University of the Aegean

UNDERGRADUATE

# programme guide

DEPARTMENT OF INFORMATION AND COMMUNICATION SYSTEMS ENGINEERING

**2019-2020**

**Karlovasi - Samos**


Designed by: Eva Kyriazi

# UNIVERSITY OF THE AEGEAN

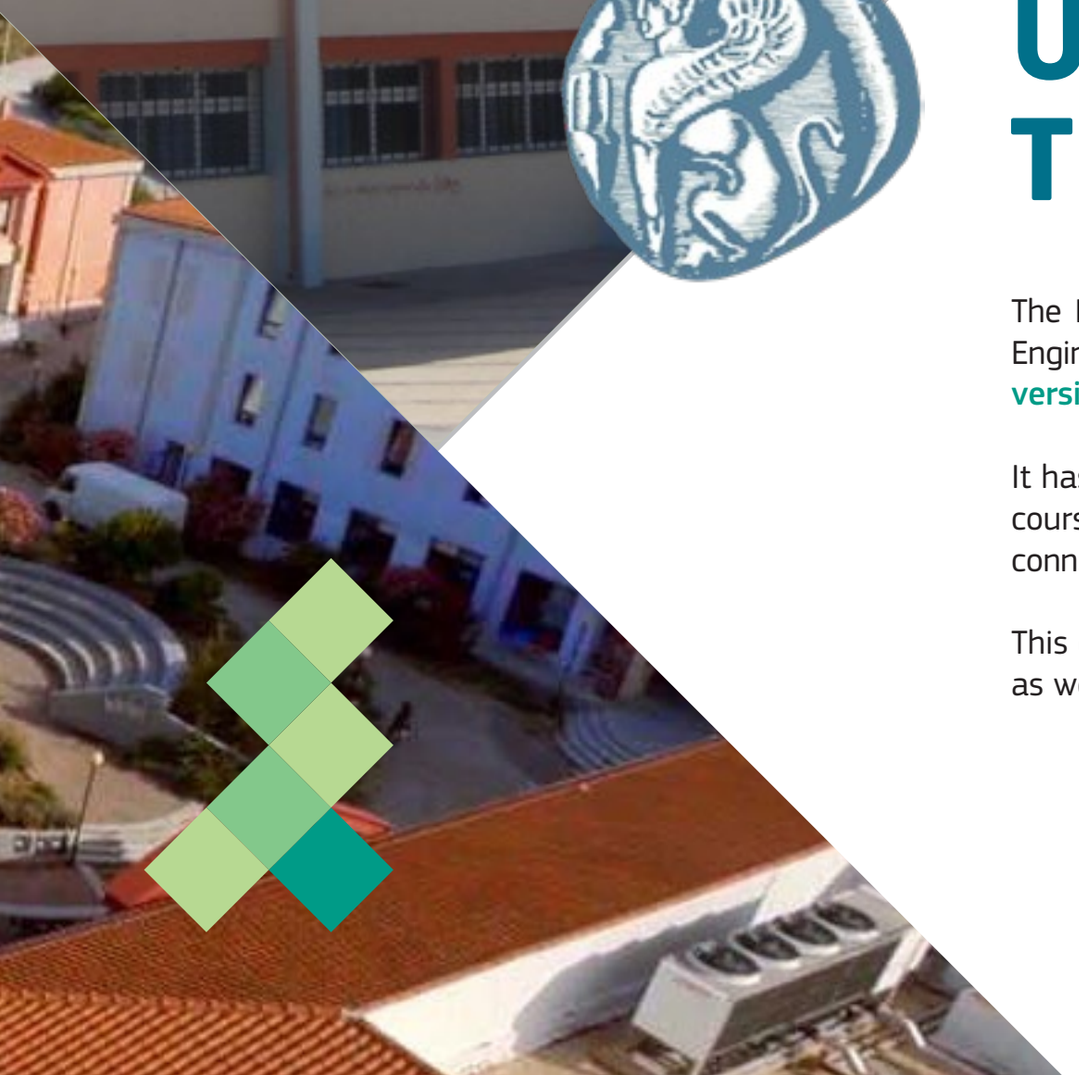
## SCHOOL OF ENGINEERING
## DEPARTMENT OF INFORMATION AND COMMUNICATION SYSTEMS ENGINEERING


**UNDERGRADUATE**

Programme Guide

ACADEMIC YEAR

2019-2020



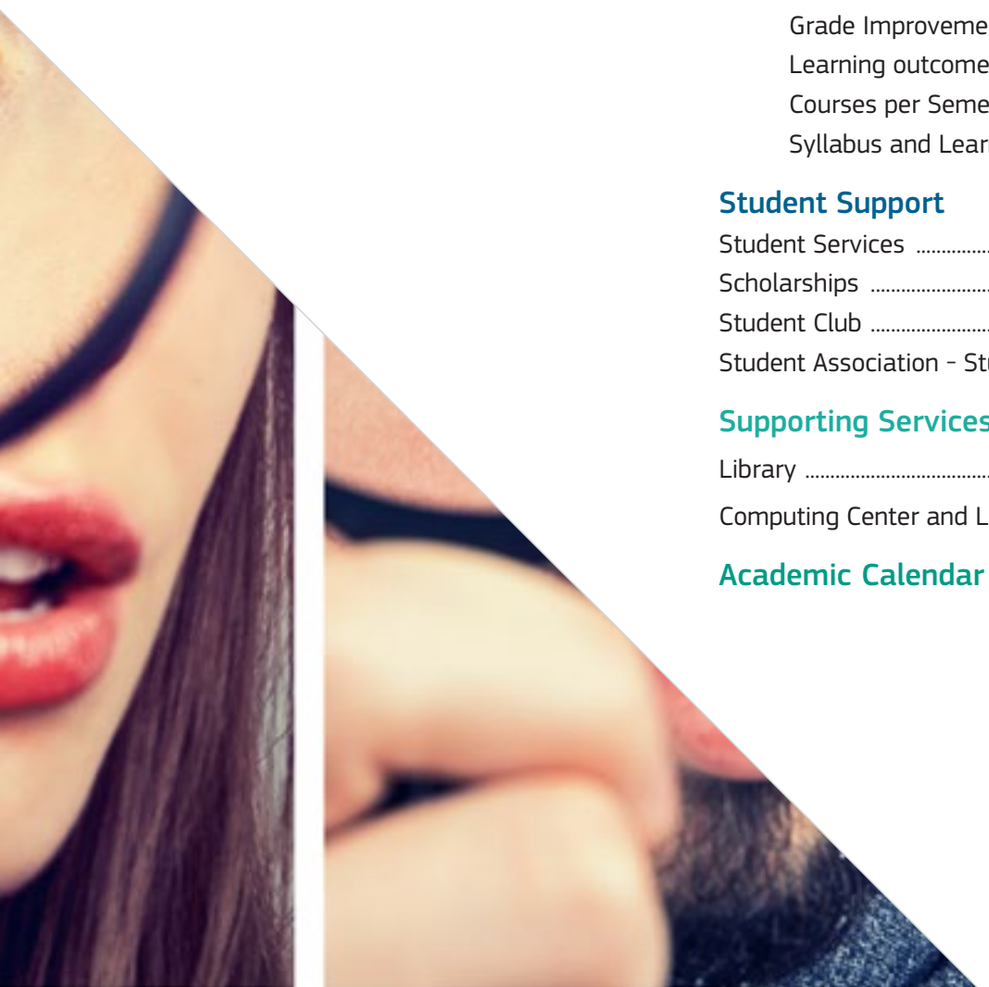
# UNIVERSITY OF THE AEGEAN

The Department of Information and Communication Systems Engineering is one of the pioneering departments of the **University of the Aegean**.

It has been designed and operates so as to offer high quality courses, within a creative environment, with emphasis on the connection of studies with practical application and research.

This guide contains all the necessary information for current, as well as future students of the Department.

# Contents



## University of the Aegean



## Department of Information & Communication Systems Engineering



## Student Support



## Supporting Services



## Academic Calendar 2019-2020 ..... 110

# UNIVERSITY of the AEGEAN

## About

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 eighteen (18) academic Departments, more than forty (40) Postgraduate Programmes and eighteen thousand (18,000) 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** (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.

# Schools and Departments

Currently the University of the Aegean comprises the following eighteen (18) Departments and six (6) Schools:

| |
|---|
| **School of Engineering** |
| Dept. of Information and Communication Systems Engineering (Samos) |
| Dept. of Product and Systems Design Engineering (Syros) |
| Dept. of Financial and Management Engineering (Chios) |
| **School of Sciences (Samos)** |
| Dept. of Mathematics |
| Dept. of Statistics and Actuarial-Financial Mathematics |
| **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 Tourism Economics and Administration |
| **School of Humanities (Rhodes)** |
| Dept. of Primary Education |
| Dept. of Pre-School Education and Educational Design |
| Dept. of Mediterranean Studies |

# Administration

The University of the Aegean is managed by the **Senate**, the **Rector** and the **Vice Rectors**, who, for the academic year **2019-2020** are:

### Rector

- Professor **Chryssi Vitsilaki**

### Vice Rectors

- Associate Professor **Maria Mavri,** *Department of Business Administration*
- Professor **Dimitris Papageorgiou**, *Department of Cultural Technology and Communication*
- Professor **Charalambos Skianis**, *Department of Information and Communication Systems Engineering*
- Professor **Helen Theodoropoulou**, *Department of Pre-School Education Sciences and Educational Design*

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

## Syros (School of Engineering's head office):

1 Constantinoupoleos str. 841 00, Ermoupolis, Syros
Dean of School of Engineering: Spyros Kokolakis, Associate Professor, Department of Information and Communication Systems Engineering

## Samos

Karlovasi, Samos, GR-83200, Greece

| | | |
|---|---|---|
| Administrative Head | Fotis Kyriakou | Tel.: +30-22730-82015<br>Email: sam_regional_dir@samos.aegean.gr |
| Head Secretary of the Department of Information and Communication Systems Engineering | Eirini Grammatikou | Tel.: +30-22730-82026<br>Fax: +30-22730-82219<br>Email: gramicsd@icsd.aegean.gr |
| Undergraduate Admissions Secretary of the Department of Information and Communication Systems Engineering | Alexandros Shoinas<br><br>Eirini Grammatikou | Tel.: +30-22730-82021<br>Fax: +30-22730-82219<br><br>Tel.: +30-22730-82026<br>Fax: +30-22730-82219<br><br>Email: dicsd@icsd.aegean.gr |
| Postgraduate Admissions Secretary of the Department of Information and Communication Systems Engineering | Eirini Grammatikou<br><br>Alexandros Shoinas | Tel.: +30-22730-82019<br>Fax: +30-22730-82219<br><br>Tel.: +30-22730-82021<br>Fax: +30-22730-82219<br><br>Email: dmicsd@icsd.aegean.gr |
| Student Support | Apostolos Galanopoulos<br><br>Giorgos Mitatakis | Tel.: +30-22730-82028<br>Fax: +30-22730-82009<br><br>Tel.: +30-22730-82011<br>Fax: +30-22730-82009<br><br>Email: merimna@samos.aegean.gr |

| | | |
|---|---|---|
| Computing Center | Aggeliki Parianou | Tel.: +30-22730-82046<br>Fax: +30-22730-82049<br>Email: apr@aegean.gr |
| | Nikos Zacharis | Tel: +30-22730-82040<br>Email: nzar@aegean.gr |
| Helpdesk | | Tel.: +30-22730-82166<br>Email: help@samos.aegean.gr |
| Library | Vasiliki Gouvala | Tel.: +30-22730-82030<br>Fax: +30-22730-82039<br>Email: vgou@aegean.gr |
| Administrative Services | Manto Katsiani | Tel.: +30-22730-82010<br>Fax: +30-22730-82008 |
| | Grammatiki Chatzikonstanti | Tel.:+30-22730-82017<br>Fax.: +30-22730-82009<br>Email: Sam_Dioik_Ypir@samos.aegean.gr |
| Financial Services | Fotis Kyriakou | Tel.: +30-22730-82015<br>Email: fotisk@aegean.gr |
| Technical Services | Constantinos Protopappas | Tel.:+30-22730-82056<br>Email: Samos_tech_ypir@samos.aegean.gr |
| Public/ International Relations and Publications | Nikoleta Tsesmeli | Tel.:+30-22730-82012<br>Fax.: +30-22730-82007<br>Email: ntsesm@aegean.gr |

For more information about the University of the Aegean please visit our web site: **http://www.aegean.gr**

For the School of Engineering please visit our web site: **http://eng.aegean.gr**

**Chios**

Michalon 8, Chios, GR-82100, Greece
Tel.: +30-22710-35000
Fax: +30-22710-35099

**Rhodes**

Demokratias Avenue 1, Rhodes,
GR-85100, Greece
Tel.: +30-22410-99000
Fax: +30-22410-99009

**Syros**

Ermoupolis, Syros
GR-84100, Greece
Tel.: +30-22810-97000
Fax: +30-22810-97009

**Lemnos**

Mitropoliti Ioakeim 2, Myrina,
GR-81400, Greece
Tel.: +30-22540-83013
Fax: +30-22540-83109

**Athens**

30 Boulgaroktonou Str., Athens, GR-11472, Greece
Tel.: +30-210-6492000
Fax: +30-210-6492299

# 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, Labotatories)
- Vourlioti Building (Faculty Offices of the Department of Statistics and Actuarial-Financial Mathematics, Secretariat)
- Morali Building (Faculty Offices of the Department of Mathematics)
- Sofouli 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 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)

# DEPARTMENT OF INFORMATION and COMMUNICATION SYSTEMS ENGINEERING

## Scope and Objectives

*"Throughout the world, information and communications technologies are generating a new industrial revolution already as significant and far-reaching as those of the past. It is a revolution based on information, itself the expression of human knowledge. Technological progress now enables us to process, store, retrieve and communicate information in whatever form it may take - oral, written or visual - unconstrained by distance, time and volume. This revolution adds huge new capacities to human intelligence and constitutes a resource which changes the way we work together and the way we live together".*

***Bangemann Committee Report 1994***

The technological revolution, which, since 1994, has led European countries to adopt, as their **central objective, the development of a European Information Society**, has changed radically almost every aspect of economic and social life. Despite the impressive penetration of new technologies in all areas of life, new trends and visions pop up constantly, **making the field of information and communication systems the most dynamic field of modern science and technology**.

At this point in time, when there is an effort for the vision of a European Information Society to be translated into action for overcoming the technical, social and economic barriers and establishing national and European information infrastructures for the benefit of European citizens and their quality of life, the scientists in this field are asked to take an important, creative, and very demanding role, as far as it regards their knowledge and skills.The **Department of Information and Communication Systems Engineering of the University of the Aegean** (**www.icsd.aegean.gr**) has, as **main goal, the training of engineers with a high level of education, creative and critical spirit, able to analyze problems and take advantage of modern Information and Communication Technologies for the design, development and management of information and communication systems.** The educational activity of the Department combined with the extensive activity


in basic and applied research aims to produce new knowledge and disseminate it in a National and European level.

Since the time of its foundation in 1997, the Department had already embraced the vision that in a very short time the classical concepts of telecommunications engineers and computer scientists would no longer be a separate entity and a new integrated scientific subject, the one of Information and Communication Systems Engineering, would be required to meet those needs. The integration of information and communication technologies has given a special character to the Department, which is maintained and enhanced until today.

The Department of Information and Communication Systems Engineering of the University of the Aegean adopts the above concept as to the nature of information and communication systems. **An information system is a system that is able to receive, store, retrieve and process information.** It is an organized set of separate interacting components: people, processes, data, software and hardware. This approach covers not only the first component of the name of the department, but the second one as well, since according to it, the term "communication system" is not regarded as an independent and complementary subject, but as an intrinsic characteristic of an integrated information system. Thus, the two dimensions of the name of the Department reflect the completeness of the studies required to achieve the stated objectives.

The Curriculum of the Department has been designed taking into account international standards of education, which are adapted to the needs of the Greek reality. It covers all the objects that make up the core of knowledge related to information and communication systems, offering high quality courses. In this direction, student-centered teaching systems, assessment of the educational process, a high level of cooperation between teachers and students and actions connecting teaching with production are adopted.

In addition, the curriculum is constantly updated following the dynamics of the industry, so that the studies offered by the Department have always a modern, dynamic and competitive character.

Successful completion of the first circle studies, organized by the Department of Information and Communication Systems Engineering of the School of Engineering of the University of the Aegean, leads to the award of a unified and inseparable Diploma of postgraduate level (integrated master), in the specialty of the Department, of level 7 of the National and European Qualifications Framework (FEK 3524/21.08.2018).

According to the information of August 2019, 1188 undergraduate students, 194 post-graduate students and 84 doctoral candidates were studying in the ICSD Department. The total number of graduates of the Department is 628, 508 and 73 for the Undergraduate, Postgraduate and PhD Programmes respectively.

The Department's alumni website can be accessed at: **https://alumni.icsd.aegean.gr/**.

# Faculty

| | |
|---|---|
| **Head of Department** | *Professor* ***Georgios Kambourakis***[1] |
| Deputy Head of Department | *Associate Professor* ***Demosthenes Vouyioukas*** |
| Director of Postgraduate Study Programmes before the 2018-19 academic year | *Professor* ***Georgios Kambourakis*** |
| Director of Postgraduate Study Programme 'Information and Communication Systems Security' | *Professor* ***Georgios Kambourakis*** |
| Director of Postgraduate Study Programme 'Internet of Things: Smart Environments in Next Generation Networks' | *Associate Professor* ***Demosthenes Vouyioukas*** |
| Director of Postgraduate Study Programme 'Electronic Governance' | *Professor* ***Euripidis Loukis*** |
| Director of Postgraduate Study Programme 'Information and Communication Systems' | *Associate Professor* ***Maria Karyda*** |
| Director of Postgraduate Study Programme 'Digital Innovation and Startup Entrepreneurship' | *Associate Professor* ***Yannis Charalabidis*** |

[1] *To be appointed*

- 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 **Georgios Kambourakis** (to be appointed), Degree in Applied Informatics, Athens University of Economics and Business, Master of Education (Ed.M.) degree, Hellenic Open University, Ph.D. in Mobile Systems Security, University of the Aegean (Mobile and Wireless Systems Security).
- Professor **Georgios Kormentzas** (to be appointed), 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).
- Professor **Euripidis Loukis**, Diploma in Mechanical Engineering, National Technical University of Athens, M.Sc. in Computers & Control, Imperial College, University of London, Ph.D. in Decision Support Systems, National Technical University of Athens (Information Systems, Decision Support Systems, e-Business, e-Government, Collaboration Support Systems, Information Systems Strategy and Investments).
- 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).
- Professor **Charalabos 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).
- 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).
- Associate Professor **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).

- Associate Professor **Maria Karyda**, Degree in Informatics, M.Sc. in Information Systems, Ph.D. in Information Systems Security Management, Athens University of Economics and Business (Information Systems, Information Systems Security, Privacy, Social Networks).
- Associate 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).
- Associate Professor **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).
- Associate Professor **Spyros Kokolakis**, Degree in Informatics, Ph.D. in Information Systems, Athens University of Economics and Business (Information Systems, Information Systems Security).
- Associate 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).
- Associate Professor **Charis Mesaritakis**, Diploma in Informatics and Telecommunications, National and Kapodistrian University of Athens, Master degree in Microelectronics and Integrated Circuit Design, Departments of Physics and Informatics/Telecommunications of National and Kapodistrian University of Athens, Ph.D. in design and experimental-numerical investigation of ultra-fast photonic systems (quantum-dot devices) mainly for telecomm applications, Photonic Technology and Optical Communication Laboratory of Department of Informatics and Telecommunications, National and Kapodistrian University of Athens.

- Associate Professor **Akrivi Vlachou**, Diploma in Informatics and Telecommunications, National and Kapodistrian University of Athens, M.Sc. in Advanced Information Systems, Department of Informatics and Telecommunications, National and Kapodistrian University of Athens, Ph.D. thesis entitled "Efficient Query Processing for Highly Distributed Data", Department of Computer Science, Athens University of Economics and Business (Databases).
- Associate Professor **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 (tenured) **Christos Goumopoulos**, Diploma in Computer Engineering and Informatics, Ph.D. in Distributed Software Systems, University of Patras (Parallel and Distributed Computing).
- Assistant Professor (tenured) **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 (tenured) **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 (tenured) **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 (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 **Dimitrios Skoutas**, Diploma in Electrical and Computer Engineering, University of Patras, PhD in Communication Networks, University of the Aegean (Wireless and Mobile Networks, Communication networks and systems).
- Dr. **Irene Karybali**, Diploma in Computer Engineering and Informatics, M.Sc. in Signal and Image Processing Systems, Ph.D. in Digital Image Processing, University of Patras (Efficient Image Registration Techniques, Digital Image Watermarking).

