objectives of the 3D systems are to extract these properties from one or more digital images and use them to mimic human vision. Basic techniques of image processing and detection features, webcam models, geometry and calibration, geometric models of one, two and multi-display systems are components of 3D computer vision systems that will be studied in this course. The primary purpose of this course is not to give an exhaustive overview of image processing techniques, but it also covers methods commonly used in the 3D systems, such as dealing with image noise, feature extraction, 3D object representation and matching image.

Comprehension of advanced topics of artificial vision. Design and development of composite systems of mechanical vision.

5.3.3.8. Business Intelligence and Big Data

The course focuses on the analysis and use of data for making rigorous and timely decisions. Today new technologies enable us to access large amounts of data (big data), which arise from the everyday consumer and business transactions. Through modern analysis and visualization of data, managers can make informed decisions that reduce
operating costs and offer paths to reengineer and optimize operational procedures.

The course will provide learners an introduction to a range of methodologies and options for implementing Big Data and analytics in an enterprise. Emphasis is on text analysis, data mining, advertising analytics, and social media analytics, exploring both technical and managerial aspects of Big Data. In the context of the course a project is assigned to apply intelligent big data analysis techniques in practical applications.

5.3.3.9. Databases for Multidimensional Data and Web Applications

Introduction to databases for multidimensional data objects. Databases for geographical, spatial, temporal and spatiotemporal data. Spatial networks and mobile objects databases. Databases for multimedia: text, documents, images, audio and video clips. Data models, query languages, indexing and retrieval of multidimensional objects. The generation and visualization of large synthetic datasets for benchmarking purposes. Access multidimensional databases through the web and specialized search engines. Database outsourcing in unsecure and untrustworthy servers. Emerging research topics. Case studies: the ESRI Geodatabase, representation and manipulation of complex multidimensional data objects in Oracle Database, in Microsoft SQL Server, in IBM DB2, in MySQL and in PostgreSQL. Software tools for the implementation of applications and the visualization of multidimensional objects through web-based interfaces: MapServer, Oracle MapViewer, etc.

The course provides the student with knowledge of the fundamentals and trends in multidimensional data handling, and also with ideas on how to apply a sequence of relative core concepts, methods and algorithms in cutting-edge and diverse application domains, such as the multimedia and geographical information systems (GIS) industry, computer-aided design & manufacturing (CAD/CAM), astronomy, molecular biology, etc., reaching beyond the traditional fields of database management applications.

5.3.3.10. Research Methods and Current Research Topics


The student learns to conduct research, to present and to report the results of his research.
5.3.3.11. Pervasive Computing Systems

See subsection 5.4.3.8.

5.3.4 Research Activities

In the Society of Knowledge, the enormous amount of information resulting from the activities of organizations and communities, has made it imperative to develop applications that are able to collect, exploit and manage different forms of information, from different sources, with different usage. The faculty members and instructors of the "Intelligent Information Systems" postgraduate Stream conduct basic and applied research, which aims: to produce schemes and languages for representing the content of information, to develop methods and techniques for data mining, to exploit semantic information, to develop algorithmic techniques for problems that arise during the processing of large amounts of data, and to develop systems that exploit distributed information. Specifically, the research areas in which the instructors of the Stream have been active are:

- Language technology
- Text mining
- Data mining
- Plagiarism detection
- Intelligent music processing
- Document image processing
- Optical character recognition
- Historical document, image and photo processing
- Bayes belief networks
- Combinatorial optimization
- Algorithmic techniques and applications
- Computational complexity
- Approximation and direct algorithms
- Large-scale optimization
- Service positioning problems
- Resource assignment and routing problems
- Algorithmic game theory issues
- Efficient algorithm implementation
Ontology engineering
Semantic Web technologies

The instructors of the "Intelligent Information Systems" postgraduate Stream have a significant number of publications in top-rated journals and the most prestigious and competitive conferences in the area. They have also participated in the organization of international workshops, conferences, and summer schools, such as: Int. Workshop on Uncovering Plagiarism, Authorship, and Social Software Misuse (2007-2014), 14th Int. Conference on Intelligent Text Processing and Computational Linguistics (2013), Int. Document Image Processing Summer School (2013-2014), Summer School on Modeling and Analysis of Environmental Data using ICT (2012), Summer School on Algorithmic Game Theory (2012).

The instructors of the "Intelligent Information Systems" postgraduate Stream have considerable experience in designing and carrying out national, as well as international research and development projects. Such projects have been funded by the European Commission, the Greek General Secretariat for Research and Technology, the Ministry of Education and Religious Affairs, and the University of the Aegean. Postgraduate and undergraduate students work as research assistants in such projects, actively participating in research activities of increased requirements.

The instructors of the Stream have also developed educational and research collaborations with many Greek and European Universities, research institutes and organizations. Examples include the following: University of Patras (Greece), Computer Technology Institute & Press "Diophantus" (Greece), University of Piraeus (Greece), University of Western Macedonia (Greece), NCSR Demokritos (Greece), Democritus University of Thrace (Greece), Ionian University (Greece), Aristotle University of Thessaloniki (Greece), National Technical University of Athens (Greece), National and Capodistrian University of Athens (Greece), General State Archives (Greece), NGO Archipelagos (Greece), Northern Aegean Region, Bauhaus Universitaet Weimar (Germany), Universitat Politecnica de Valencia (Spain), Universitat Autonoma de Barcelona (Spain), Lehigh University (USA), La Rochelle University (France), Antwerp University (Belgium), Duquesne University (USA), i-Know Center (Austria), OFAI (Austria), University of Genova (Italia), Instituto Polytechnico National (Mexico), Instituto de Astrofisica, Optica y Electronica (Mexico), Universidad de San Luis (Argentina), AU-KBC research center (India), Ludwig Maximilian University (Germany), Siauliai University (Lithuania), University of Texas at Arlington (USA).

Particular emphasis is given on linking teaching with research through the Research & Development Project, but also through invited speakers' lectures, as part of
the remaining courses of the Stream. Students prepare their theses on contemporary research topics and are encouraged to submit their work for publication, under the guidance of their supervisors.

Detailed information about all the above issues is available at the webpage of Artificial Intelligence Laboratory (http://ai-lab-webserver.aegean.gr/ai-lab/).

5.3.5 Honors – Graduates’ Impressions

The following list includes recent publications by students of the Stream (students’ names in italics):


Ioannis Kanaris (M.Sc.)

I think that the "Information Management and Web Technologies"* postgraduate Stream is one of the most challenging, as well as interesting of the Master’s Program of the Information and Communication Systems Engineering Department, University of the Aegean. The technologies taught are at the forefront of technology developments and address completely new fields in relation to the Undergraduate Program of the Department. Courses such as Machine Learning, Knowledge Representation (Ontologies) and Multi-agent Systems spurred my interest more. As a graduate of Mathematics, I initially met some difficulties, especially in terms of coding requirements, which they finally helped me to improve though. After my graduation, I worked on representation and processing of biological data, in the form of ontologies, in the field of Systems Biology at the National Hellenic Research Foundation. I also worked at the EKTORAS project of the University of the Aegean.

