UNIVERSITY OF PATRAS

SCHOOL OF ENGINEERING

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

Course Catalogue ACADEMIC YEAR

2023 - 2024

PATRAS 2023

CURRICULUM

Our curriculum is divided into ten academic 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:

- Communications
- Information Technology
- Smart Grid – Renewable Energy Sources – High Voltages
- Energy Conversion – Power Electronics – Electrotechnical Engineering Materials – Renewable Forms of Energy
- Computers: Hardware and Software
- Electronics and Embedded Systems
- Signal, Systems and Automatic Control
- Cyber-Physical Systems

Each field of specialization includes both compulsory and elective courses. Besides, basic courses from other fields of specialization must be selected in order for the students to expand their basic knowledge but retain a good degree of specialization. A prerequisite for obtaining the diploma in Electrical & Computer Engineering (equivalent to a Masters' Degree) 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.

In the description of the curriculum, below, an abbreviated title is given for each course; the complete title is given in the description of the courses that follows, together with the instructor(s). 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 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 six to seven characters. The meaning of these characters is as follows:
ECE denotes our **ECE** department.
The following character denotes either a compulsory or elective course, or the Division offering the course:

Y: Compulsory course for all students
K: Course of a Specialization Field.
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

(For a compulsory course:
5th / 6th digit: Semester the course belongs to.
Last two digits: 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
ECE_Y101	Single Variable Functions Calculus	4	2	0	6
ECE_Y104	Linear Algebra	2	1	0	3
ECE_Y106	Intr. to Computers	3	0	2	6
ECE_Y107	Modern Physics	3	1	0	4
ECE_Y108	Applied Physics	3	1	0	4
ECE_Y109	Digital Logic	2	2	0	4
Select 1 of:					
ECE_F210	Foreign Lang. - Eng.	3	0	0	3
ECE_F220	Foreign Lang. - Fra.	3	0	0	3
ECE_F230	Foreign Lang. - Ger.	3	0	0	3
ECE_F240	Foreign Lang. – Rus	3	0	0	3
	Total Credits:				**30**

2nd Semester

Code	Course	L	S	LAB	ECTS
ECE_Y211	Electrical Circuits I	3	1	0	5
ECE_Y212	Multivar. Functions Calculus & Vector Anal.	3	1	0	5
ECE_Y213	Applied Physics Lab.	0	0	2	3
ECE_Y214	Differential Equations & Complex Analysis	2	2	0	4
ECE_Y215	Procedural Programming	3	0	2	6
ECE_Y216	Engineering Mechanics	3	1	0	4
ECE_Y210	Intr. to ECE science	2	0	1	3
	Total Credits:				**30**

L: Lectures, S: Seminars, LAB: Laboratory

SECOND YEAR

3rd Semester

Code	Course	L	S	LAB	ECTS
ECE_Y320	Electrical Circuits II	3	1	2	7
ECE_Y321	Partial Diff. Equations & Transforms	4	1	0	6
ECE_Y322	Probability & Statistics	3	1	0	4
ECE_Y323	Solid State of Matter	3	1	0	5
ECE_Y324	Digital Logic Circuits & Systems	2	1	1	5
ECE_Y325	Object Oriented Technology	2	1	0	3
				Total Credits:	**30**

4th Semester

Code	Course	L	S	LAB	ECTS
ECE_Y420	Electromagnetic Fields I	2	1	0	4
ECE_Y421	Microelectronic Circuits & Devices	4	1	0	6
ECE_Y422	Power Circuits Analysis	3	1	0	5
ECE_Y423	Computer Organization	3	1	0	4
ECE_Y424	Communications Networks	2	1	2	6
ECE_Y425	Signals & Systems	4	1	0	5
				Total Credits:	**30**

L: Lectures, S: Seminars, LAB: Laboratory

THIRD YEAR

5th Semester

Code	Course	L	S	LAB	ECTS
ECE_Y520	Electromagnetic Fields II	3	1	0	5
ECE_Y521	Integrated Electronics	4	1	2	8
ECE_Y522	Numerical Analysis	2	0	1	3
ECE_Y523	Signal Processing	3	1	0	4
ECE_Y524	Communication Systems	2	1	2	5
ECE_Y525	Electrical Power Systems	3	1	0	5
				Total Credits:	**30**

