University of the Aegean

Karlovasi - Samos

UNDERGRADUATE

programme guide

DEPARTMENT OF INFORMATION AND COMMUNICATION SYSTEMS ENGINEERING

2023-2024


Designed by: Eva Kyriazi

UNIVERSITY OF THE AEGEAN

SCHOOL OF ENGINEERING
DEPARTMENT OF INFORMATION AND COMMUNICATION SYSTEMS ENGINEERING

UNDERGRADUATE
Programme Guide
ACADEMIC YEAR
2023-2024

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.

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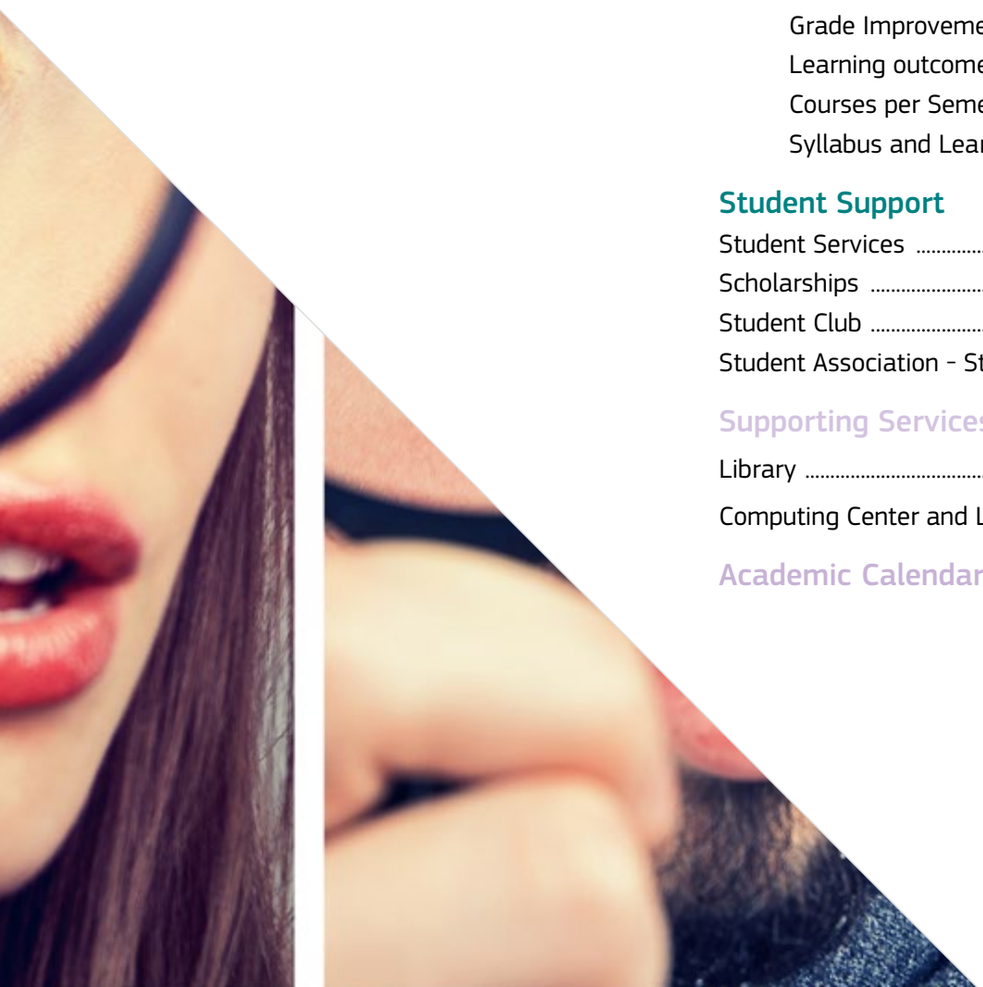


UNIVERSITY of the AEGEAN

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 Science 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 **University Council,** the **Senate** and the **Rectorate**, who, for the academic year 2023-2024, are as follows.

The University Council consists of:

- **Kokolakis Spyros**, Professor of the School of Engineering, internal member
- **Housiadas Kostas**, Professor of the School of Sciences, internal member
- **Papageorgiou Dimitris**, Professor of the School of Social Sciences, internal member
- **Troumbis Andreas**, Professor of the School of the Environment, internal member
- **Theodoropoulou Elena**, Professor of the School of Humanities, internal member
- **Mavri Maria**, Professor of the School of Business, internal member
- **Antonacopoulos Apostolos**, Professor at University of Salford (UK), external member
- **Kalantzis Mary**, Professor at University of Illinois (USA), external member
- **Kambouris Georgios**, Lieutenant General (retd), Director of Mytilene General Hospital, external member
- **Touramanis–Douramanis Christofas**, Professor at University of Liverpool (UK), external member
- **Chrousos George**, Emeritus Professor at National and Kapodistrian University of Athens, external member

The Rectorate consists of the:

Rector

- Professor **Dimitris Papageorgiou,** *Department of Cultural Technology and Communication*

Vice Rector for Administrative and Academic Affairs

- Associate Professor **Stylianos Xanthopoulos**, *Department of Statistics and Actuarial – Financial Mathematics*

Vice Rector for Finance

- Professor **Ioannis Seimenis**, *Department of Mediterranean Studies*

Vice Rector for Research and Innovation

- Associate Professor **Petros Kavassalis**, *Department of Financial and Management Engineering*

Vice Rector for International Affairs, Extroversion and Student Welfare

- Professor **Stratos Georgoulas**, *Department of Sociology*

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 (delegation of tasks): Georgios Kormentzas, Professor, Department of Information and Communication Systems Engineering

Samos

Karlovasi, Samos, GR-83200, Greece

Administrative Head	Fotis Kyriakou	Tel.: +30-22730-82015 Email: sam_regional_dir@samos.aegean.gr
Head Secretary of the Department of Information and Communication Systems Engineering	Kalliopi Karagianni	Tel.: +30-22730-82202 Email: gramicsd@icsd.aegean.gr
Undergraduate Admissions Secretary of the Department of Information and Communication Systems Engineering	Alexandros Shoinas	Tel.: +30-22730-82200 Email: dicsd@icsd.aegean.gr
Postgraduate Admissions Secretary of the Department of Information and Communication Systems Engineering	Argiro Evgenikou	Tel.: +30-22730-82210 Email: dmicsd@icsd.aegean.gr
Student Support	Giorgos Mitatakis	Tel.: +30-22730-82011 Email: merimna@samos.aegean.gr

Computing Center	Nikos Zacharis	Tel: +30-22730-82040 Email: nzar@aegean.gr
Helpdesk		Tel.: +30-22730-82166 Email: help@samos.aegean.gr
Library	Vasiliki Gouvala	Tel.: +30-22730-82030 Email: vgou@aegean.gr
Administrative Services	Grammatiki Chatzikonstanti	Tel.: +30-22730-82017
	Maroudio Charalampous	Tel.:+30-22730-82010 Email: Sam_Dioik_Ypir@samos.aegean.gr
Financial Services	Fotis Kyriakou	Tel.: +30-22730-82015 Email: fotisk@aegean.gr
Technical Services	Constantinos Protopappas	Tel.:+30-22730-82056 Email: Samos_tech_ypir@samos.aegean.gr
Regional Office of Public / International Relations and Publications	Nikoleta Tsesmeli	Tel.:+30-22730-82070 Email: sam_public_relations@samos.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)
- Alexandrio Building (Classrooms)
- Robotics Lab (located at the back of the Liberis building, entrance from Gorgyras street between the Liberis building and the Hatziantoniadis shop).