Nikolaos Pappas (M.Sc.)

Following my graduation from the Dept. of Information and Communication Systems Eng., University of the Aegean, I continued my studies in the postgraduate Stream of “Information Management and Web Technologies”*. That Stream provided all necessary sources in a wide range of areas in artificial intelligence and fascinated me to work in the areas of Natural Language Processing and Machine Learning. My involvement in the demanding learning tasks and the development of projects in that postgraduate Stream supported me with the necessary skills to conduct research and contributed in my choice to pursue an academic career as a research assistant in Idiap Research Institute and a Ph.D. student in École Polytechnique Fédérale de Lausanne (EPFL) in Switzerland.

* The “Intelligent Information Systems” postgraduate Stream was formerly entitled as “Information Management and Web Technologies”.
5.4 Stream IV

Communication and Computer Networking Technologies

5.4.1 Scope and Objectives

Communication and computer networks is probably the fastest growing areas in the field of informatics and communications, with important technological developments that change the way of life of modern people.

The “Communication and Computer Networking Technologies” postgraduate Stream is the oldest Stream of the Master’s Program of the Information and Communication Systems Engineering Department, since it operates from the beginning of the program, during academic year 2002-2003. Trying to meet the demands of the Greek and international market for well trained personnel in modern trends in this area, the Stream offers high-level postgraduate education, providing both theoretical foundations and practical knowledge on recent developments in the area of communication and computer networks.

The Stream is mainly aimed at higher education graduates with qualifications relevant to computer science, computer engineering and electrical engineering, who wish to focus on:

- the design and development and/or management and operation of wired and wireless computer networks, in small or large companies in the field of telecommunications and networks in Greece and internationally,
- research in similar areas.

The selection of the Stream courses and their content has been done in such way as to deal with specific needs and deficiencies of the telecommunications market personnel in a wide range of issues, which, among others, include technologies of access and trunk networks, protocols, architectures, reliability and performance evaluation of modern networks, as well as modern business issues. Upon successful completion of the Stream’s program of study, graduates will have gained important advantages, such as:

- strong knowledge of modern networking technologies,
- ability to compare and evaluate products and services,
- ability of management and supervision of complex and demanding telecommunications projects.
## 5.4.2 Courses per Semester

The titles as well as the distribution of the courses per semester for this Stream are the following:

### 1st SEMESTER

<table>
<thead>
<tr>
<th>CODE</th>
<th>COMPULSORY COURSES</th>
<th>ECTS</th>
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<tbody>
<tr>
<td>323-400100</td>
<td>Mobile and Satellite Communications</td>
<td>7,5</td>
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<tr>
<td>323-400200</td>
<td>Network, Green Technology and Next Generation Services Issues</td>
<td>7,5</td>
</tr>
<tr>
<td>323-400300</td>
<td>Performance Evaluation of Computer Networks</td>
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<th>ECTS</th>
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<tr>
<td>323-100100</td>
<td>Computer and Communication Networks Security</td>
<td>7,5</td>
</tr>
<tr>
<td>323-300400</td>
<td>Distributed Systems and Web Services</td>
<td>7,5</td>
</tr>
<tr>
<td>323-400400</td>
<td>Digital Integrated Systems Design</td>
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* Students are expected to choose and successfully attend one (1) of the above optional courses.

### 2nd SEMESTER

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<td>Design and Development of Networks and Services</td>
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<tr>
<td>323-410200</td>
<td>Pervasive Computing Systems</td>
<td>7,5</td>
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<tr>
<td>323-410300</td>
<td>Wireless Communication Networks</td>
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<table>
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<tr>
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<th>OPTIONAL COURSES*</th>
<th>ECTS</th>
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<td>323-410400</td>
<td>Cloud Computing</td>
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<td>323-410500</td>
<td>Embedded Systems</td>
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</tr>
<tr>
<td>323-410600</td>
<td>Multimedia Communications</td>
<td>7,5</td>
</tr>
</tbody>
</table>

* Students are expected to choose and successfully attend one (1) of the above optional courses.
5.4.3 Courses Syllabus and Learning Outcomes

For each course, syllabus is shown first and learning outcomes follow.

5.4.3.1. Mobile and Satellite Communications


The course consists of a series of lectures that address the issues of mobile and satellite communications. The aspects considered include the analysis, design and evaluation of wireless and satellite systems, along with the knowledge of wireless propagation issues, the characterization and understanding of the physical layer and the services of the advanced mobile and satellite systems. This course is designed to meet the needs of the Greek and European market in regard with the specialization in a wide range of issues relating to communication networks.

5.4.3.2. Network, Green Technology and Next Generation Services Issues

Heterogeneous Networks and user mobility. Broadband networks (WiMax, LTE, DVB-T/ DVB-H), use of DVB for triple-play services in remote areas. Cross-system and cross-layer optimization in heterogeneous wireless and mobile environments. Sensor net-
works, self-managed systems, location based services. Green networking for access and core networks. Advanced services for the Future Internet, large scale experimental infrastructures as a service (e.g., Panlab, Onelab, GENI).

Advanced topics on Networks, Green Technology & Next Generation Services. Specialized knowledge for engineers on Networks and Communications.

**5.4.3.3. Performance Evaluation of Computer Networks**

Markov and semi-Markov processes. Renewal theory. Birth-and-death processes. Queuing theory: $M/M/1$, $M/M/1/K$, $M/M/m$, $M/M/m/m$, $M/M/\infty$, $M/G/1$ systems. Queuing networks; Jackson networks; Aloha systems. Network performance evaluation. Experimental setup and simulation.

Understanding of mathematical and statistical models of computers and networks. Understanding of major elements and function of simulation software. Capability for setting up and carrying out an experiment. Capability of statistical analysis and interpretation of simulation results.

**5.4.3.4. Computer and Communication Networks Security**

See subsection 5.1.3.1.

**5.4.3.5. Distributed Systems and Web Services**

See subsection 5.3.3.5.

