UNIVERSITY OF PATRAS

SCHOOL OF ENGINEERING

DEPARTMENT
OF
ELECTRICAL AND COMPUTER ENGINEERING

BULLETIN
ACADEMIC YEAR

2018 - 2019

PATRAS 2019

This bulletin was edited by Prof. Michael Logothetis (ERASMUS Coordinator in the ECE Department of the University of Patras) and Prof. Nikolaos Avouris (Director of Interactive Technologies Laboratory, ECE Department, University of Patras).

URL for an electronic version of this Bulletin:
http://www.ece.upatras.gr/en/education/curriculum.html

Chairman’s Address

Prof. Stavros Koubias

Greetings,

The Department of Electrical and Computer Engineering (ECE) of the University of Patras has entered the period of maturity, as it is already in the 5th decade of its life. Currently, it is the largest Department of Polytechnic School, possessing excellent buildings and technological infrastructure. Our Department has gained a leading position in the Greece, and a distinct, valuable place at the international academic level. The development of the Department was so intense, both at the educational level and at the research level, contributing significantly to the high-level scientific potential, that led to the technological development of the country, while at the same time its graduates excel in the academic, scientific and professional field abroad.

Our Department has been evaluated both recently and in the past, by independent evaluators who acknowledged the high quality of the educational and research. The QS World Ranking / Top Universities system (www.topuniversities.com), one of the world’s most reputable information providers for higher education, ranks our Department among the global academic elite, in positions 300–400, after evaluating approximately 15,000 related programs (Departments) internationally.

Developments in the science of Electrical & Computer Engineering were rapid in recent years, while they are anticipated to be even more impressive in the coming years. Our Department considering what is happening both in science and in society, strives to develop and continually improve the undergraduate and postgraduate curriculum, in order to respond to technological progress and to provide modern and high-level education to its students.

This bulletin contains the curriculum of the undergraduate 5-year program of studies together with a summary of the content of the courses, the regulations and the curriculum of the postgraduate studies. Information on the foundation of the University of Patras, the structure and operation of the ECE Department. The curriculum of the undergraduate studies of our ECE Department is continiously evolving and being improved according to the scientific subjects which must correspond both to basic demands and current scientific trends, as well as to current technological peaks. This is a contemporary five-year program that covers the areas of telecommunications & information technology, electrical power systems, electronics & computers, automatic control systems & industrial informatics. There are compulsory courses of basic knowledge, common to all students, as well as elective courses that students must choose according to their special interests. Study in our Department is based upon both theoretical and laboratory consolidation of knowledge.

Our new undergraduate program of studies is divided in 10 semesters. The first six semesters are comprised of compulsory courses common to all students, plus elective courses of general education (of pedagogical, cultural or economic content) and a foreign language and terminology course. At the beginning of the 7th semester, the students have to specialize their studies, by choosing one of the following fields of specialization (while selecting basic courses from other fields of specialization in order to expand their basic knowledge and retain a good degree of specialization):

- Communications
- Information Technology
- Energy Conversion−Power Electronics−Electrical Engineering Materials−Renewable Energy Sources
- Computers
- Electronics and Embedded Systems
- Signal, Systems and Automatic Control

A prerequisite for obtaining the diploma in Electrical & Computer Engineering is the submission of the Diploma / Master Thesis. The 10th semester is devoted exclusively to the thesis in order to enhance its quality and its research character.

The Department adopted the principles and rules of the European Credit Transfer and Accumulation of Credits System (ECTS). Therefore, the transfer and accumulation of successful performance in other relevant programs at national and european level is possible; this facilitates mobility and academic recognition internationally.

The Department also offers a graduate program leading to the granting of a doctorate degree (Ph.D). To enrol in this program, students are selected twice a year basis, if they hold a degree in areas either of technology or sciences. This program initially consists in attending courses (with exams), the number of which depends on the degree held by graduate students, and, in parallel, in carrying out the Ph.D dissertation, the novelty of which is examined in accordance with the international standards.

The Department participates to several multi-disciplinary postgraduate programs: "Integrated Hardware and Software Systems" (in coperation with the Computer Engineering & Informatics Dept.), "Processing Systems of Signals and Communications", "Green Electric Power and the Advanced Network Infrastructure for its Management and Economy" (in coperation with the Dept. of Physics), Biomedical Engineering (in cooperation with the Depts. of Mechanical and Aeronautics, Computer Engineering and Informatics and the School of Medicine.), Space Sciences Technologies and Applications, Human-Computer Interaction, Applied Optoelectronics, and Computational Linguistics.

The Department has 40 faculty members, 3 teaching & research assistants, 3 members of specialized technical education staff, 4 members of laboratory teaching staff, 7 members of administrative personnel, and approximately 2500 undergraduate and postgraduate students.

As Head of this Department, I am sending our most heartfelt wishes for a happy and creative academic year!

The Head of the Department

Patras, September, 2018 — Professor Dr.-Ing. Stavros KOUBIAS

THE DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING
(www.ece.upatras.gr)

History

The Department of Electrical & Computer Engineering was founded as the first department of the School of Engineering in 1967. Initially its name was Electrical Engineering Department. It included eight chairs, an institute and five laboratories (Wireless Communications, General Electrotechnics, Wire Communications, Physical Metallurgy and Nuclear Technology). In the following period up to 1982, eleven more chairs and five laboratories (Applied Electronics, Automatic Control, Computers, Electrotechnics, and Electromechanical Energy Conversion) were established, while six chairs and the laboratories of Physical Metallurgy, Nuclear Technology and Computers were transferred to other departments (Chemical, Mechanical and Computer Engineering).

In accordance with the law 1268/82, the chair system was abolished and Divisions were created within the Departments into which all personnel and the laboratories were incorporated. Three Divisions were formed in the Department of Electrical Engineering as follows:

- Division of Electrical Power Systems (Electric Power Systems Laboratory, Electromechanical Conversion Laboratory, High Voltage Laboratory).
- Division of Telecommunications and Electronics (Wireless Communications Laboratory, Wire Communication Laboratory, Laboratory of Electrotechnics, Applied Electronics Laboratory).
- Division of Systems and Automatic Control (Systems and Measurements Laboratory, Automatic Control Laboratory).

In the '80s, the VLSI-Design Laboratory (Division of Telecommunications and Electronics), the Electrotechnic Materials Laboratory (Division of Electrical Power Systems), and the Automation and Robotics Laboratory (Division of Systems and Automatic Control) were added to the Department. In addition 39 faculty positions were established: 19 for Lecturers, 6 for Assistant Professors, 7 for Associate Professors, and 7 for Professors.

In the beginning of the '90s one more laboratory, the Laboratory of Computer Systems (Division of Telecommunications & Electronics) and further faculty positions were established. In 1994, the Division of Telecommunications & Electronics was split into two: Division of Telecommunications & Information Technology and Division of Electronics & Computers. In 1995 the Department of Electrical Engineering was renamed Electrical & Computer Engineering Department (literally, Electrical Engineering & Computer Technology) honouring its strong activity in the area of computers.

In 2004, two more new laboratories were established, the CCIS – Center for Computing, Information and Communication Systems, and the Digital

Signal and Image Processing Laboratory, which do not belong to Divisions but to the whole ECE Department. In 2016 the laboratory of Interactive Technologies was established in the Division of Electronics and Computers.

The current Divisions and the associated laboratories are as follows:

- **Division of Telecommunications and Information Technology** (Wireless Communications Laboratory, Wire Communications and Information Technology Laboratory, Laboratory of Electrotechnics).
- **Division of Electric Power Systems** (Electromechanical Energy Conversion Laboratory, Electrotechnic Materials Laboratory, Power Systems, Renewable and Distributed Generation Laboratory, High Voltage Laboratory).
- **Division of Electronics and Computers** (Applied Electronics Laboratory, Computer Systems Laboratory, VLSI Design Laboratory, Interactive Technologies Laboratory).
- **Division of Systems and Control** (Advanced Control Center, Laboratory of Automation and Robotics, Systems and Measurements Laboratory, Automatic Control Laboratory).

The Department was initially housed in temporary buildings. Since 1985 it is housed in a three-story building and an adjacent wing, while, a new three-story building was added in 2007.

The Department now has 19 Professors, 10 Associate Professors, 10 Assistant Professors and 1 Lecturer. It offers instruction and conducts research in the fields of Electric Power, Telecommunications, Information Technology, Computers, Electronics, Systems and Automatic Control, which are described below in detail.

Faculty

Professors

- **Antonios Alexandridis**
  (7.12.88)*, Dipl. El. Eng., 1981, (Univ. of Patras), Ph.D. 1988 (West Virginia Univ.).

- **Theodoros Antonakopoulos**
  (6.12.91)*, Dipl. El. Eng., 1985, Dr. El. Eng. 1989 (Univ. of Patras).

- **Nikolaos Avouris**
  (12.1.94)*, Dipl. El. Eng. 1979 (Nat. Tech. Univ. of Athens), M.Sc. 1980, Ph.D. 1983 (UMIST).

- **Alexios Birbas**
  (9.12.91)*, Dipl. El. Eng. 1985, (Univ. of Patras), M.Sc. 1986, Ph.D. 1988 (Univ. of Minnesota).

- **Nikolaos Fakotakis** *(Retired recently)*
  (11.3.87)*, B.Sc. 1978 (Chelsea College, Univ. of London), M.Sc. 1979 (Univ. of Wales), Dr. El. Eng. 1986 (Univ. of Patras).

- **Gabriel Giannakopoulos** *(Retired recently)*
  (28.12.84)*, Dipl. El. Eng., 1975, Dr. El. Eng. 1978 (Univ. of Patras).

- **Efthymios Housos**
  (20.9.89)*, B.Sc. 1975, M.Sc. 1976, Ph.D. 1980 (Columbia Univ., NY).

- **Grigorios Kalivas**
  (2.11.93)*, Dipl. El. Eng. 1980 (Univ. of Patras), M. Eng. 1982, Ph.D. 1990 (Carlton Univ.).

- **Stavros Koubias**
  (16.1.91)*, Dipl. El. Eng. 1976, Dr. El. Eng. 1982 (Univ. of Patras)

* *Note:* The date in brackets refers to the first appointment at the University, not necessarily to the appointment in the present position.

- **Stavros Kotsopoulos**
(25.2.87)*, Physics Degree 1975, (Aristotle Univ. of Thessaloniki), Dipl.El.Eng. 1980, (Univ. of Patras), M.Phil 1978, Ph.D 1986, (Univ. of Bradford, UK)

- **Odysseas Koufopavlou**
(13.4.94)*, Dipl. El. Eng. 1983, Dr. El. Eng. 1990 (Univ. of Patras).

- **Nikolaos Koussoulas**
(25.9.89)*, Dipl. El. Eng. 1977 (Aristotle Univ. of Thessaloniki), C.E.S. 1978 (Ecole Nat. Super. des Telecom.) M.Sc. 1980, Eng. Deg. 1983, Ph.D. 1984 (UCLA, Los Angeles).

- **Michael Logothetis**
(19.4.91)*, Dipl. El. Eng., 1981, Dr. El. Eng. 1990 (Univ. of Patras).

- **Dimitrios Lymperopoulos**
(20.9.89)*, Dipl. El. Eng., 1980, Dr. El. Eng. 1988 (Univ. of Patras).

- **Stamatios Manesis** *(Retired recently)*
(5.3.87)*, Dipl. El.Eng. 1975, Dr. El.Eng. 1986 (Univ. of Patras).

- **John Mourjopoulos**
(14.9.89)*, B.Sc. 1978, M.Sc. 1979, Ph.D. 1985 (Univ. of Southampton).

- **George Moustakides**
(10.1.07)*, Dipl.El.Eng. 1979 (Nat. Techn. Univ. of Athens), M.Sc. 1980 (Univ. of Pennsylvania), Ph.D. 1983 (Univ. of Princeton).

- **Efstathios Perdios**
(87)*, Degree in Math. 1980 (Univ. of Patras), Ph.D. 1985 (Univ. of Patras).

- **Dimitrios Serpanos**
(1.9.2000)*, Dipl. Comp. Eng. 1985 (Univ. of Patras), Ms.C. 1988, Ph.D. 1990 (Univ. of Princeton).

- **Athanasios Skodras**
(86)*, Physics Degree, (Aristotle Univ. of Thessaloniki), Dipl. Comp. Eng., (Univ. of Patras), Doctorate (Univ. of Patras).

- **Emmanuel Tatakis**
(20.7.93)*, Dipl. El. Eng. 1981 (Univ. of Patras), Dr. en Sc. Appl. 1989 (Univ. Libre De Bruxelles).

- **Kleanthis Thramboulidis**
(31.12.90)*, Dipl. El. Eng. 1981, Dr. El. Eng. 1989 (Univ. of Patras).

- **Antonios Tzes** *(Left recently, abroad)*
(11.2.99)*, Dipl. El.Eng. 1985 (Univ. of Patras), M.Sc. Elec.Eng. 1987, Ph.D. 1990 (Ohio State Univ.).

- **Nikolaos Vovos** *(Retired recently)*
(21.12.83)*, Dipl. El.Eng. 1974, (Univ. of Patras), M.Sc. 1975, (UMIST, England), Dr. El. Eng. 1978 (Univ. of Patras).

Associate Professors

- **Spyros Denazis**
(11.10.2004)*, Degree in Math. 1987 (Univ. of Ioannina), Ph.D. in Comp. Science 1993 (Univ. of Bradford).

- **Evangelos Dermatas**
(23.8.96)*, Dipl. El. Eng. 1984, Dr. El. Eng. 1991 (Univ. of Patras).

- **Tzogia Kappatou**
(30.8.99)*, Dipl. El. Eng. 1975, Dr. El. Eng. 1991 (Univ. of Patras).

- **Panagiotis Kounavis**
(31.12.93)*, Physics Degree 1984, Ph.D. 1991 (Univ. of Patras).

- **Costas Moustakas**

* *Note:* The date in brackets refers to the first appointment at the University, not necessarily to the appointment in the present position.

(12)*, Dipl. El. Eng. 2003, Dr. El.Eng 2007 (Aristotle Univ. of Thessaloniki).

- **Vassilios Paliouras**
  (21.7.2003)*, Dipl. El. Eng. 1992, Dr. El. Eng. 1999 (Univ. of Patras).

- **Eleftheria Pyrgioti**
  (7.10.99)*, Dipl. El. Eng. 1981, Dr. El.Eng. 1991 (Univ. of Patras).

- **Panagiotis Svarnas**
  (10)*, Dipl. El.Eng., Dr. El. Eng. (Univ. of Patras) and PhD in Physics (Univ. de Pau et des Pays de l'Adour).

- **Kyriakos Sgarbas**
  (11.10.2004)*, Dipl. El. Eng. 1989, Dr. El. Eng. 1997 (Univ. of Patras).

- **Eleftherios Skouras**
  (2016)*, Physics Degree (Univ. of Patras), Ph.D. (Imperial College, Univ. of London).

- **Constantine Sorras** *(Retired recently)*
  (31.12.90)*, Dipl. El. Eng. 1981, Dr. El.Eng. 1989 (Univ. of Patras) - *Retired (2016)*.

- **Thomas Zacharias**
  (31.12.85)*, Dipl. El. Eng. 1974, Dr. El. Eng. 1981 (Univ. of Patras).

Assistant Professors

- **Michael Birbas**
  (11.03.14)*, Dipl. El. Eng., Dr. El. Eng. (Univ. of Patras).

- **Sofia Daskalaki**
  (96)*, Degree Math. 1980 (Aristotle Univ. of Thessaloniki), M.Sc. 1983 (Oregon State University), Ph.D. 1988 (Univ. of Massachusetts).

- **Vassilis Kalantonis**
  (06)*, Degree in Math 1998, M.Sc. 2001, Dr. -Eng.Sc. 2004 (Univ. of Patras).

- **Demosthenes Kazakos**
  (14.9.89)*, Dipl. El.Eng. 1982 (Univ. of Patras), D.E.A. 1984 (Ecole Nat. Super. de Mechanique-Nantes), Dr. El.Eng. 1987 (Polytec. Nat. de Grenoble).

- **Michael Koukias** *(Retired recently)*
  (5.2.87), Dipl.El.Eng. 1975 (Univ. of Patras), MSc. 1980 (UMIST), Dr. El.Eng. 1986 (Univ. of Patras).

- **Stavros Koulouridis**
  (09)*, Dipl. El. Eng. 1999, Dr. El. Eng. 2003 (Nat. Techn. Univ. of Athens).

- **Michael Markakis**
  (04)*, Degree in Math. 1986 (Univ. of Athens), M.Sc 1987 (Université Paris VII), Ph.D. 1995 (Nat. Techn. Univ. of Athens).

- **Epaminondas Mitronikas**
  (5.12.03)*, Dipl. El. Eng. 1995, Dr. El.Eng. 2002 (Univ. of Patras).

- **Vasilis Stylianakis**
  (19.4.91)*, Dipl. El.Eng. 1981, Dr. El. Eng. 1990 (Univ. of Patras).

- **George Theodorides**
  (09)*, Dipl. El. Eng. 1994, Dr. El.Eng. 2001 (Univ. of Patras).

- **Dimitris-Alexandros Toumpakaris**
  (13.4.07)*, Dipl. El. Eng. 1997 (Nat. Techn. Univ. of Athens), Ms.C. 1999, Ph.D. 2003 (Stanford Univ.).

Lecturers

- **Polyxeni Stathopoulou** *(Retired recently)*

* *Note:* The date in brackets refers to the first appointment at the University, not necessarily to the appointment in the present position.

(30.6.06)*, Physics Degree 1975 (Univ. of Naples, Italy), Dr. El. Eng. 1989 (Univ. of Patras).

- **Panagis Vovos**
(8.01.14)*, Dipl. El. Eng. 2002, PhD 2005 (Univ. of Edinburgh).

Professors Emeriti

- **George Bitsoris**
(10.5.85)*, Dipl. El. Eng. 1973 (Nat. Techn. Univ. of Athens), DEA Automatique 1974, Dr. d'Etat 1978 (Univ. Paul Sabatier de Toulouse), Dr. Habil 1982 (Univ. of Patras).
- **Christos Georgopoulos**
(20.9.89)*, B.Sc. El.Eng. 1963 (Univ. of Lowell), M.Sc. 1967 (Northeastern Univ.), Dr.El.Eng. 1975 (Univ. of Patras).

- **Constantine Goutis**
(26.4.85)*, Physics Degree, 1966 (Univ. of Athens), M.Sc. 1974 (Herriot-Watt Univ.), Ph.D. 1978 (Univ. of Southampton).

- **Peter Groumpos**
(9.9.88)*, M.Sc. 1976, Ph.D. 1979 (State Univ. of New York at Buffalo).

- **Robert Eric King**
(20.9.89)*, B.Sc., M.Sc. (Victoria Univ. Of Manchester), Ph.D (Queens Univ. Of Belfast), D.Sc. (Victoria Univ. of Manchester).

- **George Kokkinakis**
(1.8.69)*, Dipl.-Ing. 1961, Dr.-Ing. 1966, Dipl.-Wirt.-Ing.1967 (Technical Univ., Munich).

- **Vasilios Makios**
(3.11.73)*, Dipl.-Ing. 1962, Dr.Ing. 1966 (Technical Univ., Munich).

- **George Papadopoulos**
(6.4.74)*, B.Sc. EE 1963 (City Univ., NY), M.Sc. EE 1964, Ph.D. 1970 (MIT).

- **Triantafillos Pimenides**
(30.4.84)*, Degree in Math. 1974 (Univ.of Athens), Dipl.El.Eng. 1981, Dr.El.Eng. 1984 (Univ. of Patras).

- **Athanasios Safacas**
(22.9.75)*, Dipl.-Ing. 1967, Dr.-Ing. 1971 (Technical Univ. Karlsruhe, Germany).

- **Nikolaos Spyrou**
(26.7.91)*, Mathematics Degree 1975 (Aristotle Univ. of Thessaloniki), DEA 1976, Doctorat 3eme Cycle 1979 (Univ. de Paris-Sud.)

- **Thanos Stouraitis**
(2.7.90), Physics Degree 1979, M.Sc. Elec. Autom. 1981 (Univ. of Athens), MSc. 1983 (Univ. of Cincinnati), Ph.D. 1986 (Univ. of Florida, Gainesville).

- **Dimitrios Tsanakas**
(20.9.89)*, Dipl.-Ing.1970, Dr.-Ing. 1976 (Technical Univ. Darmstad, Germany).

Honorary Doctorate/Professorship Awards

- **Bartholomew 1st** (Archbishop of Constantinople, New Rome and Ecumenical Patriarch)

- **Georgios B. Giannakis** (Professor in Signal Processing)

- **Evangelos S. Eleftheriou** (Dr Eng. in Communications)

- **Gerhard Hosemann** (Professor in Electrical Power Systems)

- **Christos H. Papadimitriou** (Professor in Algorithms and Complexity)

- **Alex Papalexopoulos** (Dr Eng. in Electrical Power and Energy Management Systems)

- **Joseph Sifakis** (Professor in Information Systems)

- **Yannis Tsividis** (Professor in Electronis)

- **Marylin Hendrix Wolf** (Professor in Embedded Systems)

Administration

- *Head of the Department*

Professor **Stavros Koubias**
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Email: head@ece.upatras.gr

- *Deputy Head of the Department*

Professor **Antonios Alexandridis**
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Fax: +30 2610 997 350
Email: alexandridis@ece.upatras.gr

- *Director of the Division of Telecommunications & Information Technology*

Professor **Theodoros Antonakopoulos**
Electrical & Computer Engineering Building, 3rd floor
Tel.: +30 2610 996 487
Fax: +30 2610 997 342
Email: antonakopoulos@upatras.gr

- *Director of the Division of Electric Power Systems*

Professor **Antonios Alexandridis**
Electrical & Computer Engineering Building, East Wing
Tel.: +30 2610 996 404
Fax: +30 2610 997 350
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- *Director* of the Division of Electronics and Computers

Professor **Efthymios Housos**
Electrical & Computer Engineering Building, 2nd floor
Tel: +30 2610 996 434
+30 2610 997 305
Fax: +30 2610 996 820
Email: housos@ece.upatras.gr

- *Director of the Division of Systems and Control*

Assist. Professor **Demosthenes Kazakos**
Electrical & Computer Engineering Building, 1st floor
Tel: +30 2610 996 461
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Email: kazakos@ece.upatras.gr

- *Departmental General Assembly*
  - Head of the Department
  - Deputy Head of the Department
  - Directors of the Divisions
  - Thirty (30) faculty members representing the Faculty.
  - One Representative of the Special Educational Staff.
  - One Representative of the Laboratory Teaching Staff.
  - One Representative of the Special Technical Laboratory Staff.
  - One Representative of the Undergraduate Students.
  - One Representative of the Postgraduate Students.

- *Departmental General Assembly with Special Composition*
  - All faculty members of the General Assembly.
  - Two Representatives of the Postgraduate Students.

- ***Secretariat and the Registrar's Office***
  Secretary: **Zoi Dotsika**
  Electrical & Computer Engineering Building, 1st floor
  Tel.: +30 2610996492
  Fax.:+30 2610991720
  Email: secretary@ece.upatras.gr

  Erasmus Secretary: **Rania Doufexi**
  Electrical & Computer Engineering Building, 1st floor
  Tel.: +30 2610996420
  Fax.:+30 2610991720
  Email: raniadou@upatras.gr

- ***Departmental ERASMUS Coordinator***
  Michael Logothetis
  Tel.: +30 2610996433
  Fax: +30 2610996471
  Email: mlogo@upatras.gr

- ***Institutional ERASMUS Coordinator***
  Nikolaos Karamanos
  (Vice-rector for International & Academic Affairs)
  Tel.: +30 2610996605
  Fax.: +30 2610997153
  Email: vice_rector_acaic@upatras.gr
  Email: N.K.Karamanos@upatras.gr

- ***International Affairs Department***
  Maria Kotsari
  Email: intern.rel@upatras.gr
  kotsari@upatras.gr
  Tel.: +30 2610969028

- ***ERASMUS Office***

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Mariza Charalampopoulou
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Dimitra Stamatopoulou
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STAFF / TEACHING MOBILITY
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intern.rel@upatras.gr
Tel.: +30 2610996610

CURRICULUM

The courses of the curriculum are divided into ten sections, which correspond to the ten academic semesters. These include both compulsory and elective courses. An abbreviated title is given for each course; the complete title is given in the following description of the curriculum courses. Each course may include lectures, seminars, and laboratory practice. The corresponding teaching hours per week are listed in the curriculum together with their credit units. The credit unit corresponds to one hour's lecture or seminar per week for one semester, or one hour's laboratory practice per week for twelve weeks. Specifically, the *European Credit Transfer and Accumulation System (ECTS)* is applied.

The credit units **ECTS** are based on the student workload required by the average student so as to achieve the objectives of a studying programme, according to the anticipated learning results, as well as the abilities and dexterity that should have been acquired after the successful completion of this programme.

The ECTS were instituted in order to make possible the transfer and accumulation of successful outcomes to similar studying programs in the same or another University, both on a national and European level. This fact facilitates mobility and academic recognition.