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 2023, 1361 undergraduate students, 259 post-graduate students and 98 doctoral candidates were studying in the ICSD Department. The total number of graduates of the Department is 890, 815 and 90 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* ***Maria Karyda***
Deputy Head of Department	*Professor* ***Efstathios Stamatatos***
Director of Postgraduate Study Programmes before the 2018-19 academic year	*Professor* ***Maria Karyda***
Director of Postgraduate Study Programme 'Information and Communication Systems Security'	*Professor* ***Spyros Kokolakis***
Director of Postgraduate Study Programme 'Internet of Things: Smart Environments in Next Generation Networks'	*Associate Professor* ***Christos Gououmopoulos***
Director of Postgraduate Study Programme 'Electronic Governance'	*Professor* ***Euripidis Loukis***
Director of Postgraduate Study Programme 'Information and Communication Systems'	*Professor* ***Maria Karyda***
Director of Postgraduate Study Programme 'Digital Innovation and Startup Entrepreneurship'	*Professor* ***Yannis Charalabidis***

- 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).
- 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).
- Professor **Georgios Kambourakis**, 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 **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, Robotics, Programming).
- Professor **Spyros Kokolakis**, Degree in Informatics, Ph.D. in Information Systems, Athens University of Economics and Business (Information Systems, Information Systems Security).
- Professor **Georgios Kormentzas**, Diploma in Electrical and Computer Engineering, Ph.D. in Traffic Control and Management of Broadband Networks using Abstract Information Models and Distributed Object Architectures, National Technical University of Athens (Computer Networks, Wireless Communications, Service Quality, Traffic Modeling and Analysis).
- 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).
- 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).
- Associate Professor **Christos Goumopoulos**, Diploma in Computer Engineering and Informatics, Ph.D. in Distributed Software Systems, University of Patras (Parallel and Distributed Computing).
- Associate Professor **Alexis Kaporis**, Degree in Mathematics, Ph.D. in Threshold Phenomena in Combinatorial Problems, University of Patras (Algorithm Analysis, Probabilistic Techniques, Algorithmic Game Theory, Data Structures).
- 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 **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).
- Associate Professor **Theodoros Kostoulas**, Diploma in Electrical and Computer Engineering, Ph.D. in Emotion Recognition from Speech Signal, University of Patras (Machine Learning, Multimodal Interaction, Multimodal Signal Processing, Affective Computing).

- Associate Professor **Kyriakos Kritikos**, Degree in Computer Science, Computer Science Department, University of Crete, M.Sc. in Computer Science, Computer Science Department, University of Crete, Ph.D. in Computer Science, Computer Science Department, University of Crete (Business Process Management, Service-Oriented Computing, Cloud Computing, Semantic Web, Constraint Programming & Optimisation, Distributed Information Systems).
- 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 **Panagiotis Symeonidis**, Degree in Applied Informatics, University of Macedonia, Master Degree in Information Systems, University of Macedonia, Ph.D. in Web Mining and Information Retrieval for Personalization, Aristotle University of Thessaloniki (Recommender Systems, Social Network Data Mining, Information Retrieval, Artificial Intelligence, Personalized Health and Precision Medicine).
- 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).
- 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) **Asimakis Leros**, Diploma in Electrical Engineering, University of Patras, M.Sc. in Electrical & Computer Engineering, University of Massachusetts at Amherst, Ph.D. in Computer Engineering and Informatics, University of Patras (Estimation Theory, Parallel Algorithms, Digital Signal Processing, Systems Modeling and Simulation).
- Assistant Professor (tenured) **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).
- Assistant Professor **Charalampos (Harris) Alexopoulos** (to be appointed), BSc in Computer Science, University of Peloponnese, MSc in Information Systems Management, PhD in Open Data Information Systems, University of the Aegean (Evaluation of Information Systems, Data Interoperability, Information Management, Open Data Infrastructures, Smart Cities).
- Assistant Professor **Vasiliki Diamantopoulou**, Diploma in Product and Systems Design Engineering, M.Sc. in Management of Information Systems, Ph.D. in Information Systems, University of the Aegean (Information Systems, Innovation).
- Assistant Professor **Konstantinos Maliatsos**, Diploma in Electrical and Computer Engineering, M.Sc. in Tecno-Economic Systems (MBA), Ph.D. in Wireless and Mobile Communications and Cognitive Radios, National Technical University of Athens (Information Theory, Mobile Radio Communications, Broadband Networks, Detection and Estimation Theory, Security in Communication systems, Channel Modeling, IoT).
- Assistant Professor **Georgios Stergiopoulos**, Degree in Informatics, University of Piraeus, M.Sc. in Information Systems, Athens University of Economics and Business, Ph.D. in Security of Information Systems and Critical Infrastructures, Athens University of Economics and Business (Securing Critical Infrastructures at software and interdependency levels).

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.
- 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 (Digital image watermarking, Efficient schemes for image registration, Optimization of digital image processing algorithms for efficient hardware implementation, Hardware security).
- **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, Gravity
- 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"

The Department of Information and Communication Systems Engineering offers research opportunities in all sectors of information and communications technology. The goal of PhD study in the Department is to advance knowledge and original research, as well as to offer a high standard of specialization. PhD study leads to a doctoral diploma (PhD), an academic title which certifies that its holder has carried out original scientific research and has effectively contributed to the advancement of science and knowledge in their field.

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. Among these courses, priority is given to courses of previous years and the remaining courses belong to the semester which the student attends. A student is allowed to register for a maximum of three (3) courses of later semesters if he/she has passed all courses of previous years (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. Students of the first cycle of studies who have completed the normal study period, which is equal to the minimum number of academic semesters required for receiving their qualification, have the right to take exams during the examination period of every semester. 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.

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 fourth 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
321-1200	Structured programming	3	4	5
321-1400	Introduction to Computer Science and Communications	3	–	5
321-2000	Logic Design	3	2	5
321-1500	Discrete Mathematics I	3	2	5
321-1100	Mathematics for Engineers I	3	2	5
321-2050	Physics	3	2	5
321-0120	English Language 1	3	-	5

Free Course

Course Code	Course Title	Teaching Hours	Lab Hours / Review-Problem Session Hours	ECTS units
321-0820	Foreign Language 1	3	-	5

2nd Semester

Compulsory Courses

Course Code	Course Title	Teaching Hours	Lab Hours / Review-Problem Session Hours	ECTS units
321-2100	Object-oriented Programming I	3	2	5
321-2550	Circuit Theory	3	2	5
321-2450	Discrete Mathematics II	3	2	5
321-3150	Mathematics for Engineers II	3	2	5
321-2400	Probability and Statistics	3	2	5
321-3300	Computer Communications	3	2	5
321-0130	English Language 2	3	-	5

Free Course

Course Code	Course Title	Teaching Hours	Lab Hours / Review-Problem Session Hours	ECTS units
321-0830	Foreign Language 2	3	-	5

3rd Semester

Compulsory Courses

Course Code	Course Title	Teaching Hours	Lab Hours / Review-Problem Session Hours	ECTS units
321-3650	Object-oriented Programming II	3	2	5
321-8950	Digital Innovation and Entrepreneurship	3	-	5
321-3000	Data Structures	3	2	5
321-3350	Computer Architecture	3	2	5
321-3750	Stochastic Processes	3	2	5
321-5500	Signals and Systems	3	2/2	5
321-0140	English Language 3	3	-	5

Free Course

Course Code	Course Title	Teaching Hours	Lab Hours / Review-Problem Session Hours	ECTS units
321-0840	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
321-3100	Information Systems Analysis and Design	3	-	5
321-4200	Algorithms and Complexity	3	2	5
321-4120	Advanced Topics of Programming Languages	3	2	5
321-3200	Databases I	3	2	5
321-4100	Opeperating Systems	3	2	5
321-7900	Microelectronics	3	2	5

Free Course

Course Code	Course Title	Teaching Hours	Lab Hours / Review-Problem Session Hours	ECTS units
321-0850	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
321-2300	Business Operations and Information Systems	3	2	5
321-6450	Computer Networks	3	2	5
321-3700	Databases II	3	2	5
321-3450	Telecommunications	3	2	5
321-4000	Software Engineering	3	2	5
321-6700	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
321-6500	Management Information Systems	3	-	5
321-3600	Artificial Intelligence	3	2	5
321-3400	Information and Communication Systems Security	3	2	5
321-7950	Distributed Systems	3	2	5
321-88100	Internet Programming	3	2	5
321-5200	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
321-9700	Computer Network Security and Privacy Enhancing Technologies	3	-	5
321-5750	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
321-7650	Systems Theory	3	-	5
321-8100	IT Project Management	3	2	5
321-5150	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
321-10300	Digital Communications	3	2	5
321-7050	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
321-8350	Network Management	3	-	5
321-7000	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
321-7750	Introduction to Robotics	3	2	5
321-6100	Natural Language Processing	3	2	5

6. Cycle Computer Science Foundations

Course Code	Course Title	Teaching Hours	Lab Hours / Review-Problem Session Hours	ECTS units
321-8600	Information Theory	3	-	5
321-99000	Numerical Analysis	3	-	5