**5.4.3.6. Digital Integrated Systems Design**

Introduction to Application Specific Integrated Circuits (ASICs) and Field-Programmable Gate Arrays (FPGAs), Hardware Description Languages (HDLs), Verilog and Very High Speed Integrated Circuits HDL (VHDL), Combinational and Sequential digital circuits, Design simulation, Design synthesis, Timing analysis, Post-synthesis simulation. Verilog HDL: Overview of Digital Design with Verilog HDL, Hierarchical Modeling Concepts, Basic Concepts of Verilog HDL, Modules and Ports, Gate-Level Modeling, Dataflow Modeling, Behavioral Modeling, Register Transfer Level (RTL) Modeling, Tasks and Functions, Useful Modeling Techniques, Timing and Delays, Logic Synthesis with Verilog HDL. Finite State Machines (FSMs), First In First Out (FIFO) memories, Handshaking, Random access memories and memory interface, Clock distribution issues, Computer Aided Design (CAD) tools.
This course aims at familiarizing the students with the process of designing and implementing a digital system by using hardware description languages, Computer Aided Design (CAD) tools and FPGA-based boards. The students will learn how a Hardware Description Language (HDL) is used to describe and implement hardware. The emphasis is not on the details and syntax of the language, but rather on how the language infers hardware. A student who successfully fulfills the course requirements will have demonstrated various abilities, such as: to discriminate between combinational and sequential digital circuits, to design combinational units to be embedded in larger systems, to design state machines to control complex systems, to identify which parts of the Verilog HDL can be synthesized and which cannot, what kind of description should be used depending on the targeted module, and to write synthesizable Verilog, to write a Verilog testbench to test Verilog modules, to target a Verilog design to an FPGA board, to perform post-synthesis simulation with timing information, to analyze and debug Verilog modules, and to build a synchronous digital system in Verilog and verify its performance.

5.4.3.7. Design and Development of Networks and Services
Introduction on advanced networking technologies and methodologies (NAT, IP multicast, WEP, IEEE 802.1X, 802.21, etc.), architectures (MPLS, Diffserv, IntServ, etc.), protocols (RSVP, Mobile IP, IPv6, OSPF, BGP, etc.) and services (WebTV, IPTV, p2p, v2v, CDN). Topics on active services with self-organisation, localization, APIs, security, mobility, QoS.

Emphasis on advanced design features for complex networks and services. Knowledge for networks and communication systems engineers.

5.4.3.8. Pervasive Computing Systems

Upon successful completion of this course, students should be able to: a) Report the characteristics of pervasive computing systems; b) Describe the issues that emerge from the heterogeneity of components, the dynamicity of the network, and the large number of nodes in a pervasive computing system; c) Explain the importance of adaptability in a pervasive computing system; d) Recognize the possibility of separation between the infrastructure, the system and the services when designing a pervas-
sive computing system; e) identify issues of privacy and security in pervasive computing systems; f) Perceive the concepts of “context” and “context-awareness”; g) Report basic location positioning systems and explain concisely the operation of each one.

5.4.3.9. Wireless Communication Networks


The aim of this course is to study advanced topics in wireless communications future generations. The issues that are studied concern wireless local area networks, packet routing, cellular and ad-hoc networks, at physical layer and MAC. Upon the successful completion of this course, students will have the opportunity to explain the limitations of wireless access and whether these restrictions will affect the performance of the upper layers. Also, they will have understood in great extent the structure and operation of the next generation wireless and cellular networks and they will be in a position to comprehend these networks’ specific features and limitations. The course includes projects in a wireless systems software for better understanding and consolidation on the part of students of the basic principles governing the design of wireless networks and the quality of the communications network.

5.4.3.10. Cloud Computing

Cloud computing technologies, types of services (PaaS, SaaS, NaaS, IaaS), development models (private, public, hybrid), tools (openflow), virtualization of networking services and functions (SDN, NFV).

Learning advanced cloud computing and virtualization topics. Specialized knowledge for networks and communication systems engineers.
5.4.3.11. Embedded Systems

The goal of this course is to introduce students to issues in hardware/software interfacing, practical microprocessor-based system design, and practical digital hardware design using modern logic synthesis tools. More specifically it includes: introduction to embedded systems, SystemVerilog Hardware Description Language (HDL), Hardware/Software interfaces, PS/2 keyboard, serial communication, USB, Ethernet, video handling, memories and their utilization in embedded systems, microprocessors, microcontrollers, FPGAs and ASICs.

This course aims at familiarizing the students with the process of designing and implementing embedded systems by using the SystemVerilog hardware description language, already designed cores and FPGA-based boards. The students who successfully fulfill the course will have also developed embedded systems programming skills.

5.4.3.12. Multimedia Communications

Introduction multimedia, categorization and applications (e.g., 3D), communication system, information and redundancy, measuring information, coding, compression (JPEG, MPEG). Multimedia and internet (P2P vs. client-server). Multimedia networking (packet & circuit switching, synchronous & asynchronous transmission). Flow technologies (HTTP/TCP, UDP, RTP, RTCP, RTSP, RSVP). Quality of Service (QoS, QoE).

Emphasis on multimedia communications. Specialized knowledge for engineers of networks and communication systems.

5.4.4 Research Activities

The members of the “Computer and Communication Systems Laboratory” and instructors of the “Communication and Computer Networking Technologies” postgraduate Stream conduct research in a wide range of areas of communication networks and their applications, and hold relevant patents and accreditations (ELOT EN ISO / IEC 17025:2005 for high frequency electromagnetic fields measurements). Their current activities balance between basic and applied research and include:

- Next generation network and communication architectures and services
- Mobile and wireless network security
- Wireless multimedia communications
Network management and middleware technologies
Networks and services focusing on energy efficiency, quality and safety
Mobile and wireless communication networks
Ad hoc networks, sensor networks and wireless grid networks
Satellite communications, cooperative satellite and terrestrial networks
Smart energy networks
Heterogeneous technologies, reconfigurable and cognitive networks
Mobile and pervasive computing
Measurement and evaluation of electromagnetic fields
Traffic modeling and performance evaluation
Radio coverage and propagation in wireless terrestrial and satellite networks
Cloud computing technologies
Network and communication applications (e.g., e-government, medical informatics)
Multimedia services, information servers and integrated platform architectures
Internet of Things services
Future Internet Applications
Smart Energy Grids
Digital integrated circuits and systems

The instructors of the Stream participate in numerous European and National research and development projects with the support of postgraduate and doctoral students, who gain significant experience in the areas of communication networks and applications. Some of these projects are:

- **Greenet** – Initial Training Network on Green Wireless Networks, 2012-2015, FP7, (ITN) Marie Curie, Funding: European Commission
- **“PASSIVE: Policy-Assessed system-level Security of Sensitive Information processing in Virtualized Environment”**, FP7, 2010-2013, Funding: European Commission
- **“COGEU: COgnitive radio systems for efficient sharing of TV white spaces in EUropean context”**, FP7, 2010-2013, Funding: European Commission
- **“HURRICANE: Handovers for Ubiquitous and optimal bRoadband Connectivty among CooperAtive Networking Environments”**, FP7, 2008-2010. Funding: European Commission
- **“UNITE: Virtual Distributed Testbed for Optimization and Co-existence of Heterogeneous Systems”**, FP6-STREP, 2006-2009, Funding: European Commission