## Laboratory Teaching Personnel

- **Georgios Chrysoloras**, BEng in Information and Communication Systems Engineering, University of the Aegean. MSc in Advanced Information Systems, University of Piraeus.
- **Anastasia Douma**, BEng in Informatics, Department of Informatics of the Technological Educational Institute of Athens. MSc degree in Information and Communication Systems Security, Department of Information and Communication Systems Engineering, University of the Aegean. Phd Candidate in the Department of Information and Communication Systems Engineering, University of the Aegean.
- **Christina Theocharopoulou**, Degree in Mathematics, University of the Aegean. MSc in Technologies and Management of Information and Communication Systems, University of Aegean.

# Research Activities- Postgraduate Programme

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 us:

- Algorithms and Computational Complexity
- Information Retrieval
- Knowledge Representation
- Information and Communication Systems Security and Protection of Privacy
- Databases
- Information Law
- Intelligent Agents
- Intelligent Systems
- Applications of Differential Equations
- e-Commerce – e-Business – e-Governance
- Foundations of Computer Science
- Mathematical Physics
- Nanotechnology and Bioelectronics
- Legal and Regulatory issues of Personal Data Protection
- Multi-agent Systems
- Investment and Strategy of Information Systems





- Personal and Mobile Communications Systems
- Pervasive Computing Systems
- Decision Support Systems
- Privacy Enhancing Technologies
- Robotic Systems
- Communication Systems and Networks
- Computer Supported Collaboration
- Digital Integrated Circuits and Systems

The faculty members of 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 programmes 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 as the General Secretariat for Research and Technology, the 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 programmes, 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.

Faculty of the Department of Information and Communication Systems Engineering offers from the academic year 2018-19 four Postgraduate Study Programmes and one Inter-university Programme in collaboration with the School of Electrical and Computer Engineering of National Technical University of Athens.

As far as the Postgraduate Programme of the Department is concerned, its aim is to provide high quality education for University graduates in the cognitive area of Information and Communication Systems. It leads to the following Degrees:

- Master's Programme (MSc) in "Information and Communication Systems Security"
- Master's Programme (MSc) in "Internet of Things: Smart Environments in Next Generation Networks"
- Master's Programme (MSc) in "Electronic Governance"
- Master's Programme (MSc) in "Information and Communication Systems"
- Master's Programme (MSc) in "Digital Innovation and Startup Entrepreneurship"
- Doctor of Philosophy (Ph.D.) Degree

For more information please visit our web site: **http://msc.icsd.aegean.gr/**

# Program Guide

## *Programme of Study Structure – Courses*

According to the Curriculum of the Department of Information and Communication Systems Engineering, in the first three years of study the students follow a program of compulsory courses, while in the fourth year they can choose courses belonging in the six scientific Cycles of studies ("**Information and Communication Systems Security and Privacy**", "**Information Systems and Entrepreneurship**", "**Computer and Telecommunication Technologies**", "**Communication Systems and Networks**", "**Information Management and Intelligent Systems**" and "**Computer Science Foundations**"). The Diploma Thesis is prepared in the fifth year of study. In the last (10th) semester there are no courses so that students can be devoted to the preparation of their Diploma Thesis. The courses of the Department are divided into the following categories: "Compulsory Courses" (C), "Cycle Courses" (CC), "Optional Courses" (O), "Free Courses" (F).

- Compulsory Courses (C). There are thirty six (36) Compulsory Courses (C) which must be successfully completed by all students. The distribution of the compulsory courses per semester is as follows:

| Semester | 1st | 2nd | 3rd | 4th | 5th | 6th |
|---|---|---|---|---|---|---|
| Compulsory Courses | 6 | 6 | 6 | 6 | 6 | 6 |

- **Diploma Thesis – English Language**. In addition to these compulsory courses, the Diploma Thesis and a successful examination in English language are also compulsory.

- **Cycle Courses (CC)**. In each of the 7th, 8th and 9th semesters and for each of the six Cycles, a number of courses is available. All students have to successfully complete a minimum of eight (8) courses that belong in groups of four (4) to at least two (2) Cycles, in order to fulfill the requirement for obtaining the Diploma.

- **Optional Courses (O)**. These courses are not included in any particular Cycle, but they are taken into consideration for obtaining the Diploma and for the calculation of the Diploma's grade (see the relevant paragraph of the Program Guide).
- **Free Courses (F)**. These courses are not taken into consideration for obtaining the Diploma or for the calculation of the Diploma's grade. The only exception to this rule (**only for the calculation of the Diploma's grade**) is the foreign language (see the relevant paragraph of the Program Guide section).

## *Course Registration*

Students of the first three years of study ***can register for a maximum of nine (9) courses in each semester***. At least six (6) of these courses must belong to the semester which the student attends or in previous semesters, while a maximum of three (3) courses can be of later semesters (exceptions can be made only in special cases, which are evaluated by the General Assembly of the Department, upon request of the student). Students of the fourth year of study (semesters 7th and 8th) are asked to register for up to twelve (12) courses, but in any way they wish. Students in the 9th and 10th semester, as well as students who have completed the expected minimum number of semesters, can register for up to fifteen (15) courses in any way they wish. The additional exam period of January/February concerns only those students who have completed the expected minimum number of semesters; those students can register for and take exams in up to five (5) courses in the additional examination period.

For the students of the Department there is also the possibility during their studies, to register for courses from the programmes of other Departments of the University Unit of Samos, which are deemed as *Optional Courses (O)*. It should be noted though that the maximum number of courses from programmes of other Departments of the University Unit of Samos that can be taken into account as Optional Courses for the calculation of the Diploma's grade is three (3). In addition, these courses may not have content that overlaps with that of courses of the Department of Information and Communication Systems Engineering.

The courses of English Language (321-0121, 321-0131 and 321-0141) cover three levels of

language skills. They are compulsory, they are not counted in the number of courses registered per semester and, as far as it regards their contribution to the Diploma's Grade, they are considered as a single course. The students, at the beginning of the first semester and after a placement test, are grouped into the first (A) and second (B) level of English language, depending on their level of knowledge. Their enrollment at the next level is possible only after successful examination of the level they attend. All students are expected to successfully attend the B and C level. The overall objective of English language courses is to ensure that students, at the end of their second year of study, will have the ability to study scientific texts of Informatics and Telecommunications in English, attend lectures and seminars and create their own oral and written presentations. Apart from the above mentioned compulsory courses of English language, the Curriculum of the Department also includes two free courses taught during the 7th and 8th semester respectively. Their purpose is to prepare the students who wish to pursue postgraduate studies in English-speaking universities, for participating in examinations that prove their ability to use the English language (TOEFL).

Similarly, the courses of the Foreign Language (321-0823, 321-0833, 321-0843 και 321-0853) cover four levels of skill and are not counted in the total number of courses declared per semester. All four levels are considered as a single free course. The students, after qualifying examinations, are distributed to the four levels, according to their knowledge of the foreign language. Their enrollment at the next level is possible only after successful examination of the level they attend. The overall objective of these courses is learning the foreign language to a sufficient level of communication, understanding and production of spoken and written speech. Furthermore, these courses, through the study of the appropriate material, enable students to read scientific texts, to attend lectures, seminars and present their own work in this specific language.

## *Graduation Requirements – Diploma's Grade*

The following requirements must be fulfilled in order for a student to obtain their Diploma:

1. Successful examination in every Compulsory Course (C).
2. Successful examination in at least four (4) courses, two (2) different Cycles (jointly, i.e., at least eight (8) courses, four of which at least would belong to each of the two different Cycles).
3. Successful examination in a total of fifty-four (54) courses (excluding the English Language courses and the Diploma Thesis).
4. Accumulation of at least 300 ECTS credits
5. Successful examination in the compulsory English Language courses.
6. Successful defense of their Diploma Thesis.

***The Diploma's Grade is calculated as follows:***

**Diploma's Grade = 0.85 x Courses Grade + 0.15 x Diploma Thesis Grade**

The Courses Grade is equal to the average of the grades in the courses required for a student to obtain their Diploma (54 courses plus a single grade for the compulsory English Language courses). If a student has successfully attended the Foreign Language course, then an additional single grade for this course can be taken into account for the calculation of the Courses Grade (i.e., the Courses Grade in this case is the average of 56 rather than 55 courses).

For the calculation of the Diploma's Grade, only a single grade is taken into account for the compulsory English Language courses (that is, the average of the grades of the courses with codes 321-0131 and 321-0141).

For the calculation of the Diploma's Grade, only a single grade is taken into account for the Foreign Language course. This grade is equal to the average of the grades obtained in the examinations of the various courses of Foreign language, which students have successfully attended (the number of these courses depends on the level at which they were initially placed, after the qualifying examinations). A student is considered to have successfully attended the Foreign Language course, only after having succeeded in the examinations of the Foreign Language 4 course (321-0853).

If a student has been successfully examined in more courses than those required for graduation, they can choose not to take into account the grades of some courses for the calculation of the Diploma's Grade, provided that requirements 1-6 above are still met.

It should be mentioned again that Free Courses (F) are not taken into consideration for obtaining the Diploma or for the calculation of the Diploma's grade. The only exceptions to that rule (only for the calculation of the Diploma's grade) are the free courses of Foreign Language.

The Department of Information and Communication Systems Engineering, in collaboration with the Department of Mathematics, offers a certificate of competency in teaching. To receive the certificate, students must pass at least 2 optional courses from the group of courses listed below, and the optional course ``Theory and Practice of Teaching''. The offered courses 1-4, as well as the maximum number of students per course, will be specified by the Department of Mathematics at the beginning of the academic year. Students can receive the certificate with their diploma or apply for it later.

Group of courses :

1. Didactics of Mathematics
2. New Technologies in Education
3. Mathematics for the Secondary Education
4. Theory and Practice in Mathematics Teaching.

## *Grade Improvements and Changes to Programme of Study*

Students, who have been successfully examined in a course and do not meet the graduation requirements, may request a repetition of the examination in order to improve their grade in the specific course, by submitting an application to the Department's Secretariat. The repetition of the examination takes place during the examination period of September and only for courses which have been declared by the student during the current academic year.

Especially for students who attend the fifth or higher year of their study, there is the possibility of repeating the examination of a maximum of five (5) courses, in which they have been successfully examined in previous years. In this case, the repetition of the examination takes place during the examination period of January

for fall semester courses, during the examination period of June for spring semester courses and during the examination period of September for all courses. In all cases, the final grade is the greater of the two grades.

The Department's Curriculum undergoes frequent changes, in order to accommodate advances in scientific knowledge and the constantly changing needs of the market.

## *Learning outcomes*

Upon the completion of their study, the graduates will have acquired the ability to:

- Recall, explain and present the basic principles of the Computer and Communications Science.
- Associate the theoretical background of the Computer and Communications Science with the design, integration and application of Information and Communications Technologies (ICT).
- Design, develop, manage and assess information and communication system.
- Analyze users' requirements for information systems.
- Design, develop and assess software applications..
- Design, develop and assess databases.
- Design, develop, manage and assess computer networks and telecommunications networks.
- Design and assess security of information and communication systems.
- Integrate and apply information systems security technologies and privacy enhancing technologies.
- Design, implement and assess digital circuits and systems.
- Describe, explain and employ microprocessors and microcontrollers, as well as design and implement systems based on them.
- Describe, explain, assess and exploit computer architectures and operating systems.

- Design and apply artificial intelligence, information management, and big data technologies.
- Describe, analyze and apply signal processing and multimedia technologies.
- Manage projects.
- Design, develop and manage e-Commerce and digital businesses.
- Describe and analyze the legal and regulatory framework of ICT.
- Analyze ICT-related problems and create solutions.
- Create, present and explain solutions for real-world ICT-related problems.
- Support the technological, social and economic development.

*Courses per Semester*

## 1st Semester

### Compulsory Courses

| Course Code | Course Title | Teaching Hours | Lab Hours / Review-Problem Session Hours | ECTS units |
|---|---|---|---|---|
| 321-1204 | Structured programming | 3 | 4 | 5 |
| 321-1407 | Introduction to Computer Science and Communications | 3 | – | 5 |
| 321-2003 | Logic Design | 3 | 2 | 5 |
| 321-1501 | Discrete Mathematics I | 3 | 2 | 5 |
| 321-1107 | Mathematics for Engineers I | 3 | 2 | 5 |
| 321-2052 | Physics | 3 | 2 | 5 |
| 321-0121 | English Language 1 | 3 | - | 5 |

### Free Course

| Course Code | Course Title | Teaching Hours | Lab Hours / Review-Problem Session Hours | ECTS units |
|---|---|---|---|---|
| 321-0823 | Foreign Language 1 | 3 | - | 5 |

## 2nd Semester

### Compulsory Courses

| Course Code | Course Title | Teaching Hours | Lab Hours / Review-Problem Session Hours | ECTS units |
|---|---|---|---|---|
| 321-2105 | Object-oriented Programming I | 3 | 2 | 5 |
| 321-2551 | Circuit Theory | 3 | 2 | 5 |
| 321-2450 | Discrete Mathematics II | 3 | 2 | 5 |
| 321-3155 | Mathematics for Engineers II | 3 | 2 | 5 |
| 321-2402 | Probability and Statistics | 3 | 2 | 5 |
| 321-4103 | Operating Systems | 3 | 2 | 5 |
| 321-0131 | English Language 2 | 3 | - | 5 |

### Free Course

| Course Code | Course Title | Teaching Hours | Lab Hours / Review-Problem Session Hours | ECTS units |
|---|---|---|---|---|
| 321-0833 | Foreign Language 2 | 3 | - | 5 |

## 3rd Semester

### Compulsory Courses

| Course Code | Course Title | Teaching Hours | Lab Hours / Review-Problem Session Hours | ECTS units |
|---|---|---|---|---|
| 321-3652 | Object-oriented Programming II | 3 | 2 | 5 |
| 321-8105 | IT Project Management | 3 | 2 | 5 |
| 321-3004 | Data Structures | 3 | 2 | 5 |
| 321-3354 | Computer Architecture | 3 | 2 | 5 |
| 321-3752 | Stochastic Processes | 3 | 2 | 5 |
| 321-5502 | Signals and Systems | 3 | 2/2 | 5 |
| 321-0141 | English Language 3 | 3 | - | 5 |

### Free Course

| Course Code | Course Title | Teaching Hours | Lab Hours / Review-Problem Session Hours | ECTS units |
|---|---|---|---|---|
| 321-0843 | Foreign Language 3 | 3 | - | 5 |

*Courses per Semester*

## 4th Semester

### Compulsory Courses

| Course Code | Course Title | Teaching Hours | Lab Hours / Review-Problem Session Hours | ECTS units |
|---|---|---|---|---|
| 321-3104 | Information Systems Analysis and Design | 4 | - | 5 |
| 321-4201 | Algorithms and Complexity | 3 | 2 | 5 |
| 321-4120 | Advanced Topics of Programming Languages | 3 | 2 | 5 |
| 321-3203 | Databases I | 3 | 2 | 5 |
| 321-3302 | Computer Communications | 3 | 2 | 5 |
| 321-7904 | Electronics | 3 | 2 | 5 |

### Free Course

| Course Code | Course Title | Teaching Hours | Lab Hours / Review-Problem Session Hours | ECTS units |
|---|---|---|---|---|
| 321-0853 | Foreign Language 4 | 3 | - | 5 |

## 5th Semester

### Every course in this semester is Compulsory

| Course Code | Course Title | Teaching Hours | Lab Hours / Review-Problem Session Hours | ECTS units |
|---|---|---|---|---|
| 321-2304 | Business Operations and Information Systems | 3 | 2 | 5 |
| 321-6451 | Computer Networks | 3 | 2 | 5 |
| 321-3703 | Databases II | 3 | 2 | 5 |
| 321-3453 | Telecommunications | 3 | 2 | 5 |
| 321-4002 | Software Engineering | 3 | 2 | 5 |
| 321-6702 | Theory of Computation | 3 | - | 5 |

## 6th Semester

**Every course in this semester is Compulsory**

| Course Code | Course Title | Teaching Hours | Lab Hours / Review-Problem Session Hours | ECTS units |
|---|---|---|---|---|
| 321-6503 | Information Systems Management | 3 | - | 5 |
| 321-3604 | Artificial Intelligence | 3 | 2 | 5 |
| 321-3404 | Information and Communication Systems Security | 3 | 2 | 5 |
| 321-7951 | Distributed Systems | 3 | 2 | 5 |
| 321-88103 | Internet Programming | 3 | 2 | 5 |
| 321-5205 | Legal Framework for the Information Society | 3 | - | 5 |

## 7th Semester

### 1. Cycle Information and Communication Systems Security and Privacy

| Course Code | Course Title | Teaching Hours | Lab Hours / Review-Problem Session Hours | ECTS units |
|---|---|---|---|---|
| 321-9703 | Computer Network Security and Privacy Enhancing Technologies | 3 | - | 5 |
| 321-5753 | Privacy and Data Protection Law | 3 | - | 5 |

### 2. Cycle Information Systems and Entrepreneurship

| Course Code | Course Title | Teaching Hours | Lab Hours / Review-Problem Session Hours | ECTS units |
|---|---|---|---|---|
| 321-8953 | Electronic Entrepreneurship | 3 | - | 5 |
| 321-5155 | Information Systems Analysis and Design Methodologies and Tools | 3 | - | 5 |

*Courses per Semester*

### 3. Cycle Computer and Telecommunication Technologies

| Course Code | Course Title | Teaching Hours | Lab Hours / Review-Problem Session Hours | ECTS units |
|---|---|---|---|---|
| 321-10302 | Digital Communications | 3 | 2 | 5 |
| 321-7051 | Digital Systems Design | 3 | 2 | 5 |

### 4. Cycle Communication Systems and Networks

| Course Code | Course Title | Teaching Hours | Lab Hours / Review-Problem Session Hours | ECTS units |
|---|---|---|---|---|
| 321-8354 | Network Management | 3 | - | 5 |
| 321-7003 | Performance Evaluation and Simulation of Computer Systems and Networks | 3 | 2 | 5 |

### 5. Cycle Information Management and Intelligent Systems

| Course Code | Course Title | Teaching Hours | Lab Hours / Review-Problem Session Hours | ECTS units |
|---|---|---|---|---|
| 321-7754 | Robotic Control | 3 | 2 | 5 |
| 321-3553 | Computational Logic and Logical Programming | 3 | 2 | 5 |

### 6. Cycle Computer Science Foundations

| Course Code | Course Title | Teaching Hours | Lab Hours / Review-Problem Session Hours | ECTS units |
|---|---|---|---|---|
| 321-8603 | Information Theory | 3 | - | 5 |
| 321-99002 | Numerical Analysis | 3 | - | 5 |

### Free Course

| Course Code | Course Title | Teaching Hours | Lab Hours / Review-Problem Session Hours | ECTS units |
|---|---|---|---|---|
| 321-0161 | English Language (TOEFL) | 3 | - | 5 |

## 8th Semester

### 1. Cycle Information and Communication Systems Security and Privacy

| Course Code | Course Title | Teaching Hours | Lab Hours / Review-Problem Session Hours | ECTS units |
|---|---|---|---|---|
| 321-8053 | Cryptography | 3 | - | 5 |
| 321-10753 | Mobile and Wireless Networks Security | 3 | - | 5 |

### 2. Cycle Information Systems and Entrepreneurship

| Course Code | Course Title | Teaching Hours | Lab Hours / Review-Problem Session Hours | ECTS units |
|---|---|---|---|---|
| 321-8504 | Decision Support Systems – Business Analytics | 3 | 2 | 5 |
| 321-5607 | Human – Computer Interaction and Web Applications | 3 | 2 | 5 |
| 321-7653 | Systems Theory | 3 | - | 5 |
| 321-11102 | Digital Government | 3 | - | 5 |

*Courses per Semester*

### 3. Cycle Computer and Telecommunication Technologies

| Course Code | Course Title | Teaching Hours | Lab Hours / Review-Problem Session Hours | ECTS units |
|---|---|---|---|---|
| 321-7803 | Wireless Communications | 3 | 2 | 5 |
| 321-8752 | Introduction to VLSI | 3 | 2/2 | 5 |
| 321-9353 | Digital Image Processing | 3 | 2 | 5 |
| 321-7853 | Microprocessors | 3 | 2 | 5 |