According to the ECTS, the work load required by every student during one full academic year of studies includes an average of: thirty six (36) to forty (40) full weeks of study, preparation, and examinations, which is estimated to be between one thousand five hundred (1500) and one thousand eight hundred (1800) working hours, which in turn correspond to sixty (60) ECTS.

On this basis, the five year undergraduate studies programme of our ECE Department leading to the Diploma of Electrical & Computer Engineering (equivalent to a Masters' Degree), correspond to 60 x 5 = 300 ECTS, in total. These include 40 ECTS for a diploma thesis which is compulsory for all students. The 300 ECTS are equally divided to the ten (10) semesters of study, and therefore, each semester corresponds to 30 ECTS.

Coding: The course code contains basically six characters. The meaning of these characters is as follows:
ECE denotes the **ECE** department.
The following character denotes either a compulsory or elective course, or the Division offering the course:

Y: Compulsory course for all students
E: Elective course
A: Division of Telecommunication & Information Technology
B: Division of Electric Power Systems
C: Division of Electronics & Computers
D: Division of Systems and Control
F: Foreign Language

5th digit: Semester the course belongs to.
6th and 7th digit: Current number of the course in the semester.
Abbreviations used in the following tables:

L: lectures (hours/week)
S: seminars (hours/week)
LAB: laboratory (hours/ week).

FIRST YEAR

1st Semester

Code	Course	L	S	LAB	ECTS
ECEY101	Single Variable Functions Calculus	4	2	0	6
ECEY104	Linear Algebra	2	1	0	3
ECEY106	Intr. to Computers	3	0	2	6
ECEY107	Modern Physics	3	1	0	4
ECEY108	Applied Physics	3	1	0	4
ECEY109	Digital Logic	2	2	0	4
Select 1 of:					
ECEF210	Foreign Lang. - Eng.	3	0	0	3
ECEF220	Foreign Lang. - Fra.	3	0	0	3
ECEF230	Foreign Lang. - Ger.	3	0	0	3
ECEF240	Foreign Lang. – Rus	3	0	0	3
			Total Credits:		**30**

2nd Semester

Code	Course	L	S	LAB	ECTS
ECEY211	Electrical Circuits I	3	1	0	5
ECEY212	Multivar. Functions Calculus & Vector Anal.	3	1	0	5
ECEY213	Applied Physics Lab.	0	0	2	3
ECEY214	Differential Equations	2	2	0	4
ECEY215	Procedural Programming	3	1	2	6
ECEY216	Engineering Mechanics	3	1	0	4
ECEY210	Intr. to ECE science	2	1	0	3
			Total Credits:		**30**

SECOND YEAR

3rd Semester

Code	Course	L	S	LAB	ECTS
ECEY302	Electrical Circuits II	3	1	2	7
ECEY304	Partial Diff. Equations & Transforms	4	1	0	6
ECEY306	Probability & Statistics	3	1	0	4
ECEY310	Solid State of Matter	3	1	0	5
ECEY404	Digital Logic Circuits & Systems	2	1	1	5
ECEY	Object Oriented Technology	2	1	0	3
				Total Credits:	**30**

4th Semester

Code	Course	L	S	LAB	ECTS
ECEY501	Electromagnetic Fields I	2	1	0	4
ECEY403	Microelectronic Circuits & Devices	3	1	0	6
ECEY406	Power Circuits Analysis	3	1	0	5
ECEY409	Computer Organization	3	1	0	4
ECEY410	Communications Networks	2	1	2	6
ECEY411	Signal & Systems	4	1	0	5
				Total Credits:	**30**

L: Lectures, S: Seminars, LAB: Laboratory

THIRD YEAR

5th Semester

Code	Course	L	S	LAB	ECTS
ECEY501	Electromagnetic Fields I	2	1	0	4
ECEY502	Analogue Integrated Electronics	3	1	3	7
ECEY505	Electrical Machines I	3	0	3	6
ECEY505	Automatic Control Systens	3	1	0	4
ECEY603	Signals & Systems II	3	0	0	4
ECEY604	Communication Systems	2	1	2	5
				Total Credits:	**30**

6th Semester

Code	Course	L	S	LAB	ECTS
ECEY601	Electromagnetic Fields II	3	1	0	4
ECEY602	Digital Integrated Circuits & Sys.	3	1	3	7
ECEY504	Intr. to Power Systems	3	1	0	4
ECEY605	Electrical Machines II	3	0	3	6
ECEY606	Digital Control Systems	3	0	2	5
ECEY608	Algorithms & Data Structures	2	2	0	4
				Total Credits:	**30**

L: Lectures, S: Seminars, LAB: Laboratory

FIELD OF SPECIALISATION: COMMUNICATIONS

FOURTH YEAR

7th semester: 30 ECTS

Code	Course	L	S	LAB	ECTS
	Group A				
ECEA702	Information Theory	3	1	0	5
ECEA701	Microwaves	2	1	0	5
ECEA805	Wireless Propagation	2	1	2	5
ECEA710	Digital Communications I	3	1	0	5
	Group B				
ECEA707	Artificial Intelligence	2	1	2	5
ECEC802	Operating Systems	2	2	0	5
ECEC706	Digital Signal Processing	3	0	2	5
ECEA805	Access & Switching Networks	2	1	0	5

8th Semester: 30 ECTS

Code	Course	L	S	LAB	ECTS
	Group A				
ECEA706	Antenna Theory	2	1	0	5
ECEA811	Wireless & Mobile Commun. Networks	2	2	0	5
ECEA806	Teletraffic Theory	2	2	0	5
ECEA001	Optical Communications	2	0	2	5
	Group B				
ECEC905	Telecom Electronics	2	1	0	5
ECEA003	Digital Communications II	3	1	0	5
ECEC702	Adv. Programming Techniques	2	1	2	5
ECEC008	Architecture of Ultra Fast Digital Systems	3	3		5
ECEC806	Adv. Digital Signal Processing	3	1	0	5
ECEC009	Linear & Combinatorial Optimization	2	1		5

L: Lectures, S: Seminars, LAB: Laboratory

FIELD OF SPECIALISATION: INFORMATION TECHNOLOGY

FOURTH YEAR

7th semester: 30 ECTS

Code	Course	L	S	LAB	ECTS
	Group A				
ECEA707	Artificial Intelligence	2	1	2	5
ECEA702	Information Theory	3	1	0	5
ECEA703	Electroacoustics	3	1	0	5
ECE	Information Retrieval	2	2	2	5
ECEC706	Digital Signal Processing	3	0	2	5
	Group B				
ECEA911	Computer Graphics & Virtual Reality	2	1	2	5
ECE ME5	Biomechanics	3	1	0	5

8th Semester: 30 ECTS

Code	Course	L	S	LAB	ECTS
	Group A				
ECEA807	Pattern Recognition	3	0	2	5
ECEA008	Digital Audio Technology	3	1	0	5
ECEC003	Digital Image Processing	3	1	0	5
	Group B				
ECEA906	Speech & Natural Lang. Processing	3	1	0	5
ECE	Intr. to Bioinformatics	3	1	0	5
ECEHY56	Data Mining & Learning Algorithms	3	1	0	5
ECEC706	Digital Signal Processing Laboratory	1	0	3	5
ECED901	Intelligent Control	3	1		5
ECE	Intelligent Programming	3	1		5
ECE	Cryptography	3	1		5
ECEC806	Adv. Digital Signal Processing	3	1	0	5
ECEA812	Computational Geometry & 3D Apps	2	1	2	5

L: Lectures, S: Seminars, LAB: Laboratory

FIELD OF SPECIALISATION:
ENERGY CONVERSION−POWER ELECTRONICS−ELECTRICAL ENGINEERING MATERIALS−RENEWABLE ENERGY SOURCES

FOURTH YEAR

7th Semester: 30 ECTS

Code	Course	L	S	LAB	ECTS
	Group A				
ECEB703	Power Electronics I	4	0	2	5
ECEB707	Electrical Installations	4	0	0	5
ECEB006	Electric Motor Drive Systems I	3	0	2	5
	Group B				
ECEB706	Electrical Power Systems Analysis	3	0	3	5
ECED701	State-Space Linear Systems Analysis	3	0	0	5
ECEA805	Wireless Propagation	2	1	2	5
ECEA703	Electroacoustics	3	1		5
ECEC704	Adv. Analog/Dig. Circuits&Compon.	2	1	0	5
ECEC706	Digital Signal Processing	3	0	2	5
ECE ME5	Biomechanics I	3	1	0	5
ECEB7M1	Thermal Plants	3	1	0	5

8th Semester: 30 ECTS

Code	Course	L	S	LAB	ECTS
	Group A				
ECEB803	Power Electronics II	4	0	2	5
ECEB905	Renewable Energy Sources I	3	0	0	5
ECEB902	High Volt. (Tests & Measurements)	3	0	3	5
	Group B				
ECEB002	Overvoltage/Lightning Protection	3	0	0	5
ECE	Electric Motor Drive Systems II	3	0	2	5
ECEB901	Power Sys. Control & Stability	3	0	3	5
ECED802	Digital Control	3	1		5
ECEA807	Pattern Recognition	3	0	2	5
ECEA703	Electroacoustics	3	1		5
ECEC704	Adv. Analog/Dig. Circuits&Compon.	3	1	0	5
ECEA008	Digital Audio Technology	3	1	0	5
ECE ME5	Biomechanics II	3	1	0	5
ECEB8M1	Energy Design &Air Conditioning	3	1	0	5

L: Lectures, S: Seminars, LAB: Laboratory

FIELD OF SPECIALISATION: COMPUTERS

FOURTH YEAR

7th Semester: 30 ECTS

Code	Course	L	S	LAB	ECTS
	Group A				
ECEC801	Computer Architecture	2	1	0	5
ECEC802	Operating Systems	2	1	0	5
ECEC901	Data Bases	3	0	2	5
ECEC703	Microcomputers & Microsystems	3	0	2	5
ECEC903	Adv. Microprocessors Systems	3	0	2	5
	Group B				
ECEA911	Computer Graphics & Virtual Reality	2	1	2	5
ECEA807	Pattern Recognition	3		2	5
ECEA707	Artificial Intelligence	2	1	2	5
ECEC706	Digital Signal Processing	3	0	2	5

8th Semester: 30 ECTS

Code	Course	L	S	LAB	ECTS
	Group A				
ECEC702	Adv. Programming Techniques	3	0	2	5
ECEC005	Internet Programming	3	0	2	5
ECEC903	Adv. Microprocessors Systems	3	0	2	5
	Group B				
ECEHY56	Data Mining & Learning Algorithms	3	0	0	5
ECEC006	Distributed Real-time Embedded Sys.	3	0	0	5
ECEC009	Linear & Combinatorial Optimization	3	0	0	5
ECEC008	Architecture of Ultra Fast Digital Sys.	3	0	0	5
ECEA812	Computational Geometry & 3D Apps	3	0	2	5

L: Lectures, S: Seminars, LAB: Laboratory

FIELD OF SPECIALISATION: ELECTRONICS AND EMBEDDED SYSTEMS

FOURTH YEAR

7th Semester: 30 ECTS

Code	Course	L	S	LAB	ECTS
	Group A				
ECEC704	Adv. Analog/Dig. Circuits&Compon.	2	1	0	5
ECEC705	VLSI Design I	3	0	2	5
ECEC901	Data Bases	3	0	2	5
ECEC703	Microcomputers & Microsystems	3	0	2	5
ECEC903	Adv. Microprocessors Systems	3	0	2	5
	Group B				
ECE	Photoelectronic Devices	3	0	2	5
ECEA701	Microwaves	3	0	0	5
ECEC706	Digital Signal Processing	3	0	2	5
ECEA703	Electroacoustics	3	1	0	5
ECEB703	Power Electronics I	4	0	2	5
ECEC801	Computer Architecture	2	1	0	5

8th Semester: 30 ECTS

Code	Course	L	S	LAB	ECTS
	Group A				
ECEC905	Telecom Electronics	2	1	0	5
ECEC804	VLSI Design II	3	0	2	5
ECEC006	Distributed Real-time Embedded Sys.	3	0	0	5
ECEC903	Adv. Microprocessors Systems	3	0	2	5
	Group B				
ECE	Nanoelectronics	3	0	0	5
ECEA001	Optical Communications	2	0	2	5
ECEC008	Architecture of Ultra Fast Digital Sys.	3	0	0	5

L: Lectures, S: Seminars, LAB: Laboratory

FIELD OF SPECIALISATION: SIGNALS, SYSTEMS AND AUTOMATIC CONTROL

FOURTH YEAR

7th Semester: 30 ECTS

Code	Course	L	S	LAB	ECTS
	Group A				
ECED701	State-Space Linear Systems Analysis	3	1	0	5
ECEA702	Information Theory	3	1	0	5
ECEC903	Adv. Microprocessors Systems	3	0	2	5
ECEC706	Digital Signal Processing	3	0	2	5
	Group B				
ECED702	Applied Optimization	3	1	0	5
ECEA710	Digital Communications I	3	1	0	5

8th Semester: 30 ECTS

Code	Course	L	S	LAB	ECTS
	Group A				
ECEA807	Pattern Recognition	3	0	2	5
ECED802	Digital Control	3	1	0	5
	Group B				
ECED006	Optimal Control	3	1	0	5
ECED904	Estimation Theory&Stochastic Control	3	1	0	5
ECEC702	Adv. Programming Techniques	3	1	0	5

L: Lectures, S: Seminars, LAB: Laboratory

FIELD OF SPECIALISATION: COMMUNICATIONS AND/OR INFORMATION TECHNOLOGY

FIFTH YEAR

9th Semester: 30 ECTS

Code	Course	L	S	LAB	ECTS
Group A (Minimum selection of 1 Course - Theory)					
ECEA908	Access Communications	2	1	0	4
ECEA910	Broadband Networks	2	1	0	4
ECEA9111	Computer Graphics&Virtual Reality	2	1	0	4
ECEA9112	Computer Graphics&Virtual Reality(Lab)	0	0	2	2
ECEA912	Antenna Theory&Microwave Apps (Lab.)	0	0	2	4
ECEA002	Multimedia Communications	2	1	0	4

Courses from the 7th semester of the same fields of specialization that have not already been chosen.

Group B

Code	Course	ECTS
ECEDE900	Diploma/Master Thesis (**Compulsory selection**)	16,14,12
ECEPA900	Training jointly with ECEDE900 (optional)	4

10th Semester: 30 ECTS

Code	Course	L	S	LAB	ECTS
Group A (Minimum selection of 1 Course - Theory)					
ECEA9061	Speech & Natural Lang. Processing	2	1	0	4
ECEA9062	Speech & Natural Laqng. Proc.(Lab)	0	0	2	2
ECEA0011	Optical Communications	2	1	0	4
ECEA0012	Optical Communications (Lab.)*	0	0	2	2
ECEA0091	Embedded Communications Sys.	2	1	0	4
ECEA0091	Embedded Commun. Sys. (Lab.)	0	0	2	2
ECEA005	Network Management	2	1	1	5
ECEA011	Person. Telemed/Biomedical Sys.	2	1	0	4

Courses from the 8th semester of the same fields of specialization that have not already been chosen.

Group B

Code	Course	ECTS
ECEDE100	Diploma/Master Thesis (**Compulsory selection**)	12,14,16
ECEPA100	Training jointly with ECEDE100 (optional)	4

* *Not taught during the current academic year.*

L: Lectures, S: Seminars, LAB: Laboratory

FIELD OF SPECIALISATION: ENERGY CONVERSION−POWER ELECTRONICS−ELECTRICAL ENGINEERING MATERIALS−RENEWABLE ENERGY SOURCES

FIFTH YEAR

9th Semester: 30 ECTS

Code	Course	L	S	LAB	ECTS
Group A (Minimum selection of 1 Course - Theory)					
ECEB9021	High Volt. Tests	3	0	0	4
ECEB9022	High Volt. Tests (Lab.)	0	0	2	2
ECEB906	Power Electronics & Indust. Apps	3	0	0	4
ECEB909	Elec. Machines Dynamics	3	0	0	4
ECEB911	Adv. Control of Elec. Machines	3	0	0	4
ECEB005	Renewable Energy Sources II	3	0	0	4
Course from the 7th semester of the same field of specialization, which has not already been chosen.					
Group B					
ECEDE900	Diploma/Master Thesis (**Compulsory selection**)				16,14,12
ECEPA900	Training jointly with ECEDE900 (optional)				4

10th Semester: 30 ECTS

Code	Course	L	S	LAB	ECTS
Group A (Minimum selection of 1 Course - Theory)					
ECEB001	Electromechanical Dynamics & Control	2	1	0	4
ECEB002	Overvoltage/Lightning Protection	3	0	0	4
ECEB011	Insulation&Nanostructured Dielectrics	3	0	0	4
Course from the 8th semester of the same field of specialization that have not already been chosen.					
Group B					
ECEDE100	Diploma/Master Thesis (**Compulsory selection**)				12,14,16
ECEPA100	Training jointly with ECEDE100 (optional)				4

L: Lectures, S: Seminars, LAB: Laboratory

FIELD OF SPECIALISATION: COMPUTERS AND/OR ELECTRONICS & EMBEDDED SYSTEMS

FIFTH YEAR

9th Semester: 30 ECTS

Code	Course	L	S	LAB	ECTS
Group A (Minimum selection of 1 Course - Theory)					
ECEC902	Software Sys. /Analysis & Design	2	1	0	4
ECEC9041	Integrated Sys. Design - VLSI	3	0	0	4
ECEC9042	Integrated Sys. Design - VLSI (Lab.)	0	0	2	2
ECEC910	Computer & Network Security	3	0	0	4
ECEC911	Parallel/Distributed Processing & Apps	3	0	0	4
ECEC0041	Human-Machine Interaction & Design	3	0	0	4
ECEC0042	Human-Machine Interact.&Design(Lab.)	0	0	2	2
ECEC010	Internet of Things	2	1	0	4
Courses from the 7th semester of the same fields of specialization that have not already been chosen.					
Group B					
ECEDE900	Diploma/Master Thesis (**Compulsory selection**)				16,14,12
ECEPA900	Training jointly with ECEDE900 (optional)				4

10th Semester: 30 ECTS

Code	Course	L	S	LAB	ECTS
Group B10 (Minimum selection of 1 Course - Theory)					
ECEC003	Digital Image Processing	3	0	0	4
ECEC006	Distributed Real-time Embedded Sys.	3	0	0	4
ECEC0051	Internet Programming	3	0	0	4
ECEC0052	Internet Programming (Lab.)	0	0	2	2
ECEC008	Architecture of Ultra Fast Digital Sys.	3	0	0	4
ECEC009	Linear & Combinatorial Optimization	3	0	0	4
Courses from the 8th semester of the same fields of specialization that have not already been chosen.					
Group B					
ECEDE100	Diploma/Master Thesis (**Compulsory selection**)				12,14,16
ECEPA100	Training jointly with ECEDE100 (optional)				4

L: Lectures, S: Seminars, LAB: Laboratory

FIELD OF SPECIALISATION: SIGNALS, SYSTEMS AND AUTOMATIC CONTROL

FIFTH YEAR

9th Semester: 30 ECTS

Code	Course	L	S	LAB	ECTS
Group A (Minimum selection of 1)					
ECED006	Optimal Control	3	0	0	4
ECED702	Applied Optimization	3	0	0	4
Courses from the 8th semester of the same field of specialization that have not already been chosen.					
Group B					
ECEDE900	Diploma/Master Thesis (**Compulsory selection**)				16,14,12
ECEPA900	Training jointly with ECEDE900 (optional)				4

10th Semester: 30 ECTS

Code	Course	L	S	LAB	ECTS
Group A (Minimum selection of 1)					
ECED904	Estimation Theory & Stochastic Control	3	0	0	4
ECED907	Non-Linear Control	3	0	0	4
ECED003	Adaptive Control	3	0	0	4
ECED010	Networked Robotic Systems	3	0	1	4
ECED011	Networked Robotic Systems (Lab.)	0	0	2	2
ECED8021	Digital Control	3	0	0	4
ECED8022	Digital Control (Lab.)	0	0	2	2
ECED901	Intelligent Control	3	0	0	4
Group B					
ECEDE100	Diploma/Master Thesis (**Compulsory selection**)				12,14,16
ECEPA100	Training jointly with ECEDE100 (optional)				4

L: Lectures, S: Seminars, LAB: Laboratory

DESCRIPTION OF COURSE UNITS

FIRST YEAR

1st semester

Code	**ECEY101**
Title	Single Varibale Functions Calculus
Instructor	Perdios Kalantonis
Credits	6 ECTS

Content:
The derivative. Rules of differentiation. The exponential function. Mean value theorems. Taylor's formula. Curvature. The indefinite integral. Simple methods of integration. Integration of rational functions. Non integrable functions. Areas as limits. The definite integral. Numerical integration. The length of a curve. Additional topics. Rational and irrational numbers. The binomial expansion. Uniform continuity. Differentiation under the integral sign. Roots of equations. Successive approximations. Curve fitting. Least squares. Series of numbers. Tests of convergence. Absolute convergence. Series approximation. Series of functions. Uniform convergence. Properties of power series and Taylor series. Improper integrals. Difference equations.

Code	**ECEY107** **ECEY108**
Title	**Modern Physics** **Applied Physics**
Instructor	Kounavis
Credits	4 + 4 ECTS

Content:
INTRODUCTION. What is Physics, physical quantities, measurements, standards and the International System of units (SI), space, time and mass measurements. The Big Bang, the expansion of the universe, gravitation theories, the fundamendal forces, interstellar matter collapse and star generation, the fundamental components of the universe, galaxies, the Milky Way galaxy, Hubble’s law, the cosmological redshift, the lives and deaths of stars, star collapse, red giants and white dwarfs, neutron stars, black holes, the Hertzsprung-Russel star diagram. Comets, meteorites, asteroids, Kepler’s laws of planetary motion, escape velocity, the Sun and the solar system.
ELASTICITY. The solid state of matter, the crystalline structure of matter, defects in matter and elastic properties of solid materials, strain and deformation, Hook’s law, the modulus of elasticity, bulk modulus, shear modulus, the Poisson constant and relations among elastic constants. Elastic limit and ultimate strength of materials.
WAVE MOTION. Phenomena in wave motion, types of waves, superposition, interference, diffraction, wave propagation through an elastic medium, sinusoidal

waves, standing waves, water waves, tidal and seismic waves, the Richter scale, sound effects, shock waves, the Doppler effect, the human ear, intensity of sound waves, pressure of sound waves, response of the ear to sound waves, the dB scale, sound pollution.

FLUID MECHANICS. Density, pressure and lift in a fluid, the Archimedes' principle, characteristics of flux, fluid dynamics, Bernoulli's law, surface tension, viscosity, friction in solids and fluids.

THERMODYNAMICS. The kinetic theory of gases, the molecular interpretation of temperature, the mean free path, the Maxwellian distribution, thermodynamic laws and thermodynamic processes, state equations, the ideal gas and real gases, thermal capacity, thermal expansion in solids and fluids, phase diagramms, phase transformations, phase equillibrium diagramms, work and thermodynamic cycles, heat flow. The Carnot cycle, heat engines, refrigerators and heat pumps, the liquefaction of gases, critical phenomena, superfluidicity. The thermal conductivity coefficient, reversible and non-reversible processes, entropy, latent heat.

KINETICS. Motion, speed, acceleration. Translational, rotational and cyclic motion. Vector derivatives. Velocity and accelaration in polar coordinates. The relativity of motion. The special theory of relativity. Scalar and vector product of vectors.

DYNAMICS. Force, mass, Newton's laws. Inertial and non-inertial reference systems. Equations of motion of the particles in one, two and three dimensions. Circular motion. Solution of the equations of motion. Applications. Forces of inertia. Dynamics of solid bodies. The centre of mass and moment of inertia. Examples. Equations of motion in rotational motion and solutions. Angular momentum and conservation. Static equillibrium in a solid body.

WORK-ENERGY. Work and kinetic energy. Conservative and non-conservative forces. Potential energy. Momentum and impulse. Conservation of momentum. Elastic and inelastic collisions, shock loading and impact phenomena.

QUANTUM PHYSICS. The limits of visible light. The blackbody spectrum. Wien's shift law. Stefan-Boltzmann's law. Efficiency of light sources. Planck's theory-quantization of energy. Quantization of the electric charge. The photoelectric effect. Photons, Einstein's photoelectric equation. Frank-Hertz' experiment. The dual aspect of matter. The principle of complementarity. Davison-Germer's experiment. Scattering of radiation-quantum interpretation of the Compton effect. The Bragg relationship. Heisenberg's principle of uncertainty.

ATOMIC PHYSICS. The spectrum of the electromagnetic radiation. Linear spectra. The Hydrogen spectrum. The Rydberg constant. The scattering of α-particles. The quantum model of the atom. The main axioms of Bohr's theory. Standing energy levels. The structure of an atom. The principle of correlation. The fine texture constant. Stern-Gerlach's experiment. Pauli's prohibitive principle and the periodic table of the elements. Lasers and masers, principle and applications. Optical pumping, ruby laser, He-Ne laser and Ar laser. Fluorescence and phosphorescence.