"Virtualized Platforms for innovative applications and sensor-based services in the context of cloud (EPIKOUROS)", 2012-, SME Support for R&D Activities, General Secretariat for Research and Technology


“Development of an Autonomous System for Measuring Electromagnetic Radiation", 2010-2011, Funding: Greek General Secretariat for Research and Technology

"Study and Measurement of Electromagnetic Radiation in the Municipality of Rhodes", 2012-, Funding: Municipality of Rhodes

"Study and Measurement of Electromagnetic Radiation in the Municipality of Samos", 2010-, Funding: Municipality of Samos

“Development of a Wireless Local Area Network (WLAN) for providing external and internal access to the students of the University of the Aegean, School of Science, Karlovasi, Samos”, 2005-2008


“High availability, reliability and management of wireless communication in special-purpose ad-hoc networks”, Pythagoras Project, 2004-2006, Funding: Greek Ministry of Education and Religious Affairs


The instructors of the Stream have also organized and/or served as chairs of technical program and organizing committees of international conferences, some of which are listed below:

Collaborations with other higher education institutions, research institutes and companies operating in the area of networks and communications have been developed in the framework of research and development projects. In order to link teaching with research and recent technological developments in the market, people from various organizations have been invited for lectures to the postgraduate students of the Stream. Additionally, for students with excellent performance, there is the opportunity to visit such organizations and/or work on a part of their M.Sc. Thesis. Some of the aforementioned collaborations are indicated below.

**National:** National Technical University of Athens, National and Kapodistrian University of Athens, NCSR Demokritos, University of Piraeus, University of Patras, University of Ioannina, Technological Educational Institute of Larissa, Technological Educational Institute of Crete, Athens Information Technology, COSMOTE SA, ERICSSON HELLAS, F-IN, Synelixis, Greek Air Force, PeSYP of Thessaly,
PeSYP of North Aegean, Municipality of Samos, Municipality of Rhodes, Municipality of Lemnos, Administrative Division of North Aegean, Informatics and Telematics Institute, General Hospital of Athens G. Gennimatas, Foundation for Research and Technology, Alfa Logic SA, Minoan Lines.

**International:** Huawei (Sweden), IBM (Zurich), FRANCE TELECOM R & D (France), University of Surrey (UK), Duke University (USA), CEA LETI (France), EURECOM (France), Anect (Czech Rep.), ATOS (Spain), ENGINEERING (Italy), Thales (UK), Rohde & Schwarz (Germany) Technische Universität Dresden (Germany), Waterford Institute of Technology (Ireland), INSTITUTO TELECOMUNICAÇÕES (Portugal), SIGINT Solutions Ltd (Cyprus), University of Malaga (Spain), University of Portsmouth (UK), University of Cyprus (Cyprus), Nowcasting International (Ireland), Cyprus Institute of Neurology and Genetics (Cyprus), Harvard Medical School, Boston (USA), OmegaCube SA (Italy), Indra Espazio SA (Spain) Mondragon-Enyca SA (Spain) Trinity College Dublin (Ireland) Poznan University of Technology (Poland) Institut für Rundfunktechnik (Germany) Centre Tecnològic de Telecomunicacions de Catalunya (Spain).

Detailed information about all the above issues is available at the webpage of Computer & Communication Systems Laboratory (http://www.icsd.aegean.gr/ccsl/).

### 5.4.5 Honors – Graduates’ Impressions

**Best Student Paper Award:**


Students awarded by the **ERICSSON Awards of Excellence in Telecommunications:**


Prodromos Makris  
(M.Sc., Ph.D.)

Current occupation: Postdoctoral researcher, at Computer Engineering and Informatics Department, University of Patras and Computer Technology Institute and Press – Diophantus. He participated as a researcher in various European and National projects of the Computer and Communication Systems Laboratory, such as FP6-IST-UNITE, FP7-ICT-HURRICANE, FP7-ICT-PASSIVE, FP7-ICT-COGEU, COSMOTE PEDION 24, etc.

The “Communication and Computer Networking Technologies” Stream of the Master’s Program of the Information and Communication Systems Engineering Department, University of the Aegean, gave me the opportunity to further develop the knowledge of a Department’s graduate on computer and communication network issues. The cooperative attitude of the instructors of this specific Stream and the general mood of cooperation among all faculty members of the Department in various converging research activities, offer the students many opportunities to develop their skills beyond their purely academic obligations. My active participation in large-scale research projects and the personal contact with colleagues from different European countries and research organizations (e.g., research institutes, universities, multinational corporations, small and medium enterprises) gave me the opportunity to enrich my CV and, most of all, to use in the best possible way the knowledge I received during the Master’s Degree Program.

Nikolaos Nomikos  
(M.Sc., Ph.D. candidate)

Current occupation: Ph.D. candidate working on “Spectral Efficient Cooperative Relaying with Interference Mitigation in Heterogeneous Networks”, Quality Manager of the Computer and Communication Systems Laboratory (ELOT EN ISO 17025:2005 Certified), Department of Information and Communication Systems Engineering, University of the Aegean, Project Engineer in the program PEDION24 for the continuous and uninterrupted awareness of the levels of electromagnetic radiation in various regions of Greece.

As a graduate of the Department of Electrical and Computer Technology Engineering, University of Patras, with specialization in Telecommunications and Information Technology, the selection of “Communication and Computer Networking Technologies” Stream of the Master’s Program of the Information and Communication Systems Engineering Department, University of the Aegean, put me in touch with the latest developments in the field of Telecommunications and Networks. Furthermore, its instructors, with their experience in research, gave me the motivation to begin my career as a Ph.D. candidate in the Department. In conclusion, my studies in Samos not only helped me build my profile as an engineer, but also gave me valuable partners in my further research and professional career.
5.5 Stream V

Information and Communication Systems

5.5.1 Scope and Objectives

The aim of the Stream is the promotion of the Science of Information and Communication Systems and in particular the principles of the analysis, design, implementation and management of an Information and Communication System keeping up with high standards and demanding requirements.

The Stream targets University and Technical Education Institute graduates with the exception of Computer Science and Engineering graduates, for obtaining horizontal knowledge in the area of Information and Communication Technologies.

The design of the curriculum of the Stream has taken into account international curriculum standards and covers all the core subjects in Information and Communication Systems, ensuring the quality of the courses. In addition, this curriculum addresses modern research topics in the cognitive area of Information and Communication Systems for the acquisition of new scientific knowledge. The curriculum is regularly updated and evolving constantly, following the dynamics of the field, so that the studies offered are always modern, dynamic and competitive in nature.

In short, the "Information and Communication Systems" Stream provides theoretical knowledge and practical training at a high level along with all the tools necessary to develop in the students scientific expertise in the most recent advances in technology, enabling them to sharpen their individual skills and to pursue a dynamic career in the constantly forward-moving field of Science of Informatics and Communications.