6th Semester

Code	Course	L	S	LAB	ECTS
ECE_Y620	Automatic Control Systems	4	1	2	8
ECE_Y621	Elec. Measuring Devices & Techniques	2	0	1	3
ECE_Y622	Microcomputers / Embedded systems	2	0	1	4
ECE_Y623	Electrical Machines	4	1	2	8
ECE_Y624	Engineering Drawing	2	0	1	3
ECE_Y625	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				
ECE_AK701	Information Theory	4	0	0	5
ECE_AK702	Wireless Propagation	3	0	0	5
ECE_AK703	Digital Communications I	3	0	0	5
ECE_AK704	Microwaves	3	0	0	5
	Group B				
ECE_AK705	Artificial Intelligence I	3	0	2	5
ECE_CK702	Operating Systems	3	0	2	5
ECE_CK705	Digital Signal Processing	3	0	2	5
ECE_CK808	Telecommunication Electronics & High Frequencies	3	0	0	5

Courses from other fields of specialization, which have not already been chosen.

8th Semester: 30 ECTS

Code	Course	L	S	LAB	ECTS
	Group A				
ECE_AK801	Communications Lab. I	3	0	2	5
ECE_AK802	Wireless & Mobile Commun. Networks	3	0	0	5
ECE_AK803	Antenna Theory	3	0	0	5
ECE_AK804	Teletraffic Theory & Queuing Systems	4	0	0	5
ECE_AK805	Optical Communications	3	0	2	5
ECE_CK813	Optoelectronic and Photonic Technology	3	0	0	5
	Group B				
ECE_AK806	Digital Communications II	3	0	0	5
ECE_CK801	Adv. Programming Techniques	3	0	2	5
ECE_CK806	Linear & Combinatorial Optimization	3	0	0	5
ECE_CK807	Network Architecture	3	0	0	5
	Courses from other fields of specialization, which have not already been chosen.				
ECE_DE100	Diploma/Master Thesis (**Optional**)				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				
ECE_AK701	Information Theory	4	0	0	5
ECE_AK705	Artificial Intelligence I	3	0	2	5
ECE_AK707	Electroacoustics	3	0	2	5
ECE_AK708	Information Retrieval	4	0	0	5
ECE_CK705	Digital Signal Processing	3	0	2	5
	Group B				
ECE_AK709	Computer Graphics & Virtual Reality	3	0	2	5
ECE_AK710	Biomechanics I	3	0	0	5

Courses from other fields of specialization, which have not already been chosen.

8th Semester: 30 ECTS

Code	Course	L	S	LAB	ECTS
	Group A				
ECE_AK801	Communications Lab. I	3	0	0	5
ECE_AK809	Digital Audio Technology	3	0	0	5
ECE_AK812	Digital Processing & Image Analysis	3	0	0	5
ECE_AK813	Artificial Intelligence II	3	0	2	5
	Group B				
ECE_AK807	Intr. to Bioinformatics	3	0	0	5
ECE_AK810	Speech & Natural Lang. Processing	3	0	2	5
ECE_AK811	3D Computer Vision and Geometry	3	0	2	5
ECE_CK804	Data Mining & Learning Algorithms	3	0	0	5
	Courses from other fields of specialization, which have not already been chosen.				
ECE_DE100	Diploma/Master Thesis (**Optional**)				5

L: Lectures, S: Seminars, LAB: Laboratory

FIELD OF SPECIALISATION: SMART GRID – RENEWABLE ENERGY SOURCES – HIGH VOLTAGES

FOURTH YEAR

7th Semester: 30 ECTS

Code	Course	L	S	LAB	ECTS
	Group A				
ECE_BK701	Electrical Power Systems Analysis	3	0	3	5
ECE_BK702	High Voltages	3	0	3	5
	Group B				
ECE_BK704	Electrical Installations	4	0	0	5
ECE_BK705	Power Electronics I	4	0	2	5
ECE_BK707	Thermal Plants	3	0	0	5
ECE_AK702	Wireless Propagation	3	0	0	5
ECE_AK703	Digital Communications I	3	0	0	5
ECE_AK705	Artificial Intelligence I	3	0	2	5
ECE_AK710	Biomechanics I	3	0	0	5
ECE_CK803	Adv. Microcomputers Systems	3	0	2	5
ECE_DK701	State-Space Linear Systems Analysis	3	0	0	5
ECE_DK702	Applied Optimization	3	0	0	5
ECE_EK701	Intr. to Cyber-Physical Sys.	3	0	0	5
Courses from other fields of specialization, which have not already been chosen.					

