UNIVERSITY OF THE AEGEAN

SCHOOL OF ENGINEERING
DEPARTMENT OF INFORMATION AND COMMUNICATION SYSTEMS ENGINEERING

Karlovasi, Samos

UNDERGRADUATE
Programme Guide
ACADEMIC YEAR
2023-2024
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.
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.
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
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 |
For more information about the University of the Aegean please visit our web site: [http://www.aegean.gr](http://www.aegean.gr)

For the School of Engineering please visit our web site: [http://eng.aegean.gr](http://eng.aegean.gr)
Facilities

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

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

**Karlovasi**
- Emporiki Sholi Building (Classrooms, Helpdesk)
- Igemoneio (Faculty Offices of Mathematics Department, Secretariat)
- Chatzigianneio (Library)
- Liberis Building (School of Science Secretariat, Faculty Offices of the Department of Information and Communication Systems Engineering, Secretariat, Classroom, Laboratories)
- Vourlioti Building (Faculty Offices of the Department of Statistics and Actuarial-Financial Mathematics, Secretariat)
- Morali Building (Faculty Offices of the Department of Mathematics)
- 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).
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 postgraduate 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

<table>
<thead>
<tr>
<th>Role</th>
<th>Professor</th>
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<tbody>
<tr>
<td>Head of Department</td>
<td><strong>Maria Karyda</strong></td>
</tr>
<tr>
<td>Deputy Head of Department</td>
<td><strong>Efstathios Stamatatos</strong></td>
</tr>
<tr>
<td>Director of Postgraduate Study Programmes before the 2018–19 academic year</td>
<td><strong>Maria Karyda</strong></td>
</tr>
<tr>
<td>Director of Postgraduate Study Programme ‘Information and Communication Systems Security’</td>
<td><strong>Spyros Kokolakis</strong></td>
</tr>
<tr>
<td>Director of Postgraduate Study Programme ‘Internet of Things: Smart Environments in Next Generation Networks’</td>
<td><strong>Christos Gououmopoulos</strong></td>
</tr>
<tr>
<td>Director of Postgraduate Study Programme ‘Electronic Governance’</td>
<td><strong>Euripidis Loukis</strong></td>
</tr>
<tr>
<td>Director of Postgraduate Study Programme ‘Information and Communication Systems’</td>
<td><strong>Maria Karyda</strong></td>
</tr>
<tr>
<td>Director of Postgraduate Study Programme ‘Digital Innovation and Startup Entrepreneurship’</td>
<td><strong>Yannis Charalabidis</strong></td>
</tr>
</tbody>
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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 **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).


Faculty

- **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 andTelecommunications, 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 **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.
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:

<table>
<thead>
<tr>
<th>Semester</th>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
<th>4th</th>
<th>5th</th>
<th>6th</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compulsory Courses</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
</tbody>
</table>

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.

The Diploma’s Grade is calculated as follows:

\[ \text{Diploma’s Grade} = 0.85 \times \text{Courses Grade} + 0.15 \times \text{Diploma Thesis Grade} \]

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 systems.

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

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<td>Logic Design</td>
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<td>Mathematics for Engineers I</td>
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<td>Physics</td>
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### Free Course

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## 2nd Semester

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<td>Circuit Theory</td>
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<td>321-3150</td>
<td>Mathematics for Engineers II</td>
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<td>Probability and Statistics</td>
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### 3rd Semester

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<td>Data Structures</td>
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<td>Stochastic Processes</td>
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### Courses per Semester

#### 4th Semester

**Compulsory Courses**

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<td>Information Systems Analysis and Design</td>
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<td>321-4200</td>
<td>Algorithms and Complexity</td>
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<td>Advanced Topics of Programming Languages</td>
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<td>Databases I</td>
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<td>Microelectronics</td>
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**Free Course**

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#### 5th Semester

**Every course in this semester is Compulsory**

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<td>Computer Networks</td>
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<td>321-3700</td>
<td>Databases II</td>
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<td>Telecommunications</td>
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<td>Theory of Computation</td>
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**6th Semester**

Every course in this semester is Compulsory

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<td>321-3600</td>
<td>Artificial Intelligence</td>
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<td>321-3400</td>
<td>Information and Communication Systems Security</td>
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<td>321-7950</td>
<td>Distributed Systems</td>
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<td>Internet Programming</td>
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<td>Legal Framework for the Information Society</td>
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**7th Semester**

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

<table>
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<td>Computer Network Security and Privacy Enhancing Technologies</td>
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<td>321-5750</td>
<td>Privacy and Data Protection Law</td>
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2. **Cycle Information Systems and Entrepreneurship**

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<td>321-8100</td>
<td>IT Project Management</td>
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<td>321-5150</td>
<td>Information Systems Analysis and Design Methodologies and Tools</td>
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### Courses per Semester