5.5.2 Courses per Semester

The titles as well as the distribution of the courses per semester are presented below. All courses of this Stream are compulsory and students are expected to successfully attend all of them.
### 1st SEMESTER

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<tr>
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<td>Information Systems, IT Project Management and Internet Entrepreneurship</td>
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<tr>
<td>323-500200</td>
<td>Design and Development of Networks and Services, Internet Technologies</td>
<td>10</td>
</tr>
<tr>
<td>323-500300</td>
<td>Algorithms, Programming Methodologies and Languages, Software Engineering</td>
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### 2nd SEMESTER

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<td>323-510200</td>
<td>Intelligent Systems</td>
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<tr>
<td>323-510300</td>
<td>Information and Communication Systems Security and Privacy Enhancing Technologies</td>
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### 5.5.3 Courses Syllabus and Learning Outcomes

For each course, syllabus is shown first and learning outcomes follow.

**5.5.3.1. Information Systems, IT Project Management and Internet Entrepreneurship**

The aim of this course is the acquisition of knowledge and skills regarding the exploitation of information and communication technologies in the context of modern enterprises, in order to support both their internal operations and also their communications and transactions with the external environment. The student will comprehend the structure and the capabilities of various types of information systems being used in modern enterprises. The student will also learn information system design and implementation methodologies, what project management is and how business plans are developed.

### 5.5.3.2. Design and Development of Networks and Services, Internet Technologies


The aim of this course is to study basic issues of communications networks and Internet technologies. The student will understand the modules of the physical layer, the data link level and sub-level access control of modern communication systems, as well as basic network elements and data transfer. Upon the successful completion of this course, students will gain introductory knowledge and skills in communication systems and network technologies and the Internet and will be able to explain the limitations of wireless and local access and whether these restrictions will affect the performance of networks and the internet.

### 5.5.3.3. Algorithms, Programming Methodologies and Languages, Software Engineering

Introduction to algorithms. Introduction to computer programming. C programming


### 5.5.3.4. Data Structures and Databases


The aim of the course is to provide the means so that the student can achieve the following: comprehend basic principles of the scientific fields of data structures and databases, describe basic data structures and comprehend their use and implementation, comprehend data base design principles through conceptual and logical modelling, learn data base query languages and develop relational databases by using appropriate tools.

### 5.5.3.5. Intelligent Systems


Learning intelligent algorithms for solving problems. Familiarization with techniques and tools of mechanic learning.
5.5.3.6. Information and Communication Systems Security and Privacy Enhancing Technologies


Learning of security concepts and technologies. Ability of risk analysis and composition of policies and technologies in the context of an integrated IS security plan.

5.5.4 Research Activities

The Postgraduate Stream “Information and Communication Systems” is supported by faculty members of the Department of Information and Communication Systems Engineering whose research activities are conducted in the research laboratories that were presented in sections 5.1.4, 5.2.4, 5.3.4 και 5.4.4.

5.5.5 Honors – Graduates’ Impressions

The Stream is offered for the first time in academic year 2014-2015.
5.6 Stream VI

Digital Innovation and Entrepreneurship

5.6.1 Scope and Objectives

Today, more than 3,500 online stores are operating on the Greek Internet. However there is a significant shortage of skilled personnel administration. Furthermore, at European level, the European Commission recently announced the areas with the greatest potential for job creation in the future, focusing on green economy and Information and Communication Technologies (ICT) services. At the same time, it notes in its report in 2012 that “The success of Europe 2020, the competitiveness and innovative capacity of European industry and social cohesion depend on the strategy and the effective use of Information and Communication Technologies, knowledge, skills, and ingenuity of the European workforce and citizens”. The Stream of Digital Innovation and Entrepreneurship expects to contribute in this direction.

The aim of this Stream is the balanced development of a curriculum that approaches both theoretically and practically, contemporary issues of e-Business. Furthermore, through lectures and workshops by invited speakers for the purposes of the education program, innovation, creativity and entrepreneurial spirit of students is boosted. Practical exercises (e.g. business plans for innovative internet companies and promotion techniques through Google AdWords and Social Media) to be implemented on individual modules contribute to the assimilation of knowledge and deeper understanding of modern business practices. The “Digital Innovation and Entrepreneurship” Stream is based on the extensive experience of our department in numerous national and international research projects of various forms of entrepreneurship, and the large network of collaborations with major European Universities, research centers and multinational firms. Specialized, experienced executives from these institutions will participate as invited speakers in courses, as well as supervisors in projects and dissertations.

Graduates of the «Digital Innovation and Entrepreneurship» Stream will gain important and essential knowledge and skills in career development. They will be able to think creatively (out-of-the-box) and aim at an international audience with prospects for extremely rapid growth. Distinguished graduates will have the opportunity to discuss possible collaboration with affiliated companies and organizations in Greece and abroad.
### 5.6.2 Courses per Semester

The titles as well as the distribution of the courses per semester for this Stream are the following:

#### 1st SEMESTER

<table>
<thead>
<tr>
<th>CODE</th>
<th>COMPULSORY COURSES</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>323-200200</td>
<td>Information Systems</td>
<td>7,5</td>
</tr>
<tr>
<td>323-200300</td>
<td>Information Systems Security and Privacy Enhancing Technologies</td>
<td>7,5</td>
</tr>
<tr>
<td>323-600100</td>
<td>Digital Business Management</td>
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</tr>
<tr>
<td>323-600200</td>
<td>Innovation &amp; Entrepreneurship</td>
<td>7,5</td>
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#### 2nd SEMESTER

<table>
<thead>
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<tbody>
<tr>
<td>323-610100</td>
<td>Digital Services and Technologies</td>
<td>7,5</td>
</tr>
<tr>
<td>323-610200</td>
<td>Enterprise Resource Planning (ERP) Systems</td>
<td>7,5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CODE</th>
<th>OPTIONAL COURSES*</th>
<th>ECTS</th>
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</thead>
<tbody>
<tr>
<td>323-110200</td>
<td>Information Law</td>
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</tr>
<tr>
<td>323-210200</td>
<td>Research Methods and Current Research Topics</td>
<td>7,5</td>
</tr>
<tr>
<td>323-610300</td>
<td>Business Intelligence and Big Data</td>
<td>2,5</td>
</tr>
<tr>
<td>323-610400</td>
<td>Digital Marketing</td>
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</tr>
<tr>
<td>323-610500</td>
<td>Electronic Supply Chain</td>
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</tr>
<tr>
<td>323-610700</td>
<td>Greek Interoperability Framework</td>
<td>7,5</td>
</tr>
<tr>
<td>323-610800</td>
<td>Internet Economics</td>
<td>2,5</td>
</tr>
</tbody>
</table>

* Students are expected to choose and successfully attend two (2) of the above optional courses and the summation of 30 ECTS in total in this semester.
5.6.3 Courses Syllabus and Learning Outcomes

For each course, syllabus is shown first and learning outcomes follow.