### 4. Cycle Communication Systems and Networks

| Course Code | Course Title | Teaching Hours | Lab Hours / Review-Problem Session Hours | ECTS units |
|---|---|---|---|---|
| 321-6257 | Internet Protocols and Architectures | 3 | - | 5 |
| 321-7256 | Mobile Communication Networks | 3 | 2 | 5 |
| 321-11001 | Networks and Cloud Technologies | 3 | 2 | 5 |

### 5. Cycle Information Management and Intelligent Systems

| Course Code | Course Title | Teaching Hours | Lab Hours / Review-Problem Session Hours | ECTS units |
|---|---|---|---|---|
| 321-9253 | Data Mining and Data Warehouses | 3 | 2 | 5 |
| 321-10202 | Information Retrieval | 3 | - | 5 |

### 6. Cycle Computer Science Foundations

| Course Code | Course Title | Teaching Hours | Lab Hours / Review-Problem Session Hours | ECTS units |
|---|---|---|---|---|
| 321-9455 | Applied Topics in Data Structures and Databases | 3 | 2 | 5 |

| Course Code | Course Title | Teaching Hours | Lab Hours / Review-Problem Session Hours | ECTS units |
|---|---|---|---|---|
| 321-8001 | Game Theory | 3 | - | 5 |
| 321-9855 | Mathematical Modeling | 3 | - | 5 |

### Optional Courses

| Course Code | Course Title | Teaching Hours | Lab Hours / Review-Problem Session Hours | ECTS units |
|---|---|---|---|---|
| 321-2631 | Simulation Techniques for Communication Systems | 3 | 2 | 5 |
| 321-7602 | Practice | - | - | 5 |

### Free Course

| Course Code | Course Title | Teaching Hours | Lab Hours / Review-Problem Session Hours | ECTS units |
|---|---|---|---|---|
| 321-0151 | English Language (TOEFL) | 3 | - | 5 |

## 9th Semester

### 1. Cycle Information and Communication Systems Security and Privacy

| Course Code | Course Title | Teaching Hours | Lab Hours / Review-Problem Session Hours | ECTS units |
|---|---|---|---|---|
| 321-99101 | Regulatory and Social Issues in Information Society | 3 | - | 5 |
| 321-7406 | Knowledge Engineering and Knowledge Systems | 3 | - | 5 |

*Courses per Semester*

### 2. Cycle Information Systems and Entrepreneurship

| Course Code | Course Title | Teaching Hours | Lab Hours / Review-Problem Session Hours | ECTS units |
|---|---|---|---|---|
| 321-5403 | Information Systems Strategy and Investment | 3 | - | 5 |

### 3. Cycle Computer and Telecommunication Technologies

| Course Code | Course Title | Teaching Hours | Lab Hours / Review-Problem Session Hours | ECTS units |
|---|---|---|---|---|
| 321-10652 | Satellite Communications | 3 | 2 | 5 |
| 321-6555 | Multimedia | 3 | 2 | 5 |
| 321-8653 | Optical Communications | 3 | - | 5 |

### 4. Cycle Communication Systems and Networks

| Course Code | Course Title | Teaching Hours | Lab Hours / Review-Problem Session Hours | ECTS units |
|---|---|---|---|---|
| 321-9404 | Broadband Networks | 3 | - | 5 |
| 321-9120 | Design and Development of Mobile Computing Applications | 3 | 2 | 5 |

### 5. Cycle Information Management and Intelligent Systems

| Course Code | Course Title | Teaching Hours | Lab Hours / Review-Problem Session Hours | ECTS units |
|---|---|---|---|---|
| 321-7406 | Knowledge Engineering and Knowledge Systems | 3 | - | 5 |
| 321-6606 | Computer Vision | 3 | - | 5 |


### 6. Cycle Computer Science Foundations

| Course Code | Course Title | Teaching Hours | Lab Hours / Review-Problem Session Hours | ECTS units |
|---|---|---|---|---|
| 321-9003 | Advanced Data Structures | 3 | - | 5 |
| 321-10001 | Algorithms and Combinatorial Optimization | 3 | - | 5 |

### Optional Courses

| Course Code | Course Title | Teaching Hours | Lab Hours / Review-Problem Session Hours | ECTS units |
|---|---|---|---|---|
| 321-2600 | Risk Theory | 3 | - | 5 |

## 10th Semester

### Compulsory Course

| Course Code | Course Title | Teaching Hours | Lab Hours / Review-Problem Session Hours | ECTS units |
|---|---|---|---|---|
| 321-7102 | Diploma Thesis | - | - | 30 |

## *Syllabus and Learning Outcomes of Courses per Semester*

(for each course, syllabus is shown first and learning outcomes follow)

### 1st Semester

#### 321-1204 Structured programming

Introduction to programming, programming languages, The C programming language,Variables and constants, Declarations, Operators, Expressions, Data input and output, conditional expressions, functions, Matrices, Pointers, Formatted input and output, Complicated structures, File manipulation.

Upon successful completion of the course, the student will:

- Have the knowledge to analyze programs written in C language and understand their structure and function.
- Have the ability to apply the principles of structured programming to error detection and correction in C language programs.
- Have the skills to design and develop C language programs.

#### 321-2003 Logic Design

Introduction: Analog and Digital Signals, Usefulness of Digital Signal Processing and Digital Circuits, Evolution of Digital Circuits. Digital Systems and Binary Numbers: Digital Systems, Binary Numbers, Number-Base Conversions, Octal and Hexadecimal Numbers, Complements, Signed Binary Numbers, Binary Codes, Binary Storage and Registers, Binary Logic. Boolean Algebra and Logic Gates: Basic Definitions, Axiomatic Definition of Boolean Algebra, Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Canonical and Standard Forms of Boolean Functions, Other Logic Operations, Digital Logic Gates. Gate-Level Minimization: The Map Method, Three, Four and Five-Variable Maps, Product-of-Sums Simplification, Don't-Care Conditions, NAND and NOR Implementations, XOR Function. Combinational Logic: Combinational Circuits, Analysis Procedure, Design Procedure, Binary Adder-Subtractor, Binary Multiplier, Magnitude Comparator, Decoders, Encoders, Multiplexers, Tri-State Gates. Synchronous Sequential Logic: Sequential Circuits, Latches, Flip-Flops, Analysis of Clocked Sequential Circuits, State Reduction and Assignment, Design Procedure. Registers and Counters: Registers, Shift Registers, Ripple Counters, Synchronous Counters, Other Counters.

A student who successfully fulfills the course requirements will have demonstrated:

- An ability to define different number systems, perform binary addition and subtraction, use 1's complement representation and perform operations with this representation, use 2's complement representation and perform operations with this representation.
- An ability to understand the different Boolean algebra theorems and apply them for logic functions.
- An ability to define the Karnaugh map for a few variables (3, 4 and 5 mainly) and perform an algorithmic reduction of logic functions.
- An ability to understand the functionality of basic logic gates (AND, OR, Inverter, NAND, NOR, Exclusive-OR, Exclusive-NOR).
- An ability to analyze and design combinational circuits by using the basic logic gates.
- An ability to define the following combinational circuits: adders (ripple-carry and carry look ahead), subtractors, simple multipliers, magnitude comparators, encoders/decoders, (de)multiplexers, buses, tri-state gates; and to be able to build simple applications by using them.
- An ability to understand the bistable element and the different latches and flip-flops.
- An ability to derive the state-machine analysis or synthesis and to perform simple projects with a few flip-flops.
- An ability to understand sequential circuits, like counters and shift registers, and to perform simple projects with them.

## 321-1407 Introduction to Computer Science and Communications

Introduction to Information Systems, conceptual framework. Categories of Information Systems and areas of application. Fundamental skills of Information & Communication Systems Engineers. Introduction to circuits. Introduction to Robotics. Introduction to Computer Architecture. Introduction to Computer Networks. Introduction to Internet and Web Technologies. Social and legal aspects of information and communication technologies. Current trends and challenges.

After the completion of the course, the students:

- Will know the fundamentals of computer science and telecommunications.
- Will be capable to with in groups and develop Web pages on their own.

## 321-1501 Discrete Mathematics I

Logic: compound statements, conditional statements, predicates, quantifiers, methods of proof. Elementary number theory: divisibility, prime numbers, parity. Elementary set theory: operations, identities, cardinality, inclusion-exclusion principle. Mathematical induction. Combinatorial analysis: multiplication rule, permutations, orderings, combinations, the pidgeonhole principle, binomial coefficients. Binary relations, functions, equivalence relations, partial ordering relations.

The aim of this course is a first exposure to the theoretical framework of Computer Science. Upon completion of the course, students will have the ability:

- to follow a basic proof;
- to state problems in formal language;
- to use basic proof techniques in elementary problems.

## 321-1107 Mathematics for Engineers I

Mathematical induction. Completeness of the real numbers. Functions. Limits. Continuity, theorems of continuous functions. Uniform continuity. Differentiation, derivative of inverse functions, derivatives of trigonometric functions, differential. Applications of derivatives, extreme values of functions, concavity, curve sketching, Cauchy mean value theorem, L' Hopital rule, graphical method of solving autonomous differential equations, Newton's approximation method. Integral, indefinite, definite, techniques of integration. Volume of solids of revolution. Improper integrals. Transcendental functions. Taylor's formula. Differential equations of first order (separable, homogeneous, linear, Bernoulli, Ricatti, exact, Euler integrating factor, equations of special form, orthogonal trajectories).

The purpose of the course is to give a complete and working knowledge of differential and integral calculus, covering and expanding material presented in the last years of the school. After the successful fulfilment of the course, the student:

- Will have a solid knowledge of the analysis of functions of a single variable as this is presented with the necessary mathematical rigor through the proofs of most of the theorems and propositions.
- Will have the ability to treat the limit of a function or to study its continuity and differentiability through the classical ε-δ definition.
- Will have the ability of the direct applications of the abstract knowledge to a number of problems from everyday life, from geometry (areas, volumes) or from physics realizing the vivid and practical aspect of calculus.

- Will have the knowledge of the definition of the definite integral as a limiting summation.
- Will have the ability to use a variety of techniques to compute complicated indefinite integrals or generalized integrals.
- Will have the ability to use Taylor expansion to approximate the value of a function.
- Will have the knowledge of the notion of the differential equation of first order and its solution within the context of differential and integral calculus.
- Will have the skills to recognize and solve various classes of useful and characteristic differential equations of first order and to act on his/her own for solving differential equations that will face during his/her future studies and career.

## 321-2052 Physics

Scalar, vector quantities. Kinematics. Relative motion. Forces, torques, centre mass. Dynamics, friction in a liquid, bodies with changing mass, angular momentum. Work, energy, potential, conservative forces, central forces. Electrostatics: Coulomb's law, electric field, potential, flux, Gauss's law, Poisson equation, potential energy, boundary conditions, method of images, electric dipole, multipole expansion, conductors, capacity, dielectrics, polarization, electrical displacement. Electric current, continuity equation, steady current, Ohm's law. Magnetostatics: Laplace's force, Lorentz, force on a current-carrying wire, magnetic dipole, Biot-Savart's law, Ampere's law, vector potential, field of a magnetic dipole, magnetic materials, magnetization. Ampere-Maxwell's equation, Faraday's equation, scalar potential of EM field, mutual inductance, self inductance, RL, RC, RLC circuits, Maxwell's equations, energy/momentum conservation theorems, equations of potentials in Coulonb, Lorentz gauges, elements of electromagnetic waves.

The course in an intense and quick manner covers and expands topics in mechanics and electromagnetism which are known in a small degree from high school but using higher mathematics. After the successful fulfilment of the course, the student:

- Will have the knowledge to use the differential and integral calculus, elements of vector analysis and simple differential equations for the description of the laws of physics.
- Will have the knowledge of the basic laws of Newtonian mechanics in inertial and non-inertial reference frames.
- Will have the knowledge of the various theorems and equations of electromagnetism (e.g. Gauss, Biot-Savart, Ampere, Faraday, Maxwell's equations) in their general form and not just in their simplified versions exposed in high school textbooks.
- Will have the ability to compute the kinematical quantities of an arbitrary motion in a straight line, in a general curvilinear motion or to find the orbit of a point particle from Newton's law, e.g. inside a Keplerian gravitational field.
- Will have the ability to determine if a given force field is conservative or not and to find

the potential energy when this exists.

- Will have the ability to compute the centre-mass, the moments of inertia and the gravitational field of an extended body.
- Will have the ability using integrals to compute the electric field and potential of various distributions of charge or respectively the magnetic field of moving charges and currents.
- Will have the skills to treat more sophisticated notions of electricity and magnetism, such as the method of images, the electric dipole, the dielectrics, the magnetic materials, the scalar and vector potentials of electromagnetism, the energy/momentum conservation theorems and elements of electromagnetic waves.

## 321-0121 English Language 1

The course includes comprehension activities on written and spoken texts, along with vocabulary exercises, grammar theory and practice, and speaking/writing exercises (e.g. letter, email, paragraph, summary). In addition, students are introduced to computing terminology.

Students who successfully complete the course will be familiar with basic concepts of English grammar and syntax, will have practised in understanding generic texts and will have developed their writing and speaking skills in English.

More specifically, upon successful completion of the course, the students will able to:

- Understand written and spoken texts of general academic content in English.
- Understand short written texts on information and communications technology.
- Know basic vocabulary which is commonly used in texts and articles of general academic content.
- Know basic vocabulary which is commonly used in texts on information and communications technology.
- Know basic grammatical and syntactical structures and be able to use them correctly in simple sentences.
- Produce written texts such as formal e-mail or letter, summary of short texts, argumentative paragraph.
- Orally produce simple sentences, express opinions and give information necessary for everyday communication.

| 321-0823 | Foreign Language 1 |
|---|---|

Basic knowledge of the foreign language (grammar, syntax), descriptions of persons and objects, exchange of simple information, suggestions and views that enable communication in familiar, everyday situations.

Ability to use the foreign language in the cases mentioned in the syllabus of the course.

## 2nd Semester

| 321-2105 | Object-oriented Programming I |
|---|---|

Object-oriented programming, Classes, Object Oriented Analysis and Design, Objects, Recursion, Constructor, Destructor, Member Functions, const Functions, Inline functions, Complex Classes, Input / Output in C++, Output to file, Input from file, Control loops, Pointers, Memory Allocation, References, Derived class, Inheritance, Overriding, Overloading vs. Overriding, Virtual functions, Abstract classes, Polymorphism, Virtual Inheritance.

The course aims to introduce object-oriented programming to the students using C++. It targets three areas; the student should be able to:

- Identify the potential classes and their structure from a brief description,
- Understand existing code, and
- Develop a system in C++.

| 321-2450 | Discrete Mathematics II |
|---|---|

Real sequences: recursive definition, monotonicity, convergence. Sums and series. Solution of linear recursive equations. Power series. Generating functions. Graphs: basic terminology, isomorphism, Euler and Hamilton paths, the travelling salesman problem, planar graphs. Trees: definitions, binary trees, spanning trees, Dijkstra's shortest path algorithm. Algorithms: O, Ω, Θ notation, time complexity, design principles.

The course is intended to introduce students to the theoretical tools and methodologies of Computer Science at a second level. Upon completion of the course the student will have:

- A basic knowledge of the terminology and properties of graphs and trees.
- The ability to use combinatorial arguments in proofs.
- An understanding of the notion of algorithm complexity and of the basic methodologies for its calculation.
- The ability to state simple algorithms to solve elemental problems.

## 321-3155 Mathematics for Engineers II

Complex numbers, conjugate, absolute value, Argand diagram, Euler relation, De Moivre theorem, powers, roots, factorization of a polynomial. Vector spaces, subspaces, sum of subspaces, subspace generated by a set of vectors, linear independence, basis, dimension. Matrices, operations, inverse, transpose, composite matrices, row space, rank, row echelon form, triangular, symmetric, hermitian, orthogonal matrices, trace, similar matrices, row equivalence, change of basis, linear systems. Determinants, properties, Laplace expansion formula, determinant of a triangular matrix, adjoint-inverse, Cramer's rule. Characteristic polynomial, Cayley-Hamilton theorem, eigenvalues-eigenvectors (properties for symmetric, orthogonal matrices), functions of matrices. Linear mappings, kernel, image, matrix associated with a linear map, rotations, change of basis of a linear map. Diagonalization of a matrix, functions of diagonalizable matrices, diagonalization of a hermitian matrix, quadratic forms. Second order linear differential equations.

After the successful fulfilment of the course, the student:

- Will have a deep and working knowledge of the theory of linear spaces, the theory of matrices and determinants.
- Will have the knowledge of more advanced and important issues of Linear Algebra, such as the theory of eigenvalues-eigenvectors, of linear mappings and diagonalization.
- Will have the ability to treat the notions of linearly dependent and independent vectors, of the basis and dimension of a linear space of subspace.
- Will have the ability to perform calculations with matrices, to use the technique of row-equivalence for various purposes and to solve linear systems of equations.
- Will have the ability to compute determinants with various methods and in various dimensions through recursion relations.
- Will have the skills to represent a linear mapping with its matrix and compute various quantities, as well as to perform its diagonalization.
- Will have the ability to solve simple differential equations of second order.


## 321-2551 Circuit Theory

Basic principles of electric circuits – levels of functional abstraction. Resistive network analysis techniques: Kirchhoff's Laws, series and parallel simplification. Network theorems: the Node method, Superposition. Equivalent circuits: the Thévenin equivalent network, the Norton equivalent network. Circuit transformations. Digital logic – noise margins. The MOSFET switch – design of digital gates. Input - Output behavior of digital gates. Capacitors and inductors: basic principles, series and parallel connections. First-order circuits: Resistor-Capacitor (RC) circuits, Resistor-Inductor (RL) circuits, analysis of first-order circuits. Physical structure of the MOSFET. Propagation delay of digital gates. Energy and power in digital circuits: energy calculation, Static power dissipation, Dynamic power dissipation. CMOS logic.

The purpose of this course is to introduce the first year students to the concepts of circuit theory, with emphasis on digital electronic circuits. A student who successfully fulfills the course requirements will have demonstrated:

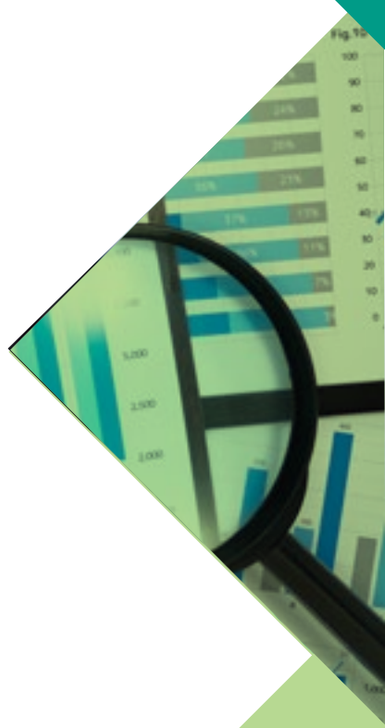
- An ability to identify linear systems and represent those systems in schematic form.
- An ability to apply Kirchhoff's current and voltage laws and Ohm's law to circuit problems.An ability to understand the notion of node voltage and apply the Node method for analyzing electrical circuits.
- An ability to simplify circuits using series and parallel equivalents, as well as Thévenin and Norton equivalents.
- An ability to understand the advantages of digital processing and how these advantages are materialized through digital circuits.
- An ability to define the structure and understand the simplified behavior (S, SR and SRC models) of MOS Field Effect Transistors (MOSFETs).
- An ability to design digital gates (either NMOS or CMOS) using MOSFETs.
- An ability to calculate the output voltages and the noise margins of digital gates and understand their significance.
- An ability to identify first-order electric systems involving capacitors and inductors.
- An ability to analyze first-order circuits and predict their behavior.
- An ability to calculate the delay of digital gates driving other gates.
- An ability to understand the notions of energy and power in digital circuits, discriminate between static and dynamic power dissipation, and to be able to calculate them (again for the case of a gate driving other gates).

## 321-4103 Operating Systems

Introduction to Operating Systems: Basic Concepts, History, Operating System Structure. Processes: The Process Model and Implementation of Processes, Interprocess Communication, Process Scheduling. Threads: The Thread Model and Thread Usage, Implementation of Threads in User Space and in the Kernel, Hybrid Implementations, Pop-up Threads, Making Single-Threaded Code Mulithreaded, Thread Scheduling. Deadlocks: Detection and Recovery, Deadlock Avoidance, Deadlock Prevention. Memory Management: Swapping, Virtual Memory, Page Replacement Algorithms, Modeling of Page Replacement Algorithms, Segmentation. Input/Output (I/O): Principles of I/O Hardware, Principles of I/O Software, I/O Software Layers, Disks. File Systems: Files and Directories, File System Implementation, Security and Protection Mechanisms.