NUCLEAR PHYSICS. Characteristics of an atom. Magnitude and shape of a nucleus-nuclear structure. Classification of nuclei. The line of stability and the prohibitive principle. The mass spectrograph. Nuclear binding energy. Nuclear transitions. Radioactive decay, the disintegration constant, the half-life and the mean life. Nuclear fission. The model of the drop for a nucleus. The quantum mechanics' tunnel effect-the Strutinski model. Separation of isotopes, enrichment methods. Nuclear energy, nuclear reactors. Energy production in stars, thermonuclear fusion, nuclear and thermonuclear weapons. Protection from radioactivity. Physics of elementary particles, accelerators, exotic matter and quarks. Cosmology.

ELECTRICITY-MAGNETISM. Electric charge, Coulomb's law, electric field, Gauss' law, electrostatic potential. Electric energy. Dielectrics and condensers. Electric conductivity. Direct current circuit, Kirchhoff's rules. Dangers from electric currents. Electric discharges. Magnetic field, magnetic flux. Biot-Savart's law. Magnetic materials. The motion of a charged particle in a magnetic field. The Hall effect and the quantum Hall effect. Ampere's law. Electromagnetic induction. The superconducting state, the Meissner effect, electron-phonon interaction and the Cooper pairs. Superconductors in magnetic fields, superconducting elements, alloys and compounds, applications of superconductivity.

OPTICS. Nature and propagation of light, interaction of electromagnetic radiation with matter, reflection and refraction. Dispersion and scattering. Geometric optics. Mirrors and lenses, the human eye and optical instruments. Interference, diffraction, scattering and polarization. Electron and X-ray diffraction in crystals.

Code	**ECEY106**
Title	**Introduction to Computers**
Instructor	Avouris Paliouras Sgarbas Karavatselou Dilios
Credits	6 ECTS

Content:

1. Digital representation, digital arithmetic. Information digitization and Character encoding.
2. Procedural programming with Python: Arithmetic expressions and commands, input/output and selection commands.
3. Loops, library functions (modules), functions defined by the user
4. Sequences, strings, lists, dictionaries and tuples.
5. Files, interface to the operating system
6. Sorting and searching algorithms, complexity.
7. Object Oriented Programming in Python, Definition of classes, objects, methods, inheritance.
8. Graphical user interfaces, programming with tkinter.
9. Computer architecture, Memory, Memory hierarchy, Central Processing Unit.
10. Operating systems: process management, scheduling, virtual memory.
11. Introduction to computer networks and the Internet. web programming
12. Data retrieval from the Internet.
13. Social aspects of computing, free and opensource software.

Lab.: The course includes laboratory exercises involving algorithmic and programming and group work project.

Code	**ECEY104**
Title	**Linear Algebra**
Instructor	Daskalaki Markakis
Credits	3 ECTS

Content:

Matrices and linear systems. Definitions and basic operations. Transpose. Sub-matrices. Determinant. Inverse. Gauss elimination. Rank. Non-unique solution of systems. Linear dependence of vectors. Eigen values and applications. Definitions and properties. The coefficients of the characteristic polynomial. Similarity and diagonalisation. Iterative methods. Instability of solutions. Quadratic forms. Functions of matrices. Vector spaces.

Code	**ECEY111**
Title	**Engineering Drawing**
Instructor	P.Vovos Pyrgioti Mitronikas
Credits	5 ECTS

Content:
– Introduction to Computer Aided Design (CAD). – Practice on orthogonal projection. – Full section: definition and design. – Complex sections. – Introduction to electrical design. – Lighting circuits. – Simple electrical installations. – One line diagrams for domestic electrical installation. – Design of electrical service panels. – Basic principles and design of automation circuits.

Code	**ECEY109**
Title	**Digital Logic**
Instructor	Antonakopoulos
Credits	4 ECTS

Content:
Introduction to digital systems. Number systems. Base Conversion. Binary arithmetic. Coding. Complement Arithmetic. Boolean Algebra. The Huntington Postulator De Morgan's theorem. Switching Function. Karnaugh maps. Quine-McClusky Algorithm. Combinational Logic. Design of Switching Circuits. Adders. Comparators. Multiplexers. Demultiplexers. Encoders/Decoders. Programmable Logic Arrays. Sequential Circuits. Flip-flops, counters. Asynchronous and synchronous sequential circuits. State Machines.

Code	**ECEF210**
Title	**Foreign Language – English**
Instructor	Rizomilioti
Credits	3 ECTS

Code	**ECEF220**
Title	**Foreign Language - French**
Instructor	
Credits	3 ECTS

Code	**ECEF230**
Title	**Foreign Language – German**
Instructor	Savva
Credits	3 ECTS

Code	**ECEF240**
Title	**Foreign Language - Russian**
Instructor	Ioannidou
Credits	3 ECTS

Code	**ECEE133**
Title	**Marketing & Sales**
Instructor	Karagianni
Credits	3 ECTS

Code	**ECEE138**
Title	**History of the European Literature**
Instructor	Gotsi
Credits	3 ECTS

2nd semester

Code	**ECEY211**
Title	**Electrical Circuits and Measurements**
Instructor	Koussoulas
Credits	5 ECTS

Content:
Circuits of lumped elements. Kirchhoff's Laws. Circuits elements: Resistor, Capacitors, Inductors, Coupled Inductors. The response of simple RC, and RLC circuits state variables. The response of constant linear circuits: Convolution state equations. Sinusoidal steady state: Phasors, impedance, admittance, network functions, resonance.
General principles. The concept of measurement. Accuracy and precision of measurements. Errors in measurements. Systematic and random errors. Combined errors. Statistical analysis of measurement data. Analogue, digital and comparison methods of measurement. Display methods. Basic analogue instruments for resistance, current and voltage measurement. Recording instruments. Magnetic tape recorders of analogue data. Cathode ray oscilloscopes. Analogue electronic instruments. Q-meter.

DC-AC bridges and their application. Measurements of resistance, inductance, capacitance, mutual inductance and frequency. Single and double ratio transformer bridges. Digital instruments-D/A and A/D conversion.

Code	**ECEY212**
Title	**Multivariable Functions and Vector Analysis**
Instructor	Kalantonis Perdios
Credits	5 ECTS

Content:
Functions of several variables. Partial derivative. Taylor expansion. Implicit functions and functional determinants. Maxima and minima of functions of two variables. Maxima and minima under constraints. Vector algebra. Vector functions. Derivatives. Vector operators. Curvilinear co-ordinates. Rotation of co-ordinates. Integrals. Line integrals. Applications in the theory of curves and surfaces. Double integrals. Area of a surface and volume of a three-dimensional region. Triple integrals. Applications in material surfaces and volumes.

Code	**ECEY213**
Title	**Apllied Physics Lab.**
Instructor	Kounavis
Credits	3 ECTS

Content:
Laboratory Exercises:
Lab.1 MEASUREMENTS, PRECISION OF MEASUREMENT-ERROR
Lab.2 DETERMINATION OF ERROR TRANSMISSION THROUGH CALCULATIONS
Lab.3 DETERMINATION OF DENSITY OF SOLID MATERIALS
Lab.4 PENDULUM OSCILLATION: MEASUREMENT OF ACCELERATION OF GRAVITY
Lab.5 A STUDY OF MOVEMENT IN A FLUID, VISCOSITY MEASUREMENT

Lab.6 STUDY OF WAVE PROPAGATING IN A CORD-STADING WAVES
Lab.7 MEASURING SPEED OF SOUND
Lab.8 DETERMINATION AND MAPPING OF ELECTROSTATIC FIELDS
Lab.9 DETERMINATION AND MAPPING OF ELECTROSTATIC FIELDS
Lab.10 MEASURING SPEED OF LIGHT A LED
Lab.11 MEASURING ELECTRICAL RESISTANCE AND SPECIFIC CONDUCTIVITY
Lab.12 A STUDY OF CHARGING AND DESCHARGING OF A CAPACITOR: RC CIRCUIT
Lab.6 STUDY AND MEASUREMENT OF MAGNETIC FIELD

Code	**ECEY214**
Title	**Differential Equations**
Instructor	Markakis
Credits	4 ECTS

Content:
Definitions and basic concepts. Ordinary DE. Linearity and linearisation. First order linear equations. Existence and behaviour of solutions. Equations reducible to linear. Non-linear DE. Existence and behaviour of solutions. Approximation methods. Direction field. Envelopes. Variables separable and homogeneous equations. Riccati equations. Exact equations. Integrating factors. Existence and uniqueness theorem for first-order equations. 2nd-order equations. Non-linear 2nd-order equations reducible to first-order. 2nd-order linear equations. The homogeneous equation. Fundamental solutions. Linear independence. Reduction of order. The homogeneous equation with constant coefficients. The non-homogeneous equation. Undetermined coefficients method. Variation of parameters method. Applications. Mechanical and electrical oscillations. Higher-order linear equations. Linear nth-order equation general. nth-order homogeneous equation. Non-homogeneous nth-order. Numerical methods. Euler, Taylor, Runge-Kutta methods.

Code	**ECEY215**
Title	**Procedural Programming**
Instructor	Dermatas Paliouras Karavatselou Dilios
Credits	6 ECTS

Content:
Introduction. Program development process. Language alphabet. Imperative-Procedural programming paradigm (C language): variables, data types, operators, expressions, statements, control statements. Arrays, type conversion, functions, recursion, scope, duration, program structure, pointers, complicated declarations, structures, input/output, file handling. Object-Oriented programming paradigm (Java language): Introduction to Object-Oriented concepts, class & object, attribute, operation, encapsulation. Java as an Object-Oriented language. Inheritance, polymorphism, constructors, garbage collection, overloading, shadowing, visibility modifiers, exception handling.

Code	**ECEY216**
Title	**Engineering Mechanics**
Instructor	Polyzos
Credits	3 ECTS

Content:
Introduction to Mechanics. The Basic Units of Mechanics. Elementary vector analysis. Static of Particles. Equilibrium of rigid bodies. Method of virtual work. Analysis of structures. Forces in beams and cables. Friction. Centroids and centres of gravity. Introduction to Dynamics. Kinematics of particles and systems of particles. Dynamics of rigid bodies. Mechanical vibrations with one degree of freedom.

Code	**ECEY210**
Title	**Intoduction to the Science of Electrical Engineer**
Instructor	ECE Faculty Members (Coordinator : Mourjopoulos)
Credits	3 ECTS

Content:
The course offers a global overview of the topics attained by the students during their future studies and prepares them for the necessary skills required for their subsequent academic and professional development. The course is structured around 8 lectures from different professors, covering basic, tutorial and research topics from all the 4 Divisions of the Department. The students are then preparing and submit a report on a selected topic related to these lectures. Furthermore, the professors of the Department propose additional topics for group projects, carried out throughout the semester. The course is successfully completed when both the submitted report and the presentation of the group project has received passing grade.

SECOND YEAR

3rd semester

Code	**ECEY402**
Title	**Electrical Circuits: Analysis & Design II**
Instructor	Koussoulas
Credits	7 ECTS

Content:
Independent network equations: Topological network. The methods of node voltages, loop currents and state variables. Frequency response: Laplace transforms, natural modes, network functions, network theorems. Two ports. Distributed parameter networks: The homogenous transmission line. Introduction to linear systems analysis.

Code	**ECEY304**
Title	**Partial Differential Equations and Transforms**
Instructor	Markakis
Credits	4 ECTS

Content:
Algebraic equations. Root finding. Iterative methods. Solution of non-linear simultaneous equations. Newton's iteration method and parameter perturbation. Solution of linear simultaneous equations. Gaussian elimination with pivoting. Iterative methods Gauss-Seidel and over-relaxation. Algebraic eigenvalue problems. Convergence acceleration. Richardson extrapolation. Numerical integration. Numerical optimisation. One-dimensional search techniques. Interpolation. Approximation. Curve fitting. Numerical solution of ordinary differential equations.

Taylor, Euler, Runge-Kutta methods. Midpoint rule. Multistep and predictor-corrector methods. Numerical instability. Two-point boundary value problems. Finite differences methods for partial differential equations. Numerical methods laboratory.

Code	**ECEY306**
Title	**Probability & Statistics**
Instructor	Daskalaki
Credits	5 ECTS

Content:
I. Introduction to probability. Counting techniques and applications. Conditional probability. Univariate and multivariate random variables. Cumulative distribution functions, probability functions and probability density functions. Functions of random variables. Independence of random variables. Conditional distributions. Moments, moment generating functions and characteristic functions. Covariance and correlation. Conditional expectation and variance. Applications of useful distributions: Bernoulli, binomial, multinomial, hypergeometric, geometric, negative binomial, Poisson, uniform, exponential, Gamma, Beta, Weibull, normal, lognormal, $\chi 2$, t, F and the multivariate normal. The Poisson stochastic process. Inequalities and limit theorems. Reliability and hazard rate. The exponential and Weibull distributions in reliability. **II.** Random sampling. Descriptive statistics. Sampling distributions and normal distribution. Basic principles of point estimation. Interval estimation. Statistical Intervals on the mean, proportion and variance of one population. Statistical Intervals on a difference in means, on a difference in proportions and on the ratio of two variables. Simple linear regression.

Code	**ECEY310**
Title	**Solid State of Matter**
Instructor	Svarnas
Credits	5 ECTS

Content:
Bonds between atoms: Bohr’s model of the atom, Pauli’s exclusion principle and the shell model of the atom, atoms in solids, ionic bonding, the repulsive force, metallic bond, the covalent bond, bonds between molecules, the relationship between the type of bond and the physical properties of a solid.
Crystals and crystalline solids: close-packed structures, non-close-packed structures, the crystal lattice, labelling crystal planes, X-ray diffraction, electron microscopes, allotropic phase transitions (changing the crystal structure).
Electrical properties of metals: Drude’s classical theory of electrical conduction, failures of the classical model, Bloch’s quantum theory of electrical conduction, band theory of solids, distribution of the electrons between the energy states (the Fermi-Dirac distribution), the density of states, the free electron model, the density of occupied states, band theory of electrical conduction.
Semiconductors: band theory of solids, the difference between insulators and semiconductors, holes, optical properties of semiconductors, the effective mass, n-type semiconductors, p-type semiconductors, majority and minority carriers, the Hall effect, the free electron model applied to semiconductors.
Semiconductor devices: junctions between two metals (the contact potential), the p-n junction (a qualitative description), the p-n junction (a quantitative analysis), the p-n junction with an applied voltage (qualitatively), the p-n junction with an applied voltage (quantitatively), transistors

(an introduction), bipolar transistors, the field-effect transistor, the integrated circuit, heterojunctions, optoelectronic devices.

Magnetic properties: macroscopic magnetic quantities, atomic magnets, materials with magnetic moment, Pauli paramagnetism, Curie paramagnetism, ordered magnetic materials, temperature dependence of permanent magnets, band theory of ferromagnetism, ferromagnetic domains, soft and hard magnets, applications of magnetic materials for information storage.

Superconductivity: the discovery of superconductivity, the resistivity of a superconductor, the Meissner effect, type II superconductors, superconductivity of superconductors, type I and type II, high-temperature superconductors, superconducting magnets, SQUID magnetometers.

Dielectrics: induced polarization, other polarization mechanisms, the frequency dependence of the dielectric constant, resonant absorption and dipole relaxation, impurities in dielectrics, piezoelectricity, ferroelectrics, dielectric breakdown.

Crystallization and amorphous solids: the melting point, crystallization, amorphous solids, optical properties of amorphous solids, amorphous semiconductors, amorphous magnets.

Polymers: elastic properties of rubber, the rubbery and glassy states, amorphous and crystalline polymers, oriented crystalline polymers, conducting polymers.

Code	**ECEY404**
Title	**Digital Logic Design**
Instructor	Theodoridis Fakotakis
Credits	5 ECTS

Content:

Single-bit memory elements: The T flip-flop, the SR flip-flop, the JK flip-flop, the D flip-flop, the latching action of a flip-flop.

Counters: series and parallel connection of counters, synchronous up/down-counters, decade binary up-down-counter, decade grey code counter, asynchronous binary counters, scale-of-ten asynchronous counter, asynchronous resettable counters, integrated-circuit counters.

Shift register counters and generators: shift register with parallel loading, shift registers as counters, the universal state diagram for shift registers, the design of a decade counter, shift register sequence generators, the ring counter.

Clock-driven sequential circuits: analysis of a clocked sequential circuit, the design procedure for clocked sequential circuits, the design of a sequence generator, moore and mealy state machines, pulsed synchronous circuits, state reduction, state assignment.

Event-driven circuits: races and cycles, race-free assignment for a three-state machine, race-free assignment for a four-state machine, a sequence detector.

Hazards: gate delays, the generation of spikes, the production of static hazards in combinational networks, the elimination of static hazards, design of hazard-free combinational hazards, detection of hazards in an existing network, dynamic hazards.

Code	**ECEC707**
Title	**Object Oriented Technology**
Instructor	Thramboulidis
Credits	5 ECTS

Content:

1. Introduction. Embedded Systems, Mechatronics, Cyber Physical Systems, IoT. From the Procedural to the Object Oriented Programming. The paradigm

shift. Abstraction (data - procedural - HAL)

2. Introduction to the object Technology. Object, class, instance. The program as an aggregation of objects. Class diagram. Object interaction diagram.
3. Introduction to the Object-Oriented Programming. The conceptual model of the object-oriented programming. Introduction to Java. The Java as an extension of C. The basic library of Java.
4. Inheritance, simple and multiple. The interface construct.
5. Polymorphism, early vs. late binding.
6. Abstraction in user interface. GUIs. The Abstract Window Toolkit (awt).
7. Exception handling. Garbage collection.
8. Event Handling.
9. Multithreading.
10. Network programming constructs for distributed applications. Servlets. Socket Programming. Java support for SOA.

Lab.1 The restrictions of C and the need for stronger language constructs. The reverse Polish notation calculator case study. Data abstraction. The Logic Gate simulator.

Lab.2 Hardware abstraction layer. Using ARM® Cortex™-M0+ processor (ARM University Program).

Lab.3 Using the BlueJ environment in the development of object-oriented applications. Exploiting the basic Java library. Simple example applications. The Reverse Polish Notation calculator.

Lab.4 The Eclipse environment for the development of object-oriented applications. Development of Reverse Polish Notation calculator with graphical user interface (3 exercises).

Lab.5 Development of a Logic Gate Simulator.

Lab.6 Network programming. Sockets, Client-Server model. Robot remote controller.

Lab.7 Multi-threading in Java. Development of Producer Consumer application.

4th semester

Code	**ECEY501**
Title	**Electromagnetic Fields I**
Instructor	Skouras Koulouridis
Credits	4 ECTS

Content:
Introduction. Relationship between electromagnetic and circuit theory. Vector Analysis Elements, Coordinate Systems. Gradient, Divergence, Rotation, Gauss, Stokes, Helmholtz Theorems.
Electrostatic field. Coulomb law. Electrical charge distributions. Electric field of point charge and continuous charge distributions. Flat and solid angles. Gauss law in Integral and differential form. Electric flux. Electric displacement. Electric potential. Circulation of electric field intensity. Potential and electric field strength ratio.
Conductors. Conditions in the interior and the surface of the conductors. Optical representation of electrostatic fields. Theorem of the reciprocity of Green. Electrostatic induction.
Calculation Methods. Poisson and Laplace equations, boundary conditions problems. Image Theory, Non-Static Charges' Images. Multipolar method, multipolar potential expansion, electric dipole. Method of variables' Separation. Introduction to numerical methods, finite difference method.
Dielectric materials. Polarization, polarization charges, polarized dielectric fields, Gauss law in dielectrics, dielectric materials types, dielectric constant, dielectric strength, boundary conditions in the interface of two media, Poisson - Laplace equations in dielectric, microscopic theory of dielectrics. Electrostatic shielding. Electrostatic energy. Conductor systems, Potential, capacitance and induction factors. Capacitance of isolated conductor, capacitors, partial capacitance.
Electrostatic forces and torques. Coulomb method, electrostatic pressure, Maxwell's pressure tensor method.
Continuous Currents Electric Field. Defintion, Electric Current Density, Electric Current distribution, Continuity equation, Boundary conditions. Relaxation time of electric Charge, Power Consumption, Joule's law. Resistance and conductivity, Methods of calculating the resistance, Modeling the sources of electric energy, The laws of Kirchhoff

Code	**ECEY403**
Title	**Microelectronic Circuits & Devices**
Instructor	Kalivas Skouras
Credits	4 ECTS

Content:
Microelectronic Systems. Linear Circuits, p-n junctions. diodes. Non Linear Circuit Applications, Junction Field Effect Transistors (JFETs). MOSFETs. Bipolar Transistors (BJT). Biasing. Transistors Models. One Stage Amplifiers. The Transistor as a Switch. SPICE. Integrated Circuits. Basic Technology of Integrates Circuits Manufacture. State of the Art Microelectronic Devices (METFETs. HEMTs. BiCMOS. SENSORS).

Code	**ECEY406**
Title	**Power Circuits Analysis**
Instructor	Alexandridis P. Vovos
Credits	5 ECTS

Content:

Sinusoidal steady-state analysis of single phase circuits: The sinusoidal source, the sinusoidal response, the concept of phasors, the passive circuit elements in the frequency domain, laws and methods for circuit analysis in the frequency domain, series and parallel resonance. Power in circuits with sinusoidal excitation: Instantaneous, real and reactive power, the concept of complex power, apparent power, the power triangle, power factor correction, equivalent circuits of loads. Circuits with periodic non sinusoidal excitation: Harmonics, power with periodic non sinusoidal voltages and currents. Multiphase circuits: Two-phase system. Symmetrical three- phase system under symmetrical load. One phase equivalent circuit. Symmetrical three- phase system under unsymmetrical load. Shift of the neutral point of the load in relation to neutral point of the source. Active, reactive and apparent power of the three- phase circuits with symmetrical and unsymmetrical load. Measurement of active and reactive power in symmetrical and unsymmetrical three- phase circuits. The two Wattmeter method (ARON). Phase sequence. Symmetrical components: Definition of symmetrical component transformation. Loads sequence impedances. Unsymmetrical three- phase voltages with symmetrical loads. Sequence circuits. Symmetrical component powers.

Code	**ECEY409**
Title	**Computer Organization**
Instructor	Theodoridis
Credits	4 ECTS

Content:

Basic principles: History of computer systems, Abstractions and technology. Performance and power consumption issues. Metric for evaluating the processor’s performance. Single- and multi-core computing systems.
Language of the computer: Operations of the computer hardware. Instruction set of the MIPS processor. Instructions for arithmetic, logic, and conditional operations. Functions and procedures. Addressing modes. Compilation and execution of the software. .
Arithmetic for computers: Algorithms for addition, subtraction, multiplication, and division in fixed- and floating-point arithmetic and their hardware implementations.
Central Processing Unit: Datapath, control, and memory units and their organization. Single-cycle implementation of the MIPS’ CPU. Pipeline and performance. Pipelined datapath and control units. Hazards (structural, data, control) in pipelined implementations and their addressing. Five-stage implementation of the MIPS’ CPU.
Memory: Memory technologies. Memory hierarchy and performance issues. Cache memory (organization, operation, and implementation). Virtual memory.

Code	**ECEY410**
Title	**Communications Networks**
Instructor	Logothetis Lymperopoulos Denazis
Credits	6 ECTS

Content:

• **Introduction:** Computer Networks and the INTERNET. Communication Protocol. Open Systems Interconnection. The protocol layers stack of the Internet. The Network Edge. The Network Core. Networks with Virtual

Circuits and Datagrams. Delay and Loss in Packet-Switched Networks. Delay and Loss in Circuit-Switched Networks

- **Elementary teletraffic/queuing theory.**
- **Application Layer (AL):** Principles of AL Protocols**.** WEB – HTTP, FTP, SMTP, DNS.
- **Transport Layer (TL):** The goal. The TL of the Internet. Basic multiplexing/de-multiplexing functions in TL. The User Datagram Protocol (UDP) (Segment structure, Checksum). Principles of Reliable Data Transfer. Stop & Wait protocol. Pipelining. The Transport Control Protocol (TCP). The TCP connection. Round-Trip time. Determination of the length of the "Sequence Numbers" field**.** Flow control. Congestion Control. Best Transmission Window Size.
- **Network Layer:** The goal. The Service Model (Virtual Circuits – Datagrams). Routing. Centralized and distributed routing algorithms. Hierarchical Routing. The Internet Protocol (IP). IPv4 addresses. Subnets definition through subnet mask. Moving a Datagram from Source to Destination: Addressing, Routing and Forwarding. The ICMP Protocol. Routing in the Internet. Intra-Autonomous System Routing: RIP, OSPF. Inter-Autonomous System Routing: BGP. IPv6. Transition from IPv4 to IPv6. Inside a Router. Head of the Line Blocking. Virtual Output Queues.
- **Data Link Layer (DLL):** The goal. The services. Broadcast channels and PPP. Adapters Communicating. Error Detection and Error Corrections Techniques. MAC – Channel Partitioning Protocols: TDM, FDM,CDMA. – Random Access Protocols: CSMA, CSMA/CD (Ethernet), IEEE 803.11 (WiFi). – Taking-Turns Protocols: Polling – Token Pass. Hubs, Bridges and Switches (comparison with routers). The LAN as a DLL protocol.
- **LABARATORY EXCERCISES (Based on OPNET, WIRESHARK and LINUX).**

Code	**ECEY411**
Title	**Signals and Systems**
Instructor	Skodras
Credits	5 ECTS

Content:
The emphasis of the course is on Continuous Time Signals and Systems. More specifically, the following topics are covered in detail: continuous time signals; linear time invariant continuous time systems; analysis in the time domain (convolution); analysis in the frequency domain (Fourier transform, Fourier series); state space system description; frequency response of continuous time systems; design of basic continuous time filters.