5.6.3.1. Information Systems
See subsection 5.2.3.2.

5.6.3.2. Information Systems Security and Privacy Enhancing Technologies
See subsection 5.2.3.3.

5.6.3.3. Digital Business Management

The acquisition of knowledge concerning the management of enterprises and organizations, the main financial, production and marketing functions of enterprises. Acquaintance with information systems and smart organization tools.

5.6.3.4. Innovation & Entrepreneurship
The course focuses on the need to persistently innovate for the sustainable and robust business development in an international and rapidly changing technological environment. Topics of the course mainly cover knowledge management, patents and diversification strategy, innovation models and international business expansion. Particular emphasis is given to the concept of entrepreneurship and its role in economic development and growth of the company, while simultaneously recognizing the key
mechanisms of generating new knowledge and the typical phases in the development process of new ICT products and services.

Upon successful completion of this course, students will be able to: a) Recognize the importance of entrepreneurship as a management style and corporate culture, with an emphasis on exploring new opportunities that lead to rapid business growth and profitability; b) Explain the role of entrepreneurship in economic development and growth of an organization; c) Understand the relation of innovation with technological changes and various forms of business strategy; d) Perceive changes in the nature and the intensity of innovation in different industry sectors; e) Explain the stages of the technological change in a market; f) Identify the e-business resources, skills, and values that can lead to innovative products and services.

5.6.3.5. Digital Services and Technologies

The course focuses on companies that base their competitive advantage in ICT technologies and applications. This course is designed to provide a deep grounding in technological innovation and entrepreneurship for managers and entrepreneurs. Over the semester we will (a) learn key technological innovations for running a business, such as SaaS, cloud ICT, (b) evaluate opportunities for technological innovation and (c) analyze markets that are strongly based on digital services (finance, marketing, media).

Understand basic concepts of technological innovation and up-to-date e-services that strategically support a company, with emphasis on the technological change management. Understanding all new ICT applications, such as social computing, cloud computing services, augmented reality, ubiquitous computing, etc. Ability to analyze radical technological innovations and predict possible incremental or radical innovations in dynamic e-markets.

5.6.3.6. Enterprise Resource Planning (ERP) Systems


Learning outcomes: a) comprehension of the structure of an ERP system, as well its basic functionality and operation of its main subsystems, b) practical familiarization with these subsystems, so that they can be used for the implementation of business scenarios, c) acquisition of knowledge regarding the electronic implementation of the main operations of an enterprise, d) acquisition of knowledge regarding the organisation of ERP projects in enterprises and skills for participating in such projects.

5.6.3.7. Information Law
See subsection 5.1.3.6.

5.6.3.8. Research Methods and Current Research Topics
See subsection 5.2.3.8.

5.6.3.9. Business Intelligence and Big Data
The course focuses on the analysis and use of data for making rigorous and timely decisions. Today new technologies enable us to access large amounts of data (big data), which arise from the everyday consumer and business transactions. Through modern analysis and visualization of data, managers can make informed decisions that reduce operating costs and offer paths to reengineer and optimize operational procedures.

The course will provide learners an introduction to a range of methodologies and options for implementing Big Data and analytics in an enterprise. Emphasis is on text analysis, data mining, advertising analytics, and social media analytics, exploring both technical and managerial aspects of Big Data.

5.6.3.10. Digital Marketing
This course provides students with the relevant theoretical background, but mainly practical approaches in contemporary issues in the field of digital marketing. Empha-
sis is given on: a) communication strategy and promotion via various digital channels (web, mobile, social networks, etc.), b) consumer digital behavior process and models, c) customization and personalization of digital content, d) usability of websites, e) CRM information systems and f) advanced digital marketing analytics.

Students will acquire the necessary theoretical background in the field of Digital Marketing adopting an interdisciplinary approach. They will not only understand the current Digital Marketing technologies and applications, but students will be in a position to apply them in different e-business cases and evaluate their performance.

5.6.3.11. Electronic Supply Chain
The module is designed for increasing the efficiency of the main supply chain processes (e.g. procurement, warehousing, and freight transport) and for minimizing the operational cost via the use of the Internet and advanced Information Systems (IS). The module drills down on IS such as Warehouse Management Systems, Vehicle Routing Systems, Fleet Management Systems, etc. that are mainly used for the optimization of the key supply chain processes as well as for the increase of the customer service level. Comprehension and evaluation of new technologies that are used for the improvement of processes of supply chain.

5.6.3.12. Greek Interoperability Framework

The acquaintance with the major challenges of interoperability at technical, semantic and organizational level. The study and understanding of the Greek National Interoperability and Electronic Government Framework.

5.6.3.13. Internet Economics
Economic models and tools used to understand different and unique phenomena in
digital markets, such as electronic transactions, business models, competition policy, auctions and e-advertising.

Students will comprehend the basic concepts and methodology of microeconomic theory, and recognize how these can be applied to enhance understanding in digital transactions and new e-business models.

### 5.6.4 Research Activities


Furthermore, significant research collaborations have been developed with major organizations and companies such as the European Commission, the General Secretariat for Research and Technology, the Swiss Federal Institute of Technology (ETH) Zürich, the Darmouth College, USA, the University of Leuven, Belgium, University of Koblenz, Germany, the National Technical University of Athens, the University of Patras, the Athens University of Economy and Business, Fraunhofer-Gesellschaft Zur Förderung Der Angewandten Forschung E.V, Germany, to N.C.S.R. «Demokritos», Google Ireland Limited, Ireland, Microsoft Innovation Center, Greece, ICAP S.A., European Dynamics S.A., Athens Technology Center (ATC), SingularLogic S.A., etc.

Moreover, the instructors of the “Digital Innovation and Entrepreneurship” postgraduate Stream have significant experience of successful participation in both national and international research projects such as the following:

- **PADGETS** (“Policy Gadgets Mashing Underlying Group Knowledge in Web 2.0 Media”), Framework Programme 7, European Commission
- **ENGAGE** (“An Infrastructure for Open, Linked Governmental Data Provision to-
Towards Research Communities and Citizens”), Framework Programme 7, European Commission

- NOMAD (“Policy Formulation through non moderated crowdsourcing”), Framework Programme 7, European Commission
- Affiliated institution in "DEMO-net", Network of Excellence in e-Participation, project IST FP6-2004-27219, European Commission
- "Factors increasing the productivity of IT and Communication expenses of Greek enterprises – international comparisons", PENED 2003, Greek General Secretariat for Research and Technology, Ministry of Development
- "i-Learn: Research and development of optimized methodology, procedures and specifications of an integrated software platform for high-standard education and training through the Internet", PAVET Program – NE 2004, Greek General Secretariat for Research and Technology, Ministry of Development
- "ICTE-PAN: Methodologies and Tools for Building Intelligent Collaboration and Transaction Environments for Public Administration Networks", project IST-2001-35120, European Union

Detailed information about all the above issues is available at the webpage of Information Systems Lab (http://www.icsd.aegean.gr/is-lab/).