It is the intent of this course that students will:

- Understand the modern computer systems' complexity and the usefulness of operating systems.
- Know the most important resource-utilization issues arising in a computer system.
- Learn the most popular solutions adopted by modern operating systems.
- Be able to describe the basic principles used in the design of modern operating systems.
- In particular, the students will:
- Be able to analyze the tradeoffs inherent in operating system design.
- Be able to distinguish different styles of operating system design.
- Understand the main principles and techniques used to implement processes and threads as well as the different algorithms for process scheduling.
- Understand the main mechanisms used for inter-process communication.
- Be able to contrast kernel and user mode in an operating system.
- Be able to explain memory hierarchy and cost-performance tradeoffs.
- Be able to give the rationale for virtual memory abstractions in operating systems.
- Have an understanding of disk organization and file system structure.
- Be able to describe how computing resources are used by application software and managed by system software.
- Understand the internal structure of an operating system and be able to write programs using system calls.
- Understand the major mechanisms of current general-purpose operating systems exemplified by Linux.
- Are capable of basic system-oriented programming and providing simple extensions to an operating system.




## 321-2402 Probability and Statistics

Axiomatic definition of probability, independent events, conditional probabilities, Bayes theorem, combinatorial analysis, discrete and continuous random variables, distribution functions, distributions of special interest: Bernoulli, binomial, Poisson, uniform, exponential, normal, Gamma, Weibull. Joint distribution functions, independent random variables, conditional distributions, moment generating functions, limit theorems, central limit theorem, strong law of large numbers. Descriptive statistics.

After the successful fulfilment of the course, the student: -will have a deep and working knowledge of the basic notions of Probability theory, Combinatorics and Statistics as these are described in the course syllabus:

- Will have the knowledge to interpret various mathematical models within Probability theory and a solid conceptual and technical background for further study and investigation.
- Will have the ability to compute probabilities and various quantities of a one-dimensional or a multi-dimensional random variable, such as its distribution function, the expected value or the variance.
- Will have the ability to recognize well-known discrete and continuous probability distributions and to interrelate them with real problems of practical interest.
- Will have the ability though the foundations of Statistics to use the methodology of the basic estimating parameters and to perform calculations.

## 321-0131 English Language 2

The course includes teaching of computer science terminology with basic computer science vocabulary, comprehension of scientific texts and lectures, theory and grammar exercises, as well as oral and written practice. Mathematical terminology in English that includes: Geometry, algebra and arithmetic, functions and their properties, real analysis, complex numbers, sequences and series.

Students who successfully complete the course will be familiar with more complex grammatical and syntactical structures in English, will have practised in understanding written and spoken academic texts and will have developed their speaking and writing skills.

More specifically, upon successful completion of the course, the students will be able to:

- Understand written or spoken academic texts on information and communications technology (ICT).
- Know specialized ICT vocabulary which is commonly found in related academic texts.
- Know complex grammatical and syntactical structures and be able to use them correctly in writing and in speaking.

- Produce technical texts (simple descriptions of graphical presentations, description of the function of systems and devices, comparison and contrast of two or more systems, giving instructions on the operation of an ICT system, etc.).
- Produce effective notes while listening to an academic lecture and be able to summarize part of a lecture.

### 321-0833 Foreign Language 2

Acquisition of communication skills through simple dialogues on familiar and contemporary issues, understanding of written and oral language, writing paragraphs, letters, CVs, announcements. Anything mentioned in the syllabus of the course.

## 3rd Semester

### 321-3652 Object-oriented Programming II

Introduction to OOP and UML. Java Language Fundamentals: Data types, Variable declarations, Operators and Assignment, Control structures, Strings, Arrays, Collections, Wrapper classes. Java as an OOP language: Classes, Constructors, Access modifiers, Packages, Interfaces, Garbage collection, Encapsulation, Cohesion, Coupling. Exception Handling: Basics, Exception Hierarchy, The Throwable class, Unchecked and checked exceptions, Exception and Inheritance, User defined Exceptions, Redirecting and Re-throwing Exceptions. Lambdas. Concurrent programming and Multithreading: Introduction, Thread Creation, Thread Life cycle, priorities and scheduling, Synchronization, Communication of Threads. Files and I/O Streams: File Input stream and File output stream, Serialization. AWT: Basics, The Graphics class, Class hierarchy of AWT, Layout Managers, Java 2D API. Swings: Introduction, Swing packages, Hierarchy of swing classes, Advanced layout Managers. Networking with Java: Introduction, Stream Socket Connections.

This course covers the fundamentals of Object Oriented Programming (OOP) using Java. The main learning objectives for this course are:

- To build and develop OOP thinking: Learn to think in objects.
- To familiarize students with the basic features of the language API and the know-how to use them correctly and efficiently.

- To cover the usage principles of encapsulation, coupling, cohesion, inheritance, polymorphism and method overloading/overriding.
- To teach and demonstrate sound OOP practices and program structuring.
- To develop analytical programming thinking and reasoning skills.
- The aforementioned objectives are achieved through course lectures and extensive laboratory exercises.

## 321-8105 IT Project Management

Introduction to IT Project Management. Basic concepts and objectives. Critical success factors for IT projects. Structured project management. Planning and controlling IT projects. IT Project life-cycle. Breaking down projects into activities. Scheduling activities. Gantt Diagrams. Managing and leveraging resources. Managing time with PERT and CPM methods. Managing time and cost. Major risks in IT projects and how to mitigate them. Managing human resources. Leadership styles. Outsourcing. Case studies and exercises using project management software.

After successful completion, students are expected to:

- Have learnt the basic principles of IT project management and be able to apply fundamental methods for managing the cost and duration of IT projects.
- Be able to identify and mitigate major risks and identify critical success factors. They will be able to manage a project team and will know basic leadership styles.
- Be able to evaluate IT project proposals and write a feasibility study. They will be able to use project management software.

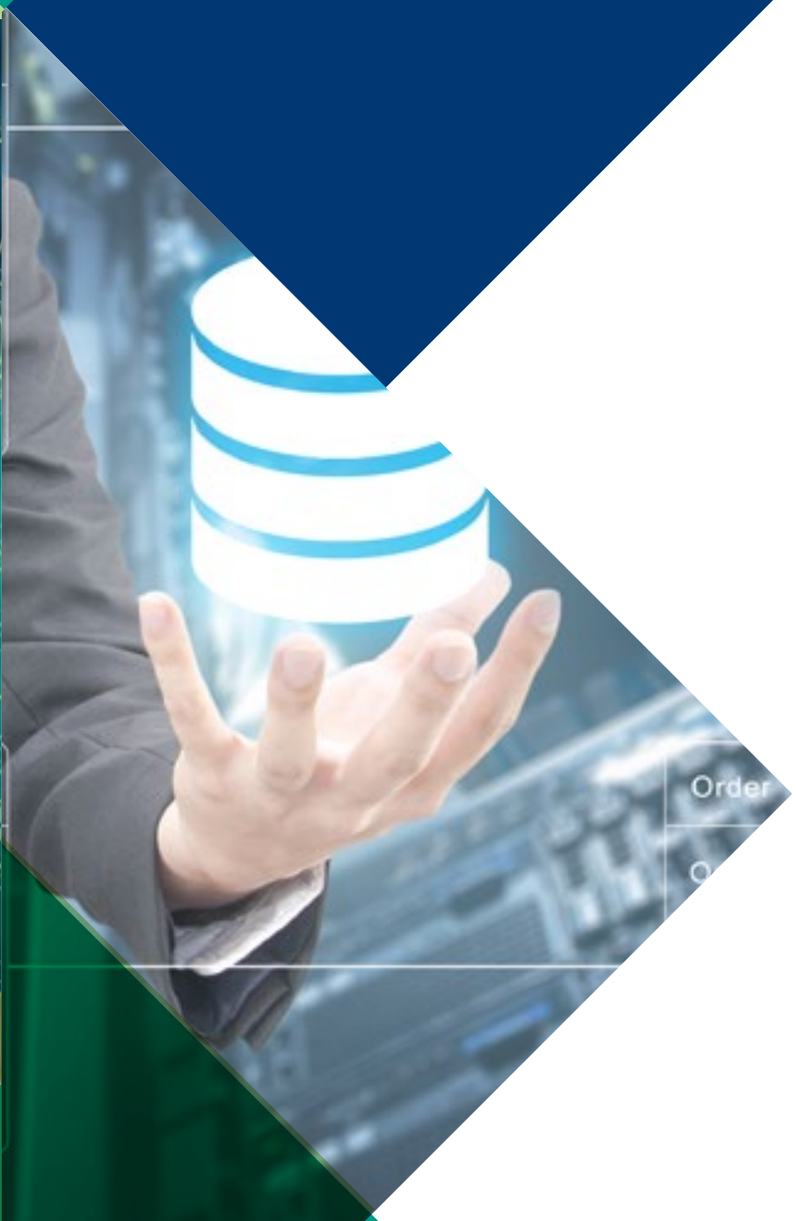
## 321-3004 Data Structures

Introduction - Basic concepts of algorithms and data structures, Abstract Data Types (ADT), Performance Algorithm, Analysis of algorithms, Asymptotic notations, Arrays (multidimensional, special forms, sparse), Lists (simply connected, circular, doubly linked), Stacks (with implementation table with a list implementation, applications), tails (realization with a round table with a list implementation, applications), Trees (quantitative data, representation of arrays and pointers, cross), priority Queue, heap Structure, Search (linear, binary, with interpolation), Sort (with option to import, bubble, quicksort, heap with merger), binary search trees, weighted search tree, red-black trees, B-trees, hash (dictionary function

and hash table, collisions, fragmentation chains, linear and double fragmentation), Graphs (a reconstruction table / list of neighborhood, breadth-first search, depth-first search). The design or selection of appropriate data structures for specific programming problems. The implementation and evaluation of different structures. Basic algorithmic techniques.

The student that will complete successfully the course is expected that will be in position to:

- Cite the characteristics of basic data structures.
- Cite basic search and sorting algorithms in basic linear and linked structures of data.
- Cite basic tree traversal and tree management algorithms.
- Cite basic graph algorithms.
- Cite three asymptotic notations.
- Explain basic search and sorting algorithms in basic linear and linked structures of data.
- Explain basic tree traversal and tree management algorithms.
- Explain basic graph algorithms.
- Select suitable algorithms for solving problems.
- Modify properly known algorithms so that they can be exploited in the solution of a problem.
- Comment the quality of a solution in relation to the execution time of the corresponding algorithm.
- Implement known and new algorithms.
- Modify known algorithms.
- Analyze a complex problem.
- Design the solution in an abstract level.
- Evaluate the quality of solution proposed and make corrective actions if required.
- Compare between various alternative choices for the solution of a problem.
- Analyze the quality of a solution in relation to the execution time of separate modules.
- Compose the solution of problem by combining individual pieces of the solution.
- Implement the solution to a problem.
- Evaluate the quality of designing a solution to a problem.
- Evaluate the quality of implementing a solution to a problem.
- Assess the correctness of a solution.
- Compare and comment various alternative solutions to a problem.
- Identify, assess and evaluate relative information via the proposed bibliographic sources and the use of Internet.




## 321-3354 Computer Architecture

Historical data on the evolution of computers. Architecture Von Neumann. Main memory. Auxiliary memory. Cache (Cache memory). Virtual Memory (Virtual Memory). I / O modules. Evaluation of Computer. Forms of representation of numerical data (both fixed and floating point). Structure and characteristics of the instruction set that supports the CPU. Machine language commands. Types of machine language commands. Types and data size. Simple computers (RISC) and complex instruction set (CISC). Support high-level programming languages. Organization and operation of the Central Processing Unit (CPU). Parallel processing. Multi-processor systems (MIMD, SIMD). Implementation of arithmetic. Channels. Technologies and methodologies for design of computer memory. Behavior management and multi-level memory hierarchy. Virtual Memory. Addressing modes for data management and from memory. Ways of addressing memory. Memory technology. Semiconductor memories. Static direct access memories, dynamic random access memory directly. Semiconductor memories accessible by content (Content Addressable Memories, CAM). Magnetic Memories. Memories of magnetic disks. Memories of magnetic tape. Optical Memories.

The student that will complete successfully the course is expected that will be in position to:

- Cite the basic components of computer architecture and explains the organization of a typical computer.
- Cite the principles of low-level programming.
- Explain the purpose of the CPU, the I/O subsystems and the various forms of storage.
- Comprehend the instruction set architecture of a machine, its design and implementation.
- Explain the representation of integer and real numbers.
- Cite the basic addressing modes of main memory.
- Categorize the computers based on their instruction set.
- Comprehend the support provided by the architecture to high-level programming languages.
- Distinguish the basic differences between RISC and CISC systems.
- Explain the operation of datapath.
- Explain the operation of control unit.
- Recognize the relation between hardware and software and the relation between low-level and high-level programming.
- Explain the concept of pipelining.
- Examine the control unit implementation in the form of a sequential circuit.
- Examine the control unit implementation in the form of microprogramming.
- Use the SPIM simulator of MIPS processor for programming at the machine level.

- Evaluate the performance of a computer system.
- Identify, assess and evaluate relative information via the proposed bibliographic sources and the use of Internet.

## 321-3752 Stochastic Processes

Discrete and continuous random variables, expectation of functions of random variables, joint distribution functions, independent random variables, moment generating functions, limit theorems, conditional probability and conditional expectation, the exponential distribution, definition of stochastic processes, the Poisson process, simulating discrete and continuous random variables, simulating stochastic processes, Markov chains, Chapman-Kolmogorov equations, classification of states, limiting probabilities, mean time spent in transient states.

After the completion of the course, the students:

- Will know the basic categories of mathematical and probabilistic tools, which are used for the solution of problems with elements of uncertainty or randomness.
- Will know the notion of stochastic process and will be familiar with the basic categories, as Poisson processes and Markov chains.
- Will be capable to cope with courses in other semesters, which base their theory on stochastic processes.

## 321-5502 Signals and Systems

Basic definitions of signals and systems, periodic signals, unit step, impulse function. Systems' categories, static and dynamic systems, causal and non-causal systems, linear and non-linear systems, time invariant and variant systems. Impulse response of linear systems. Convolution properties. Systems' stability. Fourier Transform (FT) and inverse FT. Convergence and properties of FT. Application of FT to the study of linear systems, system's frequency response, description of Linear Time Invariant (LTI) systems with differential equations and the FT, ideal lowpass filter. Fourier series, Fourier series of periodic functions, Fourier series for even or odd symmetry, Parseval's theorem. Laplace transform, properties and theorems. Inverse Laplace transform. Relation of the Laplace and Fourier transforms. Bilateral Laplace transform. Use of the Laplace transform in the solution of linear differential equations. Use of the Laplace transform in the analysis of linear systems and the study of their stability. State space, state, observability, controllability. Signal and systems of discrete time. Z transform and its properties, inverse Z transform. FT of discrete time. Unilateral Z transform. Sampling – Nyquist's theorem. Discrete Fourier Transform (DFT).

Upon completing the course, students will be able to:

- Distinguish between systems and models, and understand their interrelation.
- Understand basic system properties such as linearity, causality, stability etc.
- Use basic exponential, trigonometric and generalized functions to represent physical signals.
- Describe the relation between systems and signals by mathematical tools such as differential equations, difference equations, convolution, frequency response etc.
- Compute the output signal from the input signal and the system's mathematical model.
- Mathematically describe the interconnection of systems.
- Understand the analysis and processing of signals in the frequency domain.
- Understand the sampling process and the relation between discrete-time signals and their continuous-time counterparts.
- Use Matlab for problem solving.

## 321-0141 English Language 3

The course includes teaching of computer science terminology with basic computer science vocabulary, comprehension of scientific texts and lectures, theory and grammar exercises, as well as oral and written practice. Mathematical terminology in English that includes: Description of curves and surfaces, integration, differentiation, vectors, elementary statistics and probability, logic.

Students who successfully complete the course will be familiar with more complex grammatical and syntactical structures in English, will have practised in understanding written and spoken academic texts and will have developed their speaking and writing skills.

More specifically, upon successful completion of the course, the students will be able to:

- Understand written or spoken academic texts on information and communications technology.
- Know specialized vocabulary on information and communications technology which is commonly found in related academic texts.
- Know complex grammatical and syntactical structures and be able to use them correctly in writing and in speaking.
- Produce technical and academic texts (abstracts for academic papers, detailed descriptions of different types of diagrams, etc.).
- Produce effective notes while listening to an academic lecture and be able to summarize part of a lecture.
- Participate in a group discussion or seminar, exrpessing opinions and making effective contributions.

| 321-0843 | Foreign Language 3 |
|---|---|

Understanding and participation in discussions of issues of everyday life, oral and written presentation of information and texts in a variety of topics. Expression of feelings, opinions, arguments, conclusions, cultural elements (everyday life, education, work in France).

Anything mentioned in the syllabus of the course.

## 4th Semester

| 321-3104 | Information Systems Analysis and Design |
|---|---|

Information systems concepts and terms. Types of information systems and their role in the organization. Factors affecting the successful development of information systems. The role and challenges of the systems analyst. Requirements elicitation methods (interviews, questionnaires, JAD method, documents analysis, STRuctured Observation of the Business Environment – STROBE). Information Systems lifecycle. Data Flow Diagrams. Data dictionaries. Process specification. Data specification and analysis with Entity-Relationship Diagrams. Object-oriented analysis and design with UML (CRC cards, Use Case diagrams, Class diagrams, Sequence diagrams, Activity diagrams, etc.). Quality management and the development of information systems.

On the successful completion of this course, the student shall be able to:

- Understand the conceptual framework of information systems.
- Collect and analyze information regarding the information needs and requirements of an organization.
- Create models of information systems.
- Design information systems.

| 321-4201 | Algorithms and Complexity |
|---|---|

Combinatorial optimization problems. Divide-conquer algorithms. FFT. Dynamic programming. Greedy algorithms. Graph algorithms. Minimal spanning trees & algorithms. Maximum flow.

Randomized algorithms. Approximation algorithms.

When the student completes the course succesfully:

- She will have the knowledge of the most important algorithms of the theory of computation and the knowledge to experimentally validate their performance.
- She will have the skills to apply techniques of analyzing the time and space complexity of algorithms.
- She will have the capability to to solve problems about time and space complexity of algorithms.

## 321-3203 Databases I

Introduction to Databases and Database Systems. Advantages of using a Database System. Database Systems architecture. Database users. Schemas and instances. The principle of data independence. The entity-relationship, the relational and the object-relational model. Integrity constraints and Database update operations. Relational Database design by entity-relationship to relational model mapping. Database languages: relational algebra; tuple and domain relational calculus; the QBE language. SQL as a query language: queries, views, update statements. Introduction to primary file organizations and indexes. Presentation of commercial Database Management Systems.

The student that will complete successfully the course is expected that will be in position to:

- Analyze the requirements and design a database.
- Apply the principles of conceptual and logical modeling and designing of databases.
- Implement SQL queries in a database management systems.
- Design well structured databases based on the normalization rules.
- Understand the cost of processing a query on a database.

## 321-3302 Computer Communications

Introduction to computer communication. Network achitecture and protocols. Network Design. The OSI reference model from ISO. Transmission media (coaxial cable, fiber optics). Principles of data transfer. Local and metropolitan networks. Static and dynamic channel allocation. The ALOHA protocol. The CSMA protocol. The family of IEEE 802 for local networks (Ethernet, Token bus, Token Ring). The optical FDDI network. Design and analysis of data link layer. Error detection and correction. Flow control. The wireless IEEE 802.11. Networking devices (switches, routers, etc.).

Upon successful completion of the course the student:

- Has the basic knowledge of communications and networking engineering needed to pursue his studies.
- Has the ability to manage network problems at both theoretical and laboratory levels.
- Has the ability to interpret and judge scientific issues related to the design of computer networks that are applicable to everyday life.

## 321-4120 Advanced Topics of Programming Languages

Types of programming languages. Variables, expressions and commands. Datatypes and type definition systems. Scope and time of memory binding. Procedures. Exception handling. Concurrency. Object-oriented programming languages. Introduction to the organization and operation of compilers. Lexical analysis. Syntax directed translation. Basic detection techniques. Symbol tables. Intermediate code.

The student that will complete successfully the course is expected that will be in position to:

- Understand the fundamental concepts of programming languages.
- Understand key issues in programming language design and implementation (compiler theory).
- Know the main features of the tools and techniques governing the creation of modern programming languages.
- Use of tools for implementing lexical, syntactical and semantic analysis of a programming language.
- Use a new programming language (Python).