#### 3. Cycle Computer and Telecommunication Technologies

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<tr>
<td>321-10300</td>
<td>Digital Communications</td>
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<td>321-7050</td>
<td>Digital Systems Design</td>
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#### 4. Cycle Communication Systems and Networks

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<td>321-8350</td>
<td>Network Management</td>
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<tr>
<td>321-7000</td>
<td>Performance Evaluation and Simulation of Computer Systems and Networks</td>
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#### 5. Cycle Information Management and Intelligent Systems

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<td>Introduction to Robotics</td>
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<tr>
<td>321-6100</td>
<td>Natural Language Processing</td>
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#### 6. Cycle Computer Science Foundations

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<td>Information Theory</td>
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<td>Numerical Analysis</td>
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### 8th Semester

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

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<td>Mobile and Wireless Networks Security</td>
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<td>321-6000</td>
<td>Physical Layer Security</td>
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#### 2. Cycle Information Systems and Entrepreneurship

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<td>Decision Support Systems – Business Analytics</td>
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<td>Human – Computer Interaction and Web Applications</td>
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<td>321-11100</td>
<td>Digital Government</td>
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### Courses per Semester

#### 3. Cycle Computer and Telecommunication Technologies

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<td>Introduction to VLSI</td>
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<td>321-9350</td>
<td>Digital Image Processing</td>
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#### 4. Cycle Communication Systems and Networks

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<td>Mobile Communication Networks</td>
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<td>Cloud Technologies</td>
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#### 5. Cycle Information Management and Intelligent Systems

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<td>Information Retrieval</td>
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<td>Intelligent Recommender Systems</td>
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#### 6. Cycle Computer Science Foundations
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<td>321-9850</td>
<td>Mathematical Modeling</td>
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<td>Forecasting Techniques</td>
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### Optional Courses

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<td>Practice</td>
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### Free Course

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### 9th Semester

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

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<th>Course Title</th>
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<th>Lab Hours / Review-Problem Session Hours</th>
<th>ECTS units</th>
</tr>
</thead>
<tbody>
<tr>
<td>321-99100</td>
<td>Regulatory and Social Issues in Information Society</td>
<td>3</td>
<td>-</td>
<td>5</td>
</tr>
<tr>
<td>321-8050</td>
<td>Cryptography</td>
<td>3</td>
<td>-</td>
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</table>
### Courses per Semester

#### 2. Cycle Information Systems and Entrepreneurship

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Teaching Hours</th>
<th>Lab Hours / Review-Problem Session Hours</th>
<th>ECTS units</th>
</tr>
</thead>
<tbody>
<tr>
<td>321-5400</td>
<td>Information Systems Strategy and Investment-Digital Transformation</td>
<td>3</td>
<td>-</td>
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<tr>
<td>321-8200</td>
<td>E-Commerce Technologies and Applications</td>
<td>3</td>
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#### 3. Cycle Computer and Telecommunication Technologies

<table>
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<tr>
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<tr>
<td>321-10650</td>
<td>Satellite Communications</td>
<td>3</td>
<td>2</td>
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<tr>
<td>321-6550</td>
<td>Multimedia</td>
<td>3</td>
<td>2</td>
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</tr>
<tr>
<td>321-8650</td>
<td>Optical Communications</td>
<td>3</td>
<td>2</td>
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<tr>
<td>321-3250</td>
<td>Internet of Things</td>
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#### 4. Cycle Communication Systems and Networks

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<thead>
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<th>Teaching Hours</th>
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<tr>
<td>321-9400</td>
<td>Sensor Networks</td>
<td>3</td>
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<tr>
<td>321-9120</td>
<td>Design and Development of Mobile Computing Applications</td>
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#### 5. Cycle Information Management and Intelligent Systems

<table>
<thead>
<tr>
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<tr>
<td>321-7400</td>
<td>Knowledge Engineering and Knowledge Systems</td>
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<td>Course Title</td>
<td>Teaching Hours</td>
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</tr>
<tr>
<td>321-9450</td>
<td>Applied Topics in Data Structures and Databases</td>
<td>3</td>
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6. **Cycle Computer Science Foundations**

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<tr>
<td>321-10000</td>
<td>Algorithms and Combinatorial Optimization</td>
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**Optional Courses**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Teaching Hours</th>
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<tr>
<td>321-2600</td>
<td>Risk Theory</td>
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</table>

- **10th Semester**

**Compulsory Course**

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<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Teaching Hours</th>
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<tr>
<td>321-7100</td>
<td>Diploma Thesis</td>
<td>-</td>
<td>-</td>
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</table>
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

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


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


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


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


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,
• 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**


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

- Identify linear systems and represent those systems in schematic form.
- 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
• 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


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


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

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 English.
- 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

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 Innovation and 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


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**


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
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.
• 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 English and summarize part of a lecture.

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

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,

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


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

When the student completes the course successfully 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 solve problems about time and space complexity of algorithms.

**321-4100 Operating Systems**


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


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-

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.