Free Course

Course Code	Course Title	Teaching Hours	Lab Hours / Review-Problem Session Hours	ECTS units
321-0160	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
321-10750	Mobile and Wireless Networks Security	3	-	5
321-6000	Physical Layer Security	3	-	5

2. Cycle Information Systems and Entrepreneurship

Course Code	Course Title	Teaching Hours	Lab Hours / Review-Problem Session Hours	ECTS units
321-8500	Decision Support Systems – Business Analytics	3	2	5
321-5600	Human – Computer Interaction and Web Applications	3	2	5
321-11100	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
321-7800	Wireless Communications	3	2	5
321-8750	Introduction to VLSI	3	2/2	5
321-9350	Digital Image Processing	3	2	5
321-7850	Microprocessors	3	2	5

4. Cycle Communication Systems and Networks

Course Code	Course Title	Teaching Hours	Lab Hours / Review-Problem Session Hours	ECTS units
321-6250	Internet Protocols and Architectures	3	-	5
321-7250	Mobile Communication Networks	3	2	5
321-11000	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
321-9250	Data Mining	3	2	5
321-10200	Information Retrieval	3	-	5
321-6600	Advanced Robotics	3	2	5
321-6050	Intelligent Recommender Systems	3	-	5

6. Cycle Computer Science Foundations

Course Code	Course Title	Teaching Hours	Lab Hours / Review-Problem Session Hours	ECTS units
321-8000	Game Theory	3	-	5
321-9850	Mathematical Modeling	3	-	5
321-9000	Forecasting Techniques	3	-	5

Optional Courses

Course Code	Course Title	Teaching Hours	Lab Hours / Review-Problem Session Hours	ECTS units
321-2630	Simulation Techniques for Communication Systems	3	2	5
321-7600	Practice	-	-	5

Free Course

Course Code	Course Title	Teaching Hours	Lab Hours / Review-Problem Session Hours	ECTS units
321-0150	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
321-99100	Regulatory and Social Issues in Information Society	3	-	5
321-8050	Cryptography	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
321-5400	Information Systems Strategy and Investment-Digital Transformation	3	-	5
321-8200	E-Commerce Technologies and Applications	3	-	5

3. Cycle Computer and Telecommunication Technologies

Course Code	Course Title	Teaching Hours	Lab Hours / Review-Problem Session Hours	ECTS units
321-10650	Satellite Communications	3	2	5
321-6550	Multimedia	3	2	5
321-8650	Optical Communications	3	2	5
321-3250	Internet of Things	3	2	5

4. Cycle Communication Systems and Networks

Course Code	Course Title	Teaching Hours	Lab Hours / Review-Problem Session Hours	ECTS units
321-9400	Sensor Networks	3	2	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
321-7400	Knowledge Engineering and Knowledge Systems	3	-	5

Course Code	Course Title	Teaching Hours	Lab Hours / Review-Problem Session Hours	ECTS units
321-9450	Applied Topics in Data Structures and Databases	3	-	5

6. Cycle Computer Science Foundations

Course Code	Course Title	Teaching Hours	Lab Hours / Review-Problem Session Hours	ECTS units
321-10000	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
321-7100	Diploma Thesis	-	-	30

Syllabus and Learning Outcomes of Courses per Semester

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

1st Semester

321-1200 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.
- The ability to apply the principles of structured programming to error detection and correction in C language programs.
- The skills to design and develop C language programs.

321-2000 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.
- Understand the different Boolean algebra theorems and apply them for logic functions.
- Define the Karnaugh map for a few variables (3, 4 and 5 mainly) and perform an algorithmic reduction of logic functions.
- Understand the functionality of basic logic gates (AND, OR, Inverter, NAND, NOR, Exclusive-OR, Exclusive-NOR).
- Analyze and design combinational circuits by using the basic logic gates.
- 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.
- Understand the bistable element and the different latches and flip-flops.
- Derive the state-machine analysis or synthesis and to perform simple projects with a few flip-flops.
- Understand sequential circuits, like counters and shift registers, and to perform simple projects with them.

321-1400 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.
- Be capable to work in groups and develop Web pages on their own.

321-1500 Discrete Mathematics I

Elementary set theory: operations, identities, cartesian product, power set, cardinality. Logic: compound statements, conditional statements, predicates, quantifiers, methods of proof. Mathematical induction. Elementary number theory: divisibility, prime numbers, parity, Euclid's lemma, Fermat's little theorem, chinese remainder theorem. Case study: the RSA algorithm. Binary relations, functions, equivalence relations, partial ordering relations. The pidgeonhole principle. Combinatorial analysis: multiplication rule, permutations, orderings, combinations, binomial theorem, combinatorial proofs. Inclusion-exclusion principle.

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.

321-1100 Mathematics for Engineers I

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.
- The ability to treat the limit of a function or to study its continuity and differentiability through the classical ε-δ definition.
- 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.

- The knowledge of the definition of the definite integral as a limiting summation.
- The ability to use a variety of techniques to compute complicated indefinite integrals or generalized integrals.
- The ability to use Taylor expansion to approximate the value of a function.
- The knowledge of the notion of the differential equation of first order and its solution within the context of differential and integral calculus.
- 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.

321-2050 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.
- The knowledge of the basic laws of Newtonian mechanics in inertial and non-inertial reference frames.
- 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.
- 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.
- The ability to determine if a given force field is conservative or not and to find the potential energy when this exists.
- The ability to compute the centre-mass, the moments of inertia and the gravitational field of an extended body.
- 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.
- 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.

321-0120 English Language 1

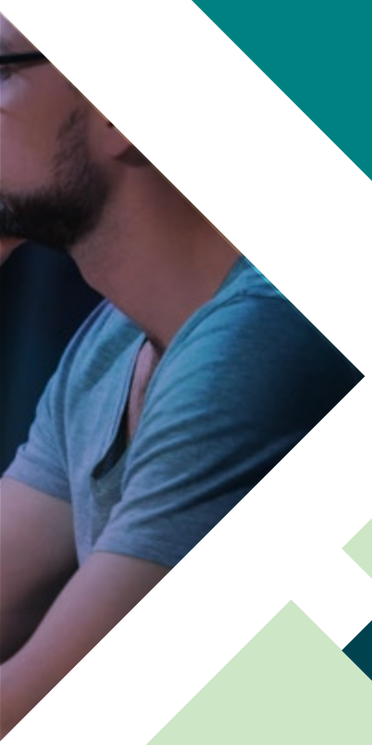
Points and lines, fractions and ordinals, writing an e-mail to a professor or university, arithmetic, algebra and formulas, describing categories in a paragraph, paragraph organization, bits and bytes, computer networking, comparing and contrasting, symbols and keys, micromachines and ICT.

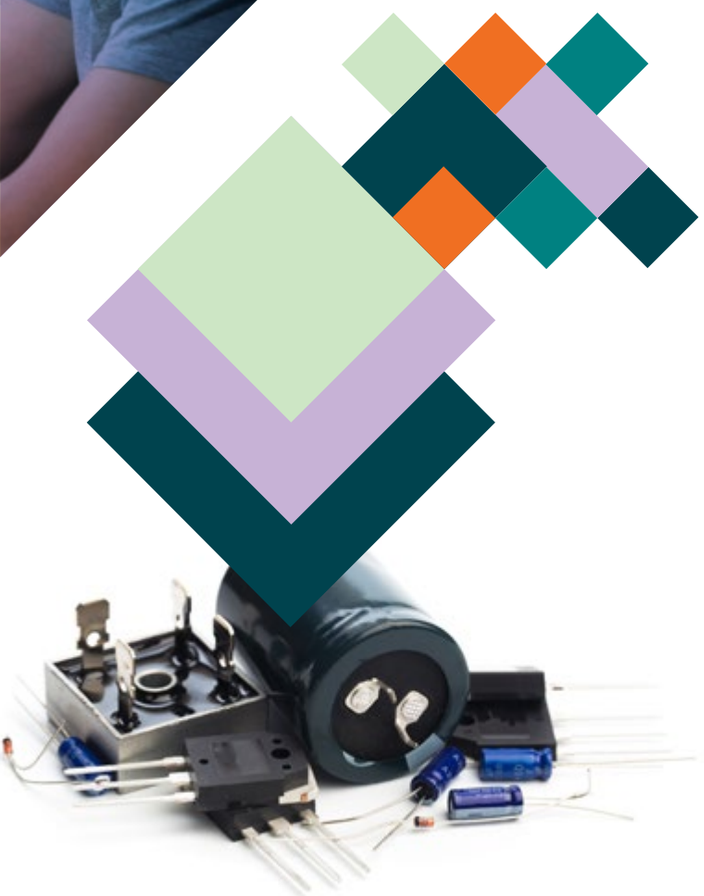
Students who successfully complete the course will be familiar with basic concepts of English grammar and syntax, will have practised in understanding technical texts and will know the basic features of written academic language. More specifically, upon successful completion of the course, the students will be able to:
- Understand technical written and spoken texts in English.
- Know basic vocabulary related to mathematics and information technology in English.
- Know basic grammatical and syntactical phenomena of the English language and be able to use them correctly in simple sentences.
- Know basic linguistic features of written academic language in English.