## 321-7904 Electronics

Nonlinear elements and circuits. Analysis of nonlinear circuits: analytical solutions, graphical analysis, piecewise linear analysis, incremental analysis. Diodes: semiconductor diode characteristics, analysis of diode circuits, method of assumed states. Dependent sources and the notion of amplification. Actual MOSFET characteristics – the Switch Unified (SU) MOSFET model. The MOSFET amplifier: biasing the MOSFET amplifier, the amplifier abstraction and the saturation discipline. Large-signal analysis, operating point selection. Small-signal analysis. The Operational Amplifier (Op Amp): the Op Amp model, the non-

inverting Op Amp, the voltage follower, inverting Op Amp, simplified method for analyzing circuits with Op Amps, adder, subtracter, differential amplifier. Analog-to-Digital and Digital-to-Analog conversion.

This is an introductory course on analog electronics. It aims at familiarizing the students with nonlinear electrical elements and circuits, as well as their analysis methods. It also introduces the students to the concepts of analog transistor behavior, analog electronic circuits, their analysis methods and amplifiers. A student who successfully fulfills the course requirements will have demonstrated:

- An ability to identify nonlinear electrical elements and circuits, and to analyze them by applying various analysis methods, namely, analytical solutions, graphical analysis, piecewise linear analysis and incremental analysis.
- An ability to understand the semiconductor diode characteristics and perform analysis of diode circuits by applying the method of assumed states.
- An ability to understand the actual behavior of MOS Field Effect Transistors (MOSFETs) and define the Switch Unified (SU) MOSFET model.
- An ability to understand how the MOSFET operates as an amplifier, what is amplifier biasing and how it is achieved, and what is the saturation discipline.
- An ability to apply the appropriate type of analysis (large signal or small signal) for determining the behavior of amplifiers depending on the magnitude of the swing of their input signals.
- An ability to understand the basic concepts of Op Amps and analyzing simple Op Amp circuits.
- An ability to understand the basic concepts of Analog-to-Digital and Digital-to-Analog conversion.

## 321-0853 Foreign Language 4

This course aims at a high level of knowledge of the Foreign language by assigning creative, academic projects. It enables recognition of advanced level of the Foreign language usage from official organizations and companies. It helps students who wish to pursue postgraduate studies at higher educational institutions and many Foreign language speaking countries. It enables the acquisition of Foreign language proficiency certificate.

Ability to participate in exams for acquisition of the Foreign language proficiency certificate.

## 5th Semester

### 321-2304 Business Operations and Information Systems

Introduction. Basic functions of a firm. Structure of the information system of a firm. Enterprise Resource Planning (ERP) systems. Commercial functions: sales, procurement, inventory management - basic concepts, implementation processes and functionality (capabilities) of the corresponding ERP modules. Financial statements - General Accounting: accounts, entries (credits/debits) for basic events and transactions, functionality of General Accounting module. Analytical Accounting - Costing: cost categories, cost centers, cost allocations, functionality of relevant modules. Production function: production planning and monitoring, Master Production Schedule - MPS, Materials Requirements Planning - MRP, functionality of production ERP modules. The laboratory of this course includes basic familiarization with the above modules of Microsoft Navision ERP system.

The main learning outcomes of this course are:

- Understanding the main functions of a firm (general accounting, sales, procurement, inventory management, production, costing – analytical accounting): basic objectives, concepts, processes and algorithms.
- Gaining basic knowledge on the electronic support of the above main functions of a firm through information systems.
- Understanding the structure of an enterprise resource planning (ERP) system, its main modules (general accounting, sales, procurement, inventory management, production, costing, analytical accounting), their files (master files and transaction files) and the main capabilities they offer.
- Practical familiarization with these modules, and ability to implement typical operation scenarios with them.
- Development of ability to understand complex enterprise information systems at a functional level, identify deficiencies and weaknesses and formulation of proposal for addressing them.
- Development of ability to participate in enterprise information systems project teams and cooperate with current and future users of various modules, for the development of functional specifications, the selection of software packages, the implementation and monitoring of such projects, and the functional design of improvements and extensions.

The above knowledge and abilities are quite useful for students' future career, since a significant part of their duties and activities will concern the understanding and electronic support of critical firm functions using modern information systems.

## 321-6451 Computer Networks

Reference Model TCP/IP and the OSI. IP Layer. Addressing. Algorithms and routing protocols. IPv6 and mobile IP. Congestion Control. Methods open (shaping, leaky backet etc.) and closed loop (blocking etc.). Internetworking, virtual networks, firewalls. Transport Layer. TCP & UDP Protocols. Multimedia applications and networks.

This course is the basic introductory course on the concepts of networking and data transfer, management processes. This course aims to introduce students to the basic concepts of networking, connecting data transfer concept with their respective targets in service quality, an environment and an understanding of the whole picture and the requirements for the effective management. It also refers to introductory concepts in data transfer management methodologies and internet impact , so that the student has an overall understanding of processes and methodologies in data transfer . In this sense, the lesson is the basis on which specific methodologies and management techniques for end-to-end data transfer are developed into individual specific courses of direction. Finally, the aim of the course is to understand from the students the importance of data promotion in the modern technological evolution and the evolution of networking , administration and management in a distinct scientific field / occupation.

Upon successful completion of this course the student will be able to:

- Have understanding of the key and critical aspects of data transfer and networking, to connect them with general technological and operational objectives.
- Is aware of the tools and techniques of data transfer and how they are used to ensure the successful completion of services in time and within quality of service goals.
- Can distinguish key roles in a real or networking study and assess the role of the levels involved in the implementation.
- Use networking and data transfer methodologies to identify key elements such as critical route, losses, security and dependencies, and a realistic environment.
- Collaborate with their fellow students to create and present comprehensive laboratory exercises that include study, analysis, and implementation elements.

## 321-3703 Databases II

Introduction to Database Design. Quality criteria for designing relational schema. Normalizing database schema. Relational Decomposition. Query processing. Query optimization. Transaction processing, time schedules and serialization. Concurrency control. Database recovery techniques, ARIES. Distributed databases and Internet databases. Interoperability between databases and user applications (ODBC, JDBC, etc). Introduction to design and

implementation of Object-Oriented Databases.

- The student that will complete successfully the course:
- Acquires the ability to perceive advanced issues in a Database Management System such as transaction management, synchronization and query optimization.
- Is able to understand and calculate the cost of processing a query in a Database Management System.
- Understands the basic principles of designing and developing systems using databases.
- Has the ability to create applications for small and medium-sized businesses.

## 321-3453 Telecommunications

Transmission methods, telecommunication system model. Statistics and stochastic processes in telecommunications. Hilbert transformation. Baseband transmission and band-pass signals. Analog Modulation AM, FM and PM, spectrum analysis, noise. Signals and Systems in Telecommunications. Fourier series and transform. Filters' classification, Distortion free transmission, Noise, Analog and/or digital data transmission over analog and/or digital systems. Sampling and quantization. Bandwidth, Nyquist and Shannon theorems. PAM and PCM modulations. Digital modulations (ASK, PSK, FSK, M-QAM).

The course seeks to introduce the students to telecommunication systems by focusing on physical layer technologies. By concluding the course, students are able to:

- Thoroughly understand the principles that govern the transmission in telecommunication systems as well as the principles of analysis and design of telecommunication systems.
- Understand the transmission of information and the its techniques.
- Recognize the discrete functions performed in a telecommunication system.
- Distinguish and explain the mathematical tools describing the functions of a telecommunication system.
- Apply mathematical notations and tools in the analysis and synthesis of both existing and new analog and digital telecommunication systems.

By concluding the lab sessions students are able to:

- Identify and apply the acquired theoretical knowledge in real-world problems.
- Use and exploit laboratory equipment for observation, measurement and comparison of real signals.

## 321-4002 Software Engineering

Introduction to Software Engineering (History, Motivation, Team Programming, The Software Process). Software Lifecycle Models (Waterfall, Rapid-Prototype, Incremental, Spiral). Requirements (Functional and Non-Functional Specifications, Requirements Planning and Scheduling, CASE Tools, Software Requirements Specification Document). Design (Data Centric design, Object centric design, Service centric design). Implementation and Integration (Coding Standards and Practices, Configuration Control, Team Organization). Testing (white box and black box, validation and verification). Modern methods and prototype (Agile programming, MSF, extreme programming).

The students get an overall view of software engineering methods and tools. Through their demo-prototype development in teams, they get initial experience in running and managing small software development projects.

## 321-6702 Theory of Computation

Regular languages, finite automata, pumping lemma for regular languages. Grammars for context free languages, pushdown automata, pumping lemma. Turing machines, computability and Church-Turing thesis. Non computability, halting problem. Time complexity, class P, Cook-Carp Thesis. NP completeness and time reductions. Space complexity and Savitch's theorem.

When the student completes the course succesfully:

- She will have the knowledge to identify the limits of the current models of computation.
- She will have the skills to study computing machines.
- She will have the capability to study the power of various computing models.

## 6th Semester

### 321-6503 Information Systems Management

Enterprise information systems. Applying IS into businesses. Gaining competitive advantage through IS. Information technology infrastructure (software, hardware, communications and Internet). Business Intelligence. Enterprise applications. Electronic commerce. Enhancing decision support. Knowledge management. Ethical and social issues.

Students who successfully fulfil the course requirements will have:

- The knowledge of understanding the role of Information Systems and the required technological infrastructure on organisations.
- The ability to identify the different types of Information Systems, to be able to assess the available technical solutions for the satisfaction of organisational problems/issues.
- The skill to identify the business environment and recognise opportunities for improvement on the efficiency and effectiveness of an organisation using Information Systems.

### 321-3604 Artificial Intelligence

Intelligent agents (basic concepts). Search in a state space for problem solving: Blind (but systematic) search, Guided search and heuristic methods, Search cost, Local search. Constraint satisfaction problems: Basic principles and algorithms. Planning: Basic principles and algorithms, Hierarchical planning. Machine learning: Introduction, Inductive learning, Machine learning algorithms.

On completion of this module, students are expected to be able:

- To have the knowledge of defining an intelligent agent and familiarity with the types of intelligent agents.
- To have the ability to represent a problem so that it can be solved via state space search. Familiarity with blind search algorithms. Familiarity with heuristic search algorithms.
- To possess the Understanding of the properties of heuristic functions. Familiarity with local search algorithms.
- To have the ability to represent a problem as a constraint satisfaction problem. Familiarity with algorithms of solving constraint satisfaction problems.
- To possess knowledge of planning methods and understanding the algorithm of partial-order planning.
- Familiarity with the basic principles and algorithms of machine learning.
- To have the capacity of developing programs that use artificial intelligence algorithms.

## 321-3404 Information and Communication Systems Security

Semantic foundation of terms on Information and Communications Systems security. Identification and authentication. Access Control. Policies and formal security models. OS security, use case: Unix. Malware. Analysis, evaluation and management of information systems risks. Information systems security policies. Elements of applied cryptography: classical cryptographic methods, symmetric and asymmetric cryptosystems, message authentication codes, digital signatures, Certification authorities, Public Key infrastructure, Legal framework in Greece. Network security. Threats and vulnerabilities. Internet Model Security: Internet layer security, Transport layer security, Application layer security, over the Application layer security. Applications.

Students:

- Will acquire knowledge of fundamental issues of Information and Communication Systems Security and Privacy.
- Will able to apply methods to address basic issues.
- Will be able to evaluate information security issues and use tools and techniques to address them.

## 321-7951 Distributed Systems

Basic concepts and principles of Distributed Systems, Middleware and resources, Client-Server Model, 3-tier Model, Models of communication and programming models (distributed transaction, remote procedure call, remote method invocation, message queue), Name Services (Domain Name System, directory services), Synchronization (logical clocks, distributed mutual exclusion, leader election, global states), Consistency and replication, Fault Tolerance.

The student that will complete successfully the course is expected that will be in position to:

- Cite well established definitions of Distributed Systems (DSs) and their characteristics.
- Recognize basic requirements that are related to the development of DSs.
- Recognize special kinds of problems that are related to the development of DSs.
- Categorize DSs using criteria that are related with the organization of their hardware.
- Explain the role of software in the operation of DSs.
- Categorize the software operating systems of DSs in three categories. - Describe three DS architectures from the software perspective.
- Cite contemporary trends that affect the development of DSs.
- Describe eight forms of transparency that are related to the design of DSs. - Describe the redundancy technique for enhancing the reliability of DSs.

- Define the concepts of flexibility and scalability.
- Describe basic requirements for designing a secure DS.
- Describe the client-server model.
- Describe five variations of the client-server architecture.
- Explain the need of clock synchronization in DSs.
- Describe at least two approaches of clock synchronization in DSs.
- Define the concepts of partial and total event ordering.
- Describe at least two algorithms of physical clock sysnchronization in DSs.
- Define the concept of mutual exclusion.
- Describe at least two algorithms that provide mutual exclusion.
- Comprehend the role of DSs and middleware software in the development of modern applications.
- Recognize special issues of DS modeling and operation (system models, interprocess communication, operating systems, distributed file systems, peer-to systems, web services) - Describe the general characteristics of interprocess communication.
- Describe the basic elements of the remote procedure call (RPC) model.
- Describe the basic elements of the remote method invocation (RMI) model.
- Use the Java RMI system for the development of distributed applications following a sequence of predefined steps.
- Explain the difference between processes and threads.
- Explain the need for thread synchronization and the concept of race condition
- Analyze problems and case studies of DSs and select the most suitable technologies for their implementation.
- Identify, assess and evaluate relative information via the proposed bibliographic sources and the use of Internet.

## 321-88103 Internet Programming

Introduction in internet technologies and web programming. Application, systems and services architecture and multi-tier layering. Content programming (HTML, XML, CSS). Client-side programming methods and tools (JavaScript, DOM, DHTML). Server-side programming (Java Servlets, PHP, MySQL database access, PHP sessions, JSP). Service oriented architectures (SOA) and web service infrastructures. Higher level content management platforms. Interoperability, security and authentication issues. Laboratory demo-prototype development.

Students will learn to build robust, safe, user-friendly web sites and understand the basic framework of server-client web applications.

| 321-5205 | Legal Framework for the Information Society |
|---|---|

Law in Information Society. Electronic acts/contracts and electronic commerce/ Electronic/ Digital Signatures: regulatory framework and legal issues. Consumer Protection in Information Society. Intellectural Property in Information Society. Software protection and SSL Agreements. Domain Names: Regulatory framework and legal issues. Computer Crime, Cybercrime and Penal Law in Information Society. Legal Issues of Electronic Communications Sector: secrecy and confidentiality, consumer protection, services and licences, universal service.

Upon completion of this course the students are expected to:

- Gain an overview of the legal and institutional issues which pertain to the Information and Communication Technologies (ICTs).
- Gain knowledge and understanding of the regulatory context of ICTs and of the main legal rules and principles.

## 7th Semester

### Cycle Information and Communication Systems Security and Privacy

| 321-9703 | Computer Network Security and Privacy Enhancing Technologies |
|---|---|

Introduction to Computer Network Security: Threats, Vulnerabilities, Countermeasures, Assurance. PKI Technologies and Services. OSI/ISO Network Security Architecture: Security Services, Security Mechanisms. Internet Model Security Architecture: Network layer security, Internet layer Security, Transport layer Security, Application layer Security. Applications. Firewalls: Capabilities and Limitations, Design issues, Firewalls Architectures, Network level Firewalls, Application level Firewalls, Hybrid Firewalls. Applications. Distributed Authentication Systems: Kerberos. Intrusion Detection Systems. Privacy Enhancing Technologies. Censhorship on the Web. Secure Electronic Payment Systems. Security Services and Products Assurance and Evaluation.

This course provides a broad-spectrum introduction to the fundamental principles of network security and privacy. The main learning objectives of this course are as follows:

- To provide a deep understanding of network security and its changing nature.

- To explain and demonstrate how network security is perceived and carried out.
- To analyze the various categories of threats, vulnerabilities, countermeasures and repelling strategies.
- To conceptualize the challenges of network security.
- To familiarize the students with the basic terminology and technologies of data privacy in networking environment and examine typical anonymity networks (Tor, I2P), applications, and use-cases.

The aim of the laboratory projects is to provide students with the knowledge and skills necessary to design and support network security and privacy. The aforementioned objectives are met through course lectures, paper readings, and laboratory exercises.

## 321-5753 Privacy and Data Protection Law

Privacy and Data Protection in Information Society. European and national data protection regulatory framework. Privacy and Data Protection in the electronic communication sector and in Internet. Anonymity in Internet. Specific issues of data protection: data protection and e-government. Personal data protection and online social networks. Personal Data protection in workplace. Data Protection and Privacy Enhancing Technologies.

The knowledge and understanding of the principles and basic legal rules referring to privacy and personal data protection are of major importance for studying, planning, designing and operating an information system. The planning and designing of information systems presuppose the knowledge of the regulatory framework and the respective legal barriers of data protection. The knowledge and the understanding of the issues concerning data protection and privacy are especially important as they are strictly co-related with the field of information systems and data security.

Upon successful completion students will:

- Understand the fundamental principles of privacy and data protection with regard to the study, design, operation and security of information systems.
- Understand the legal and regulatory framework governing information privacy and data protection and be able to identify weaknesses in the design and operation of information and communication systems and to develop solutions for improvement.

## Cycle Information Systems and Entrepreneurship

### 321-5155 Information Systems Analysis and Design Methodologies and Tools

Information Systems (IS) Development Methodologies. SSADM, RUP, SSM, Prototyping, Agile Methods. Rapid Application Development. CASE tools. Criteria for adopting an IS Development Methodology. Current trends.

Students who successfully fulfil the course requirements will have:

- The knowledge of comparing and choosing an appropriate methodology for the development of an Information System, taking into account the factors affecting this choice.
- The ability to analyse Information Systems, applying already established and well-known methodologies.
- The skill to design Information Systems following a systematic and structured approach, by using analytic and systemic way of thinking.

### 321-8953 Electronic Entrepreneurship

Electronic Business principles (E-business). Online retail stores. Internet and consumer market research. Marketplaces and B2B E-Commerce. Design and implementation of the e-shop. Digital marketing and advertising. Basic functions and types of electronic markets. Intra and inter-organizational e-systems and processes. Online auctions. Other e-business types (e-government, mobile commerce, etc.), e-business strategy.

Students who successfully fulfil the course requirements will have:

- The knowledge to identify and describe the major types of e-business, B2B and B2C business models and the appropriate revenue models.
- The ability to choose the appropriate infrastructure for each e-business initiative, key technology concepts, as well as to design the most efficient marketing strategy. All the above will be conducted after the student has understood the ethical, social and political issues that e-business raises, as well as the importance of individuals' privacy and information rights.
- The skill to develop a realistic business plan for a digital enterprise.

## Cycle Computer and Telecommunication Technologies

### 321-10302 Digital Communications

Characteristics of a digital communications system. Characteristics of telecommunications channels. Mathematical models of telecommunications channels. Coding of discrete information sources: PCM, differential PCM, adaptive PCM. Binary representation of signals: PAM, PSK, QAM, FSK, CPFSK, MSK. Spectral characteristics of digitally modulated signals. Optimal receiver for white Gaussian noise. Bit error rate performance of the optimal receiver for different digital modulation techniques. Synchronization. Inter-symbol interference. Orthogonal Frequency Division Multiplexing (OFDM). Multiple Input/Multiple Output (MIMO) transmission.

The main goal of the course is to familiarize the students with the theory of modern digital communications and to deepen their knowledge on the philosophy of digital communication systems. The course allows the students to develop their skills in performance evaluation of communication systems using Matlab and Simulink and to understand various relevant performance metrics. Finally, by simulating modern communication systems (digital modulaton, coding, OFDM, MIMO), the student will understand their mode of operation.

The students after the successful completion of the course will:

- Have the knowledge to analyze the performance of various digital communication systems, in terms of spectral-power efficiency, error probability. He/she will be able to extract the advantages and limitations of each technique and evaluate performance depending on the targeted application.
- Be able to apply techniques that will enable the extraction of the error probability under noise for digital modulation schemes such as (PAM, PPM, PSK, DPSK and QAM) and to apply techniques for optimising the efficiency of signal detection.
- Be able to develop simulation scenarios of a full scale communication system, where parameters such as BER will be extracted for different system architecture and channel impairments.

### 321-7051 Digital Systems Design

Application Specific Integrated Circuits (ASICs) and programmable devices (PLAs, PLDs, FPGAs), Hardware Description Languages (HDLs): Verilog and VHDL. Introduction to Verilog HDL, designing digital circuits with Verilog, Verilog syntax, modules and ports, structural modeling, behavioral modeling, dataflow modeling, tasks and functions. Finite State Machines (Mealy and Moore), Verilog for synthesis, design of sequential modules. Timing

and delays in Verilog, Computer Aided Design (CAD) tools, logical simulation and timing verification. Random Access Memories (RAMs) and memory interfaces. Design prototyping.