THIRD YEAR

5th semester

Code	**ECEY501**
Title	**Electromagnetic Fields I**
Instructor	Skouras Koulouridis
Credits	4 ECTS

Content:
Introduction. Relationship between electromagnetic and circuit theory. Vector Analysis Elements, Coordinate Systems. Gradient, Divergence, Rotation, Gauss, Stokes, Helmholtz Theorems.
Electrostatic field. Coulomb law. Electrical charge distributions. Electric field of point charge and continuous charge distributions. Flat and solid angles. Gauss law in Integral and differential form. Electric flux. Electric displacement. Electric potential. Circulation of electric field intensity. Potential and electric field strength ratio.
Conductors. Conditions in the interior and the surface of the conductors. Optical representation of electrostatic fields. Theorem of the reciprocity of Green. Electrostatic induction.
Calculation Methods. Poisson and Laplace equations, boundary conditions problems. Image Theory, Non-Static Charges' Images. Multipolar method, multipolar potential expansion, electric dipole. Method of variables' Separation. Introduction to numerical methods, finite difference method.
Dielectric materials. Polarization, polarization charges, polarized dielectric fields, Gauss law in dielectrics, dielectric materials types, dielectric constant, dielectric strength, boundary conditions in the interface of two media, Poisson - Laplace equations in dielectric, microscopic theory of dielectrics. Electrostatic shielding. Electrostatic energy. Conductor systems, Potential, capacitance and induction factors. Capacitance of isolated conductor, capacitors, partial capacitance.
Electrostatic forces and torques. Coulomb method, electrostatic pressure, Maxwell's pressure tensor method.
Continuous Currents Electric Field. Defintion, Electric Current Density, Electric Current distribution, Continuity equation, Boundary conditions. Relaxation time of electric Charge, Power Consumption, Joule's law. Resistance and conductivity, Methods of calculating the resistance, Modeling the sources of electric energy, The laws of Kirchhoff

Code	**ECEY502**
Title	**Analogue Integrated Electronics & Systems**
Instructor	Kalivas M. Birbas Gialelis
Credits	7 ECTS

Content:
Review of one stage amplifiers-Linear and non Linear Circuits- Differential Amplifiers-Operational Amplifiers-Frequency Response-Feedback-Stability of Feedback Amplifiers-Output stages and Power amplifiers-Analogue integrated Circuits. Filters. Tuned Amplifiers-Oscillators-Switched capacitors Wave Generators.

Code	**ECEY505**
Title	**Electrical Machines I**
Instructor	Kappatou Mitronikas Tatakis
Credits	6 ECTS

Content:
The basic principles of the electric and magnetic field, iron losses, leakage. Transformers: Basic construction (core, windings). Cooling, voltage equations and equivalent circuit of single-phase transformer, operation behaviour, efficiency, short-circuit operation, parallel operation of transformers, calculation of the leakage. Three-phase transformers, winding connections, unbalanced duty. Transformers for measurements. Advanced equivalent circuit, heating of transformers. Direct current machines: Basic construction, windings, induced voltage, electromagnetic torque, magnetic field and armature reaction, compole winding and compensating winding, armature current, current commutation, armature reaction, connections of DC machines, operation as generators and as motors, starting, braking, voltage and speed control.

Code	**ECEY506**
Title	**Automatic Control Systems**
Instructor	
Credits	4 ECTS

Content:
Introduction to Control System (ACS), open and closed loop systems. Laplace transform. System representation (block diagrams, signal flow graphs). Transfer function for a class of servo-mechanisms. Electromechanical ACS. Hydraulic and pneumatic ACS. Stability analysis. Stability criteria. Analysis of ACS in time (root locus) and frequency domain (Nyquist, Bode, Nichols). Direct and inverse polar plots. Stability of ACS in frequency domain (gain margin, phase margin, Nyquist criteria). Constant M and N contours for a closed system on complex plain. Second order systems. Steady state and transient specifications (accuracy, sensitivity, rise time, settling time, overshoot etc.)

Code	**ECEY603**
Title	**Signals and Systems II**
Instructor	Skodras
Credits	4 ECTS

Content:
The main emphasis of this course is on Discrete Time Signals and Systems. More specifically, the following topics are covered: discrete time signals; discrete time systems (linear time invariant); convolution of discrete time signals; discrete time Fourier transform; discrete Fourier transform; fast Fourier transform; Z-transform; signal sampling; frequency response of discrete time systems. Introduction to stochastic signals.

Code	**ECEY604**
Title	**Communications Systems**
Instructor	Logothetis Antonakopoulos Dermatas Mourjopoulos Karavatselou Mandellos
Credits	5 ECTS

Content:
Introduction: Communication concept and model. Basic components and resources of communications systems. Analog and digital systems (Transmitter - Transmission Channel - Receiver - Distortion - Interference). Examples. Brief review of the evolution of communications systems.

Analog Transmission: Need of Modulation. Amplitude Modulation Systems. Demodulation. Angle modulation: Frequency and Phase Modulation. Demodulation of FM signals.

Effect of noise on Analog Transmission. The noise as a Stochastic Signal. Power Spectral Density. White Noise. Bandpass noise. Efficiency of the Amplitute Modulation Systems in the presence of noise. Efficiency of the Frequency Modulation Systems in the presence of noise. Pre-emphasis, De-emphasis. Comparison of FM - AM systems.

Digitazation of analog signals: Sampling theorem. Quantization of analog signals. Quantization noise.

Pulse Modulation: Pulse Amplitute Modulation (PAM), Pulse Duration Modulation (PDM / PWM), Pulse Position Modulation (PPM), Pulse-Coded Modulation (PCM). Efficiency of PCM in the presence of noise. PCM system of 1st and higher order.

Signal multiplexing: Orthogonal, Time Division Multiplexing (TDM), Frequency Division Multiplexing (FDM).

Digital Transmission: General: Symbol coding, Line coding, Transmission Rate, Error rate, Shannon-Hartley Theorem (Shannon's capacity). Spectral (bandwidth) efficiency.

Baseband digital transmission: Pulse transmission. Inter-Symbol Interference (ISI). Eye Pattern. 1st and 2nd Nyquist criteria. Filters of Rise Cosine. Transmission channel with Additive White Gaussian Noise. Equalizer and Matched Filter. Baseband transmission using M-ary PAM. Probability of error in the presence of Gaussian noise (use of Q-function).

Digital transmission with modulated carrier: Amplitute Shift Keying (ASK, On-Off Keying, OOK), Frequency Shitf Keying (FSK), Phase Shift Keying (PSK), Combined Phase and Amplitute Modulation (QAM), M-ary Phase Modulation (QPSK, 8PSK, 16PSK) and other M-ary modulations. Constellations.

Examples of communications systems.

6th semester

Code	**ECEY601**
Title	**Electromagnetic Fields II**
Instructor	Koulouridis
Credits	4 ECTS

Content:
Static currents: Current density and continuity equation, Ohm law, electromotive force, resistance. Static current problems solving, Electrostatic equilibrium, Comparison of dielectrics and conductors equations. Static magnetic fields: Ampere and Biot-Savart laws and problem solving. Static magnetic fields in materials. Boundary conditions. Faraday law. Magnetic field dynamic energy, induction definition. Time-Variance fields: Maxwell equations, Displacement current, Wave equation, Dispersion equation, Energy and power flow. Poynting theorem. Sinusoidal time variance. Actual value and complex notation of sinusoidal waves, Helmholtz equations. Waves and propagations: Planar waves, Propagation of planar waves in conductors and isolators, Planar field polarization, skin effect, Reflection and Diffraction of planar waves, horizontal and vertical polarization, Reflection law, Snell law, Critical angle. Total reflection, Brewster angle. Normal and oblique incidence in dielectric and conductive media. Propagation constants. Wave types.

Code	**ECEY602**
Title	**Digital Integrated Circuits & Systems**
Instructor	Kalivas M. Birbas Gialelis
Credits	7 ECTS

Content:
General aspects of digital circuits and time response, delay and power consumption issues. Inverters and gates based on TTL, ECL, MOS and CMOS families, with ephasis on the latter. Use of SPICE for the analysis of the above circuits. Combinatorial digital circuits: adders, comparators, parity, multiplexers/demultiplexers, encoders/de-coders, ROM structures and applications. Sequential digital circuits: flip/flops, counters, timing circuits, memories. Dynamic structures for VLSI digital circuits and systems: dynamic MOS cells and RAMs. Digital system design using MSI components and FPGA development tools. This course is accompanied by laboratory exercises that comprise all the above aspects.

Code	**ECEY504**
Title	**Introduction to Electric Power Systems**
Instructor	P. Vovos
Credits	4 ECTS

Content:
History of Electric Power Systems. Present and future trends. Computers in power systems Engineering. Introduction to electrical energy transmission and distribution systems. Resistance, inductance and capacitance of transmission lines. Inductive interference with neighbouring communi-cation circuits. Overhead line insulators and corona. Mechanical design of overhead transmission lines. Underground cables. Distribution systems. Determination of size of conductors for distribution system. Voltage drop compensation and power loss minimisation in a distribution system. Current and voltage relation on a short transmission line medium length line and longs transmission line. Reactive compensation of

transmission lines. Wave propagation on transmission lines. System modelling per-unit impedances. Power flow analysis of transmission networks.

Code	**ECEY605**
Title	**Electrical Machines II**
Instructor	Kappatou Mitronikas Tatakis
Credits	6 ECTS

Content:
Induction Machines: Basic construction, windings, magnetic field, equations and equivalent circuit, power, currents, electromagnetic torque, starting, heating, Ossana's circle, speed control, theory of the squirrel-cage-rotor machines, higher harmonics. Synchronous machines: Basic construction, cooling, excitation, non salient-pole machines, magnetic field equations, electromagnetic torque, parallel operation, current circle diagram, armature reaction, behaviour under load, short-circuits, salient pole machine, inductive reactances, steady state equations, current circle diagram, vibrations, stability, starting, synchronism, power control. Single phase machines: Synchronous, asynchronous.

Code	**ECEY606**
Title	**Digital Control Systems**
Instructor	Kazakos
Credits	5 ECTS

Content:
Model reduction methods (approximation to second order system). Performance Indices (IAE, ISE, ITAE etc.) Root locus compensation (cascade compensation using lead, lag, lead-lag circuit). Controller design in time domain (PI, PD, PID) Closed loop tracking performance based on the frequency response. Cascade compensation in frequency domain (using Bode, Nichols plots). Controller design in frequency domain (PI, PD, PID). Studies for three term industrial controllers. Feedback compensation in time and frequency domain. Introduction to discrete control. Discretization of analog systems. Sampling, signal conditioning and reconstruction. Analog-to-digital and digital-to-analog conversion. Quantization errors. Stability of discrete transfer functions. Discrete control system design. Performance issues of discrete controllers for analog and discrete plants. Simulation of computer controlled systems. Applications of computer controlled systems.

Code	**ECEY608**
Title	**Algorithms and Data Structures**
Instructor	Housos
Credits	4 ECTS

Content:
Introduction, performance analysis, array and structures, stacks & queues. Lists. Trees. Graphs. Sorting. Searching. Recursive algorithms, hashing.

FIELD OF SPECIALIZATION: COMMUNICATIONS AND/OR INFORMATION TECHNOLOGY

FOURTH YEAR

7th semester

Code	**ECEA701**
Title	**Microwaves**
Instructor	Koulouridis
Credits	5 ECTS

Content:
Transmission Lines Theory:. Circuit analysis of transmission line. Electromagnetic analysis and distributed elements. Telegrapher’s equations. Lossless transmission line termination. Smith Chart. λ/4 transformer. Source and load matching. Lossy transmission lines.
Transmission lines and Waveguides. General solutions for TEM, TE και TM modes. Parallel plates waveguide. Rectangular and circular waveguide. Coaxial line. Striplines. Microstrips
Microwave Network Analysis. Impedance and equivalent voltages and currents. Impedance and Admittance matrices. Scattering Matrix. Transmission (ABCD) matrix. Signal Flow graphs.

Code	**ECEA702**
Title	**Information Theory**
Instructor	Denazis Birbas M
Credits	5 ECTS

Content:

- Introduction to Information Theory. What is information, how is it measured?
- Probability, Entropy, and Inference
- The Source Coding Theorem, Discrete and memoryless sources of symbols
- Symbol Codes (Fixed and Variable Length)
- Stream Codes
- Communication over a Noisy Channel
- The Noisy-Channel Coding Theorem
- Coding and Error Correction Theory.
- Introduction to Coding Theory. Error Detection. Error Correction.
- Linear Codes: Generator and Parity Check Matrix. Decoding with Cosets. Decoding with Syndromes. Hamming codes. Dual Codes. Perfect Codes.
- Cyclic Codes: Basic Theory , Encoding and Decoding of Cyclic Codes.
- Finite Fields (Galouis Fields). BCH Codes: Basic Theory, Encoding and Decoding of BCH Codes with error correction capability of 2 errors or more.
- Reference to Convolutional Codes: Basic Theory, Encoding and Decoding (Viterbi) of Convolutional Codes

Code	**ECEA707**
Title	**Artificial Intelligence**
Instructor	Sgarbas Moustakas Peppas
Credits	4 ECTS

Content:
Problem-solving methods, search techniques, propositional and categorical logic, decision-making, game theory, machine learning. The laboratory addresses problem solving with search algorithms and cnstraint satisfaction problems in Prolog programming language, game theory and machine learning.
The curriculum per week is as follows:

1. Introduction-Intelligent Agents: Definition, historical review, link to other disciplines. Rationality, performance measures, operational environment, agent structure.
2. Problem solving with search: State spaces, search trees, uninformed search methods (depth-first, breadth-first), partial-information search.
3. Informed search and exploration: Best First and A* algorithms.
4. Local search algorithms I: Hill climbing, simulated annealing.
5. Local Search Algorithms II: Genetic Algorithms.
6. Constraint Satisfaction Problems: Constraint propagation, early check, arc consistency.
7. Adversarial Search: Optimal strategies in two person games, minimax algorithm, alpha-beta pruning, extension to multiplayer games, extension to games of chance, expectiminimax algorithm.
8. Game Theory I: Games of simultaneous moves, Nash equilibrium.
9. Game Theory II: Theory of Usability and Decision Making.
10. Logic I: Propositional logic, reasoning patterns, resolution, logic circuits.
11. Logic II: First-order logic (categorical logic), inference rules for quantifiers, unification, inference chains, theorem proving.
12. Machine learning I: Introduction, modeling, decision trees.
13. Machine learning II: Bayes Networks, naive Bayes models, probabilistic reasoning, inference with Markov chains, hidden Markov models.

Code	**ECEA805**
Title	**Access and Switching Networks**
Instructor	Lymperopoulos Denazis
Credits	5 ECTS

Content:

Basic principles of network architecture of TCP/IP technology, with reference to the most important functional components found in network systems and their devices, and participate in packet routing and layer communication among the layers of Link (L2), Network (L3), Transport (L4) and Application (L5) . Operations and functions of Link layer, address structure and assignment, and frame transmission in the context of local networks, the ARP protocol and its use. Operations and functions of Network layer and its protocol IPv4, structure and address assignment in IPv4 (classfull and classless addresses), IP packet routing principles across various subnetworks in order to support end-to-end ubiquitous connectivity. Design of and functionality of L4 protocols TCP and UDP, explain the corresponding protocol state diagrams. Explain the difference between connection oriented and connectionless connections. Socket programming. Basic operations in applications layer, namely, NAT, DNS and DHCP. Introduction to IPv6 and its differences to IPv4.

1. *Introduction to Access Networks:* Telecommunications Networks. Introduction to Access Networks

2. *Access Technologies:* Wired - Wireless - Optical - BPL - Satellite - Hybrid

3. *Access Techniques:* Channel Models - Modulation - OFDM - Spread Spectrum - Standards.

4. *Techno-economic Elements:* Diffusion predictions - Genetic algorithms -

Dimensionalization - Cost analysis and comparisons.

Code	**ECEA710**
Title	**Digital Communications I**
Instructor	Stylianakis
Credits	4 ECTS

Content:

Introduction, Signal Spectra & Noise

Noise in communication systems.

Signal transmission through linear systems.

Digital Communications Model

Elements of a Digital Communications System.

Communication Channels.

A Historical Perspective in the Development of Digital Communications.

Source Coding

Sampling.

Quantization and encoding.

Baseband transmission.

Elements of Information Theory.

Information Measures.

Coding for Discrete and Analog Sources.

Optimum Receivers for the Additive White Gaussian Noise Channel

Correlation Modulation.

Matched Filter Modulation.

Maximum-Likelihood Sequence Detector.

Performance of the Optimum Receiver.

Code	**ECEA703**
Title	**Electroacoustics**
Instructor	Mourjopoulos
Credits	4 ECTS

Content:

Introduction Electroacoustics (specialization areas, applications, history). General features and structure of sound systems, types of distortions in such systems, principles of sound perception and audio system reproduction

Sound sources, waves and quantities Acoustic waves and equations. Frequency analysis of signals, relevant acoustic quantities, sound sources, directivity. Sound pressure level, loudness and noise measurement

Electromechanical and electrocoustical analogies, transduces and circuits The relationships of the elements and the transduction in electro-mechanical-acoustical systems. Equivalent (analogous) circuits, transducer sensitivity and frequency response

Microphones Principles of operation, types, electrical and acoustical characteristics. Use of microphones in recording

Loudspeakers Principles of operation, types and technology evolution. Electromechanical system response and acoustic radiation. Electromagnetic loudspeaker drivers, analysis and equivalent circuits. Loudspeaker cabinets, cross-over circuits. Measuring loudspeaker systems and principles of design and construction

Room Acoustics Significance, history and theoretical approaches. Principles of wave theory, sound field in an enclosed space, Reverberation Time, Geometric approach, use of Signal theory and processing. Speech intelligibility and acoustic reverberation. Systems for simulating, predicting and analysing room acoustics, computer software methods, Acoustics and Virtual Reality applications

Sound systems: general principles and acoustic coverage Acoustic principles of electroacoustic and sound installations / systems. Aspects of source / receiver distance, acoustic gain, delay, directivity.

Loudspeaker properties, arrays, directivity, installation and acoustic system equalisation
<u>*Sound systems: electrical properties*</u> Input/ output relationships. Preamplifier characteristics, operation and circuit analysis. Power amplifiers (stages, types, design, properties), digital amplifiers. Interconnections principles and practice in sound systems. Typical examples of sound systems and installations

Lab.1 *Introductory concepts - signal processing and its application in Electroacoustics*
Frequency Response Measurements in Electroacoustic Systems. Signal to Noise and Harmonic Distortion Measurements in Electroacoustic Systems.
Lab.2 *Measurement of Environmental Noise & of Noise Insulation*
The students familiarize with the use and the functions of sound level meter and learns to measure noise levels, equivalent level and noise in 1/3 octaves, as well as the measurement of Sound Reduction Index and Sound Insulation in a building arrangement.
Lab.3 *Measurement of Microphone and Loudspeaker characteristics*.
The exercise covers measurement of sensitivity and directivity for different microphones as well as measurement of sensitivity, response and impedance of loudspeaker systems.
Lab.4 *Measurement, Analysis and Computational simulation of Acoustics in Enclosed Spaces*
The exercise combines prediction and measurement of the acoustic parameters for a given enclosed space. The students must compare the results between the predictions and the measurements and discuss any differences. Another aim of the exercise is to optimize the acoustics of a simple “show-box” shaped space by choosing appropriate absorption materials for the various surfaces. This optimization will be based on dedicated acoustic prediction software. The results will be assessed with respect to the optimal choice for Reverberation Time and speech intelligibility.
Lab.5 *Measurement of the specifications for a power amplifier*
The exercise covers the measurement procedure for assessment of a power amplifier total harmonic distortion with respect to the variation of its output load (via combinations of different number of loudspeakers).
Lab.6 *Electroacoustic installation: connections, measurement and sound engineering*
The exercise familiarizes the students with the practices involving setting up a realistic sound system and the use of the individual system components and devices. After connecting the individual components, the students must measure the response of the installation using computer software.

Code	**ECEA805**
Title	**Wireless Propagation**
Instructor	Kotsopoulos
Credits	5 ECTS

Content:
Electromagnetic propagation mechanisms, multipath phenomenon, diffraction by edges and corners, geometrical theory of diffraction, uniform theory of diffraction, fresnel zones, Fresnel zone clearance, path gai for wireless applications, diffraction by multiple edges, propagation in the presence of building in various terrain, shadow fading and the effects of terrain and trees, site specific propagation prediction, path loss models (indoor areas, outdoor areas and open air areas), Empirical RF models, stochastic RF models, applications in the design and optimization of wireless networks

8th semester

Code	**ECEA706**
Title	**Antennae Theory**
Instructor	Kotsopoulos
Credits	4 ECTS

Content:
Basic antenna concepts, point sources, arrays of point sources, the electric dipole and thin linear antennas, the loop antenna, the helical antenna, the biconical antenna, the cylindrical antenna and the moment method, self and mutual impendences, arrays of dipoles and its apertures, reflector antennas and their feed systems, slot, horn and complementary antennas, lens antennas, antennas measurements, antennae applications

Principles of radio propagation in homogeneous media, Principles of radio propagation in turbulent media, Fundamental technical parameters of the antennae, Linear Wire Antennae. Aperture Antennae, Antennae Arrays, Design of special type of antennae (Planar Antennae, Reflector Antennae, Broadband Antennae), Antennae Measurements and Matching Techniques, Applications: Analysis of the Line–of– Sight (LOS) Radiolink Systems (ERP, 1st Fresnel Zone Clearance, Excess Path Loss due to the K factor, Free Space Loss, Hydrometeor Attenuation, Link Budget, Radiolink System Availability, Performance Parameters of Radiolink systems * Analysis of the Troposcatter Communications Systems (Scattering Effects and Link Budget) * Radar Equation and analysis of the involved electromagnetic parameters * Antennae Co-location techniques and Analysis of the involved Technical Parameters of an Antennae Park (Notch Filters, Combiners, Patch Panels and Power Dividers, Antennae Feeders), The practical experience of the fourth year students, include laboratory work in the investigation of the Antennae Technical Parameters (VSWR measurements, Gain Measurements, Radiation Pattern Measurements, Radiolink Measurements).

Code	**ECEA807**
Title	**Pattern Recognition**
Instructor	Dermatas
Credits	4 ECTS

Content:
Basic concepts of pattern recognition. Supervised and unsupervised training. Estimation of the probability of classification error-Error bounds. Distance functions. Minimum distance pattern classification. k-nearest neighbour classification. Single and multiply prototypes. Decision functions. Linear decision functions. Perceptron and k-means algorithm. Bayes classifier. Bayes decision rule for minimum risk. Estimation of probability density function: Maximum entropy criterion, Parzen estimate, ortho-normal functions approximation. Stochastic approximation of the probability density function: Robbins-Monro and LMS algorithm. Neural networks structure. Error correction, competitive and hebbian learning. Multilayer perceptron. Back-propagation of error. Radial-Basis function networks. Hopfield machine. Syntactic pattern recognition. Formal languages. Type-0,1,2,3. CYK algorithm. Stochastic languages. Grammatical inference. Error correction.

Training pattern recognition systems: Line search, gradient descent, Conjugate gradients, Newton, the Levenberg-Marquart algorithm, Bayes learning, Monte Carlo methods, simulated annealing, Genetic algorithms.

Minimum description length principle. Pre-processing and feature selection. Karhunen-Leone expansion. Syntactic pattern recognition and error correction. Markov and hidden Markov models, recurrent neural networks and non-linear temporal processing. Image recognition applications.

Code	**ECEA811**
Title	**Wireless and Mobile Communications Networks**
Instructor	Kotsopoulos Lymperopoulos
Credits	5 ECTS

Content:
Basic concept of cellular wireless networks, the hierarchical structure of an organized wireless network (the radionetwork level, the switching level and the management level), the architectures of cellular systems of various technologies and various generations (e.g. GSM, GPRS, EDGE, LTE, UMTS, Wi-Fi, etc), Satellite Networks and the effect of the wireless satellite channel, QoS issues, SNR, BER and G/Ts, Blocking Probability, Design issues of terrestrial wireless networks and design issues of satellite networks, involved protocols in terrestrial and satellite networks.