321-0820 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

321-2100 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++.

321-2550 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 fulfils the course requirements will have demonstrated an ability to:

- Identify linear systems and represent those systems in schematic form.
- Apply Kirchhoff's current and voltage laws and Ohm's law to circuit problems.
- Understand the notion of node voltage and apply the Node method for analyzing electrical circuits.
- Simplify circuits using series and parallel equivalents, as well as Thévenin and Norton

equivalents.

- Understand the advantages of digital processing and how these advantages are materialized through digital circuits.
- Define the structure and understand the simplified behavior (S, SR and SRC models) of MOS Field Effect Transistors (MOSFETs).
- Design digital gates (either NMOS or CMOS) using MOSFETs.
- Calculate the output voltages and the noise margins of digital gates and understand their significance.
- Identify first-order electric systems involving capacitors and inductors.
- Analyze first-order circuits and predict their behavior.
- calculate the delay of digital gates driving other gates.
- 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).

321-3150 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,
- The knowledge of more advanced and important issues of Linear Algebra, such as the theory of eigenvalues-eigenvectors, of linear mappings and diagonalization,

- The ability to treat the notions of linearly dependent and independent vectors, of the basis and dimension of a linear space of subspace,
- The ability to perform calculations with matrices, to use the technique of row-equivalence for various purposes and to solve linear systems of equations,
- The ability to compute determinants with various methods and in various dimensions through recursion relations,
- The skills to represent a linear mapping with its matrix and compute various quantities, as well as to perform its diagonalization,
- The ability to solve simple differential equations of second order.

321-2450 Discrete Mathematics II

Sequences of real numbers: monotonicity, convergence. Series, sums ans approximations. Recursive definitions, recursive problem solving. Application: the towers of Hanoi. Solution of linear recursive equations. Power series, generating functions, exponential generating functions. Applications of generating functions to combinatorial problems. Pólya enumeration theory, the Burnside theorem. Graphs: basic terminology, isomorphism, Euler and Hamilton circles, Dijkstra's shortest path algorithm, the travelling salesman problem, planar graphs, graph coloring. Trees: definitions, binary trees, spanning trees, Prim's and Kruskal's algorithms.

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:

- The ability to state Computer Science problems using mathematical language.
- The capability to solve elementary Computer Science problems using mathematical tools.
- A basic knowledge of the terminology and properties of graphs and trees.
- Basic background required for the study of algorithms.

321-3300 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.).

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

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

321-2400 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.
- The knowledge to interpret various mathematical models within Probability theory and a solid conceptual and technical background for further study and investigation.
- 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.
- The ability to recognize well-known discrete and continuous probability distributions and to interrelate them with real problems of practical interest.
- The ability though the foundations of Statistics to use the methodology of the basic estimating parameters and to perform calculations.

321-0130 English Language 2

What is ICT, writing covering emails and motivation letters, ICT in the workplace, ICT systems, types of essays, writing an introduction to an essay, participating in a group discussion, ICT in education, describing data in diagrams, history of ICT, the Internet, writing an academic paragraph.

Students who successfully complete the course will be familiar with complex grammatical and syntactical structures in English, will have practised in understanding written and

spoken academic texts and will be familiar with the typical features of spoken and written academic language.

More specifically, upon successful completion of the course, the students:

- Will be able to understand written and spoken academic texts on information and communications technology (ICT) in English.
- Will know specialized ICT vocabulary which is commonly found in related academic texts.
- Will be familiar with vocabulary and grammar which is commonly found in spoken and written academic texts.
- Will be able to take notes during academic lectures in Engnlish.
- Will know the language that is used in a group discussion in English.

321-0830 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

321-3650 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.

321-3000 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 and explain basic search and sorting algorithms in basic linear and linked structures of data.
- Cite and explain basic tree traversal and management algorithms of tree and graph structure.
- Cite three asymptotic notations.
- Comment the quality of a solution in relation to the execution time of the corresponding algorithm.
- Select suitable algorithms for solving problems by choosing appropriate data structures.

Analyze the quality of a solution in relation to the execution time of separate modules.

- Modify properly known algorithms so that they can be exploited in the solution of a problem.
- Implement the solution to a problem.
- Evaluate the quality of solution proposed and compare between various alternative choices for the solution of a problem.
- Assess the correctness of a solution.

321-8950 Digital Innonnovation and Entreprenentrprurship

Introduction to Entrepreneurship. Concepts and definitions. Business Models of Digital Entrepreneurship. Main areas of digital innovation and new technological trends. Basic markets of digital entrepreneurship: finance, governance, health, tourism, agricultural production, etc. Digital Entrepreneurship Infrastructures: Internet and mobile platforms, Basic components of internet business presence: Websites, mobile sites and applications. Business plan development, documentation and pitching. Types of business. Ways of financing. The Greek Start-Up Ecosystem. Ethical, social and political issues in digital entrepreneurship.

Upon completing the course, students will:

- Have the knowledge to recognize the basic types of digital entrepreneurship, the business models that are found in each type, and their basic revenue models.
- Have the skills to select the right digital infrastructure and design the right components for an online business.
- Have the ability to develop a business plan for a digital startup.

321-3350 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.

321-3750 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.
- Know the notion of stochastic process and will be familiar with the basic categories, as Poisson processes and Markov chains.
- Be capable to cope with courses in other semesters, which base their theory on stochastic processes.

321-5500 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

321-0140 English Language 3

Software development, describing trends, efficiency in computer systems, human-computer interaction, writing a research report, giving presentations, e-commerce and e-government, making comparisons in diagrams, computing and ethics, ICT in the future.

Students who successfully complete the course will be familiar with complex grammatical and syntactical structures in English, will have practised in understanding written and spoken academic texts and will be familiar with the typical features of spoken and written academic language.

More specifically, upon successful completion of the course, the students:

- Will be able to understand written and spoken academic texts on information and communications technology (ICT) in English.
- Wll know specialized ICT vocabulary which is commonly found in related academic texts.
- Will be familiar with vocabulary and grammar which is commonly found in spoken and written academic texts.
- Will be able to take notes during academic lectures in English and summarize part of a lecture.

321-0840 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

321-3100 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. 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.

321-3200 Databases I

Introduction to Database Management Systems (DBMS). Advantages of using a DBMS. DBMS architecture. Disk usage for data storage. The principle of data independence. The entity-relationship and the relational model. Transformation of entity-relationalship model to relational model. Integrity constraints. Database update operations. Database languages. Relational algebra. SQL as a query language: queries, views, update statements. Introduction to primary file organizations and indexes. Normalization and introduction to optimization and query processing.

The students 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.

321-4200 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 will:

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

321-4100 Operating Systems

Introduction to Operating Systems: Basic Concepts, History, Operating System Structure. Processes: The Process Model and Implementation of Processes, Interprocess Communication, Critical Sections and Semaphores, Process Scheduling. Threads: The Thread Model and Thread Usage, Implementation of Threads in User Space and in the Kernel, Hybrid Implementations, Pop-up Threads, Converting 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.

321-4120 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 tools for implementing lexical, syntactical and semantic analysis of a programming language.
- Use a new programming language (Python).

321-7900 Microelectronics

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.

321-0850 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

321-2300 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.

21-6450 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:

- Understand the key and critical aspects of data transfer and networking, to connect them with general technological and operational objectives.
- Comprehend 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
- 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 its fellow students to create and present comprehensive laboratory exercises that include study, analysis, and implementation elements.