Students who successfully fulfill the course requirements will have:

- Knowledge of the differences between programmable devices and ASICs.
- Knowledge of the main features of FPGAs structure.
- The ability to use Verilog HDL for designing combinational and sequential digital circuits.
- The ability to write testbenches in Verilog.
- The ability to write Verilog for synthesis.
- The ability to simulate their designs.
- Knowledge of the structure of RAMs and how to use them in digital systems.
- The skill to use prototyping boards for transferring their designs in hardware.

## Cycle Communication Systems and Networks

### 321 8354 Network Management

Management of TCP/IP based networks. SNMP protocol. Database of Information Management. Abstract transmision syntax. Management of OSI networks. CMIP protocol. Tree of Information management. Comparison of management of OSI and TCP/IP systems. Management of bridged networks. Spanning tree algorithms. TMN prototype. Modern technics/methods of management WBM, CORBA, Java-based

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

- Have the basic knowledge of communications and networking engineering needed for postgraduate or continuing professional studies.
- Have the ability to manage network management problems at both theoretical and laboratory levels.
- Have the ability to interpret and judge scientific issues related to the management of computer networks that are applicable to everyday life.

### 321-7003 Performance Evaluation and Simulation of Computer Systems and Networks

Quantitative analysis of discrete-event systems, including computer systems and networks, both by statistical tools and by simulation. Poisson arrivals. Markov processes. Queueing

theory: M/M/1, M/M/c, M/M/1/K, M/M/1/K/K models. Queueing networks, Jackson networks, BCMP networks. Discrete-event simulation: random number generation, simulation of Poisson arrivals, simulation of queueing networks. Simulation using Arena.

Upon completion of the course, students will have:

- The knowledge of the basic building blocks of a simulation program.
- The capability to use statistical tools for system modelling.
- The capability to use simulation software such as Arena.

## Cycle Information Management and Intelligent Systems

### 321-7754 Robotic Control

Overview of the course, definitions, applications for robotics, challenge, historical highlights. Why robots need sensing - Factors that affect sensing capability. Effectors and Actuators. Mechanisms for acting. Degrees of freedom and mobility. Methods of locomotion: wheels, legs and beyond. Methods of manipulation: arms, grippers. Methods of actuation & choices. Introduction & 3D coordinate systems, forward & inverse kinematics. Configuration space, sequential & parallel mechanisms. Specifying robot positions. Why robots need self-sensing. Proprioception in biological systems. Proprioception in robots. Odometry. Navigating with beacons. Haptic perception. Robot Control, the control problem, linear dynamic models. Open-loop Control. Feedback control. Proportional error control. Proportional Integral error control - PID control. Robot architectures.

At the end of the course, students should be able:

- To describe and analyze rigid motion.
- To give the kinematic with the resulting equations.
- To solve simple problems of inverse kinematics.
- To choose sensors for specific applications.
- To solve design problems.

### 321-3553 Computational Logic and Logical Programming

Propositional logic: Syntax and semantics, Propositional entailment, Truth tables and formal proofs (inference rules, axiom schemata, provability, soundness and completeness). Propositional resolution and search strategies. Predicate logic: Syntax and semantics,

Entailment, Herbrand method, Proofs in predicate logic (inference rules, axiom schemata, soundness and completeness). Unification and Resolution in Predicate logic. PROLOG: syntax and program structure, control mechanism, fail and negation, applications.

After successfully completing the course the students have:

- The necessary know-how to form valid expressions in Propositional and Predicate Logic as well as in PROLOG programming language.
- The skill to apply proof methods given a set of assumptions and a possible conclusion. Such methods include truth tables, syntactic proof, and resolution.
- The ability to represent knowledge about an application area and extract new knowledge using proof methods.

## Cycle Computer Science Foundations

### 321-8603 Information Theory

Discrete information sources, alphabets. Entropy. Source coding: Huffman codes, Lempel-Ziv, arithmetic codes. Channel capacity. Second Shannon's theorem. Binary symmetric channel. Source modeling with Markov chains. Modulation and channel restrictions. Sequences (d, k) and codes RLL. Linear error detection and error correction codes. Codes representation in a binary vectorial space. Hamming distance. Decoding of linear codes. Codes Hamming: design, binary code, extended Hamming codes. Performance bounds of linear codes. ARQ protocols. This course offers an introduction to the theory of information and its applications to communication systems. Emphasis is given on the design, analysis and application of error detection and correction codes.

- The student will learn the foundations of information theory.
- The student will be able to compute information that a source produces and examine the possibility to transmit it over a specific channel.
- The student will be able to choose the most adequate compression algorithms.
- The student will be able to evaluate the impact of the application of compression algorithms.
- The student will be able to choose the most adequate error correction algorithms under specific noise conditions and transmission rate.

### 321-99002 Numerical Analysis

Errors, Computer Arithmetic, Error method and algorithm, Linear Systems, Method of Gauss, Gauss-Jordan, factorization LU, Method Choleski, Iterative method of Jacobi, Gauss, Gauss-seidel, SOR, Nonlinear equations and systems, partition method, fixed point, Newton-

Raphson, secant, Interpolation and Approximation of Lagrange, Newton, Hermite, functions, spline, Numerical Differentiation and Integration type Lagrange, Taylor, Richardson, rule rectangle, trapezoid, Simpson, type Newton-Cotes, Numerical solution of ordinary differential equations, partial differential equations.

The purpose of this course is to provide a complete knowledge of numerical methods for solving problems that appear in Science and Technology. More precisely the aim of this course is the comprehension of the basic numerical methods for approximating solutions of various mathematical problems using a computer. Emphasis is also given on the theoretical/ mathematical background of these methods for their full comprehension. After the successful completion of this course, the student should be able to:

- Understand the floating point arithmetic and floating point numbers.
- Understand, calculate and estimate the error that occurs from approximate solutions of problems.
- Approximate solutions of systems of linear and non-linear equations, using basic arithmetic methods.
- Approximate solutions of non-linear equations, using basic arithmetic methods.
- Describe the behavior of functions in one variable using suitable interpolation polynomials.
- Approximate the derivative and the integral functions in one variable, using arithmetic differentiation and integration methods.
- Apply basic arithmetic methods for solving simple differential equations..

## 321-0161 English Language (TOEFL)

In this course students will be able to: (1) Learn more about what the TOEFL test is and how they can register for it. (2) Get familiar with the test's format and tasks. (3) Practise reading, listening, writing and speaking skills in English that are required for the test. (4) Practise with questions and tasks that simulate the real exam.

The purpose of this course is to prepare students who wish to pursue postgraduate studies in English-speaking universities to participate in the TOEFL examinations, which certify their ability to use the English language.

In this course students will be able to:

- Learn more about what the TOEFL test is and how they can register for it.
- Get familiar with the test's format and tasks.
- Practise reading, listening, writing and speaking skills in English that are required for the test.
- Practise with questions and tasks that simulate the real exam.

## 8th Semester

### Cycle Information and Communication Systems Security and Privacy

| 321-8053 | Cryptography |
|---|---|

Introduction to cryptography and cryptanalysis, historical cryptographic algorithms, basic notions of number theory, modular arithmetic, one-way functions, the definition of perfect secrecy, Shannon's theorem, Vernam's cryptosystem, public key cryptography (RSA, Rabin), symmetric algorithms, DES and AES, hash functions, digital signatures.

After the completion of the course, the students will:

- Comprehend basic notions of number theory and understand the operation of well known cryptographic algorithms.
- Have the ability to use GNUMP library and see in practise the operation of known cryptographic algorithms.

| 321-10753 | Mobile and Wireless Networks Security |
|---|---|

Introduction to wireless networks security: Wired vs. wireless network security, categories of Threats and the OSI model, Vulnerabilities, Countermeasures, Security architectures. IEEE 802.11 standard security issues: Authentication and authorization mechanisms, Confidentiality and Integrity, pre-RSNA protocols (WEP), TSNs (TKIP), RSNA (802.11i), Key management, Threat analysis and case studies. Mobile networks security (3GPP): GSM/GPRS/UMTS/LTE security issues, Network access and Authentication mechanisms, Key hierarchy and administration, Encryption, Integrity and user Privacy, Inter and Intra-network security, classification of attacks.

This course covers the major security and privacy topics in wireless and mobile networking. The main learning objectives of this course are:

- To conceptualize the idiosyncrasies of wireless terrain in terms of security and privacy.
- To impart state-of-the-art technologies of wireless network security.
- To analyse the various categories of threats, vulnerabilities, countermeasures in the area of wireless and mobile networking.
- To familiarize students with the issues and technologies involved in designing a wireless system that is robust against attack.

The course considers basic security topics and technologies in the following standards: 3GPP GSM/UMTS/LTE, IEEE 802.11. The emphasis is put on the security issues of MAC and upper

layers. The aforementioned objectives are fulfilled through course lectures, paper readings, and projects.

## Cycle Information Systems and Entrepreneurship

### 321-8504 Decision Support Systems – Business Analytics

Introduction. Categories of decisions in modern firms. Architecture of a Decision Support System. Analysis of discrete options' decision problems. Influence Diagrams - Decision Trees. Creation of models, solution, risk profiles and sensitivity analysis. Utility functions and their use for decision support. Role and value of perfect and imperfect information - Bayes theorem use. Multi-criteria decision making. Structure and capabilities of software tools for the analysis of discrete options' decision problems. Analysis of decision problems with continuous range of options - Linear Programming - Creation of models, solution and sensitivity analysis. Structure and capabilities of software tools for the analysis of decision problems with continuous range of options. Basic concepts, structure and design of data warehouses – star, constellation and snowflake schemes. Techniques of data mining for extraction of knowledge from data in order to provide decision support. Structure and capabilities of datawarehousing and datamining software tools. The laboratory of this course includes familiarization with software tools for the analysis of both discrete options and continuous ranges of options decision problems, and also data warehousing and data mining tools.

The main learning outcomes of this course are:

- Understanding basic methods for the analysis of decision problems of firms and public organizations based on the creation of models and the solution of them.
- Understanding basic methods for supporting decision making in firms and public organizations based on the provision of appropriate forms of processed information to the decision-makers, and the extraction from the available data of knowledge useful for decision making.
- Familiarization with software tools supporting the above tasks.
- Development of ability to model decision problems, and then to solve the models, understand the results, and use them for drawing conclusions and formulate proposals-recommendations for the decision makers.
- Development of ability to exploit the data of 'traditional' internal on-line transaction processing systems of firms and public organizations, and also other external sources, through appropriate processing, for providing support to various levels and types of decision makers.

## 321-5607 Human – Computer Interaction and Web Applications

Introduction, historical background in HCI. Man and computer as interaction elements. Structural elements and interaction styles. Interactivity levels. Dialogue Modeling. Human-centric design on interactive systems. Requirement analysis. Scenario based design. Design norms and guidelines. Evaluation Techniques (interviews, focus groups, cognitive walkthrough, etc.). Develop web applications in the laboratory. Hypothesis formulation. Intelligent Interfaces.

Upon successful completion of this course, students should be able to:

- Design, implement and evaluate effective and usable graphical computer interfaces.
- Describe and apply core theories, models and methodologies from the field of Human – Computer Interaction (HCI).
- Describe and discuss current research in the field of HCI.

## 321-11102 Digital Government

Introduction to e-Government domain – key issues and topics. The Public sector – structure and operations. G2C, G2B, G2G services. Business Process Management in the public sector and local administration. Enterprise Architecture for Government Systems. Key infrastructures and government services. Local Government. World, European and National status (e-government indexes). Issues and principles of open and collaborative governance. Systems and methods for electronic participation and electronic democracy. Open governmental data: administrative processes and relative ICT tools. Social media in the public sector, for provision of services towards citizens and businesses. National and Local Government cases. Team Project: Development of innovative e-government services and solution prototypes.

The student that wiil complete the present module will be able to:

- Know the structure of the Greek public sector and the main EU organisations.
- Understand the various information systems used in the public sector.
- Know the key digital public services (to be) provided towards citizens and businesses.
- Analyse the current status of an organisation, pertaining to the level of digitasation.
- Use the various digital governance and interoperability standards in Greece and EU.
- Take part in the design and implementation of innovative information systems for the public sector.

## 321-7653 Systems Theory

How science evolves: Scientific paradigms and scientific revolutions. Information systems epistemology. Taxonomy of systems. Information Systems as Human Activity Systems. Methodologies for systems. Soft Systems Methodology. General Systems Theory. Cybernetics and Control Systems. Structured and unstructured problems. The Viable System Model. Systems Dynamics. Applications for Information Systems.

Students who successfully fulfil the course requirements will have:

- The knowledge to identify simple or complex systems, to identify epistemological issues, to apply the principles of Cybernetics and Control Systems, to successfully apply Soft Systems Methodology, Viable System Models and Self-Organising Systems.
- The ability to handle a problem following a systemic approach, identifying the critical characteristics that make it an unstructured problem.
- The skill to apply appropriate methodologies of systemic thinking for the realisation and solving of unstructured problems.

### Cycle Computer and Telecommunication Technologies

## 321-7803 Wireless Communications

Electromagnetic waves in space. Introduction to antenna theory and radiation mechanism. Antenna radiation regions. Field and power antenna patterns. Basic antenna parameters (gain, directive gain, directivity, temperature, etc.). Antenna equivalent circuits (transmission and reception). Reciprocity theorem and far-field radiation. Linear, loop and aperture antennas. Antenna polarization and loss factor. A generic methodology for the calculation of radiated fields. Basic antenna examples (Hertz dipole, longer dipoles, λ/2 dipole, small loops, etc.). Linear, planar and circular arrays. Noise and antenna noise temperature. Tropospheric and ionospheric waves. Ground waves. Basic wireless propagation equations (Friis, reflection, scattering, diffraction). Applications and antenna measurements.

The aim of the course is to enable students to understand the basic principles of electromagnetic systems for wireless communications, the theory of electromagnetism and its applications to transmissions of electromagnetic signals carrying information, as well as antennas. By concluding the course, students are able to:

- Identify, describe and distinguish the basic characteristics of electromagnetic systems describe physical laws of electromagnetism using appropriate mathematical tools.

- Distinguish the type of antenna and examine its characteristics.
- Compute metrics which are extensively used in wireless systems and design basic wireless links.
- Analyze and design more complicated wireless systems.

By concluding the lab sessions students are able to:

- Understand physical phenomenon by using mathematical tools.
- Identify and apply theory in real world problems.
- Use professional antenna measurement equipment for the first time.

## 321-7853 Microprocessors

Introduction: number systems and essential digital circuits. Microprocessor architecture: Principles of microprocessor systems, control unit, registers, arithmetic and logical unit, microprocessor state, microprocessors classification. Case study: 8085 architecture. Machine language and assembly. Memories and addressing modes: Organization of static and dynamic RAMs (SRAMs and RAMs) – principles of operation, reprogrammable ROMs, memory systems, addressing modes. Input/Output (I/O): program controlled I/O, polling, interrupts, Direct Memory Access (DMA). Description of 80x86 microprocessor family. More advanced microprocessors.

Upon completion of the course, students will have:

- In-depth understanding of computer systems hardware, as well as the relation between hardware and software.
- Capability of programming microprocessors and microcontrollers in C and assembly.
- Hands-on experience on applications of microcontrollers.

## 321-8752 Introduction to VLSI

Introduction: MOS transistors, CMOS logic, basic gates and memory elements, CMOS fabrication and layout. MOS transistor theory: ideal (long-channel) I-V characteristics, C-V characteristics, non-ideal I-V effects, DC transfer characteristics. Delay: RC delay model, linear delay model – Logical Effort, transistor sizing. Power dissipation: dynamic power, static power, energy-delay optimization, low-power circuit design. Interconnect: wire geometry, metal layers, wire modeling, delay, energy, noise, wire engineering. Process

and environmental variations. Scaling. Combinational circuit design: circuit families, circuit pitfalls. Sequential circuit design: circuit design of latches and flip-flops, max-delay constraints, min-delay constraints, time borrowing, clock skew. Semiconductor memories.

A student who successfully fulfills the course requirements will have demonstrated:

- An ability to design static CMOS combinational and sequential logic at the transistor level, including mask layout.
- An ability to describe the general steps required for processing of CMOS integrated circuits.
- An ability to understand the accurate (non-ideal) MOS transistor behavior.
- An ability to estimate and optimize combinational circuit delay using RC delay models and logical effort.
- An ability to estimate and optimize interconnect delay and noise.
- An ability to define the different kinds of power dissipation in VLSI circuits, as well as approaches for reducing it.
- An ability to design for higher performance or lower area using alternative circuit families.
- An ability to describe and avoid common CMOS circuit pitfalls.
- An ability to compare the tradeoffs of sequencing elements including flip-flops, transparent latches, and pulsed latches.
- An ability to understand and calculate max-delay constraints, min-delay constraints and the time that can be borrowed in all sequencing cases mentioned above.
- An ability to describe the sources and effects of clock skew.
- An ability to design and evaluate integrated circuits using Computer Aided Design (CAD) tools.
- An ability to describe the structure and functionality of semiconductor memories.

## 321-9353 Digital Image Processing

Introduction: what is Digital Image Processing (DIP), fields of using DIP. Digital image fundamentals: elements of visual perception, light and electromagnetic spectrum, image sensing and acquisition, sampling and quantization, mathematical tools used in DIP. Intensity transformation functions. Histogram processing. Spatial filtering, smoothing and sharpening spatial filters. Filtering in the frequency domain: sampling and the Fourier transform of sampled functions, 2-D Discrete Fourier Transform and its properties, filtering in the frequency domain, smoothing and sharpening frequency domain filters. Image restoration: noise models, restoration in the presence of noise only, linear position-invariant degradations, estimating the degradation function, inverse filtering, Minimum Mean Square

Error (Wiener) filtering. Image compression: fundamentals (coding, spatial and temporal redundancy, irrelevant information, measuring image information, etc.), basic compression methods (lossy and lossless). Color image processing: color models, pseudocolor and full-color image processing, image segmentation based on color, noise in color images, color image compression.

Knowledge of the theoreticaIt is the intent of this course that students will:

- Be able to describe and explain basic principles of digital image processing and identify and describe the goal of each stage in a Digital Image Processing System.
- Have a basic understanding of human visual perception.
- Have knowledge of the theoretical background needed for Digital Image Processing.
- Understand digital image representations.
- Be able to use basic relationships between pixels and describe basic transformations.
- Be able to define and compute the histogram of a digital image as well as the information that could be inferred from it.
- Be able to enhance digital images using filtering techniques in the spatial domain.
- Know how to analyze images (as 2-D signals) in the frequency domain through the Fourier transformation.
- Be able to enhance digital images using filtering techniques in the frequency domain.
- Understand the effects of noise on all aspects of digital imaging and implement a range of noise reduction filtering approaches.
- Understand the need for compact image representations, learn the theory of digital image compression and be familiar to the most frequently used compression techniques and the industrial standards that make them useful.
- Be able to describe different color spaces and perform pseudocolor and full-color image processing.
- Be familiar with Matlab programming and Image Processing toolbox.
- Be able to design and implement algorithms that perform image processing.

## Cycle Communication Systems and Networks

### 321-7256 Mobile Communication Networks

Introduction to wireless systems and networks. Evolution of wireless mobile communication systems. Propagation and path-loss in wireless communication. Analytical and empirical propagation path-loss models. Types of fading and channel characterization. Radio planning principles for cellular systems. Types of interference. Mobility management and handover process. Techniques for efficient allocation and management of radio resources. Digital

modulation techniques for mobile communication systems and channel capacity. Medium access control protocols and multiple access techniques FDMA, TDMA, CDMA and OFDMA as well as how they are implemented in the respective wireless cellular systems GSM, GPRS/EDGE, UMTS, LTE, LTE-A.

The course offers an introduction to mobile communication networks, i.e. GSM, GPRS, UMTS, LTE and LTE-A. The operating principles and main features of these systems are studied, and the course concludes with a short introduction to the features of future wireless networks (5G).

The lab part of the course includes a set of carefully selected exercises to accelerate the learning process. Through simulation, the students study basic processes of a mobile telephony system, such as Call Admission Control, Management of radio channel quality in Line Of Sight (LOS) and NLOS scenarios, as well as transmission rate management using Adaptive Modulation and Coding (AMC).