8th Semester: 30 ECTS

Code	Course	L	S	LAB	ECTS
	Group A				
ECE_BK801	Power Sys. Control & Stability	3	0	3	5
ECE_BK803	High Voltages (Tests & Measurements)	3	0	3	5
ECE_BK812	Renewable Energy Sources	3	0	0	5
	Group B				
ECE_BK804	Electrical Power Systems Protection	3	0	0	5
ECE_BK805	Control Tech. in Renewable Energy Sources	3	0	0	5
ECE_BK806	Dynamics & Control of E-L Systems	3	0	0	5
ECE_BK807	Overvoltage/Lightning Protection	3	0	0	5
ECE_BK811	Energy Design & Air Conditioning	3	0	0	5
ECE_AK802	Wireless & Mobile Commun. Networks	3	0	0	5
ECE_AK813	Artificial Intelligence II	3	0	2	5
Courses from other fields of specialization, which have not already been chosen.					
ECE_DE100	Diploma/Master Thesis (**Optional**)				5

L: Lectures, S: Seminars, LAB: Laboratory

FIELD OF SPECIALISATION: ENERGY CONVERSION – POWER ELECTRONICS – ELECTROTECHNICAL MATERIALS – RENEWABLE FORMS OF ENERGY

FOURTH YEAR

7th Semester: 30 ECTS

Code	Course	L	S	LAB	ECTS
	Group A				
ECE_BK704	Electrical Installations	4	0	0	5
ECE_BK705	Power Electronics I	4	0	2	5
ECE_BK706	Electric Motor Drive Systems I	3	0	2	5
	Group B				
ECE_BK701	Electrical Power Systems Analysis	3	0	3	5
ECE_BK707	Thermal Plants	3	0	0	5
ECE_CK705	Digital Signal Processing	3	0	2	5
ECE_CK803	Adv. Microcomputers Systems	3	0	2	5
ECE_DK701	State-Space Linear Systems Analysis	3	0	0	5
	Courses from other fields of specialization, which have not already been chosen.				

8th Semester: 30 ECTS

Code	Course	L	S	LAB	ECTS
	Group A				
ECE_BK803	High Voltages (Tests & Measurements)	3	0	3	5
ECE_BK808	Electric Motor Drive Systems II	3	0	2	5
ECE_BK809	Power Electronics II	4	0	2	5
	Group B				
ECE_BK801	Power Sys. Control & Stability	3	0	3	5
ECE_BK807	Overvoltage/Lightning Protection	3	0	0	5
ECE_BK810	Biomechanics II	3	0	0	5
ECE_BK811	Energy Design & Air Conditioning	3	0	0	5
ECE_AK813	Artificial Intelligence II	3	0	2	5
ECE_DK801	Digital Control	3	0	2	5
	Courses from other fields of specialization, which have not already been chosen.				
ECE_DE100	Diploma/Master Thesis (**Optional**)				5

L: Lectures, S: Seminars, LAB: Laboratory

FIELD OF SPECIALISATION: COMPUTERS: SOFTWARE AND HARDWARE

FOURTH YEAR

7th Semester: 30 ECTS

Code	Course	L	S	LAB	ECTS
	Group A				
ECE_CK701	Computer Architecture	3	0	0	5
ECE_CK702	Operating Systems	3	0	2	5
ECE_CK703	Data Bases	3	0	2	5
ECE_CK803	Adv. Microcomputers Systems	3	0	2	5
ECE_AK705	Artificial Intelligence I	3	0	2	5
	Group B				
ECE_AK709	Computer Graphics & Virtual Reality	3	0	2	5
ECE_CK705	Digital Signal Processing	3	0	2	5
ECE_CK709	Intr. to Quantum Electronics	3	0	0	5

Courses from other fields of specialization, which have not already been chosen.