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


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. Parallel and Distributed 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


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


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**


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 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**

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

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


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


Students who successfully fulfil the course requirements will have:

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

### 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 synchronization 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


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

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


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 analyze security protocols across the different levels of the Internet model.
• To introduce and analyze 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 |


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 Management |


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


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:

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 modulation, 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**

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<th>Course Code</th>
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<tr>
<td>321-7000</td>
<td>Performance Evaluation and Simulation of Computer Systems and Networks</td>
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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, probability of loss, and their relation to system parameters.
• The capability to use simulation software such as Arena.

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<td>321 8350</td>
<td>Network Management</td>
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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**


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**


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


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

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


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 |


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


The student that will 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 digitisation.
- 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

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**


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


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,

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


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


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


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


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


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

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

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>321-0150</td>
<td>English Language (TOEFL)</td>
</tr>
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See course 321-0160.

9th Semester

Cycle Information and Communication Systems Security and Privacy

<table>
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<th>Course Code</th>
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</thead>
<tbody>
<tr>
<td>321-99100</td>
<td>Regulatory and Social Issues in Information Society</td>
</tr>
</tbody>
</table>

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.

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

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.

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


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 through
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, types 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 successful 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 and optical fibers, the basic light generation mechanisms (stimulated-spontaneous emission), the electro-optic circuits for optical signal detection/conversion. Knowledge over transmission effects such as dispersion 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 dispersion compensation.
• Be able to design fully 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


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


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 advisor 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.
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:

<table>
<thead>
<tr>
<th>Student Group</th>
<th>Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men and Women Sports Teams</td>
<td>Euripides Gerontis, Faculties of Science and Engineering Trainer&lt;br&gt;<a href="mailto:egerontis@aegean.gr">egerontis@aegean.gr</a></td>
</tr>
<tr>
<td>IEEE Student Branch – University of the Aegean</td>
<td><a href="http://www.icsd.aegean.gr/ieee">http://www.icsd.aegean.gr/ieee</a>&lt;br&gt;<a href="mailto:ieee@aegean.gr">ieee@aegean.gr</a></td>
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<td>Music group</td>
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<tr>
<td>Cycling club</td>
<td><a href="mailto:bike_club@samos.aegean.gr">bike_club@samos.aegean.gr</a></td>
</tr>
<tr>
<td>Faculties of Science and Engineering Football Club (participates in the local championship of the Greek Football Federation)</td>
<td><a href="mailto:samos_sthe_fc@aegean.gr">samos_sthe_fc@aegean.gr</a></td>
</tr>
<tr>
<td>Chess group</td>
<td><a href="mailto:skaki@samos.aegean.gr">skaki@samos.aegean.gr</a></td>
</tr>
<tr>
<td>Students cafeteria – “Algorithm of Taste”</td>
<td><a href="mailto:flesxi@aegean.gr">flesxi@aegean.gr</a></td>
</tr>
<tr>
<td>Students magazine – “Φ” (“Phi”)</td>
<td><a href="mailto:f@samos.aegean.gr">f@samos.aegean.gr</a></td>
</tr>
<tr>
<td>Students Radio Station “Choros” (“Space”) 94.2 FM</td>
<td><a href="http://xoros.samos.aegean.gr">http://xoros.samos.aegean.gr</a>&lt;br&gt;<a href="mailto:xoros94.2@samos.aegean.gr">xoros94.2@samos.aegean.gr</a></td>
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<tr>
<td>Dancing group</td>
<td><a href="mailto:samodance@aegean.gr">samodance@aegean.gr</a></td>
</tr>
</tbody>
</table>
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, some days are open until 20:00, depending on the available administrative staff. The library has:

- **24,000 volumes of books.** The largest part of the collection is related to the scientific disciplines of Computer Science, Mathematics, Technology and Natural Sciences, in order to serve the teaching and research needs of the Departments of the University Unit of Samos. There are also literary books, essays, etc.
- **360 foreign and Greek journal titles.** Some of these journals are available in electronic form or in microfilm.
- **Access to Electronic Scientific Databases,** which offer the capability of scientific articles search, up to the level of full text.
- **Informational material** (encyclopedias, dictionaries, etc.)
- **Doctoral Dissertations, Master and Diploma Theses.**
- **Audiovisual material** which includes disks, CDs, videotapes, cassettes, CD-ROMs, DVD-ROMs.

All the services of the Library (Lending, Orders, Cataloguing, catalog search, journals, etc.) are automated. The search can be done from the website: http://www.lib.aegean.gr
The primary purpose of the Computing Center is the development and maintenance of the necessary telecommunication and network infrastructure, for serving the teaching and research needs of the Departments of the University Unit of Samos.

In this context, the Computing Center helps and supports users during working hours, assists in software installation, develops and supports new applications as well as telecommunication and network connections that are created in Samos, and takes care of supplying, upgrading and monitoring of equipment and software. Meanwhile, students can use the specialized laboratories of the Department (Laboratories ALKMINI, ELECTRA, 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
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