Upon completion of the course the student:

- Will have understood the concepts of cellular radio coverage, cellular planning and radio resource management (Call Admission Control, Wireless Channel Capacity and Quality, Dedicated and Shared Channel Management, Service based QoS differentiation etc.) at advanced mobile communications systems.
- Will be able to utilise basic RRM techniques to calculate the network resources that are required to achieve a QoS (Quality of Service) target.
- Will be able to calculate and analyse the key performance indicators of a mobile communication system.

## 321 -11001 Networks and Cloud Technologies

Cloud computing technologies, types of services (NaaS, IaaS), development models (private, public, hybrid), tools (openflow), virtualization of networking services and functions (SDN, NFV). Advanced technologies for access and core networks (e.g., IEEE 802.1X, 802.21, 5G, DSL, Gigabit Ethernet), architectures (eg. MPLS, Diffserv, IntServ), protocols (eg. RSVP, Mobile IP, IPv6, OSPF, BGP) and services (WebTV, IPTV, P2P, V2V).

The course is a basic introduction to the concepts of cloud computing and resource virtualization and services virtualization. This course aims to introduce students to the basic concepts of cloud computing, connecting the concept of service offered by their respective necessary resources and requirements for the effective management of s. It also refers to introductory concepts in infrastructure management and access technology methodologies,

so that the student has a comprehensive understanding of processes and methodologies in cloud computing. In this sense the lesson exploits knowledge and is the basis on which specific methodologies and techniques for the creation and management of virtual services. Finally, the aim of the course is to understand from the students the importance of the management of virtual services in the modern economy and the transformation of the cloud computing into a distinct scientific field / occupation.

Upon successful completion of this course the student will be able to:

- Understanding has the key and critical aspects of cloud computing, connecting t th with broader economic and operational objectives and principles of the service lifecycle.
- Has knowledge of the tools and techniques of virtualization Mr. century that are used to ensure the successful completion of a year the services and resources taking into account the budget.
- It is able to distinguish the main roles in a real or a case study of a cloud computing project and to assess the role of the stakeholders in the implementation of the project.
- It uses cloud computing methodologies to identify key elements such as critical infrastructures, interfaces, dependencies, and a realistic or implementation.
- Analyzes and calculates the basic costs of the service and the connection with the timing.
- Collaborate with its fellow students to create and present a project in a computational cloud service case study that includes the organization, allocation of key tasks, architectural design and implementation of the service (Environmental Analysis - Communications, Objectives, Work Structure Analysis, Chronoprogramming, and Budget).

## 321-6257 Internet Protocols and Architectures

Client-server model vs. P2P model, BOOTP and DHCP protocols, The Domain Name System (DNS), Differentiated Services (DiffServ) protocol and Resource ReSerVation Protocol (RSVP), Virtual Private Networks (VPN), Mobile IP and mobility management in Next Generation networks, Software-Defined Networking – SDN, Network Function Virtualization – NFV, Cloud Infrastructures and Services, Multicasting and Network coding, Data transmission over power line transmission networks, Visible Light Communication Networks, Machine to machine M2M networks over internet, Green Technologies In Next-Generation Networks, Fiber Optic Internet Technologies.

The aim of this course is to familiarize students with both basic and advanced concepts of Internet protocols and architectures. In particular, basic network architectures such as client-server and peer-to-peer as well as virtual private networks and protocols that allow for IP portability and QoS in internet (RSVP, DiffServ), are discussed in detail.

Furthermore, through the study and analysis of the relative scientific literature the students get introduced to advanced topics such as Software-Based Networking (SDN) and Network Function Virtualisation (NFV), multicasting and network coding, data transmission over energy networks, visible light networks as well as IoT networks and Green technologies.

Upon completion of the course students:

- Will have understood basic web protocols and architectures.
- Will have achieved an introductory understanding of a number of advanced networking concepts and techniques that are currently under development.

## Cycle Information Management and Intelligent Systems

### 321-9253 Data Mining and Data Warehouses

Introduction to Data Mining Techniques: a) data, b) problems, c) applications, d) general analysis and processing techniques. Data pre-processing: a) data cleansing, b) data transformations, c) dimension reduction techniques. Clustering, Part I: a) introduction to clustering, b) proximity measures, c) k-means and its variations, d) hierarchical clustering. Clustering, Part II: a) DBSCAN, b) cluster validity, c) BIRCH. Association Rules I: a) problem definition, b) a-priori algorithm, c) frequent itemsets. Association Rules II: a) advanced methods for finding frequent itemsets, b) FP-Growth, c) association rules validation. Classification I: a) introduction, b) Decision Trees (entropy, Gini Index, classification error). Classification II: a) Bayesian classifiers, b) Support Vector Machines, c) KNN, d) rule-based classifiers, e) overfitting. Data Warehouses and OLAP: a) definitions, ROLAP, MOLAP, HOLAP, b) cuboid, c) cuboid implementation.

On completion of this module, students are expected to be able:

- To have the knowledge of explaining the Critical awareness of current problems and research issues in Data Mining. To have the knowledge of comprehensive understanding of current advanced scholarship and research in data mining and how this may contribute to the effective design and implementation of data mining applications.
- To have the ability to consistently apply knowledge concerning current data mining research issues in an original manner and produce work which is at the forefront of current developments in the sub-discipline of data mining.
- Developing their proficiency with leading data mining software, including RapidMiner, Weka and Business Intelligence of MS SQL server. Understanding of how to apply a wide range of clustering, estimation, prediction and classification algorithms, including k-means clustering, BIRCH clustering, DBSCAN clustering, classification and regression


trees, the C4.5 algorithm, logistic Regression, k-nearest neighbor, multiple regression, neural networks and support vector machines.

- To possess the capacity for understanding how to apply the most current data mining techniques and applications, such as text mining, mining genomics data, and other current issues. Understanding of the mathematical/statistics foundations of the algorithms outlined above.

### 321-10202 Information Retrieval

Introduction to information retrieval systems. Information retrieval/filtering and browsing. Modeling: Set theoretic models, Algebraic models, Probabilistic models. Text processing and compression. Zipf's law and Heaps' law. Introduction to markup languages. Indexing methods: inverted files, suffix trees and arrays, signature files. Online search methods. Evaluation of information retrieval systems. User feedback and query expansion. Web search: search engines, web crawling techniques, link-based methods.

Upon successful completion of the course, the student will:

- Have the knowledge to distinguish between data retrieval and information retrieval, to analyze the architecture of an information retrieval system and to understand the properties of binary, vector and probabilistic information retrieval models.
- Have the skills to apply the most common methods of indexing, user feedback and query extension to information retrieval systems.
- Have the ability to evaluate information retrieval systems and understand web crawling techniques and the particularities of retrieving information on the Web.

## Cycle Computer Science Foundations

### 321-9455 Applied Topics in Data Structures and Databases

This course focuses on advanced and applied topic of data structures and database systems. The main focus is on modern applications such as distributed systems, spatial databases, multi-dimensional data and data warehousing. The goal is that the students learn the requirements of different applications that differ from traditional relational databases and to be able to develop solutions for data management in such applications.

The student that will complete successfully the course:

- Will be familiar with modern applications such as distributed systems, spatial databases,

multi-dimensional data and data warehousing.

- Will be able to  the requirements of applications that differ from traditional relational databases.
- Will be able to develop solutions for data management in such applications.

## 321-8001 Game Theory

Introduction to game theory, definition of equilibrium notions, examples. Pure and mixed Nash equilibriums. Price of anarchy. Non zero sum games. Lemke-Howson's algorithm. The complexity of computing equilibriums and Brower's fixed point. The PPAD class. The PLS class. Approximate equilibriums. Stackelberg strategies. Braess's paradox.

The student who completes the course successfully:

- Will have the knowledge to model the interaction of rational entities, with respect to antagonistic or cooperative nature.
- Will have the skills to study contexts and real world applications of algorithmic game theory.
- Will have the capability to analyze theoretically and experimentally various games.

## 321-9855 Mathematical Modeling

The concept of mathematical modeling and its applications, modeling of stochastic systems and simulation of random variables, random number generators and properties, simulation methods for continuous and discrete random variables, synthesis method, simulation of Poisson processes with constant / changing rate, Monte Carlo simulation, statistical tests.

After the completion of the course, the students:

- Will known the most well known methods of simulation of random variables using Matlab, as well as their application to engineering problems.
- Will be able to understand the basic properties and applications of pseudo-random sequences and to simulate stochastic processes of discrete and continuous time.

## Optional Courses

### 321-7602 Practice

Practice in a real business environment. Familiarity of the student with the conditions and requirements of real working environments.

### 321-2631 Simulation Techniques for Communication Systems

Introduction to Matlab, performance evaluation metrics of communication systems. Signals and linear systems, representation and analysis of signals in time and frequency. Stochastic process, generation of random variables, probability distribution functions. Modeling of a digital transmitter, modulation and coding techniques. Modeling of a digital receiver, demodulation and decoding, performance evaluation of the receiver. Wireless propagation, free-space loss models. Shadowing, multipath propagation, Rayleigh fading, transmit and receive diversity. Capacity and outage probability of a wireless channel, Shannon's formula. Cooperative relaying without and with power control. Cooperative relaying with interference mitigation, performance evaluation of interference mitigation techniques. Capacity and outage probability in networks with secrecy constraints, performance evaluation of secrecy techniques. Simulation of a Multiple-Input Multiple-Output (MIMO) antenna system, channel models of MIMO systems, modulation and coding for MIMO systems.

The goal of this module is to familiarize students with the Matlab software and to simulate various types of communication systems. The student is introduced to using Matlab and to producing fundamental signals, variables and transmission channels. Moreover, the module allows the students to develop their skills in performance evaluation of communication systems using Matlab and to understand the meaning of significant performance metrics of digital communication systems. Finally, by simulating modern communication systems (cooperative relaying, MIMO), the students will acquire a deep understanding of their operation.

**Free Course**

| 321-0151 | English Language (TOEFL) |
|---|---|

In this course students will be able to: (1) Learn more about what the TOEFL test is and how they can register for it. (2) Get familiar with the test's format and tasks. (3) Practise reading, listening, writing and speaking skills in English that are required for the test. (4) Practise with questions and tasks that simulate the real exam.

The purpose of this course is to prepare students who wish to pursue postgraduate studies in English-speaking universities to participate in the TOEFL examinations, which certify their ability to use the English language.

In this course students will be able to:

- Learn more about what the TOEFL test is and how they can register for it.
- Get familiar with the test's format and tasks.
- Practise reading, listening, writing and speaking skills in English that are required for the test.
- Practise with questions and tasks that simulate the real exam.

## 9th Semester

### Cycle Information and Communication Systems Security and Privacy

| 321-7406 | Knowledge Engineering and Knowledge Systems |
|---|---|

Systems that represent, organize and utilize knowledge. Semantic Networks, Systems that use frames, systems that use rules, reasoning using rules (forwards and backward chaining), Rete algorithm, design and implementation of rule-based systems. Case-based reasoning. Reasoning under uncertainty. Application of knowledge systems: configuration, design, diagnosis and classification. Introduction to Semantic Web technologies: Structuring XML documents, describing resources using RDF, Ontology Web Language. Logic and reasoning: Rule markup in XML, Applications (Data integration, Information retrieval, Portals, e-Learning, Web Services, etc.). Protégé, an environment for deploying ontologies, Pellet reasoning engine.

On completion of this module, students are expected to be able:

- To have the knowledge of explaining the role of knowledge engineering within Artificial Intelligence, identifing and explaining the various stages in the development of a knowledge based system.
- To have skills of designing and developing a rule-based knowledge based system, designing and developing a case-based knowledge based system, designing and developing Bayesian reasoning systems.
- To posses the capability of understanding the mathematical foundations of Bayesian networks, comparing and contrasting rule- and case-based knowledge based systems, designing and developing Semantic Web concepts and ontologies, comparing and contrasting Semantic Web markup Technologies, and building Ontologies and Reasoning systems in Protégé.

### 321-99101 Regulatory and Social Issues in Information Society

Information as a good. Law/Regulation in Information Society. Law, Regulation and technological neutrality. Subjects, communities and actors in WEB 2.0. Cyberspace as space. Governance in Information Society. Information, Computer Science and social discourse. Social responsibility in Information Society. Social gap and challenges. Trust in Information Society. Social and Legal issues of identity management. Digital speech and freedom of speech in Information Society.

The objective of this course is the discussion and the closer examination of issues concerning the conceiving, understanding and dealing with information and communication technologies and their application by users, society and economic, technological and political organizations.

Upon completion, students should be able to understand in depth the social and institutional issues that are raised with regard to the development of ICTs.

## Cycle Information Systems and Entrepreneurship

### 321-5403 Information Systems Strategy and Investment

Introduction. Definitions, components and methodology of business strategy and information systems strategy. Strategic information systems. Analysis of external macro and industry environment – identification of opportunities and threats. Porter's model - structural analysis of an industry. The role and impact of information and communication technologies.

Analysis of internal environment - resources and capabilities – identification of strengths and weaknesses. Value chain and value system. The role of internal-intraorganizational and interorganizational information systems. Strategies for competitive advantage: cost leadership, differentiation, focus, hybrid strategies – ways of supporting each of them with information systems. Products-services portfolio strategies - the BCG method of analysis of products-services portfolio – elaboration for the information technologies sector. Formulation of information systems strategy – methodologies and frameworks. e-Business strategy. The course will include for each of the above chapters the analysis in class of one or more real-life cases.

The main learning outcomes of this course are:

- Understanding the concepts and the components of business strategy and information systems strategy, and also the interconnection between them.
- Understanding the basic methodology of business strategy formulation, through the analysis of its external and internal environment, and also the role and the importance of information and communication technologies in shaping them.
- Gaining knowledge on the basic strategies for achieving competitive advantage, and on ways of supporting them with information systems.
- Development of ability to understand the strategy of a firm and identify the required information systems for supporting it, and also for its enrichment and expansion (e.g. with new products and services, new markets, etc.).
- Development of ability to recognize the main information and communication technologies that create opportunities or pose threats to a firm, and to formulate strategies for exploiting/addressing them.

The above knowledge and abilities are quite useful for students' future careers, since in most firms there is a 'fragmented' exploitation of information and communication technologies (without being based on a sound integrated plan), which is not aligned with business strategy (lack of strategic alignment).

## Cycle Computer and Telecommunication Technologies

### 321-10652 Satellite Communications

Introduction to satellite-link subsystems and examination of the geometrical theory of geosynchronous and geostatic satellites. Orbit mechanics. Specialized topics on the satellite channel (e.g. satellite antennas) and analysis of the satellite link in terms of radiated and received power, signal-to-noise ratios, and random effects. Analog and digital modulation

and multiple access techniques and their implementation in satellite communication systems. Emphasis on the matched filter and calculation of the probability of error in digital communication systems. Detailed examination of the satellite transponder. Emphasis on transponder signal processing and the effects of nonlinearities in satellite amplifiers. Development of satellite networks based using multiple access techniques. Digital Video Broadcasting and applications.

Aim of this course is the understanding of methods of analysis and design of satellite communication systems. By concluding the course, students are able to:

- Understand the specific features of satellite communication networks as well as their application field.
- Familiarize with terms and techniques for the evaluation of the performance and of the availability of satellite links.
- Identify, describe, distinguish and design the characteristics of different orbits.
- Analyze and design links of particular telecommunication requirements.
- Analyze and design appropriate criteria, on the computation of performance threshold values for the links.
- Evaluate of the final performance of digital satellite systems.

By concluding the lab sessions students are able to:

- Use mathematical tools, identify and apply theory to real-world problems.
- Design and implement satellite orbits and simple link budget models.

## 321-6555 Multimedia

Introduction to Multimedia. Historical perspective, basic multimedia concepts, current state-of-the-art. Multimedia content generation. Digital data acquisition: analog and digital signals, analog to digital conversion, signals and systems, sampling theorem and aliasing, filtering, Fourier theory. Media representations and media formats: digital representation of images, aspect ratios, digital image formats, representation of digital video, types of video signals, YUV subsampling schemes, digital video formats, digital representation of audio, surround sound, spatial audio, commonly used audio formats. Color theory: trichromacity theory, color spaces. Multimedia compression: the need for compression, basics of information theory, lossless and lossy compression. Image compression: redundancy and relevancy of image data, lossless image coding, transform image coding, wavelet based coding. Video compression: general theory of video compression (temporal redundancy, block-based frame prediction, computing motion vectors, size of macroblocks), types of predictions, video – coding standards. Audio compression: audio – compression theory,

audio as a waveform, audio compression using psychoacoustics, model – based audio compression, audio coding standards. Multimedia distribution. Multimedia networking: modes of communication, multimedia communication standards and protocols.

It is the intent of this course (through appropriate classroom and laboratory experiences) that students will:

- Understand the basic meanings concerning the representation, coding and transmission of multimedia data.
- Know the digitization process for all media types, explaining the theoretical and practical details, issues in rendering on various display/sound devices, working of cameras, and formats of different media types.
- Have skill of analyzing the individual features of the different multimedia data (e.g., image, video, audio), from its simplistic individual aspects to more complex content formed by the combinations, such as surround sound, spatial audio, composite video, and component video.
- Understand the theoretical and practical limits of information compression and will be able to describe some compression techniques of various media types and the important compression standards.
- Know about the distribution of compressed content and will be able to describe the fundamentals of digital communications.
- Understand that an important issue for end clients is the steady and synchronized consumption of multimedia information in the presence of varying network throughput, jitter, and errors and know how such fluid throughput can be achieved.
- Know the principles and current technologies of multimedia systems.
- Have skill of developing multimedia applications.

## 321-8653 Optical Communications

Introduction to basic concepts of optical communication systems, optical fibers, types of fibers (single mode, multi-mode, silicon-PMMA, step-graded index), waveguiding though ray optics, Maxwell's equations, Helmholtz equation, transversal modes, dispersion (group velocity, waveguide, chromatic), waveguide losses, bandwidth, non linear effects such as: cross phase modulation, four wave mixing. Optical sources: lasers, LEDs, spontaneous and stimulated emission, lasing threshold, longitudinal modes, tyes of lasers, noise in laser systems, modulation bandwidth and modulation techniques. Optical receivers, quantum efficiency, noise, bandwidth, sensitivity and demodulation circuits. Design and evaluate different optical system architectures in terms of power budget, optical dispersion. Analysis of coherent optical communication links and multi-channel approaches.


The course offers to the students an in-depth introduction to the field of optical-communications, by analyzing critical components such as optical emitters, receivers, optical fibers and by realistic optical links taking into consideration different technical specifications and architectures.

In detail, after the succesfull completion of the course:

- Students will have the necessary knowledge to identify the building blocks of an optical link alongside their basic properties and key parameters. Will be able to analyze specific modulation formats and multiplexing techniques, know the physical mechanisms involved in optical waveguides anf optical fibers, the basic light generation mechanisms (stimulated-spontanous emission), the electro-optic circuits for optical signal detection/conversion. Knowledge over transmission effects such as disperssion and nonlinearities (cross phase modulation self phase modulation, four-wave-mixing etc.).
- Students will have the ability to perform basic calculation regarding optical links such as power budget, maximum bandwidth, distances between successive repeaters-amplifiers, detector's sensitivity etc. Perform calculation for disperssion compensation.
- Students will be able to desing fuly functional communication links, evaluate and optimize deployment architecture, modulation formats, type of fibers whereas they will be able by using transmission theory and lasing theory to extract-model specifications for the building blocks (lasers, PDs, fibers, EDFAs etc.).

## Cycle Communication Systems and Networks

| 321-9404 | Broadband Networks |
|---|---|

Introduction to wideband networks, wired and wireless wideband communications and services. Analysis and design of fiber-to-the-x (FTTx) networks. Passive Optical Network (PON), Wavelength Division Multiplexing (WDM). Digital Subscriber Line (DSL) Very high bitrate DSL (VDSL) networks and services. Gigabit Ethernet, Power over Ethernet (PoE) technologies. Wireless Local Area Network – WLAN. Cooperative Communications. Fourth Generation (4G) cellular networks, Long Term Evolution (LTE) protocol. Millimiter Waveband (mmWave) networks, transmission techniques, channel model, combination with RF networks. Free Space Optical (FSO) networks, transmission techniques, channel model, combination with RF networks. Visible Light Communications (VLC), transmission techniques, channel model, gains over RF networks. Digital video broadcasting (DVB), terrestrial (DVB-T) and satellite (DVB-S) networks, modulation and coding techniques, services. Heterogeneous Networks (HetNets), topologies, combination of RF, mmWave, FSO and VLC networks.

The goal of this module is to familiarize students with various types of wideband networks.