8th Semester: 30 ECTS

Code	Course	L	S	LAB	ECTS
	Group A				
ECE_CK801	Adv. Programming Techniques	3	0	2	5
ECE_CK802	Internet Programming	3	0	2	5
ECE_CK812	Machine Learning	0	0	0	0
ECE_CK901	Software Technology	3	0	0	5
	Group B				
ECE_CK804	Data Mining & Machine Learning	3	0	0	5
ECE_CK806	Linear & Combinatorial Optimization	3	0	0	5
ECE_CK807	Network Architecture	3	0	0	5
ECE_AK811	3D Computer Vision & Geometry	3	0	2	5
ECE_AK813	Artificial Intelligence II	3	0	2	5
	Courses from other fields of specialization, which have not already been chosen.				
ECE_DE100	Diploma/Master Thesis (**Optional**)				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				
ECE_CK705	Digital Signal Processing	3	0	2	5
ECE_CK707	Integrated Circuits Design I	3	0	2	5
ECE_CK803	Adv. Microcomputers Systems	3	0	2	5
ECE_CK808	Telecom Electronics & High Frequencies	3	0	0	5
	Group B				
ECE_CK701	Computer Architecture	3	0	0	5
ECE_CK709	Intro.to Quantum Electronics	3	0	0	5
ECE_AK704	Microwaves	3	0	0	5
ECE_AK707	Electroacoustics	3	0	2	5
ECE_BK705	Power Electronics I	3	0	2	5

Courses from other fields of specialization, which have not already been chosen.

8th Semester: 30 ECTS

Code	Course	L	S	LAB	ECTS
	Group A				
ECE_CK706	Adv. Anal./Dig. Integrated Circuits & Comp.	3	0	0	5
ECE_CK809	Integrated Circuits Design II	3	0	2	5
ECE_CK812	Machine Learning	0	0	0	0
ECE_CK813	Optoelectronic & Photonic Technology	3	0	0	5
	Group B				
ECE_CK807	Network Architecture	3	0	0	5
ECE_CK814	Satellite Technologies	3	0	0	5
ECE_CK901	Software Technology	3	0	0	5
ECE_AK801	Communications Lab. I	3	0	2	5
ECE_AK805	Optical Communications	3	0	2	5

Courses from other fields of specialization, which have not already been chosen.

ECE_DE100	Diploma/Master Thesis (**Optional**)				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				
ECE_DK701	State-Space Linear Systems Analysis	3	0	0	5
ECE_DK702	Applied Optimization	3	0	0	5
ECE_DK703	Intr. to Robotics	3	0	0	5
	Group B				
ECE_AK705	Artificial Intelligence I	3	0	2	5
ECE_AK709	Computer Graphics & Virtual Reality	3	0	2	5
ECE_BK701	Electrical Power Systems Analysis	3	0	0	5
ECE_BK706	Electric Motor Drive Systems I	3	0	2	5
ECE_CK705	Digital Signal Processing	3	0	2	5
ECE_EK701	Intr. to Cyber-Physics Sys.	3	0	0	5

Courses from other fields of specialization, which have not already been chosen.

8th Semester: 30 ECTS

Code	Course	L	S	LAB	ECTS
	Group A				
ECE_DK801	Digital Control	3	0	2	5
ECE_DK804	Industrial Automation	3	0	0	5
ECE_DK806	Robust Control	3	0	0	5
ECE_DK807	Intelligent Control	3	0	0	5
ECE_DK808	Robotic Systems I	3	0	0	5
	Group B				
ECE_AK811	3D Computer Vision & Geometry	3	0	2	5
ECE_AK813	Artificial Intelligence II	3	0	2	5
ECE_BK801	Power Sys. Control & Stability	3	0	3	5
ECE_BK806	Dynamics & Control of E-L Systems	3	0	0	5
ECE_BK808	Electric Motor Drive Systems II	3	0	2	5
ECE_CK806	Linear & Combinatorial Optimization	3	0	0	5

Courses from other fields of specialization, which have not already been chosen.

ECE_DE100	Diploma/Master Thesis (**Optional**)				5

L: Lectures, S: Seminars, LAB: Laboratory

FIELD OF SPECIALISATION: CYBER-PHYSICS SYSTEMS

FOURTH YEAR

7th Semester: 30 ECTS

Code	Course	L	S	LAB	ECTS
	Group A				
ECE_EK701	Intr. to Cyber-Physics Sys.	3	0	0	5
ECE_AK705	Artificial Intelligence I	3	0	2	5
ECE_CK701	Digital Signal Processing	3	0	2	5
ECE_DK703	Intr. to Robotics	3	0	1	5
	Group B				
ECE_CK701	Computer Architectures	3	0	0	5
ECE_CK702	Operating Systms	3	0	0	5
ECE_DK701	State-Space Linear Systems Analysis	3	0	0	5
ECE_DK702	Applied Optimization	3	0	0	5

Courses from other fields of specialization, which have not already been chosen.