Code	**ECEA003**
Title	**Digital Communications II**
Instructor	Stylianakis
Credits	5 ECTS

Content:
Channel Capacity and Coding
Channel Models.
Channel Capacity.
Channel Capacity with Orthogonal Signals.
Channel Reliability Functions.
Signal Design and Communication for Band-Limited Channels
Signal Design for Band-Limited Channels.
Probability of Error.
Modulation Codes for Spectrum Shaping.
Optimum Receiver for Channels with ISI and AWGN.
Equalization.
Multichannel and Multicarrier Systems and Multiuser Communications
Introduction to Multiple Access Techniques
OFDM
Spread Spectrum
CDMA

Code	**ECEA806**
Title	**Teletraffic Theory**
Instructor	Logothetis
Credits	4 ECTS

Content:
Introduction - The objectives of Teletraffic Engineering - The Nature of Teletraffic. Features and Modelling of Teletraffic Systems.
Traffic load - Properties. Markov Property. Little’s Law. Traffic from Terminals and Aggregated Traffic.
Markovian Loss Systems.
Markovian Delay (Queueing) Systems. Birth-Death Process.
Open & Close Queueing Networks.
Mean Value Analysis.
Multi-Dimensional Traffic Models - Trunk Reservation System.
Restricted availability.
Overflow System - Equivalent Random Theory. Design of Alternative Routing. Traffic Simulation.

Computer Implementation of Basic Teletraffic Formulas.

Code	**ECEA812**
Title	**Computational Geometry and 3D Modelling Applications**
Instructor	Moustakas
Credits	2 ECTS

Content:

1. *Basic concepts*

Introduction, sections, search, duality, geometric data structures, tree structures, KD trees, BSP trees, quadtrees, non-uniform grids, surface convex hull.

2. *Advanced topics*

Delaunay triangulation, Voronoi diagrams, convex hull in 2D and 3D, space partitioning, medial axis extraction.

3. *Applications*

Applications in robotics, in autonomous navigation, in finite element models, in 3D games and virtual reality, in computer vision and in geographic information systems.

Lab.1 *Introduction (Programming geometric problems in C++)* Introduction in the programming environment. Geometric data structures. Simple examples.

Lab.2 *Convex Hull (2D)*

Computation of the convex hull of a 2D point set. Usage of simple algorithm. $O(n^3)$. Performance comparison with implementations of quick algorithms.

Lab.3 *Primary Shape Intersections (2D)*

Intersection of line segments. Intersection of circles. Intersections of triangles.

Lab.4 *Point set triangulation (2D)*

Implementation of incremental triangulation algorithm and interactive execution on the point set with the ability to observe the individual steps. Detections and correction of delaunay violations.

Lab.5 Processing and manipulation of *3D triangle meshes.*

Center mass computation. Computations of Axis Aligned Bounding Box (AABB). Mesh alignment. Computation of primary axis. (PCA). Intersection of the mesh with a plane. Model split.

Lab.6 Model *Molding (2D)*

Detection of ability to mold a 2D model. (non-convex polygon). Detection of blocking sides. Computation of allowable direction of extraction.

Lab.7 *Geometric transformations*

Voronoi diagram. Duality and dual mesh graph. Shortest path problems.

Code	**ECEA008**
Title	**Digital Audio Technology**
Instructor	Mourjopoulos
Credits	4 ECTS

Content:

Introduction

Analysis of technology history, evolution and market trends. Current developments and future predictions.

Theory of digital audio

Principles of digital audio conversion (samling, quantisation), Oversampling, Noise Shaping, signal arithmetic representation and coding, ADC and DAC subsystems

Coding and compression

Coding formats, data representation, PCM, Σ/Δ, PWM and other relevant audio signal representations. Perceptual audio data reduction, MPEG-1 (MP3), MPEG-2, Dolby, MPEG-4 coding standards. Standards and technologies for audio data transmission and storage, optical disc formats (CD, DVD, BD)

Systems and methods
Structure and general properties of digital audio systems, digital interconnection standards (S/PDIF, AES/EBU, MADI, etc), MIDI, implementation of DSP methods for audio, DSP processor based systems, implementation in software. DSP applications (digital equalization, compression, reverb / delay, moise reduction, etc.). Analysis of systems for typical case studies.

Code	**ECEA004**
Title	**Advanced Topics in Information Theory**
Instructor	Toumpakaris
Credits	5 ECTS

Content:
Continuation of Information Theory; Compression and Transmission are revisited, albeit at a more advanced and detailed level. Introduction to Network Information Theory.

Review of important properties and results that were covered in Information Theory.

Asymptotic Equipartition Property (AEP) and Typical Sequences. The Entropy is equal to the optimal compression rate. Fixed and variable length coding. Kraft inequality. Optimality of Huffman codes.

Channel Capacity. Jointly Typical Sequences, Joint AEP. Channel Coding Theorem. Source-Channel separation Theorem.

Network Information Theory: The Multiple-Access Channel (MAC), the Broadcast Channel (BC), the Relay Channel, the Interference Channel.

FIFTH YEAR

9th semester

Code	**ECEA908**
Title	**Access Communications**
Instructor	Stylianakis
Credits	4 ECTS

Content:
1. *Introduction to Access Networks:* Telecommunications Networks. Introduction to Access Networks
2. *Access Technologies:* Wired - Wireless - Optical - BPL - Satellite - Hybrid
3. *Access Techniques:* Channel Models - Modulation - OFDM - Spread Spectrum - Standards.
4. *Techno-economic Elements:* Diffusion predictions - Genetic algorithms - Dimensionalization - Cost analysis and comparisons.

Code	**ECEA910**
Title	**Broadband Networks**
Instructor	Logothetis
Credits	4 ECTS

Content:
Introduction - Trends in Requirements for Telecommunication - Progress in Technology and in System Concept. Narrowband-ISDN and Broadband -ISDN Services. Transfer Modes - Circuit Switching - Multi-rate Circuit Switching - Fast Circuit Switching - Packet Switching - Fast Packet Switching - Asynchronous Transfer Mode (ATM) - Frame Relay - Switched Multi-Megabit Data Service (SMDS).

ATM Technology. B-ISDN Protocol Reference Model (PRM) - ATM PRM. Asynchronous Transfer Mode - An Overview - ATM Network Interfaces - Protocol Layers - ATM Cell Header Format - Connection Identifiers - VP/VC Assignment - Header Error Check (HEC) - LAN Emulation - ATM Virtual LANs - IP Over ATM. Comparison of ATM with other Transfer Modes.
Statistical Multiplexing in ATM Networks. Resource management in ATM networks. Principles of Traffic and Congestion Control in ATM Networks.
Synchronous Digital Hierarchy (SDH): architecture of Transmission Systems. Principles of ATM Switching.
Multi-Protocol Label Switching (MPLS). Packet Switching & Forwarding. Label Switching Routers (LSR, LER). Forwarding Equivalence Classes. Labels: Label Maping, Creation, Distribution and Control. Compatibility between ATM and MPLS. Tunneling. Explicit routing. Quality of Service. MPLS and Differentiated Services. MPLS and Integrated Services.
Optical Networks – Architecture. Wavelength Division Multiplexing. Optical Time Division Multiplexing. Optical Switching. Optical Network Componets. Core/Backbone networks, Metropolitan Area Optical Networks and Optical Access Networks. Passive Optical Networks (PON) for Broadband Access.
Gigabit Ethernet Technology – Need for Gigabit Ethernet. Description of Gigabit Ethernet. Pros and cons of the Gigabit Ethernet.

Code	**ECEA9111**
Title	**Computer Graphics & Virtual Reality**
Instructor	Moustakas
Credits	4 ECTS

Content:

1. *Basic Concepts*

Introduction in computer graphics and virtual reality, graphics pipeline, I/O graphics devices, drawing algorithms, polygon drawing, anti-aliasing. Affine transformations, 2D and 3D transformations, homogenous coordinates, viewport transformations.

2. *Common procedures*

Line and polygon culling algorithms in 2D and 3D. Projections. Stereoscopic vision. Z-buffering. Shadows, texture. Basic shading principles. Color.

3. *Advanced topics*

Ray tracing, global illumination, motion, articulated motion, virtual reality simulations, physics based simulations. Virtual, augmented and mixed reality.

Code	**ECEA9112**
Title	**Computer Graphics & Virtual Reality (Lab.)**
Instructor	Moustakas
Credits	2 ECTS

Content:

Lab.1 *Introduction in OpenGL*

OpenGL application interface (Initialization/ Event handling/Representation). Orthogonal Projection. Colors RGBA. Basic shapes.
This Lab aims to present to the students, the structure and functionality of OpenGL through glut library. Also after the first exercise students will learn to draw, color on RGBA mode and project to the screen basic geometric shapes.

Lab.2 *Motion*

Basic 3D objects. Transformations. Perspective projection. Objects Motion.
In this Lab students learn to apply motion in basic 3D objects and shapes using several

transformations. Moreover perspective projection helps to better perceive motion in 3D space.

Lab.3 *Lights*

Lighting and light sources. Colors and materials. Polygonal models.

Lights are very important for the nice and correct rendering of a 3D scene in an virtual reality environment. Different types of light sources in combination with different material types can give the feeling of real in this environment. Students will learn not only how to apply and manage lights sources, but also how to load and manage polygonal models in a more format.

Lab.4 *VRML*

Virtual Reality Markup Language. Basic shapes. Lights.

VRML is a markup language that easily can describe objects in 3D environment. Students will use this language to describe the 3D objects that hey use in previous labs. Moreover they will apply RGB and CKY lights in a scene.

Lab.5 *Interaction Part 1*

Fonts in OpenGL. Menu creation. Event handling from IO devices (keyboard/ mouse)

Interaction with the user is a very important aspect of virtual reality. In this exercise students will learn how to create menus and manage select events using glut library.

Lab.6 *Interaction Part 2*

Interaction (apply transformation based on keyboard and mouse events). Camera.

Following the previous Lab students will learn how to manipulate the orientation and the position of the camera in 3D scene, using keyboard and mouse events.

Lab.7 *Texture*

Texture mapping on basic geometric objects. Applying textures is an important element in all virtual reality applications. Students by completing this Lab exercise will learn how to map a texture in a simple geometric object and how to load and apply an already mapped texture on a more complex mesh model.

Lab.8 *Physics Engine*

Newton laws. Collision detection. Spring simulation.

Behavior of the objects in a virtual reality 3D scene and the interaction between them should be in a way that seems real to the human eye. Physics law have to be applied. Collision detection, the calculation of the forces that will produced after the collision and the accurate calculation of the position of all objects in each time frame is a difficult problem to solve.

Code	**ECEA912**
Title	**Antenna Theory & Microwave Apps (Lab.)**
Instructor	Kotsopoulos
Credits	2 ECTS

Content:

Lab.1 Reflex Klystron tube.

Lab.2 A. Gunn diode and B. Measurement of wavelength inside waveguide and in free space, double stub tunner and measurement of dielectric properties of samples.

Lab.3 Generator Frequency Curve and Measurement of Antenna Input Impedance.

Lab.4 A. Measurement of Transmission Line Atennuation Coeffcient and Measurements of multiport devices and B. Analysis of Microwave Optical Link.

Lab.5 Familiarization with Network Analyzer. Measurement of filters, couplers, circulators, Transmission Line attenuation coefficient etc.

Lab.6 Use of TDR (Time Domain Reflectometers) for analzying transmission lines.

Lab.7 Polar Antenna Radiation Diagrams.

Lab.8 Measurement of Antenna parameters.
Lab.9 Doppler effect. Speed measurement with RADAR.
Lab.10 Familliarization with spectrum analyzer.

Code	**ECEA002**
Title	**Multimedia Communications**
Instructor	Lymperopoulos
Credits	5 ECTS

Content:

- **Introduction:** Definitions. Necessity for multimedia communication. Basic requirements in transmission / storage. Multimedia implementation over IP infrastructure. Sources of multimedia data (Image, Speech, Audio, Still images, Moving video, Audiovisual information). Multimedia data structures. Processing of multimedia data. Integration of multimedia data in services and applications.
- **Next Generation Networks (NGN):** Definitions. Layer and Architecture Analysis of NGN. NGN Interfaces. Access Network Structure of NGN. Basic NGN Services. IP Multimedia Subsystem (IMS). Creation - Distribution - Management of multimedia Services over NGN/IMS.
- **Multimedia Sessions:** Definitions. SIP Protocol Analysis. Multipoint Control Unit (MCU). Analysis of establishing sessions in selected Applications. Analysis of data streaming processes. RTP / RTCP protocol analysis.
- **Interactive Multimedia Communication Structures:** Definitions. Interactions Analysis among Terminal Entities. Analysis of Interactive Multimedia Communication Support Protocols.
- **Examples of multimedia implementations.**

Code	**ECEA0091**
Title	**Embedded Communication Systems**
Instructor	Antonakopoulos
Credits	4 ECTS

Content:
Introduction to Embedded Systems. Architecture issues and Codesign methodologies. Communication protocols design methodology. Specifications, functional description and implementation. Modeling of Embedded Communication Systems. Protocol processing and transmission algorithms implementation. Real-time operating systems. High level description languages and validation procedures. Synchronization and inter-modules communications. Performance analysis and optimization. Examples of integrated communication devices and systems.

Code	**ECEA0092**
Title	**Embedded Communication Systems (Lab.)**
Instructor	Antonakopoulos
Credits	2 ECTS

Content:
Lab.1 Introduction to Simulink and Discrete Time Systems.
Lab.2 Introduction to Stateflow (FSMs, memory management).

Lab.3 Management of processes for serial communications – transmission using TCP-UDP/IP.
Lab.4 Design and implementation of the XON/XOFF protocol.
Lab.5 Design and implementation of a PAM transceiver.
Lab.6 Design and implementation of synchronization circuits
Lab.7 Integration of protocols and circuits.
Lab.8 Performance measurements at different transmission conditions.
Lab.9 Measuring the transfer function and noise conditions of a communications channel.
Lab.10 Implementation - Measurements using multiple computing systems.

Code	**ECE ME5**
Title	**Biomechanics I**
Instructor	Athanassiou Deligianni Mavrilas
Credits	4 ECTS

Content:
Introduction to biomechanics principles, Structural elements of the human body. Biomechanics of the musculoskeletal system - bones, muscle: Basic anatomy and physiology, Mechanical functions, Physiological functions, Composition, Microscopic- macroscopic structure, Tissue mechanical characteristics. Bone fracture and remodeling. Mechanical adaptation. Muscle contraction and its modeling. Kinematics elements. Musculoskeletal modeling.
Biomechanics of soft connective tissues (SCT): Anatomy - histology of SCT. Biopolymers composing SCT. Mechanics of SCT, static & dynamic, correlation with its components and structure. Mathematical modeling of SCT mechanics. Biomechanics of blood circulation: Anatomy and physiology. The heart as a pump. Circulation fluid dynamics. Systemic circulation in arteries, veins, bifurcations. Blood-Vessel interaction. Mechanical characteristics of cardiovascular implants (heart valves, vessels). Blood flow equations, blood flow dynamics.
Respiratory system. Artificicial oxygenation, extracorporeal blood circulation. Kidneys, artificial kidney, hemodialysis systems. Measurement techniques for pressure, strain, velocities in the human body and in artificial organs.

10th semester

Code	**ECEA906**
Title	**Speech and Natural Language Processing**
Instructor	Sgarbas
Credits	4 ECTS

Content:
The syllabus includes: Stages of Language Processing, Coding, Levenshtein Distance, Optimal Paths on the Levelshtein Matrix, Multiple Paths at the Levenshtein Matrix, Regular Expressions, Finite State Automata (FSA), Transition from Regular Expressions to FSA, FSA Types: Cyclic, Acyclic, Deterministic, Mathematical Definition of Automata, FSA Extensions: Twins, Parallel, Transducers, FSA Applications, Morphological Analysis, the Morphological Model of Kay-Kaplan, the Two-Level Morphological Model, Formal Languages and Grammars, Chomsky Hierarchy, Chomsky Normal Form (CNF), CKY Algorithm, Logarithms and Logprobs, Probabilistic Type-2 Grammars, Text Corpora Categories, PCFG to CNF Conversion, Probabilistic CKY, Language Models, Bigram Count Matrix, Bigram Probabilities Matrix, Laplace Smoothing, Backoff, Interpolation, Trigram Count Matrix, Language Model Files, Spell-Check Correction with Language Models, Entropy and Perplexity, Text Classification with Compression, WordNet. Speech production modeling modeling: Speech production mechanism, Speech sounds, Speech production model. Digital speech signal pre-processing: Selection of sampling frequency, Digitization, Short-term speech signal analysis, Frame length selection, Pre-emphasis, Window filter selection, Frame movement rate. Acoustic Parameters: Energy, Zero Transitions, Fundamental Frequency, Pitch Estimation Methods, Spectrum analysis, Formants, Linear Prediction Coefficients (LPC), Filter Bank, Reflection Coefficients, Cepstral Coefficients. Speech Processing Techniques: Auditory Pattern Matching, Dynamic Time Warping (DTW), Vector Quantization, K-means Algorithm, VQ Codebook with Density Mixing, Hidden Markov Models (HMM) Modeling, Forward-Backward Algorithm, Viterbi Algorithm. Speech recognition systems. Speaker recognition systems. Speech Synthesis: Basic Principles, Unit Size, Unit Types, Synthesis Methods, Limited vs Unlimited Vocabulary Systems. Synthesis with Formants, LPC synthesis, Modeling of the source of stimulation, Prosody Modeling, Evaluation of the LPC model by sample-sample procedure, Modeling the speech signal with poles and zeros, Methods of calculating the parameters of the ARMA model, Problems of the ARMA model. Digital noise filtering techniques. Speech coding: Techniques for coding the speech waveform (time domain), Coding using the speech spectrum (frequency domain), Coding techniques using analysis-synthesis (frequency domain), Linear prediction coding.

Code	**ECEA9062**
Title	**Speech Technology (Lab.)**
Instructor	Dermatas Sgarbas
Credits	2 ECTS

Content:
The lab includes guided programming exercises and software tools for designing Speech processing systems:

Lab.1 Microphones - Analog filtering. Converting the analog voice signal to digital. Learning the basic functions of Audacity-

MATLAB. Study the impact of digitization accuracy and selection of the sampling frequency. Oversampling.

Lab.2 Reducing Noise quantization. Digital filters. Removing narrow bandwidth Noise. Linear-nonlinear Coding-Decoding. Speech intelligibility.

Lab.3 Digital preprocessing and short-time analysis of speech signals. Window functions. Short-time spectral analysis. Effect of the windowing analysis . Spectrogram.

Lab.4 Preemphasis, Feature extraction: Energy, zero crossings. Enf-point detection. Pitch. Linear prediction analysis. Effect of the number of parameters in the spectral accuracy.

Lab.5 Dynamic time programming (DTW). Model Hidden Markov (HMM).

Lab.6 Speech recognition of isolated words using dynamic programming and Hidden Markov model.

Lab.7 Speech synthesis.

Lab.8 Revision Lab.

Lab.exam Examamination Laboratory

Code	**ECEA0011**
Title	**Optical Communications**
Instructor	-
Credits	4 ECTS

Content:

Historical overview, optical fibers (geometrical optics description, solution of Maxwell equations for step-index fiber, loss, chromatic dispersion, polarization –mode dispersion, nonlinear effects), optical transmitters (with directly modulated single-frequency semiconductor lasers and with external modulators), optical receivers (with p-i-n and avalanche photodiodes, using direct or coherent detection), erbium-doped fiber amplifiers, single-wavelength and multiwavelength optical communications systems design and performance evaluation, introduction to transparent optical networks.

Code	**ECEA0012**
Title	**Optical Communications (Lab.)**
Instructor	-
Credits	2 ECTS

Content:

Code	**ECEA005**
Title	**Network Management**
Instructor	Denazis
Credits	5 ECTS

Content:
Overview of the different network management approaches and models proposed (OSI, Internet, TMN etc), their structure and the corresponding specifications (standards) issued. The basic concepts of network management architectures, their organization in functional areas, and their system components. Detailed presentation of the Internet model based on SNMP protocol suite as specified by IETF through selected RFCs. It comprises the Information model and the definition of the basic MIB objects along with RMON 1 & 2 for the collection of monitoring data and statistics with analytic examples, the communication model based on SNMPv1 & SNMPv2 protocol suite and the organizational model based on the client-server paradigm between the Network Management Station and the Agent of the network devices. Design of network topologies and IPv4 address assignment to the various network interfaces. Introduction to modern trends in network management and network control. This includes Netconf protocol specification that includes Data model and Communication model and comparison with SNMP. Presentation of the basic principles of Software Defined Networking and Network Function Virtualization architectures and their impact on network management and control. The theoretical presentations above are complemented with practical examples in the form of lab exercises in order for the student to acquire important hands-on experience.

Code	**ECEA010**
Title	**WEB Services**
Instructor	-
Credits	4 ECTS

Content:
Need for information systems integration, Middleware Technologies, Enterprise Application Integration (EAI) and Service Oriented Architecture (SOA). Web Services, core functionality and standards. XML, SOAP, Web Services Description Language(WSDL), Universal Description, Discovery and Integration (UDDI). Web Services Governance, Service composition, Web Services Orchestration and Choreography. Unified Modeling Language (UML), Software Agents and Agent Systems, characteristics and properties of Agents, Agent modeling according to gaia method, case study.

Code	**ECEA011**
Title	Personalised Telemedicine and Biomedical Systems
Instructor	Lymperopoulos
Credits	5 ECTS

- **Introduction:** Concepts, prospects and domains of biomedical technology, employment areas of biomedical engineers, electronic health, telemedicine, mobile and pervasive health.
- **Electronic health record systems:** Incentives, definition, relevant terms, uses, data types, functional components, interoperability issues and standards, approaches to acquiring and displaying electronic health record data, virtual electronic health record, personal health records.

- **Medical imaging and medical image processing:** Architecture of imaging systems, modern medical imaging techniques and devices, quality features, representation, management, digital processing and integration of medical images.
- **Telemedicine systems and applications:** Concept, objectives, historical evolution, system architecture, technological infrastructure, operational modes, types of medical data, types of involved networks and use cases of telemedicine.
- **Introduction to pervasive computing.** Concept, operational framework, device types, basic functions, properties, key features and examples of pervasive computing applications.
- **Context awareness.** Definition, parameters, categories and uses, architectures and types of context-aware systems, middleware (software infrastructure) services, design process and examples of context-aware systems.
- **Mobile and pervasive health.** Definitions, drivers of emergence, impact in healthcare, technology and application domains of mobile and pervasive health, mobile and pervasive computing in professional medical care facilities; end users, range, general architecture, categories and non-functional requirements of mobile and pervasive health and wellness management systems for citizens.
- **Sensors and wireless technologies in health.** Wireless sensor networks; types, measured parameters and sensor operating principles, wireless communication technologies, sensor network development platforms for health applications.
- **Biomedical signal processing.** Types and examples of biosignals, biomedical data acquisition and processing architecture and procedures, conversion from analogue to digital, digital signal processing basics, analog and digital filters and examples of their application to biomedical signals.
- **Clinical decision support systems.** Definition, motivation, uses, characteristics, architecture, types, approaches to data acquisition, data processing algorithms, design and development challenges, implementation guidelines, current status and examples of clinical decision support systems.
- **Mobile and pervasive health applications.** Range of systems, user types, requirements, usε cases and examples of mobile and pervasive health applications.
- **Ambient assisted living.** Definition, target audience, needs, technological infrastructure, ambient assisted living scenarios and applications, Internet of Things systems architecture and examples of their application to health.

Code	**ECEME10**
Title	**Biomechanics II**
Instructor	Athanassiou Deligianni
Credits	4 ECTS

Content:

Introduction in the relationship between the neuromuscular system and the response of the human musculoskeletal system. Neuromuscular human system. Neuron. The current and the conductivity functions of Na and K ions into the neuromuscular system. Rest potential and action potential. Neuromuscular unit. Correlation of biochemical and/or bioelectrical functions of neuromuscular system with muscle contraction and forces producing. Electromyography. Methodologies to musculoskeletal fatigue estimation.

Musculoskeletal system - cartilage, tendons, ligaments: Basic anatomy and physiology, mechanical functions, physiological functions, composition, microscopic-macroscopic structure, tissue mechanical characteristics, correlation with structure. 3-D musculoskeletal system modeling.

FIELD OF SPECIALIZATION: ENERGY CONVERSION–POWER ELECTRONICS–ELECTRICAL ENGINEERING MATERIALS–RENEWABLE ENERGY SOURCES

FOURTH YEAR

7th semester

Code	**ECEB703**
Title	**Power Electronics I**
Instructor	Tatakis
Credits	5 ECTS

Content:
Operation of high power electronic converters, semi-conductive elements, constructional and operational properties of thyristors and their static and dynamic behaviour, triggering, protection, cooling. Converters without commutation (ac-choppers), single-phase and three phase converters with anti-parallel thyristors and their control, reactive power, waveforms of the current and voltage. Converters with line commutation, fully controlled single-phase bridge, commutation phenomena, current and voltage wave-forms, reactive power, control of dc-machines, double single-phase converter, half controlled single phase bridge. Three pulse converter, three phase bridge, waveforms, power, single and double commutation. Calculation of a rectifying system, transformers for power electronic converters, commutation and control reactive power.