5.6.5 Honors – Graduates’ Impressions

All doctoral and a significant number of postgraduate students of the "Digital Innovation and Entrepreneurship" postgraduate Stream have presented original papers in peer-reviewed scientific journals and international conferences. Detailed information about these publications is available at the webpage of Information Systems Lab (students’ names in italics):

and Greek Micro Data’, 10th Annual International Industrial Organization Conference, May 17-19, 2013, to be held in Boston, USA.


Michalis Karypidis  
(M.Sc.)

After completing my undergraduate studies in the Department of Information and Communication Systems Engineering at University of the Aegean, I decided to continue my postgraduate studies Digital Innovation and Entrepreneurship at the University of the Aegean again, making, in my opinion, the ideal choice. Knowing how several professors teach from my undergraduate courses, I knew that the level of teaching and learning would be quite high, as it happened.

The lessons were structured based on the needs of the modern business. Professors, with their theoretical backgrounds and professional training, had the answers to all the questions. Finally, I should not forget the many conferences we participated (either online or in person) as well as our, priceless, visits to companies such as Microsoft, Singular Logic etc. learning firsthand the best practices of a healthy and modern business. Already my knowledge and prestige of this Master’s degree have helped me in my professional path.

Maria Gkouni  
(M.Sc.)

After my undergraduate studies of Department of Digital Systems of the University of Piraeus, I decided to further improve my skills in Information Management Systems, for a carrier in the field of business consulting. The choice of this Master of ‘Digital Innovation and Entrepreneurship’ of the University of the Aegean was ideal. The course structure included a series of very interesting courses about basic business operations, the use of ICT in firms (e.g. Enterprise Resource Planning, e-Commerce systems, etc.), Information Systems management, etc. Faculty combines theoretical knowledge and work experience in their areas of expertise. In addition, they are part of intense international research activities (participation in international research projects, international publications, etc.), qualities that they successfully integrated as part of their lectures. Moreover, the academic community in Samos is small and human centric, which results in good communication with the teachers and co-students. The knowledge that I gained will help my future career.
The Library of the University Unit of Samos is housed in a renovated neoclassical building of 1903, the “Chatzigianneio”. It is an annex of the Central Library of the University of the Aegean, which is located in Lesvos (Mytilene). It operates as a lending library and the opening hours are 8:30-15:00 daily, while, during the winter and spring semester, is some days open until 20:00, depending on the available administrative staff. The library has:

- 24,000 volumes of books. The largest part of the collection is related to the scientific disciplines of Computer Science, Mathematics, Technology and Natural Sciences, in order to serve the teaching and research needs of the
Departments of the University Unit of Samos. There are also literary books, essays, etc.

- 360 foreign and Greek journal titles. Some of these journals are available in electronic form or in microfilm.
- Access to Electronic Scientific Databases, which offer the capability of scientific articles search, up to the level of full text.
- Informational material (encyclopedias, dictionaries, etc.)
- Doctoral Dissertations, Master and Diploma Theses
- Audiovisual material which includes disks, CDs, videotapes, cassettes, CD-ROMs, DVD-ROMs.

All the services of the Library (Lending, Orders, Cataloguing, catalog search, journals, etc.) are automated. The search can be done from the website:

http://www.lib.aegean.gr
The primary purpose of the Computing Center is the development and maintenance of the necessary telecommunication and network infrastructure, for serving the teaching and research needs of the Departments of the University Unit of Samos. In this context, the Computing Center helps and supports users during working hours, assists in software installation, develops and supports new applications as well as telecommunication and network connections that are created in Samos, and takes care of supplying, upgrading and monitoring of equipment and software. Meanwhile, students can use the specialized laboratories of the Department (Laboratories ALKMINI, ELECTRA, PHAE-DRA, DORYSSA and ARTEMIS), which have modern computer systems, software products and hardware instruments, for supporting the teaching and research needs of the Department. Additionally, in Emporiki building, there is a fully equipped teleconference room.
The following services are provided for the postgraduates students of the Department:

- Full medical and hospital care, which includes medical, hospital and clinical examinations and pharmaceutical care.
- Free meals and accommodation, under the condition that, according to the law and the internal regulation of the University of the Aegean, specific requirements relating to financial and family situation are met.
- Scholarships and loans, in accordance with the law and the internal regulation of the University.
- Discount tickets for public transport, including ferry, under certain conditions. The discount is interrupted throughout periods of possible suspension of study, military service or loss of student status.

More information is available on the Department’s website:

http://www.icsd.aegean.gr
According to the current legal framework for the organization and operation of the Postgraduate Program of the Department, the competent bodies are:

- The General Assembly of Special Composition (G.A.S.C.) of the Information and Communication Systems Engineering Department
- The Coordinating Committee of Postgraduate Studies (C.C.P.S.) of the Information and Communication Systems Engineering Department
- The Director of Postgraduate Studies

The Director of Postgraduate Studies deals with the problems arising during the operation of the Postgraduate Program and brings in to the G.A.S.C. all matters relating to the effective implementation of the Postgraduate Program.

The C.C.P.S. is responsible for monitoring and coordinating the operation of the Postgraduate Program.

The G.A.S.C. is responsible for taking decisions on any matter regarding the Postgraduate Program.

### Duration of Study

The duration of study for obtaining the Master’s Degree (M.Sc.) is three (3) full-time semesters, two of which are teaching semesters and include attending courses, laboratories, seminars and any other educational or research activity of the Master’s Program, and the third is dedicated to the preparation of the M.Sc. Thesis.

The teaching hours per week for each course are three (3). In addition to these hours and in order to meet the needs of possible laboratories, seminars, practical exercises, etc., extra hours can be added by a decision of the G.A.S.C.
Teaching, Studying, Exams

1. The start and end of the courses of the Master’s Program are defined according to the annual academic calendar of the University of the Aegean, which is included in the final pages of this guide.

2. Each teaching semester comprises thirteen (13) full-time weeks of teaching. Exams are taken twice a year in February and June. In case a course is taught less than twelve weeks or thirty six hours of teaching, laboratories, practical exercises, etc. in total, the course is considered not to have been adequately taught and postgraduate students have to attend this course in a following semester.

3. The Master’s Program uses standard education methods that could combine: a) courses, with obligatory attendance and b) standard (electronic) distance learning methodologies. Course attendance provides the ground for discussing theoretical problems, clarifying concepts, promoting creative thinking and collaborative learning and evaluating part of the curriculum courses. The use of e-learning tools, on the other hand, ensures continuous participation of the students in the learning process, synchronous and asynchronous communication between tutors and students, as well as between students themselves, access to the educational material and literature and thorough student evaluation.