8th Semester: 30 ECTS

Code	Course	L	S	LAB	ECTS
	Group A				
ECE_AK801	Communications Lab. I	3	0	2	5
ECE_DK801	Digital Control	3	0	2	5
	Group B				
ECE_AK813	Artificial Intelligence II	3	0	2	5
ECE_CK804	Data Mining & Learning Algorithms	3	0	0	5
ECE_CK806	Linear & Combinatorial Optimization	3	0	0	5
ECE_CK812	Machine Learning	0	0	0	0
	Courses from other fields of specialization, which have not already been chosen.				
ECE_DE100	Diploma/Master Thesis (**Optional**)				5

L: Lectures, S: Seminars, LAB: Laboratory

FIELD OF SPECIALISATION: COMMUNICATIONS

FIFTH YEAR

9th Semester: 30 ECTS

Code	Course	L	S	LAB	ECTS
	Group A				
ECE_AK901	Communications Lab. II	3	0	2	5
	Group B				
ECE_AK902	Programmable Networks & Management	3	0	1	5
ECE_AK903	Multimedia Communications	3	0	0	5
ECE_AK904	Broadband Networks – Optical Networks	3	0	0	5
ECE_AK905	Personal Telemed/Biomedical Sys.	3	0	0	5
ECE_CK902	Computer & Network Security	3	0	0	5
ECE_CK905	Internet of Things	3	0	0	5
ECE_DE100	Diploma/Master Thesis (**Compulsory selection**)				5
ECE_DE100	Diploma/Master Thesis (**Optional**)				5

10th Semester: 30 ECTS

Code	Course	L	S	LAB	ECTS
ECE_DE100	Diploma/Master Thesis (**Compulsory selection**)				30

L: Lectures, S: Seminars, LAB: Laboratory

FIELD OF SPECIALISATION: INFORMATION TECHNOLOGY

FIFTH YEAR

9th Semester: 30 ECTS

Code	Course	L	S	LAB	ECTS
	Group A				
ECE_AK901	Communications Lab. II	3	0	2	5
ECE_AK902	Programmable Networks & Management	3	0	1	5
ECE_CK703	Data Bases	3	0	2	5
	Group B				
ECE_AK905	Personal Telemed/Biomedical Sys.	3	0	0	5
ECE_AK906	Software & Programming in High Performance Sys.	3	0	2	5
ECE_AK907	Quantum Computers	3	0	0	5
ECE_CK902	Computer & Network Security	3	0	0	5
ECE_CK903	Parallel Processing	3	0	0	5
ECE_CK904	Interactive Technologies	3	0	0	5
ECE_DK902	Non Linear Systems & Control	3	0	0	5
Courses from other fields of specialization, which have not already been chosen.					
ECE_DE100	Diploma/Master Thesis (**Compulsory selection**)				5
ECE_DE100	Diploma/Master Thesis (**Optional**)				5

10th Semester: 30 ECTS

Code	Course	L	S	LAB	ECTS
ECE_DE100	Diploma/Master Thesis (**Compulsory selection**)				30

L: Lectures, S: Seminars, LAB: Laboratory

FIELD OF SPECIALISATION:
SMART GRID – RENEWABLE ENERGY SOURCES – HIGH VOLTAGES

FIFTH YEAR

9th Semester: 30 ECTS

Code	Course	L	S	LAB	ECTS
	Group A				
ECE_BK901	Electrical Economy	3	0	0	5
	Group B				
ECE_BK902	Adv. Control of Elec. Machines	3	0	0	5
ECE_BK904	Insulation Tech. & Nanostructured Dielectrics	3	0	0	5
ECE_CK902	Computer & Network Security	3	0	0	5
ECE_CK905	Internet of Things	3	0	0	5
ECE_DK902	Non Linear Systems & Control	3	0	0	5
ECE_DK903	Optimal Control	3	0	0	5
	Courses from other fields of specialization, which have not already been chosen.				
ECE_DE100	Diploma/Master Thesis (**Compulsory selection**)				5
ECE_DE100	Diploma/Master Thesis (**Optional**)				5

10th Semester: 30 ECTS

Code	Course	L	S	LAB	ECTS
ECE_DE100	Diploma/Master Thesis (**Compulsory selection**)				30