Through theory, the student will gain knowledge on various topics of wired and wireless wideband networks. Furthermore, the student will acquire deep knowledge of the design and the architecture of wideband networks. Moreover, the module provides user requirements and the ways that modern wideband networks satisfy these requirements. Finally, the student will be educated on how wideband networks can interconnect and complement each other targeting the provision of robust wideband services.

Upon successful completion, students are expected to:

- Have the knowledge to analyze wired (fiber-to-x) and wireless (802.11, LTE) broadband architectures, the specific functionalities of their building blocks, as well as the advantages and limitation of each architecture, in the context of broadband services.
- Have the skill to choose the optimal architecture, depending on the broadband service and the operation environment, as well as to suggest synergies among the various architectures, in the context of heterogeneous broadband networks.
- Have the ability to calculate critical metrics, such as the data rate, depending on the adopted broadband network topology, as well as the outage probability of cooperative transmissions and the diversity gain.

## 321-9120 Design and Development of Mobile Computing Applications

Introduction to mobile computing, emerging mobile technologies and applications, issues and challenges, smartphone applications and services, mobile computing software platforms, mobile Web, responsive web design, geolocation, context-aware applications, Android platform architecture, programming in Android environment, case studies.

The student that will complete successfully the course is expected that will be in position to:

- Understand the basic principles of application development for mobile devices.
- Understand and assess the issues involved in designing and developing context-aware applications for mobile devices.
- Understand the architecture of the Android platform and the process of developing applications for mobile devices.
- Analyze, evaluate and discuss problems and case studies for mobile applications.
- Use, modify and develop the appropriate technologies for the implementation of mobile applications.

## Cycle Information Management and Intelligent Systems

### 321-6606 Computer Vision

Image formation - Feature-based image alignment - Structure from motion - Computational photography - Feature detection and matching - Dense motion estimation - Image stitching - Stereo correspondence – Recognition

Upon successful completion of the course, the student will:

- Have the knowledge to describe computer vision systems and understand their structure and function.
- Have the skills to apply basic techniques of image enhancement, feature detection, motion tracking, segmentation and object recognition.
- Have the ability to design and implement algorithms to solve computer vision problems.

### 321-7406 Knowledge Engineering and Knowledge Systems

Systems that represent, organize and utilize knowledge. Semantic Networks, Systems that use frames, systems that use rules, reasoning using rules (forwards and backward chaining), Rete algorithm, design and implementation of rule-based systems. Case-based reasoning. Reasoning under uncertainty. Application of knowledge systems: configuration, design, diagnosis and classification. Introduction to Semantic Web technologies: Structuring XML documents, describing resources using RDF, Ontology Web Language. Logic and reasoning: Rule markup in XML, Applications (Data integration, Information retrieval, Portals, e-Learning, Web Services, etc.). Protégé, an environment for deploying ontologies, Pellet reasoning engine.

On completion of this module, students are expected to be able: to explain the role of knowledge engineering within Artificial Intelligence, to identify and explain the various stages in the development of a knowledge based system, to design and develop a rule-based knowledge based system, to design and develop a case-based knowledge based system, to design and Develop Bayesian reasoning systems, to understand the mathematical foundations of Bayesian networks, to compare and contrast rule- and case-based knowledge based systems, to design and develop Semantic Web concepts and ontologies, to compare and contrast Semantic Web markup Technologies, and to build Ontologies and Reasoning systems in Protégé.

## Cycle Computer Science Foundations

### 321-9003 Advanced Data Structures

Time and space complexity classes. Relations between complexity classes. Reduction. Approximation algorithms. Probabilistic complexity classes. The factorization problem.

Upon successful completion of the course, the student will:

- Obtain the knowledge to analyze algorithms (light paths, maximum flows, coherence, maximum fits, minimum cost flows) and related data structures (Fibonacci heaps, dynamic trees) in optimization problems.
- Have the ability to apply randomized algorithms such as light paths, lightweight connective trees, minimum cuts, random walks, Markov chains, universal scattering.
- Acquire the ability to solve NP-difficult problems and approximation algorithms (heuristic methods, linear programming and rounding).

### 321-10001 Algorithms and Combinatorial Optimization

Mathematical modeling of combinatorial optimization problems, in the realm of areas such as Biology, Networks, time-dependent processes, resources allocation, game theory, etc. Study of techniques to tackle such problems, as branch and bound, heuristics, probabilistic techniques. Exploiting the limitations of these techniques and case study of resent developments. Dynamic programming and approximation algorithms. Polynomial time approximation schemes. Local search methods, PLS-completeness, neighborhood structures. Local search methods in the perspective of game theory.

When the student completes the course successfully:

- She will have the knowledge to model as a linear/convex program some of the most important problems of the combinatorial optimization.
- She will have the skills to apply techniques and algorithms that solve linear/convex programs.
- She will have the capability to solve problems of linear/convex programming.

## Optional Course

| 321-2600 | Risk Theory |
|---|---|

Historical background of the ‘risk theory’. Presentation of the problem “Crashing systems”. Basic distributions with heavy tails that are used in situations of extreme events. The risk theory for distributions with heavy tails. The Cramer- Ludberg model. The law of large numbers. The central limit theorem. The Brownian motion in the analysis of extreme events. The generalized distributions of extreme values. Generalized Pareto distribution. Statistical methods to analyze extreme events. Parametric estimation in generalized distributions. Programme languages for the parametric analysis.The theory of large deviations on extreme events. Applications of large deviations in the renewal model.

The course aims at dealing with the principles of external events theory. The stochastic models that can predict the collapse of large systems, such as computer systems are presented in an analytical and interactive way. It stimulates students to further research on computational methods using programming languages such as C ++ or mathematical package as Matlab. Using data, students will be able to estimate the system parameters (such as averages or variations) of the distributions that we use in extreme events.

After successful completion, students will be able to understand and apply:

- The Poisson process, the renewal process.
- The collective risk model.
- The classic risk model. Compound distributions.
- Theory of extreme events.

## 10th Semester

| 321-7102 | Diploma Thesis |
|---|---|

Complete an original development and/or research project. Deeper approach in a field of the student's interests and specialty. Familiarity with the process of addressing and solving complex problems. The student submits his/her thesis to a three-member board of professors and mandatorily presents his/her work to a public audience. The final evaluation of the submitted thesis is done by the three-member committee.

The dissertation must follow the layout specified below:

- Front page and accompanying pages. These should include names of Institution, School, Department, dissertation title, full name of the author(s), full name of dissertation adviser and committee members (if a committee has been set up).

- Acknowledgements. This includes thanking the people who contributed to the completion of the dissertation.

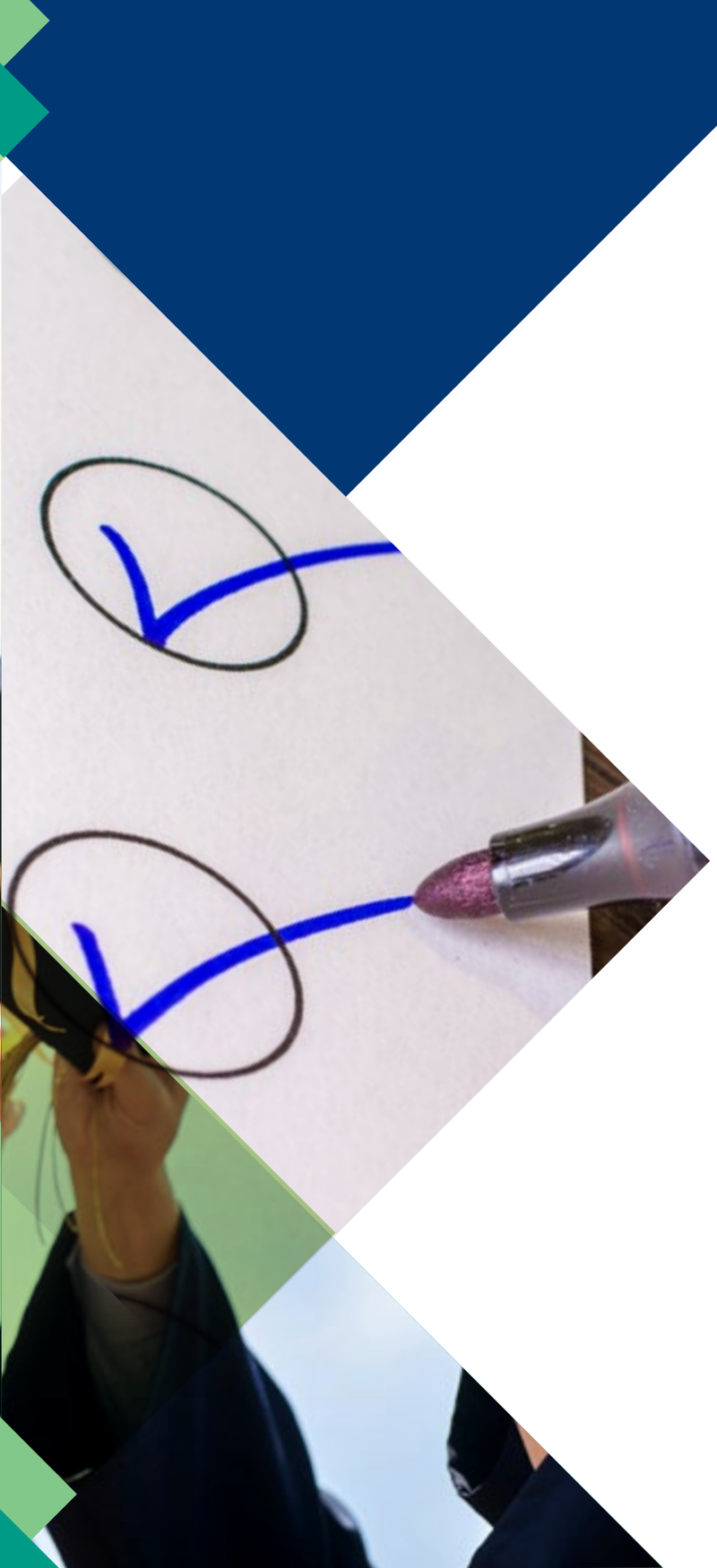
- Abstract in Greek (about 300 words). It should briefly describe the topic, the purposes, the methodology, and the basic conclusions of the dissertation.

- Abstract in English.

- Table of contents with a maximum of 3 numbering levels.

- List of figures, list of tables, list of acronyms.

- Dissertation body



Chapter 1: Introduction. It includes a short introduction to the topic and its significance, the motivation for and purpose of the dissertation, the methodology followed, and the dissertation layout. It doesn't include results or conclusions.

Chapter 2, 3 … Their contents depend on the dissertation topic. If, for example, the dissertation discusses the development of a software system and its laboratory evaluation, it should include separate chapters discussing the theoretical background (previous knowledge, literature), the methodology that was followed, the results, and the analysis-evaluation of the results.

Chapter X – Conclusions: This is the last chapter of the dissertation. It summarizes and discusses the dissertation's main findings. The conclusions must be clear and closely connected to the topic's development in the previous chapters. Suggestions for future research should also be included.

- References. Full list of the resources that were used for writing the dissertation, as well as of the in-text references. The references should follow one format: APA, MLA, or Harvard.

- Appendices, if there are any. These include extra information, which is not necessary for the dissertation's development or understanding. The author can provide further information to the reader in order to improve understanding and/or provide evidence of the results.

Upon successful completion, students are expected to have the skills of:

- Working Independently.
- Using the bibliography.
- Presenting the thesis.

# STUDENT SUPPORT

## Student Services

The following services are provided for the students of the Department:

- Full medical and hospital care, which includes: medical examination, hospital examination, pharmaceutical care, clinical examinations, examination at home, births, physiotherapy, dental care and orthopedics.
- Discount tickets for public transport, including ferry, for traveling inside the country, according to the law. The discount is interrupted throughout periods of possible suspension of study, military service, loss of student status or upon graduation or completion of six years of study.
- Free meals under conditions which relate to individual and family financial situation. Free meals stop when a student successfully completes their studies, or after six (6) years from registration, regardless of whether they have completed their studies.
- Student loans depending on students' financial situation and their performance in their studies. 50% of the amount of the loan awarded to each student is a scholarship and the remaining 50% is an interest-free loan.



# Scholarships

Scholarships are awarded to students **based on their academic performance and financial condition**. The Greek State Scholarship Foundation awards scholarships and prizes to students who excelled: a) in the examinations for entering the Department and b) in semesters' examinations for each academic year. The scholarships are granted according to the students' economic situation and academic performance. For awards, which consist of a written certificate and a grant, only the performance of the student is taken into account. In addition to the above scholarships, institutions such as the City Samos, the North Aegean Administrative Division and other local organizations award students with some scholarships based on their performance in studies.

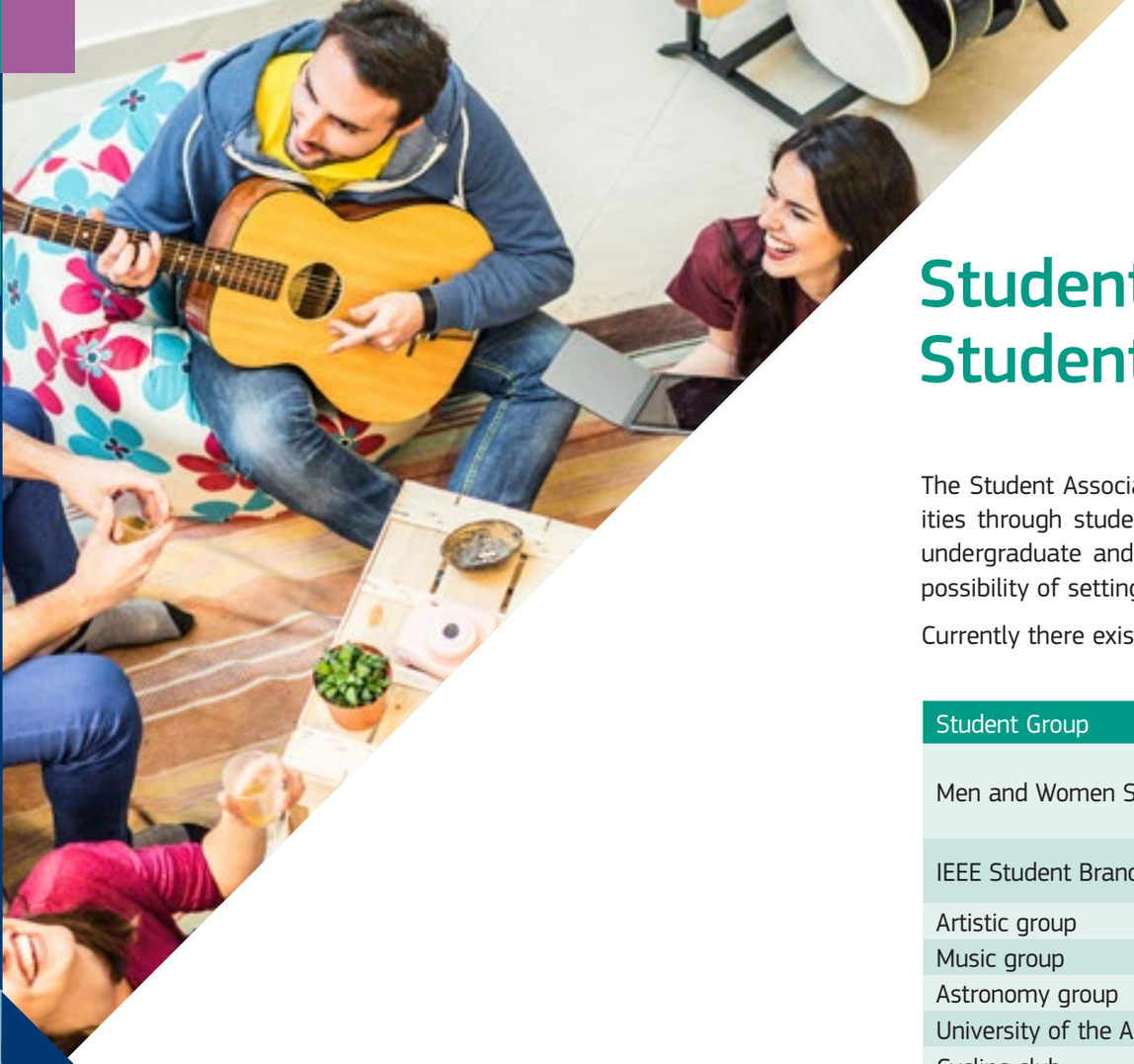
Effective from academic year 2019-2020, an annual monetary prize of 1.000€ is going to be awarded by the Department to those students who complete their studies by the expected date of completion, as this is specified by the programme of studies, that is, within 5 years, and have achieved a final diploma's grade of 8.5 or higher ("Excellent"). If there are no students with final diploma's grade of at least 8.5, then the prize will be awarded to the student or students who have achieved the highest final diploma's grade and have completed their studies within 5 years.

As far as the prerequisites, supporting documents, and application periods for the various scholarships are concerned, the students are advised to contact the Department's Secretariat.

More information is available on the Department's website:
**http://www.icsd.aegean.gr.**

# Student Club

Students' parallel activities are part of their academic life and contribute positively to the development of their personality. The main venue for such activities is the Student Club. The purpose of the Student Club is entertainment, sports and the development of the artistic inclinations of the students. The University seeks to extend the activities of the Club and encourages the establishment of new committees.



# Student Association – Student Groups

The Student Association supports sporting, recreational, artistic, academic and other activities through student groups that operate independently. Student groups are open to all undergraduate and postgraduate students of the Department, while there is always the possibility of setting up new groups.

Currently there exist the following groups:

| Student Group | Contact |
|---|---|
| Men and Women Sports Teams | Euripides Gerontis, Faculties of Science and Engineering Trainer<br>egerontis@aegean.gr |
| IEEE Student Branch – University of the Aegean | http://www.icsd.aegean.gr/ieee<br>ieee@aegean.gr |
| Artistic group | artsam@aegean.gr |
| Music group | musicteam@aegean.gr |
| Astronomy group | aristarchos@samos.aegean.gr |
| University of the Aegean Juggling club | jugglingc@aegean.gr |
| Cycling club | bike_club@samos.aegean.gr |
| Faculties of Science and Engineering Football Club (participates in the local championship of the Greek Football Federation) | samos_sthe_fc@aegean.gr |
| Chess group | skaki@samos.aegean.gr |
| Students cafeteria – "Algorithm of Taste" | flesxi@aegean.gr |
| Students magazine – "Φ" *("Phi")* | f@samos.aegean.gr |
| Students Radio Station "Choros" *("Space")* 94.2 FM | http://xoros.samos.aegean.gr<br>xoros94.2@samos.aegean.gr |
| Dancing group | samosdance@aegean.gr |

# SUPPORTING SERVICES

## Library

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**

# Computing Center - Laboratories

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, PHAEDRA, DORYSSA, and ARTEMIS), which have modern computer systems, software products and hardware instruments, for supporting the teaching and research needs the Department. Additionally, in Emporiki building, there is a fully equipped teleconference room.

# ACADEMIC CALENDAR

## WINTER SEMESTER 2019 - 2020

| | |
|---|---|
| **Beginning of courses:** | 30.09.2019 |
| **End of courses:** | 10.01.2020 |
| **Semester duration:** | 13 weeks |
| **Examination period:** | From 13.01.2020 to 07.02.2020 |

**Holidays:**

| | |
|---|---|
| National Holiday: | Monday 28.10.2019 |
| Regional Holiday: | Monday 11.11.2019 |
| Polytechnion Anniversary: | Sunday 17.11.2019 |
| Christmas Holidays: | 24.12.2019 – 06.01.2020 |
| Religious Holiday (Trion Ierarhon): | Thursday 30.01.2020 |

## SPRING SEMESTER 2019 - 2020

| | |
|---|---|
| **Beginning of courses:** | 10.02.2020 |
| **End of courses:** | 22.05.2020 |
| **Semester duration:** | 13 weeks |
| **Examination period:** | From 25.05.2020 to 19.06.2020 |

**Holidays:**

| | |
|---|---|
| Monday, the first day of Lent: | Monday 02.03.2020 |
| National Holiday: | Wednesday 25.03.2020 |
| Easter Holidays: | 13.04.2020 – 26.04.2020 |
| First of May Holiday: | Friday 01.05.2020 |
| Religious Holiday (Holy Spirit): | Monday 08.06.2020 |
| Students' elections: | *Exact date to be announced* |

2019
2020


**UNIVERSITY OF THE AEGEAN**

Karlovasi, Samos
T: 22730 82021 | F: 22730 82219
www.icsd.aegean.gr

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THE AEGEAN

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