Code	**ECEB707**
Title	**Electrical Installations**
Instructor	Zacharias
Credits	5 ECTS

Content:
Effects of the electric current through the human body and protection according to IEC 479-1, 479-2, CENELEC 384 and IEC 364.
Protection against electric and magnetic fields according to the ICNIRP-guidelines and the Norm CENELEC ENV 50166-1.
Protection of low-voltage equipment: Protection devices, selective protection, protection of lines, transformers and motors.
Description of low-voltage electrical installation's equipment: energy consumption devices, wires and cables, distribution boards, low-voltage switchgear, controlgear and protective devices etc.
Lighting engineering: definitions, quantity and quality of illumination, lamps, luminaires, calculation methods for indoor- and outdoor lighting, floodlighting. Motor installations: technical and operational characteristics, switching of motors via contactors, starting, reversing, pole-changing and stopping, application of induction motors in pumps, ventilating fans, elevators.
Selection criteria and calculations for electrical equipment: wiring systems, current-carrying capacity, cross-section of insulated conductors and cables, voltage drop in consumer's installations, selection of devices for isolation, switching and protection, power-factor correction.

Code	**ECEB006**
Title	**Electric Motor Drive Systems I**
Instructor	Mitronikas
Credits	5 ECTS

Content:
The purpose of the electric motor drive systems, their construction, the operation of the system motor-work machine, stability, torque of inertia, transient operation, the selection of the electric motors, losses and heating problems, operation behaviour and control, block diagrams and transfer functions, power electronic converters for controllable supply of electrical motors, automation. Special types of motors, very low power motors, applications, linear motor.

Code	**ECEB706**
Title	**Electrical Power Systems Analysis**
Instructor	P. Vovos Alexandridis
Credits	5 ECTS

Content:
Fundamental concepts of electric power systems engineering: concepts of real, reactive and complex power. Per unit system. The structure of electric power systems. Transmission capacity. Operational characteristics of power systems. Modelling of basic components of power systems: the synchronous machine, the power transformer, the high-energy transmission line. System modelling and load flow analysis: construction of the general equations, load flow solution by the Gauss-Seidel and Newton-Raphson iterative methods.
Lab.1 getting familiar with basic equipment, phase sequence, active and reactive power measurement.
Lab.2 active and reactive power flow on a transmission line feeding various load types.
Lab.3 system operating parameters affecting active and reactive power flow.
Lab.4 dependence of active power flow on delta angle difference between buses.
Lab.5 the synchronous machine as a motor and as a generator.
Lab.6 the synchronous compensator.
Lab.7 Revision lab.
Lab.exams

Code	**ECEB705**
Title	**Electrical Economy**
Instructor	
Credits	4 ECTS

Content:
Power generation units and their characteristics. Load behaviour and load forecast. The economic dispatch problem for thermal units. The lambda-iteration method. Thermal units dispatching with network losses considered. Optimization within constraints. Constraints in unit commitment. Unit commitment solution methods. The short-term hydrothermal scheduling problem. Dynamic-programming solution to the hydrothermal scheduling problem. Hydro-units in series. Economy interchange between interconnected utilities. Interchange evaluation with unit commitment. Multiple-utility interchange transactions. Energy banking. Power pools.

Code	**ECEB7M1**
Title	**Thermal Plants**
Instructor	Perrakis
Credits	5 ECTS

Content:
Cooling and Heating Systems.

8th semester

Code	**ECEB803**
Title	**Power Electronics II**
Instructor	Tatakis
Credits	5 ECTS

Content:
Line commutated converters with current reversal, line commutated frequency-converters, converters with forced commutation. Chopper: operation analysis, improved types, control of DC machines, control of ohmic load. Single phase DC-AC inverter: analysis of the circuit of the basic DC-AC inverter, improved types (conversion from DC-voltage to three phase voltage, PWM methods, voltage and frequency control, control of asynchronous and synchronous machines, speed and torque control, current and voltage waveforms, higher harmonics.

Code	**ECEB905**
Title	**Renewable Energy Sources I**
Instructor	Zacharias
Credits	4 ECTS

Content:
Fundamental principles of Electric Power Systems protection. The evaluation of Protective Relaying. Fundamental operating principles and characteristics of Electro-magnetic-Attraction and induction type relays. The impedance and reactance type distance relays. Line protection with overcurrent relays. Line protection with distance relays. Unit protection in lines. Line protection with wire-pilot relaying. Line protection with carrier-current pilot relaying. Line protection with microwave-pilot relaying. Line protection with phase and directional comparison. Bus-zone protection. Power transformer protection with gas relays. Percentage differential relaying for power transformers. AC generator and motor protection.

Code	**ECEB902**
Title	**Tests and Measurements of High Voltages**
Instructor	Svarnas
Credits	5 ECTS

Content:
Introduction: Generation and transmission of electric energy, voltage stresses, testing voltages (testing with power frequency voltages, testing with lightning impulse voltages, testing with switching impulses, D.C. voltages, testing with very low frequency voltage).
Generation of high voltages: direct voltages (A.C. to D.C. conversion, electrostatic generators), alternating voltages (testing transformers, series resonant circuits), impulse voltages (impulse voltage generator circuits, operation, design and construction of impulse generators), control systems.
Measurement of high voltages: peak voltage measurements by spark gaps (sphere gaps, reference measuring systems, uniform field gaps, rod gaps), electrostatic voltmeters, ammeter in series with high ohmic resistors and high ohmic resistor voltage dividers, generating voltmeters and field sensors, the measurement of peak voltages (the Chubb-Fortescue method, voltage dividers and passive rectifier circuits, active peak-reading circuits, high-voltage capacitors for measuring circuits), voltage dividing systems and impulse voltage measurements (generalized voltage generation and

measuring circuit, demands upon transfer characteristics of the measuring system, fundamentals for the computation of the measuring system, voltage dividers, interaction between voltage divider and its lead, the divider's low-voltage arm), fast digital transient recorders for impulse measurements (principles and historical development of transient digital recorders, errors inherent in digital recorders, specification of ideal A/D recorder and parameters required for h.v. impulse testing, future trends).
Non-destructive insulation test techniques: dynamic properties of dielectrics (dynamic properties in the time domain, dynamic properties in the frequency domain, modelling of dielectric properties, applications to insulation ageing), dielectric loss and capacitance measurements (the Schering bridge, current comparator bridges, loss measurement on complete equipment, null detectors), partial-discharge measurements (the basic PD test circuit, PD currents, PD measuring systems within the PD test circuit, measuring systems for apparent charge, sources and reduction of disturbances, other PD quantities, calibration of PD detectors in a complete test circuit, digital PD instruments and measurements).

Code	**ECEB002**
Title	**Overvoltage Protection – Lightning Surge Arresters**
Instructor	Pyrgioti
Credits	5 ECTS

Content:
This course provides the basic knowledge for the protection of transmision lines, buildings and other facilities from overvoltages caused by lightning, by teaching the following subjects: Lightning discharges. Creation of lightning discharge. The consequences of lightning strike on buildings, industires, playing fields, telecommunication systems and other facilities. The consequences of lightning strike on Transmission Lines. Lightning electromagnetic fields. Evolvement and propagation of overvoltages on Transmission Lines. Overvoltage proctection of overhead transmission lines. The electrogeometric model. Surge arresters on High Voltage Transmission Lines. Lightning protection methods of buildings, industires, playing fields and other facilities.Lightning protection of high-rise buildings, danger structures and other facilities. Protection of ships and aircraft. Protection of telecommunication systems.

Code	**ECEB006**
Title	**Electric Motor Drive Systems II**
Instructor	Mitronikas
Credits	5 ECTS

Code	**ECEB901**
Title	**Power Systems Control and Stability**
Instructor	Alexandridis
Credits	5 ECTS

Content:
Load dispatch centres. Control systems structure. Active power-frequency (P-f) control. Division of power system into control areas. P-f control of single and multi-control area systems. Optimum control strategy. Reactive power-voltage control. Methods for the bus voltages control. Series and shunt compensation. Thyristor controlled series or shunt capacitor or reactor. Static synchronous series compensator, static var compensator, static synchronous compensator, synchronous compensator and dynamic voltage regulator. Voltage stability. Power systems transient stability. Swing equation. Transient generator active power. Equal area criterion. Explanation of power systems transient stability. Computer solution of power systems transient stability. State estimation of electric power systems. Flexible AC Transmission Systems (FACTS) and Flexible Distribution System. Deregulation of electric power market.

Laboratory Exercises

Main purpose of the laboratory exercises is the practical training of students in power system control, which aims at maintaining constant balance between production and consumption of electricity.

Lab.1 Introduction to symmetrical components in three-phase power systems.
Lab.2 Identification, measurement and calculation of sequence impedances for synchronous machines, transmission lines and transformers.
Lab.3 Analysis of balanced and unbalanced faults using sequence equivalent networks.
Lab.4 Response of a synchronous machine to a sudden load change, study of dependences between maximum loading, power angle and field current on a synchronous machine.
Lab.5 Study of shaft angle oscillations and stability of a synchronous generator after a disturbance.
Lab.6 operation and configuration of protection relays in a power system.

Code	**ECEB702**
Title	**High Voltages**
Instructor	-
Credits	5 ECTS

Content:
This course provides the basic knowledge on the technology of High Voltages and their application on transmission, distribution and industrial networks and facilities, by teaching the following subjects: The necessity of using High Voltages. The evolution of High Voltage networks in Greece, Europe and worldwide. Basics on the behaviour of solide, liquid nad gaseous dielectrics. High Voltage Electric fields. High Voltage neworks and substations. Open air and gas insulated substations. Generation of overvoltages. Low frequency dynamic and transient overvoltages. High Voltage network behaviour under lightning and switching overvoltages. Overvoltage propagation on High Voltage Transmission Lines. Regulations and standards for High Voltage techology. The necessity for testing of High Voltage electrical equipment. The behaviour of air and SF_6 gaps in different forms of High Voltages. Study and desing of dielectric insulation of Transmission Lines and Substations. Insulation coordination in Electric Power Systems. Phenomenon Corona in High Voltage Transmission Lines.

Electromagnetic interference caused by High Voltage power systems. Applications of High Voltages in bioengineering and electrostatic precipitators and other industrial operations.

Lab.1 *Impulse Breakdown test in air*

Aim of the exercise is the generation and measurement of Impulse High Voltage and stressing on Air gap. It is studied the impact of: the breakdown Voltage, the electrodes geometry, the timescale of the impulse voltage and the environmental conditions. Accordingly are statistically analyzed the experimental results estimation of V50%, σ derived from the tests and compared with the theoretical evaluation of these configurations.

Lab.2 *Determination of the Voltage distribution along the insulator strings*

In this exercise it is determined the distribution of the High Voltage along the insulator strings, which is an indicative test for the quality of the insulator string condition. Hence, it is studied the impact of the addition of toroid on the insulator string. This method is also used for tracing of damaged insulator discs on the string. Furthermore the High Voltage laboratory is equipped with the aforementioned equipment for Electric Field measurement on insulator strings.

Lab.3 *Grounding resistance and ground resistivity measurement*

On this exercise the values of installed groundings are measured along with measurement or evaluation of ground resistivity. The measurements are compared with the calculated theoretical formulas and analyzed.

Lab.4 *Dielectric Liquids – Dielectric Strength*

On this study, Breakdown Voltage measurements are held in order to evaluate the conformity of the dielectric oil with the IEC standards. The measurements are made according the regulations with High Voltage AC and Impulse Voltage measurements.

Lab.5 *Corona Discharge study for High Voltage transmission and distribution lines.*

It is calculated theoretically the initiation of Corona discharge for different types and configurations of lines under High Voltage. Accordingly the experimental initiation of the Corona discharge is compared with the calculated ones.

Lab.6 *Fuell Cell*

On this case study an effort to acquaint with the operation of a PEM type fuel cell is done for three different loads. The voltage and the current are recorded for every ten degrees of elevation, and the I-V waveforms are obtained.

Lab.7 *Standarized tests of equipments with Impulse High Voltage*

Aim of this work is to test the High Voltage equipment according to the International standards. Herein, the students are attuned with the test method and the standardized technique of measurement.

Code	**22805**
Title	**Power Systems Protection**
Instructor	
Credits	4 ECTS

Content:

Fundamental principles of Electric Power Systems protection. The evaluation of Protective Relaying. Fundamental operating principles and characteristics of Electro-magnetic-Attraction and induction type relays. The impedance and reactance type distance relays. Line protection with overcurrent relays. Line protection with distance relays. Unit protection in lines. Line protection with wire-pilot relaying. Line protection with carrier-current pilot relaying.

Line protection with microwave-pilot relaying. Line protection with phase and directional comparison. Bus-zone protection. Power transformer protection with gas relays. Percentage differential relaying for power transformers. AC generator and motor protection.

Code	**ECEB810**
Title	**Control Technology for Wind-Turbine Systems**
Instructor	Alexandridis
Credits	4 ECTS

Content:

Code	**ECEB8M1**
Title	**Energy Design & Air Conditioning**
Instructor	Kaouris
Credits	4 ECTS

Content:
Energy Design and Heating Systems.

FIFTH YEAR

9th semester

Code	**ECEB9021**
Title	**Tests and Measurements of High Voltages**
Instructor	Svarnas
Credits	4 ECTS

Content:
Introduction: Generation and transmission of electric energy, voltage stresses, testing voltages (testing with power frequency voltages, testing with lightning impulse voltages, testing with switching impulses, D.C. voltages, testing with very low frequency voltage).
Generation of high voltages: direct voltages (A.C. to D.C. conversion, electrostatic generators), alternating voltages (testing transformers, series resonant circuits), impulse voltages (impulse voltage generator circuits, operation, design and construction of impulse generators), control systems.
Measurement of high voltages: peak voltage measurements by spark gaps (sphere gaps, reference measuring systems, uniform field gaps, rod gaps), electrostatic voltmeters, ammeter in series with high ohmic resistors and high ohmic resistor voltage dividers, generating voltmeters and field sensors, the measurement of peak voltages (the Chubb-Fortescue method, voltage dividers and passive rectifier circuits, active peak-reading circuits, high-voltage capacitors for measuring circuits), voltage dividing systems and impulse voltage measurements (generalized voltage generation and measuring circuit, demands upon transfer characteristics of the measuring system, fundamentals for the computation of the measuring system, voltage dividers,

interaction between voltage divider and its lead, the divider's low-voltage arm), fast digital transient recorders for impulse measurements (principles and historical development of transient digital recorders, errors inherent in digital recorders, specification of ideal A/D recorder and parameters required for h.v. impulse testing, future trends).
Non-destructive insulation test techniques: dynamic properties of dielectrics (dynamic properties in the time domain, dynamic properties in the frequency domain, modelling of dielectric properties, applications to insulation ageing), dielectric loss and capacitance measurements (the Schering bridge, current comparator bridges, loss measurement on complete equipment, null detectors), partial-discharge measurements (the basic PD test circuit, PD currents, PD measuring systems within the PD test circuit, measuring systems for apparent charge, sources and reduction of disturbances, other PD quantities, calibration of PD detectors in a complete test circuit, digital PD instruments and measurements).

Code	**ECEB9022**
Title	**Tests and Measurements of High Voltages (Lab.)**
Instructor	Svarnas
Credits	2 ECTS

Content:

Code	**ECEB906**
Title	**Power Electronic Devices and Industrial Applications**
Instructor	Tatakis
Credits	4 ECTS

Content:
Structures and operational characteristics of power transistors BJT, MOSFET, IGBT and power diodes, structures and characteristics of emerging power semiconductor devices (MCT, IGCT, etc.) Static and dynamic behaviour, safe operating area, conduction and switching losses, overvoltage and overcurrent protection (snubbers). Design and analysis of different drive circuits. Equivalent circuits, simulation of power electronic devices and parameter's extraction methods. Inverters with power transistors, PWM technique (asynchronous, synchronous, precalculated), induction motor drives, industrial applications of DC to AC converters. PWM DC-DC Converters, analysis of different topologies (Buck, Boost, Buck-Boost), PWM DC-DC Converters with insulation transformer (Forward, Flyback, Push-Pull), Inductors and transformers design, Switch-Mode Power Supplies, other applications (UPS, chargers, etc.) Quasi-Resonant DC-DC converters, Zero-Current and Zero-Voltage techniques, Full-wave and Half-Wave topologies, applications (telecommunication, electronic equipment etc.)

Code	**ECEB909**
Title	**Electric Machines Dynamics**
Instructor	Kappatou
Credits	4 ECTS

Content:

Generalized models based on the two axes theory for electrical machines a, self and mutual inductances of induction and synchronous machines, Park's transformation. Transient phenomena analysis (short circuits, changes of load, disconnection and connection to the grid) by using digital simulation. Space vectors. Electromechanical vibrations.

Code	**ECEB911**
Title	**Advanced Control of Electric Machines**
Instructor	Alexandridis Mitronikas
Credits	4 ECTS

Content:

Code	**ECEB004**
Title	**Computer Methods in Power Systems Analysis**
Instructor	
Credits	4 ECTS

Content:
Matrix algebra. Graph theory. Incidence and network matrices. Formation of network matrices by singular and non-singular transformations. Sparce matrix techniques. Triangular factorisation techniques. Algorithms for formation of network matrices. Three phase networks. Transformation matrices. Incidence and network matrices of three-phase networks.

Power system modelling and simulation. Application of the simulation techniques to develop the computer programs used to perform the basic studies concerning the power systems, that is: a) Load flow studies, b) Short circuit studies and c) Transient stability studies.

Code	**ECEB005**
Title	**Renewable Energy Sources II**
Instructor	Zacharias
Credits	4 ECTS

Content:
Solar cells, photovoltaic effect, equivalent circuit, current-voltage characteristics, energy conversion efficiency, solar cell materials and technologies. Solar cell arrays, definitions, mismatch loss and hot-spot effects, optical, mechanical and electrical characteristics, blocking diodes. Storage batteries, general description, charging, discharging, capacity, efficiency, battery types, storage battery applications in photovoltaic systems. Economic analysis of energy systems. Power conditioning units, voltage regulators (linear, switch-mode), maximum power point trackers, DC to AC conversion. Design of stand-alone photovoltaic systems.

10th semester

Code	**ECEB001**
Title	**Dynamics & Control of Electromechanical Systems**
Instructor	Alexandridis
Credits	4 ECTS

Content:
The fundamental electromechanical system. Power conversion in a simple electro-mechanical system. Equations of linear and rotational motion. Voltage and torque equations. Obtaining dynamic equations by using classical methods. Generalised dynamic and kinetic energy of the fundamental electromechanical components. The principle of the least action: Lagrange equation. Electromechanical systems for linear motion: Variable capacitors and coils. Dynamic model of the direct current (DC) machine. Universal motor. The synchronous machine: Calculation and measurement of self-inductances, mutual-inductances and rotating inductances. Active and orthonormal transformations: Park's transformation. The synchronous machine on the d, q, O axes system. Abnormal and transient condition. Vector description. The asynchronous machine: Park's transformation and dynamic description on the d, q, 0 axes system.

Code	**ECEB002**
Title	**Overvoltage Protection – Lightning Surge Arresters**
Instructor	Pyrgioti
Credits	4 ECTS

Content:
This course provides the basic knowledge for the protection of transmision lines, buildings and other facilities from overvoltages caused by lightning, by teaching the following subjects: Lightning discharges. Creation of lightning discharge. The consequences of lightning strike on buildings, industires, playing fields, telecommunication systems and other facilities. The consequences of lightning strike on Transmission Lines. Lightning electromagnetic fields. Evolvement and propagation of overvoltages on Transmission Lines. Overvoltage proctection of overhead transmission lines. The electrogeometric model. Surge arresters on High Voltage Transmission Lines. Lightning protection methods of buildings, industires, playing fields and other facilities.Lightning protection of high-rise buildings, danger structures and other facilities. Protection of ships and aircraft. Protection of telecommunication systems.

Code	**ECEB011**
Title	**Electrical Insulation Technology and Nanostructured Dielectrics**
Instructor	Svarnas
Credits	4 ECTS

Content:
Electrical breakdown in gases: classical gas laws (velocity distribution of a swarm of molecules, the free path of molecules and electrons, distribution of free paths, collision-energy transfer); ionization and decay processes (Townsend first ionization coefficient, photoionization, ionization by interaction of metastables with atoms, thermal ionization, deionization by recombination, deionization by attachment-

negative ion formation, mobility of gaseous ions and deionization by diffusion, relation between diffusion and mobility); cathode processes – secondary effects (photoelectric emission, electron emission by positive ion and excited atom impact, thermionic emission, field emission, Townsend second ionization coefficient, secondary electron emission by photon impact); transition from non-self-sustained discharges to breakdown (the Townsend mechanism); the streamer or 'kanal' mechanism of spark; the sparking voltage – Paschen's law; penning effect; the breakdown field strength; breakdown in non-uniform fields; effect of electron attachment on the breakdown criteria; partial breakdown, corona discharges (positive or anode coronas, negative or cathode corona); polarity effect – influence of space charge; surge breakdown voltage – time lag (breakdown under impulse voltages, volt-time characteristics, experimental studies of time lags).

Breakdown in solid and liquid dielectrics: breakdown in solids (intrinsic breakdown, streamer breakdown, electromechanical breakdown, edge breakdown and treeing, thermal breakdown, erosion breakdown, tracking); breakdown in liquids (electronic breakdown, suspended solid particle mechanism, cavity breakdown, electroconvection and electrohydrodynamic model of dielectric breakdown, static electrification in power transformers).

Industrial applications perspective of nanodielectrics: introduction and background; polymer nanocomposites; the commercial impact of enhanced electric strength and endurance; opportunities for enhanced high-temperature dielectrics; cryogenic applications and other extreme environments; high-voltage stress grading materials and conducting nanocomposites; applications in the capacitor industry; multi-functional opportunities.

Electrical properties: charge storage and transport in polymers and nanocomposites (introduction, charge transport in insulating systems, charge transport in polymers, electrode effects, space charge effects, effect of nanoparticles and interaction zone on charge transport, percolation effects, examples of charge movement in nanocomposites, internal charge distribution in nanocomposites, concluding remarks on charges in nanocomposites); dielectric response (dielectric spectroscopy, dielectric response of nanocomposites); electrical breakdown (introduction, polyethylene nanocomposites, epoxy nanocomposites, PVA nanocomposite, surface functionalization of nanoparticles, voltage endurance).

Code	**ECEB008**
Title	Plasma Technology & Applications
Instructor	-
Credits	4 ECTS

Content:
Elements of gas kinetic theory, distributions, cross section, reaction coefficient, Langevin model, Townsend discharge, Paschen's law, glow discharge, breakdown mechanisms (streamer). Glow to Arc transition, Corona Discharges, Applications.

Code	**ECEB0131**
Title	**Electrical Measurements/ Methodology**
Instructor	
Credits	4 ECTS

Code	**ECEB0132**
Title	**Electrical Measurements/ Methodology (Lab.)**
Instructor	
Credits	2 ECTS

FIELD OF SPECIALIZATION: COMPUTERS AND/OR ELECTRONICS & EMBEDDED SYSTEMS

FOURTH YEAR

7th semester

Code	**ECEC704**
Title	**Advanced Analogue/Digital Integrated Circuits and Componets**
Instructor	M. Birbas Kalivas A. Birbas
Credits	5 ECTS

Content:
Basic structures of analogue integrated circuits. Integrated circuits. Integrated operational amplifiers, analogue comparators and voltage regulators. Tuned amplifiers and oscillators, switching capacitor filters. Mixed analogue and digital circuits including principles of A/D-D/A and V/F-F/V converters). Design of circuits based on surface acoustic wave (SAW) devices. Interfaces between analogue and digital arrays in a system. Electromagnetic interference (EMI) in analogue circuits.

Code	**ECEC705**
Title	**VLSI Design I**
Instructor	Theodoridis Koufopavlou
Credits	5 ECTS

Content:

CMOS Processing Technology: Silicon Semiconductor Technology, Layout Design Rules, Latchup.

Circuit characterisation and performance estimation: Resistance and Capacitance Estimation, Inductance, Switching Characteristics, Transistor Sizing, Power Dissipation, Design Margins, CMOS Logic Structures.

Physical design: CMOS Logic Gate Design, Physical Design of Logic Gates.

CMOS circuit and logic design: Power Dissipation, Yield, Reliability, CMOS Logic Structures: CMOS Complementary Logic, BiCMOS Logic, Pseudo-nMOS Logic, Dynamic CMOS Logic, Clocked CMOS Logic (C2MOS), Pass-Transistor Logic, CMOS Domino Logic, NP Domino Logic (Zipper CMOS), Cascade Voltage Switch Logic (CVSL).