321-3700 Databases II

Transactions and Concurrency. Database Recovery. Query Planning and Optimization. Paraller and Disctributed 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.

321-4000 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).

Students who will have successfully completed the course will be able to:

- Analyze the requirements of a problem and produce solutions following the object-oriented approach.
- Apply their theoretical knowledge in solving problems.
- Follow a critical approach in producing solutions.
- Look for qualitative solutions by evaluating their plans according to the quality criteria that they apply on checkpoints in the development process.
- Install and utilize Computer-Aided Software Engineering (CASE) tools.

321-6700 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.

Upon successful completion of the course the student will have:

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

321-3450 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.

6th Semester

321-88100 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.

A student that successfully completes this course is expected to be in the position to:

- Explain the way the World Wide Web functions
- Locate, assess and evaluate relevant information through the use of recommended bibliographic sources and the World Wide Web.
- Determine the peculiarities of programming on the Web.
- Determine the main benefits and drawbacks of client-side and server-side programming.
- Report the syntax rules of the HTML/XHTML language.
- Report basic elements of the CSS formatting, Javascript and PHP language.
- Report basic elements of the JSP and World Wide Web technologies.
- Distinguish the peculiarities and usefulness of the CSS, HTML, Javascript and PHP languages.
- Utilise syntax rules of the HTML/XHTML language in order to solve particular problems
- Utilise the basic elements of CSS, Javascript and PHP languages as well as of the JSP technology in order to solve particular problems.
- Distinguish between static and dynamic web pages.
- Design the representation of documents via the Document Object Model (DOM).
- Design the representation of an XML document.
- Specify and analyse the requirements of a web application.
- Report the basic design principles of a web application.
- Explain the basic design steps of a web application.
- Design web applications based on specific requirements.
- Evaluate different web application development methodologies.
- Implement web applications by utilising different web technologies and integrating various functions.

321-3400 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.

Upon successful completion of the course, the student will:

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

321-3600 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, Heuristic methods. Machine learning: Introduction, Inductive learning, Decision trees, Neural networks, Methods to avoid overfitting.

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 using inductive learning to extract knowledge from data.
- Familiarity with the basic principles and algorithms of machine learning.
- To have the capacity of developing programs that use artificial intelligence algorithms.

321-6500 Management Information Systems

Information Systems in Organizations, Porter's 5 Forces Model, Value Chain, Strategic Information Systems, Enterprise Architecture, Information Resources Management, Financial Information Systems, Human Resource Management Systems, Supply Chain Management Systems, Customer Relationship Management Systems, Enterprise Resource Management Systems, Online presence, E-commerce, Business Intelligence and Analytics.

Students who successfully fulfil the course requirements will have:

- The knowledge of understanding the role of Information Systems and the required tech-

nological 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.

321-7950 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.

321-5200 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

321-5750 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.

321-9700 Computer Network Security and Privacy Enhancing Technologies

Introduction to Computer Network Security: Terminology, Threats, Vulnerabilities, Countermeasures, Assurance. PKI Technologies and Services. Threats, Attacks & Vulnerabilities: Threat Types, Threat Modelling, Attack Types, Attack Surfaces & Trees, OWASP Risk Assessment Methodology, OWASP Top-10, Vulnerability Management. OSI/ISO Network Security Architecture: Security Services, Security Mechanisms, Security Management. Internet Model Security Architecture: Network layer security, Internet layer Security, Transport layer Security, Application layer Security. Firewalls: Capabilities and Limitations, Design issues, Firewalls Architectures, Network level Firewalls, Application-level Firewalls, Hybrid Firewalls. Intrusion Detection Systems: System Taxonomy & Analysis, System Architecture, Control Strategy, Intrusion Detection Models, Response Mechanisms, Alternative Intrusion Detection Systems. Privacy & Anonymity: Basic Terms, Threats, Basic Privacy Protection Technologies, Core Anonymity Properties, Anonymity Types, Anonymity Protection Techniques & Technologies.

This course provides a broad-spectrum introduction to the fundamental principles of network security and privacy enhancing technologies. The structure of this course follows the OSI/ISO architecture of network security and more specifically that of the TCP/IP model.

The main learning objectives of the course are as follows:

- To acquire and develop a security culture in networking environments.
- 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 introduce and analyse security protocols across the different levels of the Internet model.
- To introduce and analyse firewalls and intrusion detection systems as well as the perception of the issues related to the placement of these security mechanisms in security architectures.
- To familiarize the students with the basic terminology and technologies of data privacy in networking environments.
- To familiarize the students with the basic terminology as well as techniques and technologies of anonymity in networking environments.

Cycle Information Systems and Entrepreneurship

321-5150 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.

321-8100 IT Project Manaanagement

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.

Upon completing the course, students will be able to:

- Learn the basic principles of IT project management and will be able to apply fundamental methods for managing the cost and duration of IT projects.
- 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.
- Evaluate IT project proposals and write a feasibility study.

Use project management software.

321-7650 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

321-10300 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.

321-7050 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

321-7000 Performance Evaluation and Simulation of Computer Systems and Networks

Quantitative analysis of discrete-event systems, including computer systems and networks, both by statistical models and tools, and by simulation. Poisson, birth-and-death and Markov processes, and their application to modelling and performance evaluation. Queueing theory: M/M/1, M/M/c, M/M/1/K, M/M/1/K/K models; application to modelling a network node. Queueing networks, Jackson networks, BCMP networks; application to modelling communication networks. Computer system models, including the central server model. Simulation of discrete-event systems using Arena. Case studies: latency in multiprocessor systems, modelling and simulation of sensor networks, user modelling.

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 discrete-event system modelling.
- Understanding of performance measures such as throughput, queue size, response time, pUrobability of loss, and their relation to system parameters.
- The capability to use simulation software such as Arena.

321 8350 Network Management

Management of TCP/IP based networks. SNMP protocol. Database of Information Management. Abstract transmission 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.

Upon successful completion of the course, the student will:

- 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.

Cycle Information Management and Intelligent Systems

321-7750 Introduction to Robotics

Robot position, robot orientation, robot pose, inertial navigation, Car-like vehicles, Quadcopter flying robot, Reactive navigation, Map-based navigation, location estimation.

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

- To describe the position, orientation and pose of a robot in 2D and 3D.
- To give a varying pose as a function of time.
- To describe inertial navigation.
- To talk about Car-like vehicles and Quadcopter flying robot.
- To describe Reactive navigation and Map-based navigation.
- To estimate the location of a robot.
- To make a map.

321-6100 Natural Language Processing

Introduction: basic concepts, applications. Morphological analysis, text tokenization and sentence splitting. Language modeling using n-grams. Basic supervised learning methods. Deep learning architectures for classification and sequence labeling. Language modeling using neural networks. Vector semantics, word and document embeddings. Text classification and applications. Part-of-Speech tagging and named-entity recognition. Constituency grammars and parsing, stochastic parsing. Dependency parsing. Logical representations of sentence meaning. Semantic analysis.

After successfully completing the course the students should be able to:

- Describe the basic principles and analysis levels of natural language processing.
- Understand and use word and document representation techniques.
- Understand algorithms and use tools for sequence labeling.
- Understand algorithms and use tools to perform syntactic analysis.
- Understand algorithms and use tools to classify documents.
- Get familiar with deep learning methods and their application to natural language processing applications.

Cycle Computer Science Foundations

321-99000 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.

321-8600 Information Theory

Discrete information sources and alphabets. Definition of Information and Entropy. Source coding: the 1st Shannon Theorem, Huffman codes, Shannon Code, Shannon-Fano Code, Lempel-Ziv, arithmetic codes. Rate-distortion theory. The concept of Mutual Information and 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. Code representation in a binary vectorial

space. Hamming distance. Decoding of linear codes. Hamming Codes: design, binary code, extended Hamming codes. Linear block codes and introduction to LDPC. Convolutional codes, Trellis diagram, Viterbi algorithm. Performance bounds of linear codes. Noise, spectral analysis, sampling theorem. 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.

Upon successful completion of the course, the student will:

- Learn and comprehend the foundations of information theory.
- Be able to compute information that a source produces and examine the possibility to transmit it over a specific channel.
- Be able to choose the most adequate compression algorithms.
- Be able to evaluate the impact of the application of compression algorithms.
- Be able to design reliable communication systems and choose the most adequate error correction algorithm under specific noise conditions and transmission rate.