4. The attendance of the educational (lectures) and other activities of the Master’s Program is mandatory for the postgraduate students. The instructor of each course determines the fulfillment of this requirement.

5. The method of evaluation of the postgraduate students' progress in each course may include written examination, oral examination, preparation and presentation of project(s), another method or combination of methods at the discretion of the instructor. Written examinations take place at the end of each semester, according to the annual academic calendar of the University of the Aegean.

6. Each postgraduate student can be examined only once in each course. If a student fails the examination in one or more courses, then the possibility of repeating the examination, as well as the details of such an examination, are determined by a decision of the G.A.S.C., upon a reasoned request.

7. Teaching language is Greek, whereas the educational material and literature can be in Greek or/and in English language. Towards internationalization of the Master’s Program education (e.g., invitation of foreign tutors) part of the courses could be taught in the English language by a decision of the G.A.S.C.
8. A postgraduate student must accumulate 60 credit units (ECTS) worth of courses, laboratory exercises and seminars, as well as 30 credit units (ECTS) worth of Master Thesis in order to earn the Master's Degree (M.Sc.).

9. The working effort required by a postgraduate student in order to earn the Master's Degree (M.Sc.) is estimated in two thousands and four hundred (2400) hours corresponding to the minimum number of thirty nine (39) complete weeks of teaching, attendance in all kinds of educational and research activities of the program, preparation and examinations, excluding student holidays. In more detail, the working effort required by a postgraduate student for each course of the Master's Degree Program is two hundred (200) hours, whereas for the fulfillment of Master thesis eight hundred (800) hours are required. In total, the winter semester requires 800 hours of working effort, the spring semester 800 hours of working effort and the fulfillment of Master Thesis 800 hours of working effort.

**M.Sc. Thesis**

The cognitive area and the exact topic of the M.Sc. Thesis can be set after the end of the second semester of study, after consulting with a supervisor. For each postgraduate student, a faculty member is appointed as a supervisor by the G.A.S.C., after a proposal of the C.C.P.S. The supervisor has the scientific responsibility of the preparation of the M.Sc. Thesis and is appointed when the choice of the subject is made. Researchers at recognized research institutions, who hold a Ph.D., or other faculty members, may be appointed as co-supervisors of the postgraduate student. For the examination of the Master’s Thesis, a three-member committee is appointed by the G.A.S.C. of the Department, comprising the supervisor and two (2) other faculty members or researchers of grades A, B and C, who hold a Doctoral Degree. The examining committee members must have the same or a related scientific specialty to the subject of the Master's Program.

The title of the M.Sc. Thesis and the appointment of supervisor(s) are decided by the G.A.S.C., upon recommendation of C.C.P.S. at the end of the second semester of study. The M.Sc. Thesis is submitted to the three-member examining committee appointed by the decision of the G.A.S.C.

The M.Sc. Thesis defense is done in front of an audience at a date and time designated by the supervisor, during the examination period of the winter semester of each year. After M.Sc. Thesis defense, the committee evaluates and grades the thesis.
The three-member examining committee may refer back the M.Sc. Thesis for corrections, for a period of up to one (1) month. The Examining Committee Report shall be signed by all members present during M.Sc. Thesis defense, while a separate document with the signatures of all committee members who vote positively (i.e., that the candidate has passed) should be also included in the original text of the M.Sc. Thesis.

**Completion of Study**

A postgraduate student is considered to have fulfilled their obligations if they have completed at least three (3) semesters of study, have attended and been examined successfully in all courses, laboratory and practical exercises included in the Master’s Program, and their M.Sc. Thesis has been approved by the examining committee, according to the regulation of postgraduate studies. Additionally, the postgraduate student must have been successfully examined in all preparatory undergraduate courses that may have been set by the G.A.S.C., and they should have provided sufficient and consistent supportive work as a teaching assistant (see Other Obligations section).

During the first two semesters of study, postgraduate students attend the courses and any other educational and research activities included in the Master’s Program. At the end of the second semester, and after having successfully been examined in all courses of the first two semesters, a postgraduate student may apply for starting preparing their M.Sc. Thesis.

**Calculation of the M.Sc. Degree Grade**

Postgraduate students, who have successfully fulfilled their obligations, receive the M.Sc. Degree, the final grade of which is calculated as follows:

- M.Sc. Thesis: weight factor of 12
- Compulsory and Optional courses: weight factor of 3 (each)

**Suspension of Study**

1. Each postgraduate student has the right to request a suspension of attending the courses of the Master’s Program or of the preparation of their M.Sc. Thesis. The permission is granted by a decision of the G.A.S.C., can be given only once and cannot be longer than two semesters or shorter than one semester. Suspension permission for more than two semesters may be granted only in cases of prolonged health problems or significant personal reasons.
2. During the suspension of study, the student status is lost as well as all relevant rights of the postgraduate student. The student status is recovered after the expiry of the suspension.

3. Postgraduate students, who continue their studies after suspension, are expected to attend all courses and any other academic activities, in which they had not been succeeded before the suspension of the study.

**Other Obligations**

Instead of tuition fees, postgraduate students are obliged to serve, for two semesters, as teaching assistants in the labs or the review-problem sessions of the courses of the undergraduate program of the Department, for eight (8) hours per week.

The consistency and adequacy of this supportive work is decided by the G.A.S.C., upon recommendation of the instructors of the corresponding courses of the undergraduate program, and is necessary and obligatory for all the postgraduate students so as to obtain the M.Sc. degree.

*These provisions are further specified in the Regulation of Postgraduate Studies of the Department of Information and Communication Systems Engineering, which is available on the website: [http://msc.icsd.aegean.gr/](http://msc.icsd.aegean.gr/)*
### WINTER SEMESTER

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<tr>
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<td>Examination period</td>
<td>From 19.01.2015 to 13.02.2015</td>
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<td>Holidays</td>
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<td>28.10.2014: National Holiday</td>
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<td>17.11.2014: Polytechnion Anniversary</td>
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<td>22.12.2014-06.01.2015: Christmas Holidays</td>
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<td>30.01.2015: Religious Holiday (Trion Ierarhon)</td>
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### SPRING SEMESTER

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<td>23.02.2015: Monday, the first day of Lent</td>
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<td>25.03.2015: National Holiday</td>
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<td>06.04.2015-17.04.2015: Easter Holidays</td>
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<td>01.05.2015: First of May Holiday</td>
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<tr>
<td>Students' elections: the exact date has not yet been decided</td>
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<tr>
<td>01.06.2015: Religious Holiday (Holy Spirit)</td>
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</table>
Postgraduate Program Guide

Technologies and Management of Information and Communication Systems

Information and Communication Systems Security
e-Government
Intelligent Information Systems
Communication and Computer Networking Technologies
Information and Communication Systems
Digital Innovation and Entrepreneurship

Academic Year 2014-2015