Lab.1 *Design and Simulation of Basic CMOS Circuits.*
Introduction to the CAD tool Microwind and understanding of its basic capabilities and features through the design and simulation of a CMOS inverter and a NAND gate. Homework: Design and simulation of different logic gates and delay measurement.
Lab.2 *Study of the gate and diffusion capacitance and the delay of CMOS Circuits.*
Study of the parameters that affect the delay of CMOS circuits with emphasis in its capacitances. Layout design of logic gates with different parameters and delay analysis. Homework: Theoretical calculation of the capacitances and comparison with the experimental results, and computation of the gates' sensitivity.
Lab.3 *Study of the Power Consumption of CMOS Circuits.*
Exploration of the parameters that affect the total power consumption through the layout design of logic gates. The designed circuit is exported from Microwind and imported to Spice, where the consumption is measured. Homework: Layout design and power measurement in different logic gates, comparisons and evaluation of the parameters that affect the consumption. •
Lab.4 *Layout Design of Complex CMOS Logic Gates.*
Layout design of compound gates through the method of Euler paths, so that the gate shares more diffusion regions and requires less area and has less delay. Homework: Layout design of complex gates with discrete gates and Euler paths, and delay comparison between the two methods.
Lab.5 *Study of the Critical Path Delay.*
Experimental study of the characteristics that affect the critical path delay through the layout design of a 4-bit full adder. Homework: Theoretical calculation of the adder's delay and comparison with the experimental results. Adder design with Euler paths and evaluation of the circuit. •
Lab.6 *Circuit Design and Simulation in Spice.*
Introduction to the CAD environment Capture CIS and design of complex logic functions in transistor level. Circuit design using static CMOS, pseudo-NMOS and dynamic logic. Homework: Design of a different logic function and comparison of the power consumption of different logic families.
Lab.7 *Study of the Logical Effort.*
Experimental study of the delay of CMOS circuits using the logical effort. Design of logical functions with default transistor size and stages of logic and their calculation through the logical effort. Redesign of the circuit with the optimal transistor size and stages and evaluation by measuring the delay. Homework: Design of complex logic

functions using the method of logical effort, study and improvement of their delay •
Lab.exams Design of a CMOS circuit which has already been design during the exercises, .measurement of the performance characteristics and evaluation of the results.

Code	**ECEC901**
Title	**Data Bases**
Instructor	Avouris
Credits	5 ECTS

Content:
This course is an introduction to the subject of databases with particular emphasis on the relational model and SQL.
Unit 1. (weeks 1 and 2) Introduction, conceptual design of databases. Data Modeling with the Entity-Relationship Model.
Unit 2. (week 3) Introduction to the relational model, transformation of entity-relationship model to a relational schema.
Unit 3. (Week 4) Relational Algebra.
Unit 4. (weeks 5-7) SQL, embedded SQL, programming interfaces to SQL.
Unit 5. (weeks 8-9) Internal Scheme, file Organization, indexes, multi-level indexes, B trees.
Unit 6. (weeks 10-11) Large Databases, transaction systems, security, interface of relational databases to the internet, interface of database to XML, X Schema, Xpath.
Unit 7. (weeks 12-13) NoSQL databases, MongoDB.
Laboratory Exercises
The laboratory work includes guided analysis, design and development Database in a web DBMS, following the schedule below (10 lab sessions, total contact time 20 hours/ semester):
Lab.1 Entity Relationship Model (ERD): An example of creation of an ERD is given and the the students are asked to design a new entity-relation model using online tools (www.gliffy.com or www.draw.io).
Lab.2 As Lab 1, with a different case (tools as in Lab.1).
Lab.3 From Entity Relationship Model (SSD) to the Relational Model. For the design of the Relational model we use Database design tool Mysql workbench. (Https://www.mysql.com/products/workbench/).
Lab.4 In this lab we use Mysql Workbench to design the relational model and SQL code generation for building a database. There is particular emphasis on the integrity constraints of the database model produced.
Lab.5 Create a database in the MySQL environment. Using data definition language (DDL SQL). MYSQL included in XAMPP distirbution will be used. H database itself is built in the Mysql Workbench environment and XAMPP (PHPMyadmin). (www.apachefriends.org).
Lab.6 Data manipulation with SQL in XAMPP (PHPMyadmin). Example: Academic Library.
Lab.7 Data manipulation with SQL in XAMPP (PHPMyadmin). Example: Company.
Lab.8 Data manipulation with SQL in XAMPP (PHPMyadmin). Example: Company - Part B Connection with programming environment.
Lab.exam This session is dedicated to the laboratory examination. Given a problem (microworld) the students are asked to design the ERD, RM, SQL ddl, SQL dml.
Lab.10 Recovery Laboratory.

Code	**ECEC703**
Title	**Microcomputers and Microsystems**
Instructor	Koubias Kalivas
Credits	5 ECTS

Content:
- Study in depth of the philosophy CISC microprocessor architectures
- Architecture and programming methods using as vehicle the Intel 8085 microprocessor. Assembly language programming using the instruction set of 8085. Timing diagrams.
- ROM/RAM memories. Design of memory devices and selection methods.
- Input / Output controlled by a program. Device selection circuits, implementation of I/O ports.
- Parallel communication. In-depth study and use of INTEL-8155 and -8255 peripherals. Application examples.
- Systems and interrupt mechanisms. The 8085 interrupt system. Input / Output through interrupt.
- Introduction to serial interfacing (asynchronous, synchronous). In-depth study and use the USART 8251. Application examples.
- Connection to external systems (I/O) for control and processing. Design and implementation of microsystems.
- Introduction to INTEL 8086, internal architecture, description of control signals, programming model.

The course offers laboratory training using appropriate H/W, in order to deepen the knowledge of the objects that are taught in the Theory (course ECEC7031 Microcomputers and Microsystems I). The subject of the lab. includes the design and implementation of specific applications based primarily on the INTEL 8085 microprocessor and its peripherals.

Code	**ECEC903**
Title	**Advanced Microprocessors**
Instructor	Koubias M. Birbas
Credits	5 ECTS

Content:
- CISC (Complex Instruction Set Computers) microprocessor architectures. Architecture of INTEL x86 microprocessors.
- In depth study of the architectures and applications of the latest products in INTEL x86 family: 8086, 80286, 80386, 80486, embedded μικροεπεξεργαστών 80386EX and 80196, Pentium and P6.
- Segmantation, pipelining, paging etc.
- I/O programming, multi-programming.
- Structural presentation of modern microprocessors such as PENTIUM and POWER PC as well as of interfacing architectures (PCI Bus).
- RISC (Reduced Instruction Set Computers) architectures. Study of embedded architectures using as presentation vehicles the 80960 and ARM microprocessors.
- Application of the aforementioned microprocessors to complex systems (Microsystems). Programming Models. Development tools.

Laboratory Exercises

The course offers laboratory training using appropriate H/W, in order to deepen the knowledge of the objects that are taught in the Theory.

Code	**ECEC706**
Title	**Digital Signal Processing**
Instructor	Dermatas
Credits	5 ECTS

Content:
Introduction. Discrete-time signals and systems. Signal and system representation in the frequency domain. Z-transform and its properties. Analysis of signals and systems in the frequency domain. Discrete-time system architectures. Discrete-time system implementation issues.

Laboratory Exercises
The architecture and functions of an advanced DSP processor (Texas Instruments DSP C6711) are presented and analyzed. Then a series of 5 exercises, completed in two 3-hour sessions each, is executed, in assembly programming of the C6711.
The exercises focus on:

Lab.1 Learning of the TI C67XX basic assembly instructons and their execution in hardware. Familiarization with the TI Code Composer Studio software

Lab.2 Construction of complex assembly programs and forming of basic DSP algorithms (e.g.: convolution)Data representation and their dynamic ranges

Lab.3 Interrupt requests and their use in increasing the processor's efficiency in communicating with its peripherals. Comparison to polling.

Lab.4 Analog/digital/analog conversion and audio signal sampling through the PCM3003 (de)coder and its communication with the processor through a serial port (McBSP).

Lab.5 Digital FIR filter implementation on the processorMATLAB design of various filters and their TI DSP processor implementation in the processing of a sampled audio signal.

Code	**ECEC801**
Title	**Computer Architecture**
Instructor	Serpanos
Credits	5 ECTS

Content:
Computer abstractions and technology. Integrated circuits. The role of performance. Measuring performance. Performance metrics. Instructions: Language of the machine. Operations and operands of the computer hardware. Computer Instructions. Procedures, arrays and pointers. Arithmetic for computers. Negative numbers. Addition, subtraction multiplication and division. Floating point. The processor: Datapath and control. Building a datapath. Simple and multiple clock cycle implementations. Microprogramming. Enhancing performance with pipeline. Pipeline datapath and control. Data and branch hazards. Exceptions and performance of pipelined systems. Large and fast: Exploiting memory hierarchy. Caches. Virtual memory. Interfacing processors and peripherals. I/O performance measures. Types and characteristics of I/O devices. Buses. Interfacing I/O devices.

Code	**ECEC802**
Title	**Operating Systems**
Instructor	Housos
Credits	5 ECTS

Content:
Definitions, historical progress, main components of an operating system. Operating System Structures. Concurrent processes, semaphores. Process communication. Memory management, paging, virtual memory. CPU scheduling, dead-locks and deadlock prevention, avoidance and detection.

Secondary storage management, file systems, protection. Distribution and parallel systems. Introduction to the Unix operating system.

Code	**ECEC708**
Title	**Photovoltaic Element Technology**
Instructor	Skouras
Credits	4 ECTS

Content:
Solar irradiance. Characteristics of the terrestrial and extraterrestrial solar spectrum. Photovoltaic effect. A diode p-n as a solar cell. Spectral response, photocurrent. Equivalent solar cell circuits. Recording and analysis of I-V characteristic curves. Short circuit current, open circuit voltage, maximum power point. Efficiency, quantum efficiency and fill factor. Factors limiting efficiency and maximum power generated. Parasitic resistances. Effect of series and shunt resistances on the efficiency of cells and modules. Solar cells connected in series and in parallel. Photovoltaic modules. Stand-alone photovoltaic systems. Power consumption demands. Calculation using minimum number of PV panels. Optimal cable sizing in photovoltaic systems. Inverters. Advanced methods of fabricating high efficiency Si solar cells. Surface texturing. Increase of photon path length. Emitter wrap-through and semi-transparent Si solar cells. Laser drilling, cutting, engraving, surface texturing and fired contacts. Environmentally friendly ohmic connections. Homo- and hetero-junction III-V solar cells. Concentrator and vertical architecture photovoltaic systems.

8th semester

Code	**ECEC702**
Title	**Advanced Programming Techniques**
Instructor	Thramboulidis
Credits	5 ECTS

Content:
1. Introduction to embedded systems. Technologies for the design and implementation of embedded systems. Internet of Things.
2. Advanced programming constructs in C. Pointers to functions, low level file handling.
3. Low level programming. C language constructs for low level programming.
4. The C programming interface to assembly language.
5. Interfacing to the operating system services.
6. Direct access to the system's hardware. Handling Interrupts.
7. Case Study: Development of an application to exploit the UART 8250. Programming using the ARM® Cortex™-M0+ processor. (ARM University Program).
8. Concurrent Programming. Conceptual model of concurrent programming. The mutual exclusion problem.
9. The Dekker's algorithm. Semaphores. Monitors. The producer-consumer problem. Java mechanisms for concurrent programming. Case study: The sleeping Barber problem.
10. Using the Object technology for the development of embedded systems. Introduction of the UML for system design - basic diagrams.
11. Java as a programming language for IoT.
12. The real time Java specification.

Lab.1 Advanced C. Pointers to functions, low level file handling, dynamic memory handling. Development of address book application.
Lab.2 Development of an application to exploit the UART 16550 in x86 systems. Programming using the ARM® Cortex™-M0+ processor. (ARM University Program). Handling of interrupts. Use of OS series, Direct access to hardware. Interfacing to assembly.
Lab.3 Development of sleeping barber application. Utilizing semaphores and monitors and java constructs for concurrent programming.
Lab.4 Development of application in the context of IoT. THe Liqueur Plant example application using Raspberry Pi.
Lab.5 Concurrent programming using low level constructs. Development on ARM embedded board ARM® Cortex™-M0+ processor (ARM University Program).

Code	**ECEC005**
Title	**Internet Programming**
Instructor	Avouris
Credits	5 ECTS

Content:
The objective of the course is the study of the architecture and structure of the Internet, basic Internet application development tools, both from the client and server side.
1. Introduction to the Internet architecture, protocols.
2. Programming on the client side (HTML)
3. HTML: forms
4. HTML: stylesheets (CSS)
5. JavaScript, basic structures
6. JavaScript, objects, DOM, events
7. PHP: Introduction
8. PHP, Part 2
9. PHP and interface to databases
10. Introduction to XML
11. XML DTD, XML Schema, XSLT
12. AJAX

Laboratory Exercises
The lab includes guided programming exercises and software tools for designing web applications, according to the following schedule (10 lab sessions, total contact time every semester: 20 hours):
Lab.1 Designing a website using simple commands of HTML. Students are asked to design an application concerning the creation of an online form for requesting a certificate to a website on a service. In the first 2 exercises it is recommended to use editors such as Notepad and Notepad++ which allow the students to focus mainly on focusing on basic commands of HTML
Lab.2 Students are asked to improve the design of the Lab 1 website, using more advanced commands of HTML and constructs of HTML5 with the same tools of Lab.1.
Lab.3 Javascript, Extending the functionality of website of Lab 2 with JavaScript code. The JavaScript is intended to check validity of user input data before sent to the Server. In this Lab more specialized editors (free JavaScript editors) are used.
Lab.4 The website of Lab 3, is re-designed with CSS (Cascading Style Sheets), which allow to define flexible rendering of the various items on our website and create special effects.
Lab.5 Introduction to PHP, which is suitable for developing web applications with dynamic web pages, using basic commands and inherent data structures. In this phase the student will have to install the XAMPP package (https://www.apachefriends.org/index.html) and make use of the environment of MYSQL and PHPMyadmin, editing PHP files.
Lab.6 Create an application that combines the technologies of previous labs (HTML, CSS, JavaScript, PHP), without a database. Interface design that allows user with the help

of a browser to submit queries to Web Server and receive responses.

Lab.7 Design an application (using HTML, CSS, JavaScript, PHP), in order to connect to a given database. Development of full web application.

Lab.8 Experimenting with XML (Extensible Markup Language), data description language interface via XML with web application.

Lab.9 Revision Workshop.

Code	**ECEC905**
Title	**Telecommunication Electronics**
Instructor	Kalivas
Credits	4 ECTS

Content:

Analog and Digital Phase-Locked-Loops (PLL). Applications of PLL in clock recovery, frequency synthesis. Analog Multipliers, Mixers, RF Amplifiers, IF Amplifiers, Voltage Controlled Oscillators. Circuits for analog modulation Systems: AM, DSB, SSB, FM, PM. Circuits for Pulse and Digital modulation systems. Analog-to-Digital (A/D) and Digital-to-Analog (D/A) conversion. RF Transceiver subsystems and characteristics.

Code	**ECEC904**
Title	**Integrated Systems Design –VLSI II**
Instructor	Koufopavlou
Credits	4 ECTS

Content:

System Specification, Formal Methods, Validation, Design of Data Paths and Control Subsystems, Interfaces, Design of Bus Oriented Versus Local Interconnect Structures, Area-Time-Power-Optimisation, Memory Management, Design Based on Existing Subsystems (IP Design), HDL Languages, Design Methodologies Based on VHDL Hardware Structural Specification, Design Organisation and Parameterisation, Data Flow Description and Behavioural Description, Realisation of DSP Systems, e.g. VLIW, Harvard and Modified Harvard Structures, Multiprocessors. Design of Special Purpose Processors, ASIP Design, Hierarchical Design of Layout, Power Management.

Lab.1 Basic structures of VHDL. Data types, operators, and attributes. Valid and invalid operation between different data types. Arrays (1D, 1Dx1D, 2D). Description of ROM circuits.

Lab.2 Concurrent VHDL code. Circuit implementation of concurrent statements. Development of combinational circuits with concurrent code such programmable priority encoder, barrel shifter with fixed amount of shifting, comparison circuits, Hamming distance calculation etc.

Lab.3 Multiple VHDL descriptions per circuit with concurrent code and study the impact of the descriptions in the speed and area of the synthesized design. Circuits' examples: addition/subtraction of signed and unsigned numbers, addition/subtraction of BCD numbers, conversion from HEX to ASCII, driving a seven segment display etc.

Lab.4 Sequential VHDL code. Understanding the process structure statement and the difference between signal and variables. Circuit implementation of the sequential statements. Development with sequential code of typical circuits such as counters (simple, decimal counters, up/down counters, universal counters), serial to parallel, calculating the average value of an input set etc. Study of existing codes in terms of correct functionality, generation of unwanted latches and flip-flops, delay, and area.

Lab.5 Multiple VHDL descriptions per circuit with sequential code and study the impact of the descriptions in the speed and area of the synthesized design. Circuits' examples: register file, merge sort implementation, switch debounce, programmable pulse width generator, driving LED display with time multiplexing etc. Study of existing codes in terms of correct functionality, generation of unwanted latches and flip-flops, delay, and area.
Lab.6 Development and synthesis of circuits based on Finite State Machines. Circuits' examples: programmable and not programmable arbiter, FIFO memory, extraction of FSM from specifications, FSMs with programmable timers, Mealy and Moore FSM implementations etc.
Lab.7 Parametric structural VHDL, function, procedures, and packages. Circuits' examples: counters, adders, substractors, multipliers, registers with multiple operations etc.
Lab.8 FPGA implementations of RTL circuits in Xilinx development platforms. Functional simulation and verification, development of constraint files, synthesis and study of the reports, pin assignment, implementations strategies, Place and Route (P&R) post-P&R simulation and design verification, FPGA programming, simulation with ChipScope
Lab.Project Complete development of an algorithm (finding of the architecture, application of design techniques such parallelism, pipeline, folding/unfolding, and resource sharing, RTL VHDL development, functional verification, synthesis, and FPGA implementation and verification). Algorithms' application domains: DSP and multimedia (e.g. filters, FFT, DCT), cryptography (e.g. DES, GOST, FEAL, IDEA) etc.

Code	**ECEC006**
Title	**Distributed Real-time Embedded Systems**
Instructor	Koubias
Credits	4 ECTS

Content:
- The Real Time Environment, Modeling of Real Time Systems, Modelling of RT systems.
- Embedded systems, Architectures of Distributed Embedded Systems.
- Wired/wireless local networking structures, Time/event triggering networking architectures Event/Time-Triggered Protocols and Architectures.
- Hardware/Software Interaction, Fault Tolerance.
- Real Time Communications, Communication Delay Estimation.
- Input-Output, Real Time Operating Systems, Real Time Scheduling, Performance Analysis. Design of a complete Real Time System Based on Embedded Architectures.
- Design (hardware and software) of Distributed Control Systems Using Advanced Embedded Architectures.
- Case stydy: Real Time Fieldbuses. Real time industrial networks.

Code	**ECE**
Title	**Nanoelectronics**
Instructor	-
Credits	5 ECTS

Content:

Code	**22HY56**
Title	**Data Mining & Learning Algorithms**
Instructor	
Credits	4 ECTS

Content:
Course from the Department of Computer Engineering and Informatics.

Code	**ECEC008**
Title	**Architecture of Ultra Fast Digital Systems**
Instructor	Serpanos
Credits	4 ECTS

Content:
Fundamental architectures of networking systems. Performance of networking systems. Architecture of packet switches. Architecture bridges. Architecture of routers and gateways. Architecture of advanced network adapters). Special functions to support real-time services. Protocol processors. Network processors. Subsystems of special functions.

Code	**ECEC009**
Title	**Linear & Combinatorial Optimization**
Instructor	Daskalaki
Credits	4 ECTS

Content:

Code	**ECEC806**
Title	**Advanced Signal Processing**
Instructor	-
Credits	4 ECTS

Content:
Sampling and signal reconstruction. Discrete Fourier transform, FFT, Linear and cyclic convolution, Overlap and add, Overlap and save. FIR digital filter design methods: minimum mean squares, don't care. The min-max criterion, Remez exchange algorithm. IIR analog and digital filters: Butterworth, Chebyshev, Design using frequency transformations. Special digital filters: Notch filters, Differentiators, Integrators, Hilbert transformers. Introduction to optimum stochastic signal processing: Wiener filtering with finite and infinite impulse response. Basic spectrum estimation techniques: Spectrogram, Periodogram, AR-model based techniques.

Code	**ECEC807**
Title	**Digital Signal Processing II (Lab.)**
Instructor	Skodras
Credits	2 ECTS

Content:
The architecture and functions of an advanced DSP processor (Texas Instruments DSP C6711) are first presented and analyzed. Then a series of 5 exercises, completed in two 3-hour sessions each, is executed, in C programming of the C6711 to implement basic DSP algorithms as well as more advanced projects.
The exercises focus on:
Lab.1 Introduction to the TI code development environment Code Composer Studio. Use of polling for the audio data

sampling through the PCM3003 (de)coder and the serial port (McBSP). The sound is guided to the speakers both in its unprocessed and its processed form, when echo is inserted and additional routines create a potentionmeter at the processor's peripheral LEDs.

Lab.2 IIR filter implementation

Lab.3 Dual-Tone Multi-Frequency (DTMF) decoder implementation

Lab.4 Adaptive filter implementation

Lab.5 Real-time spectrum analyzer implementation.

FIFTH YEAR

9th semester

Code	**ECEC902**
Title	**Analysis & Design of Software Systems**
Instructor	Thramboulidis
Credits	4 ECTS

Content:

1. Introduction to Software Engineering. Embedded systems, Mechatronic Systems, Cyber Physical Systems, IoT. Software and system life cycle process. The concept of Model.
2. Software life-cycle models. Basic software and system development phases. CASE tools. The Scrum method. The concept of the model.
3. Modern structured analysis (SA) methodology. Requirements specification document. Data flow diagrams (DFDs), data dictionary, mini specification techniques, entity relation diagrams (ERDs), state transition diagrams (STDs).
4. Moving into the design phase. Quality of the design specification, coupling, cohesion.
5. Object Technology. The UML as a language to represent analysis and design models. UML's main diagrams. Structural and behavioral models.
6. System architecture. Architectural models.
7. Model driven development. Model-to-model transformations.
8. System development using the component-based development paradigm.
9. Development based on the concept of service. Service oriented Architectures

(SOA). Basic concepts and technologies. The CORBA architecture.
10. System modeling. The system modeling language SysML.
11. Verification and Validation. Safety critical systems. Safety Engineering.
12. State-of-the-art trends in system development.

Case Study: Analysis, design and implementation of an embedded system. Typical examples: Liqueur Plant system, washing machine, Intruder Alarm System, Festo Modular Production System (Festo MPS), Multi cabin elevator system, Festo Mini Pulp Process (Festo MPP).

Code	**ECEC906**
Title	**Advanced Computer Systems**
Instructor	-
Credits	4 ECTS

Content:
Introduction to parallel processing. Interconnection networks. Parallel programming. Shared memory multiprocessors. Memory consistency protocols. Message-passing multiprocessors. Networks of workstations. Parallel I/O systems.

Code	**ECEC909**
Title	**Optoelectronics Applications**
Instructor	
Credits	4 ECTS

Content:

Overview, introduction to semiconductor physics (basic notions of crystallography, crystal growth techniques), electronic properties of semiconductors (energy bands, E-k diagram, nearly-free-electron model, density of states, Fermi-Dirac distribution), optical properties of semiconductors (band-to-band absorption and emission rates), p-n junction, light-emitting diodes, semi-conductor laser amplifiers, semiconductor lasers (static and dynamic properties), photodiodes, optical modulators, opto-electronics applications with emphasis in optical communications.

Code	**ECEC910**
Title	**Computer & Network Security**
Instructor	Serpanos
Credits	4 ECTS

Content:
Analysis, design and implementation of secure systems. Architecture of secure military and commercial systems. Cryptography with secret keys and public keys. Digital signatures and certificates. Cryptographic protocols. Computer Security. Communications security. Architecture of cryptosystems and computer/network security systems. Topics on how to implement secure systems.

Code	**ECEC911**
Title	**Parallel/Distributed Processing & Applications**
Instructor	Housos
Credits	4 ECTS

Content:

Parallel processing and algorithms for parallel and distributed computing systems. Historical overview of the development of parallel computing systems. Computational grid systems (GRIDS). Procedure of access to grids, with execution procedures and information storage. Synchronize Distributed processes. Web services and grid. Programming for parallel / distributed systems.

10th semester

Code	**ECEC002**
Title	**Control & Controlability of Digital Systems**
Instructor	-
Credits	4 ECTS

Content:
Modelling. Functional modelling at the logic and register level. Structural models. Logic simulation. Types of simulation. Compiled and event-driven simulation. Delay models. Hazard detection. Fault modelling. Logical fault models. Fault detection and redundancy. Fault equivalence and fault location. Fault dominance. Single and multiple stuck-fault model. Fault simulation. Simulation techniques. Fault simulation for combinational circuits. Fault sampling. Testing for single stuck faults. ATG and SSFs in combinational and sequential circuits. Testing for bridging faults. Functional testing without fault models. Exhaustive and pseudo-exhaustive testing. Functional testing with specific fault models. Design for testability. Ad hoc design for testability techniques. Scan registers and scan-based designs. Built-in self-test.

Code	**ECEC003**
Title	**Digital Image Processing**
Instructor	Dermatas
Credits	4 ECTS

Content:
Introduction. 2-D discrete signals. Theory of 2-D discrete systems. 2-D discrete Fourier Transform. Design and implementation of linear digital filters. Digital picture recording. Picture quality improvement.