321-0160 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 to participate in the TOEFL examinations, which certify their ability to use the English language.

8th Semester

Cycle Information and Communication Systems Security and Privacy

321-10750 Mobile and Wireless Networks Security

Introduction to wireless networks security: wired vs. wireless network security, security architectures, categories of threats, vulnerabilities, countermeasures. Security in IEEE 802.11 std, including pre-RSNA, TSNs, and RSNA networks: authentication, confidentiality, integrity, key management, attacks. Cellular networks security (3GPP): network access and

authentication mechanisms, key hierarchy and administration, encryption, integrity, user privacy, inter and intra-network security, attacks.

This course covers key 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, and countermeasures in the field of wireless and mobile networking.
- To familiarize students with the issues and technologies involved in designing a wireless system that is robust against attacks.
- The course considers basic security topics and technologies in the 3GPP and IEEE 802.11 standards. The emphasis is put on the security issues of MAC and upper layers. The course objectives are fulfilled through course lectures, paper readings, and projects.

321-6000 Physical Layer Security

Introduction to security through an information-theoretic approach. Basic elements of information theory (information, entropy, mutual information, capacity, Gaussian channel, rate-distortion theory). Definition of physical-layer security. Metrics of secrecy, perfect secrecy in information-theoretic terms. Degraded Wiretap Channels, Broadcast Channels and Wiretap Channels. Secrecy capacity and secret key capacity. Shannon cipher system. Secrecy bounds in wireless channels. Coding for secrecy and security. Beamforming and pre-coding for security enhancement, MIMO channels and transmission techniques. Use of common randomness and artificial noise. Secure source coding. Basics on Diffie-Hellman, AES, and side-channel attacks. Secret key agreement (one direction of public communication, two-way, unlimited rate, and quantum key exchange). Secret key generation, secret key distillation, advantage distillation. Fingerprinting, multi-user channel jamming, network encryption security. LDPC codes on the wiretap channel. Addressing wiretap channel modeling, secrecy assessment exercises. Development of source codes for PHY security. Simulation of beamforming, artificial noise, and channel-based key generation schemes.

Upon successful completion of the course, students will be able to:

- To comprehend the basic information analysis methods,
- To be able to quantify the (mutual) information and entropy, to evaluate the channel capacity,

- To familiarize with information and uncertainty metrics, to understand secrecy, secrecy metrics, secrecy capacity and secret-key capacity
- To comprehend the basic principles of achieving safety at the physical level and the benefits and advantages it offers,
- To study and analyze the wiretap channels and to understand risks and mitigation techniques,
- To investigate beamforming, pre-coding and collaborative transmission as a means of secure communications,
- To comprehend the procedures for secure source coding through physical layer.

Cycle Information Systems and Entrepreneurship

321-8500 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 1 and 2.
- Development of ability to model decision problems, and then to solve the models, under-

stand 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.

321-11100 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.

321-5600 Human – Computer Interaction and Web Applications

Introduction, Historical background. Theoretical foundations, Elements of Cognitive Psychology. Man and computer as interaction elements. Structural elements and inter-action styles. Analysis Levels of Interaction. Dialogue Modeling. Human-centric design on interactive systems. Requirement analysis. Scenario based design. Prototyping techniques. Design rules and directives. Evaluation Techniques (interviews, focus groups, cognitive walkthrough, etc.). Experimental evaluation at 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.

Cycle Computer and Telecommunication Technologies

321-9350 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.

It 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.

321-7800 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.

321-8750 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.

321-7850 Microprocessors

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. Input/Output (I/O): program controlled I/O, polling, interrupts, direct memory access (DMA). Using microcontrollers in basic applications. Case study: AVR microcontroller family. Programming in Assembly and C. I/O units in the AVR microcontrollers: I/O ports, timers/counters, A/D converters, serial communication units. 8-bit PIC and 32-bit ARM microcontroller families.

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.
- Basic understanding of the hardware of IoT.

Cycle Communication Systems and Networks

321 -11000 Cloud Technologies

Core cloud characteristics, Types of offered cloud services (IaaS, PaaS, SaaS, IaaS), Cloud development models (private, public, hybrid community), Cloud activation technologies, Virtualization technologies, Data centre technologies, Cloud infrastructure mechanisms, Networking issues and mechanisms in the cloud, Network service and function virtualization (Software Defined Networks - SDNs, Network Function Virtualization - NFV), Cloud storage mechanisms, Issues and mechanisms for cloud security, Programmatic resource management, Container management and orchestration for micro-service based applications, Serverless computing, Cloud management & brokerage.

The course is a basic introduction to the concepts of cloud computing as well as resource and services virtualization. This course aims to introduce students to the basic concepts of cloud computing, connecting the concept of the services offered by their respective necessary resources and requirements for effective resource management. 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 empirical knowledge and constitutes the basis on which specific methodologies and techniques for the creation and management of virtual services can be applied. Further, the course determines ways to apply micro-service architectures for web applications through the creation, management and orchestration of containers that map to the components of these applications. In addition, the course

outlines the importance of the development and management of applications and services across multiple clouds. Finally, the aim of the course is to make students understand the importance of managing virtual services in the modern economy and the evolution of the cloud computing into a distinct scientific field.

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

- Understand the key and critical aspects of cloud computing, connecting them with broader economic and operational objectives and principles of the service lifecycle.
- Acquire knowledge of the basic cloud mechanisms and technologies in different levels (infrastructure, platform, software).
- Acquire knowledge of virtualization tools and techniques as well as of how such tools and techniques can be used to ensure the successful and timely provisioning of offered services and resources by taking into account the available budget.
- Use cloud computing methodologies to identify key elements, such as critical infrastructures, interfaces & interconnections, dependencies, and realistic implementations.
- Indulge in micro-service architectures as well as in the management and orchestration of containers for the realisation of such architecture in the context of web cloud applications.
- Learn how to manage both manually and programmatically virtual resources & infrastructures across different clouds.

321-7250 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. Introduction to the technological features of future 5G systems.

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.
- Be able to utilise basic RRM techniques to calculate the network resources that are required to achieve a QoS (Quality of Service) target.
- Be able to calculate and analyse the key performance indicators of a mobile communication system.

321-6250 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.
- 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

321-10200 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.

321-9250 Data Mining

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. Mining from multimodal data.

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.

- To develop 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.

321-6600 Advanced Robotics

Localization, Robot Arm, Kinematics, Forward Kinematics, Inverse Kinematics, Trajectories, Jacobian, Inverse Kinematics, Dynamics, Joint Control, Rigid-Body Equations, Forward Dynamics, Rigid-Body Dynamics.

The course provides basic knowledge about the comprehension and use of robotic vision systems. The student is aware of the principles of robotic optical systems. He/she is able to talk about:

- Localization
- Robot Arm Kinematics
- Forward Kinematics
- Inverse Kinematics
- Trajectories
- Manipulator Jacobian
- Jacobian Condition and Manipulability
- Inverse Kinematics: a General Numerical Approach
- Dynamics and Control
- Independent Joint Control
- Rigid-Body Equations of Motion
- Forward Dynamics
- Rigid-Body Dynamics Compensation

321-6050 Intelligent Recommender Systems

Collaborative filtering algorithms. Content-based filtering algorithms. The Vector Space Model. Decision Tree Classifier. Hybrid Recommendation Systems. Graph-based Recommendation Systems. Context-based systems/contextual user-system interaction. Time-based, and location-based Recommendation Systems. Recommendations with privacy protection. Decision making. Matrix Analysis and Factorization for Recommendation Systems. Eigenvalue Analysis. Multi-dimensional matrix factorization. Deep neural networks. Reinforcement Learning and Genetic Algorithms for Recommendation Systems. Recommendations based on Fairness. Evaluation of Recommendation Systems. Evaluation of Recommendation Systems beyond simply measuring the effectiveness and accuracy of recommendations. Explanations of Recommendations. Novel Recommendations.

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

- Understand the skills, tools and techniques required to effectively use data science.
- Know artificial intelligence techniques and methods for implementing intelligent recommender systems.
- Evaluate tools and techniques in the field of data science for recommendations.
- Solve problems using scientific methods to provide recommendations.
- Apply innovative data mining techniques.
- Apply machine learning techniques to extract knowledge from complex and heterogeneous data.
- Produce scientific and technical reports.