Picture reconstruction. Digital image compression. Algorithms for edge detection. Algorithms for picture segmentation. Shape description.

Code	**ECEC0041**
Title	**Man-Machine Interaction and Design**
Instructor	Avouris
Credits	4 ECTS

Content:

1. Introduction, overview of human-computer interaction and design of interactive systems
2. Modeling of human as a user of computer system - Cognitive models of perception, attention and memory, knowledge representation and organization
3. Mental models, cognitive user models, distributed cognititve models.
4. Models of interaction
5. Interactive technologies - Interaction Style
6. Physical Man-machine interfaces
7. Haptic interaction
8. Methods and rules of interactive systems design
9. Usability Engineering
10. Evaluation of interactive systems
11. Tools and methods of interactive systems specifications.
12. Introduction to collaborative technology and technology for people with disabilities

Code	**ECEC0042**
Title	**Human-Machine Interaction & Design of Interactive Systems (Lab.)**
Instructor	Avouris
Credits	2 ECTS

Content:

The laboratory work includes guided analysis for the analysis, design and evaluation of interactive systems, following the schedule below (10 lab sessions, total contact time 20 hours/ semester):

Lab.1 This lab is aimed at studying the effect of conflicting impulses in the process of human attention and perception. In particular, Stroopes law will be validated during the lab. An additional objective is to familiarize with conducting empirical studies (experiments) and drawing conclusions through statistical data analysis techniques.

Lab.2 This lab aims to familiarize students with analytical models and techniques of human computer interaction with the aim to compare human performance in accomplishing tasks through diverse interaction device types. In particular, Fitts law will be validated during the lab. An additional aim is to further familiarize with conducting empirical studies (experiments) and and drawing conclusions through statistical data analysis techniques.

Lab.3 This lab aims to familiarize students with predictive analytical models and techniques (we will apply KLM) for measuring the performance of human-computer interaction. An additional aim is to further familiarize with conducting empirical studies (experiments) and and drawing conclusions through statistical data analysis techniques.

Lab.4 The purpose of this lab is to familiarize students with accessibility technologies with a focus on software and hardware that supports people with disabilities.

Lab.5 This lab aims to familiarize students with information classification techniques for designing efficient and effective information spaces and user interfaces. In particular we apply the card sorting technique (Card Sorting -CS) which is one of the most widespread classification techniques.

Lab.6 This lab aims to familiarize students with expert based user interface usability evaluation techniques. In particular we will apply the cognitive walkthrough evaluation technique.

Lab.7 This lab aims to familiarize students with rapid prototyping techniques during the design process of a user interface.

Lab.8 This lab aims to familiarize students with usability heuristic evaluation rules. In particular we will apply a heuristic evaluation for accomplishing specific tasks on existing interactive systems and will provide recommendations for improvements.

Lab.9 Exam. This session is dedicated to the laboratory examination.

Lab.10 Recovery Laboratory.

Code	**ECEC007**
Title	**Technology of Advanced Digital Circuits and Systems**
Instructor	
Credits	4 ECTS

Content:

This course addresses issues of technology and engineering for modern CMOS digital circuit design, having in mind the problems an engineer will face when he designs a high performance digital system for on-chip implementation. These include: models and limitations of deep sub-micron technology, high performance static and dynamic circuits, electrical wire modeling and on-chip interconnects, energy and delay optimization, timing issues, memory related circuits, interconnecting sub-systems and packaging. Part of the course requirements is a small project.

FIELD OF SPECIALIZATION D: SIGNALS, SYSTEMS AND AUTOMATIC CONTROL

FOURTH YEAR

7th semester

Code	**ECED701**
Title	**State-Space Linear System Analysis**
Instructor	
Credits	5 ECTS

Content:

Introduction - The state space approach to the design of control systems. - Controllability and observability of dynamical systems – Canonical forms of linear systems - Stability analysis: Stability under persistent perturbations. Bounded Input-Bounded Output stability . Stability under instantaneous perturbations.

Code	**ECED702**
Title	**Applied Optimization**
Instructor	Alexandridis
Credits	5 ECTS

Content:

Local minima of multivariable functions. Stationary points of multivariable functions under equality and inequality constraints. Lagrange multipliers. Linear programming and the Simplex method. Non-linear programming: Optimisation algorithms (gradient methods etc.) Curve fitting. Minimisation using iterative methods. Applied optimisation using iterative methods. Applied optimisation on industrial processing.

Optimisation of parallel and cascade processing systems.

Code	**ECED7E1**
Title	**Laboratory for Analogue and Digital Control Systems I**
Instructor	-
Credits	2 ECTS

Content:
The main purpose of this Laboratory course is to present to the student the basic notions of analog and digital control through especially designed laboratory experiments.

The specific experiments performed during the first semester consist of a servo system for open-loop and closed- loop control, a P.I.D. control configuration, the control of a thermal process, a system for studying the frequency response of control systems, and a digital control system configuration.

Code	**ECED704**
Title	**Industrial Automation I**
Instructor	-
Credits	4 ECTS

Content:
Instrumentation in industrial process control automation. Basic devices for automation systems implementation. Human-machine dialogue, detection and signal processing devices. Relays in control applications. Relay-Ladder diagrams. Design of automation arrangements. State diagrams in designing control circuits and state reduction. Basic Electropneumatics process control.

Code	**ECED902**
Title	**Introduction to Robotics**
Instructor	-
Credits	4 ECTS

Content:
Historical perspectives, Robot configuration and classification. Direct and inverse kinematics, Trajectory planning, Static analysis (Jacobian matrix and torque/force transformation), Robot Dynamics (N-E and Lagrange approaches), Fundamental of robot control (PID, feedforward).

Code	**ECED705**
Title	**Applied Computational Methods**
Instructor	Koussoulas
Credits	4 ECTS

Content:
Introduction. Number representation in a digital computer. Round-off and truncation errors. Solution of systems of linear algebraic equations. Norms and condition number. Eigenvalue computation. Special transformations. The QR method. Hermitian matrices. Sorting algorithms. Modeling and statistical analysis of data. Goodness of fit tests. Maximum likelihood and least squares estimation. Robust estimation.

8th semester

Code	**ECED801**
Title	**State-Space System Design**
Instructor	-
Credits	4 ECTS

Content:
Lyapunov type stability. The direct and the indirect Lyapunov methods. Estimation of stability regions. -State feedback control. The regulation and the tracking problem. - State estimation: Design of observers - The decoupling problem – Control of nonlinear systems-Applications to the control of multivariable systems.

Code	**ECED8E1**
Title	**Laboratory for Analogue and Digital Control Systems II**
Instructor	-
Credits	2 ECTS

Content:
The main purpose of this Laboratory course is to present to the student the basic notions of analog and digital control through especially designed laboratory experiments.

The corresponding experiments for the second semester consist of a three-tank system for analog and digital control, a nonlinear system of ball and beam for analog and digital control, and a system for temperature and level control of a liquid in a tank.

All the experiments' configurations can be assigned to undergraduate and postgraduate students for advanced studies concerning the theory and practice of control systems.

Code	**ECED802**
Title	**Digital Control**
Instructor	Groumpos
Credits	5 ECTS

Content:
Conversion of continuous-time systems to digital ones with samplers and holders. Definition, properties and applications of z-transform. Digital system transfer functions. Stability systems analysis on the time and frequency domain. Properties of digital filters and methods of discretizing of analogue filters. Realisations of digital filters with the state variable technique. Digital control algorithms (PID, Deadbeat). Realisation of digital filters with microprocessors. Determination of sampling period, wordlength of the microprocessor and the A/D and D/A converters. Error analysis and non-linearities due to Discretisation. Digital control applications of a mechanical artificial hand, of an automatic pilot and target tracking system.

Code	**ECED904**
Title	**Estimation Theory & Stochastic Control**
Instructor	Moustakides
Credits	5 ECTS

Content:
Introduction and overview. Review of probability theory, stochastic processes and linear system theory. The stochastic approach for modelling uncertainty. White noise. Analysis of the behaviour of stochastic dynamic systems. Fundamentals of estimation theory. Discrete time Kalman filter. Continuous time Kalman filter. Stochastic observers. Optimal smoothing. Extended Kalman filter. Applications. Error analysis and implementation. Solution of algebraic Riccati equations. Square root algorithms.

Stochastic control techniques. The LQG problem. Non-linear stochastic control and the dual effect. Robustness issues.

Code	**ECED804**
Title	**Industrial Automation II**
Instructor	-
Credits	4 ECTS

Content:
Programmable Logic Controllers. Hardware: structure and operation, central processor unit, input-output modules, analogue-digital modules. Software: ladder, Boolean statement list and control system flowchart programming, MATH functions, programming applications. Petri net theory. Modelling of complex systems with petri nets. Applications of petri nets in industrial automation systems. Special topics in automatic control applications: Step motors and their control with microprocessor. PID controllers and their industrial applications. Automated process control systems planning.

Code	**ECED806**
Title	**Simulation Methodology**
Instructor	Koussoulas
Credits	4 ECTS

Content:
Introduction and overview. Modelling and simulation: methodologies and techniques for continuous and discrete-event dynamic systems. Random number generators: uniform distribution. Tests and implementation. Random number generators: general distributions. Output analysis. Steady-state simulations. Bias and variance reduction. Elements of stochastic modelling. Integration of ordinary differential equations. Single-step and multi-step methods. Stability of algorithms. Stiff systems. Examples from industry. Project.

FIFTH YEAR

9th semester

Code	**ECED006**
Title	**Optimal Control**
Instructor	Alexandridis
Credits	4 ECTS

Content:
Introduction to the Calculus of Variations. Functionals. Minimisation of functionals: Euler-Lagrange equation. Minimisation of functionals under constraints. Cost criteria. Optimal control of continuous or discrete time systems. The linear quadratic (LQ) regulation and tracking problem: Open and closed-loop solution, infinite time solution, Riccati equation. The minimum Principle of Pontryagin. Bang-bang control. Optimal control of systems, with input and state constraints. Optimal PI controllers. Hamilton-Jacobi-Bellman theory. Dynamic programming. The linear quadratic Gaussian (LQG) problem.

Code	**ECED9E1**
Title	**Systems and Control Laboratory I**
Instructor	Manesis
Credits	2 ECTS

Content:
The aim of this unified laboratory course is to familiarize the students with some of the basic problems that arise in various applications of Systems Control and Process Automation. At the end of the course the student should be familiarized with the use and operation of programmable logic controllers, electro-pneumatic equipment, software for industrial applications, robotic arms and fuzzy controllers. The laboratory exercises include: Digital control applications with micro-controllers, control applications with programmable logic controllers, computer control of robotic arm KATANA, expert fuzzy control, use of software packets as Automation Studio and SCADA WinCC Flexible, control of an electro-pneumatic crane and control applications in Lab-View environment.
The titles of the laboratory exercises are:

Lab.1 Expert-Fuzzy control of a waste water treatment plant.

Lab.2 Programming applications of an S7-200 programmable logic controller in LAD and STL languages.

Lab.3 Robotic arm KATANA 400. Its operation and programming.

Lab.4 An experimental set-up for producing, measurement and visualized monitoring (SCADA) of basic physical magnitudes.

Lab.5 Training of the automation software packet “Automation Studio”.

Lab.6 Position and oscillation control of a pendulum load in a crane-type linear carrier operated with compressed air.

Code	**ECED909**
Title	**Advanced Topics on Systems & Control I**
Instructor	-
Credits	4 ECTS

Content:
Basic concepts of Systems and Control. Methods of analysis and design in large scale systems, industrial automation, robotic systems, etc. Applications.

10th semester

Code	**ECED907**
Title	**Non Linear Control**
Instructor	Bitsoris
Credits	4 ECTS

Content:
1. Nonlinear phenomena: Multiple equilibrium situations. Limit cycles. Chaos. Regions of attractors. 2. Analysis of nonlinear systems: analysis in the phase domain. The description of the function. 3. Stability. Stability in persistent disturbances-stability clogged Inlet clogged state. Stability in temporary disturbances. The first method of Lyapunov. The second method of Lyapunov. Rating stability regions. 4. Controllability of nonlinear systems: Controllable and approachable situations. 5. Control of nonlinear systems: Design of control systems based on the linear approximation. Design of control systems based on linearization. Control methods with the help of Lyapunov functions. Control of linear and nonlinear systems with bounded inputs and situations. Control of chaotic systems.

Code	**ECED003**
Title	**Adaptive Control**
Instructor	Kazakos
Credits	4 ECTS

Content:
Paradigms and historical perspective of adaptive control. Fundamentals of adaptive control and self-tuning systems. Introduction to system identification. Off-line techniques (Least Squares, Maximum Likelihood, Deconvolution-based algorithms). On-line transfer function estimation (ETFE, Recursive Least Squares, Least Mean Squares, Projection algorithms) and system output prediction. Controller design framework (Pole-placement, Generalized minimum variance, LQ-suboptimal control, Generalized Predictive Control). Model Reference Adaptive Control (MIT-Rule, Backstepping techniques). Adaptive Internal Model Control.

Code	**ECED901**
Title	**Intelligent Control**
Instructor	Groumpos
Credits	4 ECTS

Content:
Characteristics of the Computational Intelligence. Expert, Fuzzy, Neural and Evolutional Systems. Facing the Certainty and Fuzziness. Elements of the Fuzzy Logic. Artificial Neural Networks and the Learning. Evolutional Programming: Genetic Algorithm. Theories of Intelligent Systems, Modelling Complex Dynamic Systems with Fuzzy Cognitive Maps. Case Studies and Applications in: energy, environment, health, agriculture, finance, business and ecology.

Code	**ECED803**
Title	**Computer Aided Control Systems Design**
Instructor	-
Credits	4 ECTS

Content:
An introduction to software Engineering in Control Systems. Software quality. Requirements analysis. Software design. Structured programming. Software testing. Packages for Computer Aided Design. Advanced Programming in MATLAB.

Classical analysis and design of control systems using MATLAB. Modern design of Control Systems using MATLAB (pole placement, decoupling, model matching, observers). Algebraic design of Control Systems using MATLAB (UFC, RST compensators). Uncertainty and Robustness, Robust stability and Performance analysis. H-2 and H-Infinity Controller design. Multivariable frequency Control System analysis and design (Transfer-Function Matrix representation, Matrix-Fraction descriptions, poles, zeros, McMillan form, Inverse Nyquist arrays, Characteristic Locus, Multivariable Root-Locus, Principal Gain). Tracking Regulators design for Industrial Control Systems. Laboratory exercises.

Code	**ECED906**
Title	**Robust Control**
Instructor	-
Credits	4 ECTS

Content:
Transfer function of Multivariable Control System with multi inputs and multi outputs. Smith MacMillan form. Poles, Zeros, Eigenvalues, Eigenfunctions, Eigenvectors. Characteristic Locus, analysis and design. Transfer function factorization. Uncertainty and System Robustness. Uncertainty Models of Control Systems. Robust Stability and Robust Performance of Multivariable Systems. Structured singular value (SSV/μ) analysis. H_2 Optimization and Loop Transfer Recovery (LTR). Robust/ $H\infty$ Control, Two Port Formulation of Control Systems and mu synthesis. Stabilizing Controllers Parameterization. Youla factorization. $H\infty$ Controllers design using Transfer Function and State Space Models. Applications on Distillation Column, and Flight Control.

Code	**ECED001**
Title	**Industrial Automation Networks**
Instructor	Manesis
Credits	4 ECTS

Content:
Programmable Logic Controllers; their communication capabilities. Process Computer and Programmable Logic Controller networking. Distributed Control strategies. Communication tasks in a CIM system. Interconnection of heterogeneous Automation Islands. Factory Automation Network Standards. Basic Automation Network Devices and Software tools. Commercial Networks used in Factory Automation. Data Acquisition Systems and Supervisory Control.

Code	**ECED007**
Title	**Robotic Systems**
Instructor	-
Credits	4 ECTS

Content:

Code	**ECED010**
Title	**Networked Robotic Systems**
Instructor	Dermatas
Credits	4 ECTS

Content:
MCU Architecture. Peripherals: GPIO, UART, ADC, DAC, SPI, I2C. Boot Process.
C, C++ for Embedded Systems. IDE. Compilation, Linking and Debugging. Register Maps. Operators: Bit Manipulation. Modulus and Shifting. Interrupt Basics. Interrupt Vector Tables. Nesting and Priorities. State Machines. State Charts. Software Interrupts. Introduction to Real-time Operating Systems. Interrupts Best Practice. Classes in Embedded systems. Examples.
Real-Time Operating Systems. Scheduling. Tasks and States. Tasks communication and synchronization: Mutexes, Semaphores, Queues, Mailboxes. Examples.
Robotic Car (Hardware). Sensors and actuators: Sensing and Sensors, Accuracy and precision, Resolution, range, sensitivity and linearity, calibration, noise, saturation. Distance estimation based on Infrared and Ultrasonic sensors. DC and Servo Motors. PWM motor control. Wheel drivers. MEMS: Accelerometers, Gyroscopes, Magnetometers. Digital Cameras. Wireless communication.
Robotic Car (Software). Basic robot movements. Use of interrupts for speed and direction control. Line follower. Obstacle Detector. Edge Avoider. Robots communication.
Robotic vision. Fundamentals of image processing (Geometric primitives and transformations, Photometric image formation). Image processing (Point operators, Linear and non-linear filtering, Neighborhood operators, Fourier transforms, Pyramids). Feature detection and matching (Points and patches,Edges, Lines). Segmentation(Active contours, Split and merge). Feature-based alignment (2D and 3D feature-based alignment,Pose estimation Geometric intrinsic calibration). Image stitching (SIFT algorithm). Stereo correspondence and 3D-reconstruction (Epipolar geometry, RGB-D, Octomap). Mobile robot modeling and control (wheeled vehicles, trajectory following). Control of Swarms of mobile point robots. Control of Networked Mobile Robots. Collaborative and Distributed Control of Mobile Robots (Area Coverage and Surveillance problems).

Code	**ECED0E1**
Title	**Systems and Control Laboratory II**
Instructor	-
Credits	2 ECTS

Content:
The aim of this unified laboratory course is to familiarise the students with some of the basic problems that arise in various applications of Systems Control and Process Automation. Typical laboratory exercises include: AC Servosystem Analysis, Systems Control with PLC' s Computer Control of Robotic Arms, Hybrid Computer Systems Simulation, System Identification, Simu-lation and Design of a process Controller, etc.

Code	**ECED009**
Title	**Advanced Topics on Systems & Control II**
Instructor	-
Credits	4 ECTS

Content:
Basic concepts of Systems and Control. Methods of analysis and design in large scale systems, industrial automation, robotic systems, etc. Applications.

POSTGRADUATE STUDIES - RESEARCH

Postgraduate Studies

The Department of Electrical & Computer Engineering offers postgraduate studies leading to the Doctorate in Electrical & Computer Engineering. The general regulations for attending a Postgraduate Programme (PGP) and acquiring a Doctorate are stated in law 2083/92.

The specific regulations for the PGP at the Department of Electrical & Computer Engineering are included in the decree 562 T.B./ 28.6.95, by which this PGP was accepted by the Ministry of Education and Culture.

Candidates have to apply to the Secretariat of the Department either in September for studies starting in WS or in January for studies starting in SS designating the division(s) in which they want to study. They must possess a diploma in Electrical & Computer Engineering from a University department in Greece or an equivalent, recognised department abroad. Furthermore, candidates with a diploma in Computer and Information Engineering, Mechanical or Chemical or Civil Engineering and Candidates with a certificate in Physics, Mathematics, Computer Science or Informatics may be accepted. The selection of candidates is performed by the "General Assembly of Special Synthesis (GASS)" of the Department upon recommendation of the "Co-ordinating Committee of the Post Graduate Programme (CCPP)" of the Department on the basis of the diploma grade, the marks in the diploma thesis and in the main courses of the designated division, two recommendation letters and an interview with the CCPP. Accepted candidates with a diploma other than in Electrical & Computer Engineering (or equivalent) have to attend and pass examinations in a number of under-graduate courses in addition to the courses of the PGP.

The PGP includes several specialised, elective courses offered by the four divisions of the Department. Each postgraduate student has to select and attend six courses, and pass the corresponding examinations in the first four semesters of his/her studies. Furthermore, he/she has to start working in the first semester on a doctorate thesis, the subject of which is determined in co-operation with a faculty member that is willing to serve as the principal supervisor of the thesis. Upon request of this faculty member and recommendation of the CCPP, the GASS appoints a three member supervisory committee headed by the principal supervisor.

Postgraduate studies have a minimum duration of 6 semesters and a maximum duration of 12 semesters. As soon as the supervisory committee considers that the student has completed all requirements, a 7 faculty member examination committee, including the 3 supervising committee members, is appointed by the GASS, upon recommendation of the CCPP.

The candidate defends his/her thesis in public before the examination committee which decides whether the thesis is original and contributes to the advancement of science. In a positive case, the GASS awards the doctorate degree naming the candidate who possesses a diploma in Electrical & Computer Engineering "Doctor of Electrical & Computer Engineering", and a candidate with a different diploma, "Doctor of the Department of Electrical & Computer Engineering".

Research

The backbone of post-graduate studies is the Research and Development (R & D) that is being carried out in the Department of Electrical & Computer Engineering. As a rule, the research is conducted in the existing Laboratories of the Department, within the framework of the research programs of each Laboratory. The research programs are supported either by current state funding awarded to the University Laboratories, or by non-university institutions (*The General Secretariat of Research and Technology, Industry, the EU*, etc.) which, by various means, fund research and development at the University.

Ever since it was founded, the Department of Electrical & Computer Engineering has developed intense activity in research as well as in development. Its participation in international research projects, and its collaboration with the industry is of special importance. The result of this effort is manifested in the high number of doctorates awarded and of papers presented at international conferences and published in international journals.

Coordinating Committee of the Post Graduate Programme

Headed by:

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Members:

Prof. **J. Mourjopoulos** (Associate Director, Divison A)
Assoc. Prof. **G. Kalivas** (Division C)
Prof. **A. Skodras** (Division D)

POSTGRADUATE COURSES

Postgraduate courses

A list of postgraduate courses offered at the Department of Electrical & Computer Engineering is given below. Most of these cources can also be selected from the master students (fith year of studies towards the diploma of El.&Comp.Eng.). The chacacter P in the code denotes the course can be selected from PhD students only.

AUTUMN SEMESTER

A/A	Code	Course	L	S	LAB	Credits	Instructor
1	22MM001	Non Linear Systems/Analysis & Control[*]	3	0	0	3	Bitsoris Tzes
2	22MM002	DSP Architectures/Arithmetic	3	0	0	3	Paliouras
3	22MM003	Security in Computers & Networks	3	0	0	3	Serpanos
4	22MM004	Discrete Event Dynamic Systems/Hybrid Control	3	0	0	3	Koussoulas
5	22MM005	Hardware & Software Spec. Sys./Design	3		0	3	Papadopoulos
6	22MM006	Non Holonomic Systems[*]	3	0	0	3	Manesis
7	22MM007	Advanced Topics: Electromagnetic Compatiblility	3	0	0	3	Georgopoulos
8	22MM015	Parallel/Distributed Processing & Applications	3	0	0	3	Housos
9	22MM022	Electrical Motors of Low Power/Structure – Control	3	0	0	3	Mitronikas
10	22MM028	Techno-economic Design of Telecom Networks	2	1	0	3	Stylianakis

[*] *Not taught during the current academic year*.

SPRING SEMESTER

A/A	Code	Course	L	S	LAB	Credits	Instructor
1	22MM008	Software Technology & Applications	3	0	0	3	Thramboulidis
2	22MM010	High Speed Networking Systems*	3	0	0	3	-
3	22MM011	Industrial Computer Networks	3	0	0	3	Koubias Gialelis
4	22MM012	Special Topics on Human-Machine Communication: Introduction into Group-working Technology	3	0	0	3	Avouris
5	22MM013	Telecom Electronics/Sp. Topics	3	0	0	3	Kalivas
6	22MM014	Microsystems	3	0	0	3	A. Birbas
7	22MM016	Multivariable Systems & Robust Control*	3	0	0	3	-
8	22MM017	Digital Communications/Sp. Topics*	3	0	0	3	-
9	22MM018	Systems in Integrated Circuits	3	0	0	3	Koufopavlou Theodoridis
10	22MM019	Digital Processing Systems	3	0	0	3	Paliouras
11	22MM020	Intr. to Estimation & Detection Theory	3	0	0	3	Moustakides
12	22MM023	Reliability	3	0	0	3	Pyrgioti
13	22MM024	Data Bases	3	0	0	3	Avouris
14	22MM025	Electromagnetics/Sp. Topics*	3	0	0	3	-
15	22MM027	Quantum Information Processing	2	1	0	3	Sgarbas
16	22MM029	Adv. Control Tech. for Wind-Turbine Sys.	2	1	0	3	Alexandridis

* *Not taught during the current academic year*.

Appendix

Directory of Faculty

Name	Position	Division	Telephone	Email address
Alexandridis A.	Professor	B	+30 2610996404	a.t.alexandridis@ece.upatras.gr
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