Cycle Computer Science Foundations

321-9850 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:

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

321-8000 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 that completes the course successfully will:

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

321-9000 Forecasting Techniques

Time Series Data, Correlation, Time Series Analysis, Forecasting Strategies, Demanding forecasting, Basic Stochastic Models, Characteristics of Time Series, Definition of Prediction, Prediction Fields and Applications, Categories of Predictive Paths, Predictive Performance Measures, Basic statistical concepts, Statistical Methods in the Frequency Domain, Basic Statistical Analysis and prediction models, Statistical measures of accuracy in Predictions, Graphical Data Representation, Parameter Estimation, Growth Rate, Normalization Terms, classical Decomposition methods, Stationary Models, Non-stationary Models, Introduction to Spectral Analysis and Filtering, State Space Models, Multivariate Models, Confidence Space, Business Forecast Process, Mobile Intermediate Terms for Exposure, Methods of Exposure Smoothing , Seasonal Smoothing), Selection of smoothing model, Introduction to ARIMA Timeline Forecasting Models (Prediction Limits). Time Series Regression and Exploratory Data Analysis (simple linear and multiple regression), Binary Categorization (such as Support Vector Machines and Multiple Layer Perceptron) and Machine Learning applications as well as Clustering techniques (such as Neural Networks, k-Nearest Neighbours, Expectation Maximization). Detection of embarrassing and malicious behavioral patterns (description of SAX technique) in online dialogues (questions of predator to a candidate minor victim).

The aim of the course is to enable students to understand the basic principles of time series analysis, strategies prediction, basic Statistical Analysis and Performance measures in forecasting, Time Series Regression and Exploratory Data Analysis (simple linear and multiple regression), Binary Categorization (such as Support Vector Machines and Multiple Layer Perceptron) and Machine Learning applications as well as Clustering techniques (such as Neural Networks, k-Nearest Neighbours, Expectation Maximization).

By concluding the course, students are able to:

- Analyze and adapt data in original form
- Estimate the parameters and compute the mobile average of data based on basic Statistic methodology
- Distinguish the quality of characteristics in time series data
- Apply forecasting methods analyzing and designing data required for prediction
- Develop deep knowledge in Time Series Regression and Exploratory Data Analysis
- Understand the content / role of forecasting based on basic prediction models
- Identify, describe and distinguish the main methods and prediction techniques in Binary Classification as well as clustering
- Have comprehensive knowledge in methodology and application of forecasting techniques

Optional Courses

321-7600 Practice

The content of the course is not specified due to its nature – depended on the internship placement. The number of the internship placements are assured by the Department via its synergies with public and private industrial enterprises.

Learning outcomes:

- Ability for students to get in touch with workplaces, acquire new knowledge, participate actively in teamwork and decision making, develop their skills, participate in the design and completion of projects and generally gain work experience.
- Contribution of internships to strengthen the interconnection of educational institutions with the market and development of networking – partnerships.
- Promote modern methods for developing young entrepreneurship
- Qualitative evaluation of the actions so far and the next actions and contribution to improving the career prospects of the students.

321-2630 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-simulink software and to simulate various types of communication systems.
- Use Matlab and to produce fundamental signals, variables and transmission channels.
- Develop the students' skills in performance evaluation of communication systems using Matlab.
- Understand the meaning of significant performance metrics of digital communication systems.
- Acquire a deep understanding of their operation by simulating modern communication systems.

Free Course

321-0150	English Language (TOEFL)

See course 321-0160.

9th Semester

Cycle Information and Communication Systems Security and Privacy

321-99100	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.

321-8050 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.

Cycle Information Systems and Entrepreneurship

321-8200 E-Commerce Technologies and Applications

E-commerce overview. Basic principles of e-commerce - e-business. E-commerce categories and forms. E-commerce products and services. E-commerce mechanisms, platforms and tools. E-commerce business models. Retail sales in e-commerce. Online marketplaces. Online auctions. Marketing and advertising in e-commerce. Strategy in the electronic business environment. E-commerce infrastructure. Implementation of e-commerce systems. Creating an e-business by developing a business model and e-commerce application.

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

- Understand the basic principles, forms and categories of e-commerce.
- Recognise and analyse e-commerce business models.
- Become familiar with e-commerce technologies, tools and applications.
- Understand how e-commerce companies operate and their infrastructure.
- Create an e-business by developing a business model and an e-commerce application.

321-5400 Information Systems Strategy and Investment - Digital Transformation

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

321-10650 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.

321-6550 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.

321-3250 Internet of Things

Introduction to IoT: motivations, definitions, key concepts, features, enabling technologies, challenges, applications. IoT Hardware: smart devices, sensors/actuators, h/w IoT platforms, data digitization. IoT network connectivity: Low power wireless and mobile protocols and architectures (IEEE 802.11ac/ad/ah/ax/ba, IEEE 802.15.4 and ZigBee, BLE protocols), sensor networks, routing in sensor networks, etc. IoT device and machine networking: IoT specific communication protocols, M2M/IoT networks (LoRa/LoRaWAN, Sigfox). IoT in cellular communications: NB-IoT, LTE-M, etc. Cloud IoT: Architecture and Implementation (Virtual Resource Pool, Database, Proxies and Load Balancing). Fog Computing: Architecture and Evaluation. IoT operating systems (Contiki, Android Things, TinyOS), IoT application-level protocols (CoAP, MQTT, XMPP, HTTP RESTFUL Services, AMQP, Websockets). IoT software platforms: role, architecture, services, challenges, case studies (TheThingsNetwork, ThingWorx, ThingSpeak, Google Cloud IoT). Data collection, preprocessing, and storage (Big data and processing of serial data by sensors). Data analysis, detection-decision theory and visualization. Machine Learning and its connection to IoT. Use Cases: smart home, smart health, precision agriculture, smart cities, industrial IoT, Intelligent Transportation Systems.

The aim of the course is to explore the definition and use of the term “Internet of Things” in different environments, to present the basic elements that make up an IoT system, to distinguish the levels of the IoT stack and to present basic technologies and protocols used in each layer of the stack and on a practical level to apply the knowledge and skills acquired during the course to develop and test functional IoT prototypes.

Upon successful completion of the course, the students will be able to:

- Understand the definition and use of the term “Internet of Things” in different environments.
- Understand the basic elements that make up an IoT system.
- Discern and explain the architecture layers of an IoT system and identify key technologies and protocols used in each layer of the architecture.
- Understand and assess the issues involved in designing and developing IoT applications.
- Design and develop IoT applications utilizing services from available platforms.
- Analyze, evaluate and discuss problems and case studies for IoT applications.

321-8650 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.).
- 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.
- 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

321-9400	Sensor Networks

Lectures: Introduction to sensor networks, basic similarities and differences with other wireless and mobile networking systems, sensor network architectures, physical communication protocols, medium access control protocols, energy-efficient protocols, synchronization protocols, addressing problem, optimal placement of network devices, automatic node grouping algorithms, optimization techniques, self-organized sensor networks, self-adaptive sensors, data clustering techniques for efficient data compression, routing algorithms,

content-based networking, context-aware networking, context-aware resource management algorithms, security issues, developing integrated sensor network environments in smart home and business environments, integrated networks and the role of sensor networks as a core system element, use case of smart cities and smart islands, use cases in culture and health, unified data management platforms, innovative business models based on the principles of linked and open data.

Laboratory: Laboratory exercise for practical implementation of a functional network of sensors (server, gateway, temperature / humidity / motion measuring sensors, smart controllers, etc.) with data acquisition, storage, processing and visualization. Exercises for studying MAC protocols, routing, resource management algorithms and data clustering algorithms.

Course objectives can be categorized into three levels. Upon successful completion of the course, students will be able to:

At the level of knowledge acquisition:

- To comprehend the basic notions of Sensor Networks
- To comprehend the basic functionalities of Sensor Networks and the latter's interaction with other types of networking systems (e.g. mobile/fixed networking systems)
- To comprehend the particular problems and solutions in the different layers (i.e. physical, MAC, network, transport layer) of the Sensor Networks.
- To study various ways that sensor network protocols collaborate in order to implement the basis upon which the various applications may run.
- To study the design features and ways of implementation of protocols and their application in sensor networks.

At the level of practical knowledge:

- To design and analyze the requirements of a sensor network.
- To design and analyze innovative business models for specific sensor network applications.
- To evaluate the performance of a sensor network according to various key performance indicators.
- To implement a small-scale application for a sensor network.

At the level of competencies:

- To be able to communicate effectively with specialized and non-specialized personnel as members or leaders of a project team working on development and management of a sensor network.
- To be able to work on complex sensor network problems both in a systematic and creative way.
- To be able to function autonomously and propose/implement solutions in real-life sensor network problems.
- To be able to exploit software tools in order to be able to effectively analyze the performance of a sensor network.

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

321-7400 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, identifying and explaining the various stages in the development of a knowledge-based system.
- 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.

- Possess 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.

321-9450 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.
- Able to the requirements of applications that differ from traditional relational databases.
- Able to develop solutions for data management in such applications.

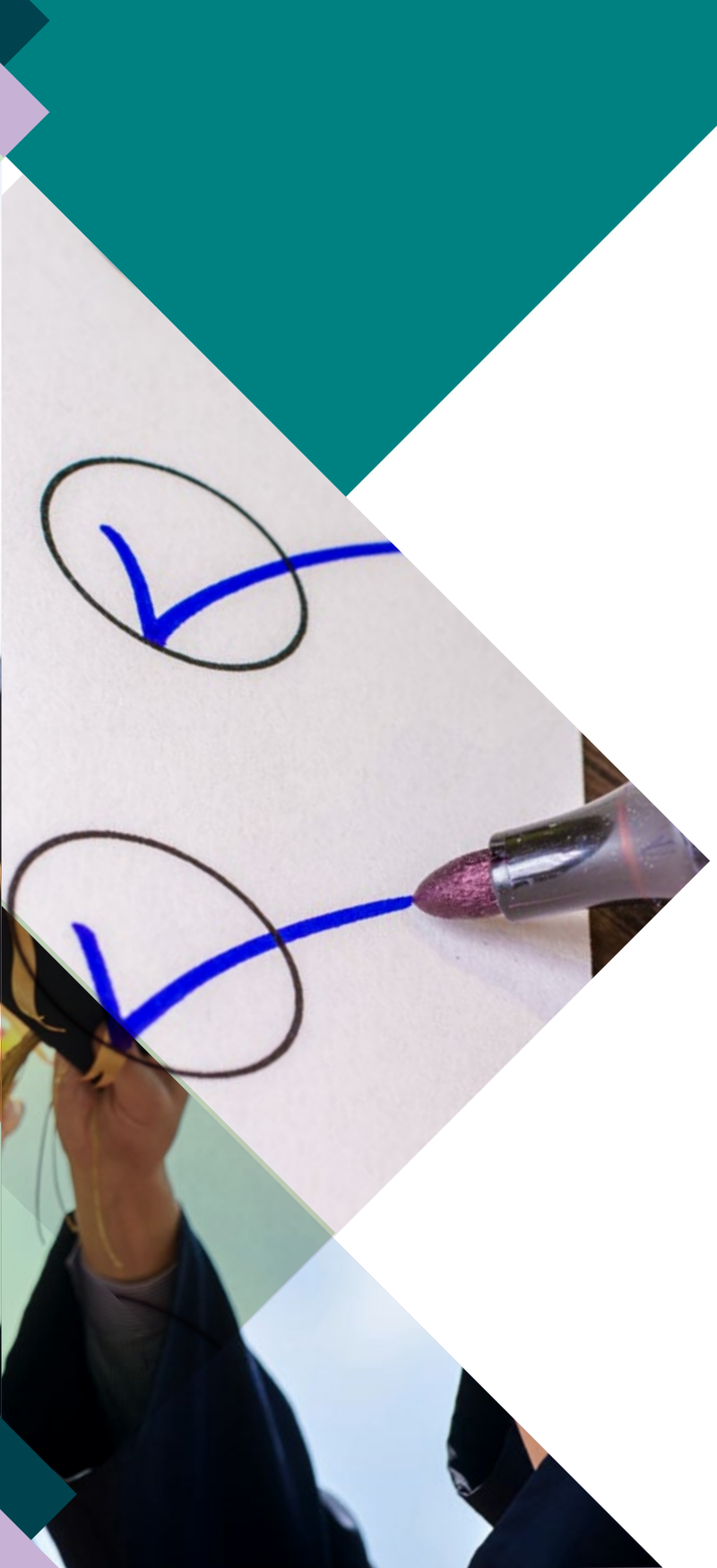
Cycle Computer Science Foundations

321-10000 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.

The student that completes the course successfully will have:

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



Optional Course

321-2600	Risk Theory

Restatement in Probabilities. Poisson processes. Renewal processes. Collective risk theory. Compound distributions. Approach of risk probability. Assumptions of development of extreme events. Security factor. Lundber inequality. The classic model. The assumptions of collapse systems.

The learning outcomes are:

- Know 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

The dissertation must follow the layout specified below:

1. 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).
2. Acknowledgements. This includes thanking the people who contributed to the completion of the dissertation.
3. Abstract in Greek (about 300 words). It should briefly describe the topic, the purposes, the methodology, and the basic conclusions of the dissertation.
4. Abstract in English.
5. Table of contents with a maximum of 3 numbering levels.
6. List of figures, list of tables, list of acronyms.
7. 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.

Learning outcomes:

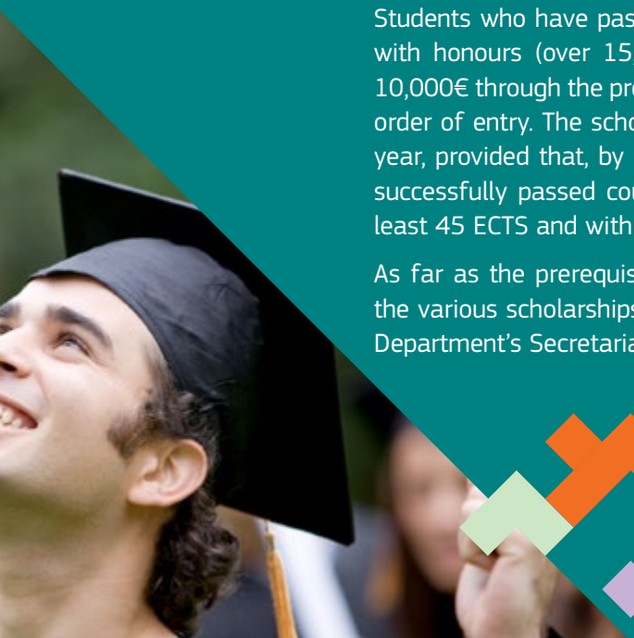
- Work Independently
- Use the bibliography
- Presenting the thesis

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.

Students who have passed the 2023 Panhellenic Exams from General Lyceum, with honours (over 15,000 points), will be awarded up to 3 scholarships of 10,000€ through the programme "***Samos supports its students***", based on their order of entry. The scholarship will be offered in parts and proportionally every year, provided that, by the September examination period, the holder will have successfully passed courses of the previous academic year with a total of at least 45 ECTS and with an average score of at least 7.

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 egerontis@aegean.gr
IEEE Student Branch – University of the Aegean	http://www.icsd.aegean.gr/ieee ieee@aegean.gr
Artistic group	artsam@aegean.gr
Music group	musicteam@aegean.gr
Astronomy group	aristarchos@samos.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 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 2023 - 2024

Beginning of courses:	02.10.2023
End of courses:	14.01.2024
Semester duration:	13 weeks
Examination period:	From 15.01.2024 to 09.02.2024

Holidays:

National Holiday:	Saturday 28.10.2023
Regional Holiday:	Saturday 11.11.2023
Polytechnion Anniversary:	Friday 17.11.2023
Christmas Holidays:	24.12.2023 – 06.01.2024
Religious Holiday (Trion Ierarhon):	Tuesday 30.01.2024

SPRING SEMESTER 2023 - 2024

Beginning of courses:	12.02.2024
End of courses:	26.05.2024
Semester duration:	13 weeks
Examination period:	From 27.05.2024 to 21.06.2024

Holidays:

Monday, the first day of Lent:	Monday 18.03.2024
National Holiday:	Monday 25.03.2024
Easter Holidays:	29.04.2024 – 12.05.2024
First of May Holiday:	Wednesday 01.05.2024
Religious Holiday (Holy Spirit):	Monday 24.06.2024
Students' elections:	*Exact date to be announced*

UNIVERSITY OF THE AEGEAN

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