L: Lectures, S: Seminars, LAB: Laboratory

FIELD OF SPECIALISATION: ENERGY CONVERSION – POWER ELECTRONICS – ELECTROTECHNICAL MATERIALS – RENEWABLE FORMS OF ENERGY

FIFTH YEAR

9th Semester: 30 ECTS

Code	Course	L	S	LAB	ECTS
	Group A				
ECE_BK904	Insulation Tech. & Nanostructured Dielectrics	3	0	0	5
ECE_BK906	Power Electr. with Modern Semiconductor Tech.	3	0	0	5
	Group B				
ECE_BK902	Adv. Control of Elec. Machines	3	0	0	5
ECE_BK905	Anal. & Design of Elec. Machines-Finite Elem.	3	0	0	5
ECE_DK702	Applied Optimization	3	0	0	5
ECE_DK902	Non Linear Sysatems & Control	3	0	0	5
	Courses from other fields of specialization, which have not already been chosen.				
ECE_DE100	Diploma/Master Thesis (**Compulsory selection**)				5
ECE_DE100	Diploma/Master Thesis (**Optional**)				5

10th Semester: 30 ECTS

Code	Course	L	S	LAB	ECTS
ECE_DE100	Diploma/Master Thesis (**Compulsory selection**)				30

L: Lectures, S: Seminars, LAB: Laboratory

FIELD OF SPECIALISATION: COMPUTERS: SOFTWARE AND HARDWARE

FIFTH YEAR

9th Semester: 30 ECTS

Code	Course	L	S	LAB	ECTS
	Group A				
ECE_CK805	Distributed Real-time Embedded Systems	3	0	0	5
ECE_CK902	Computer & Network Security	3	0	0	5
ECE_CK904	Interactive Technologies	3	0	0	5
	Group B				
ECE_CK903	Parallel Processing	3	0	0	5
ECE_CK905	Internet of Things	3	0	0	5
ECE_CK908	Modern Network Security Applications	2	0	3	5
	Courses from other fields of specialization, which have not already been chosen.				
ECE_DE100	Diploma/Master Thesis (**Compulsory selection**)				5
ECE_DE100	Diploma/Master Thesis (**Optional**)				5

10th Semester: 30 ECTS

Code	Course	L	S	LAB	ECTS
ECE_DE100	Diploma/Master Thesis (**Compulsory selection**)				30

L: Lectures, S: Seminars, LAB: Laboratory

FIELD OF SPECIALISATION:
ELECTRONICS AND EMBEDDED SYSTEMS

FIFTH YEAR

9th Semester: 30 ECTS

Code	Course	L	S	LAB	ECTS
	Group A				
ECE_CK805	Distributed Real-time Embedded Systems	3	0	0	5
ECE_CK906	Integrated Systems Design	3	0	2	5
ECE_CK907	High Speed Electronics	3	0	0	5
	Group B				
ECE_CK902	Computer & Network Security	3	0	0	5
ECE_CK905	Internet of Things	3	0	0	5
ECE_CK908	Modern Network Security Applications	2	0	3	5
ECE_AK901	Communications Lab. II	3	0	2	5
	Courses from other fields of specialization, which have not already been chosen.				
ECE_DE100	Diploma/Master Thesis (**Compulsory selection**)				5
ECE_DE100	Diploma/Master Thesis (**Optional**)				5

10th Semester: 30 ECTS

Code	Course	L	S	LAB	ECTS
ECE_DE100	Diploma/Master Thesis (**Compulsory selection**)				30

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				
ECE_DK901	Adaptive Control & Reinforcement Learning	3	0	0	5
ECE_DK902	Non-Linear Systems & Control	3	0	0	5
ECE_DK903	Optimal Control	3	0	0	5
ECE_DK904	Robotic Systems II	3	0	2	5
	Group B				
ECE_AK701	Information Theory	4	0	0	5
ECE_BK902	Adv. Control of Elec. Machines	3	0	0	5
ECE_CK803	Adv. Microcoputer Systems	3	0	2	5
ECE_CK902	Computer & Network Security	3	0	0	5
ECE_CK904	Interactive Technologies	3	0	0	5
Courses from other fields of specialization, which have not already been chosen.					
ECE_DE100	Diploma/Master Thesis (**Compulsory selection**)				5
ECE_DE100	Diploma/Master Thesis (**Optional**)				5

10th Semester: 30 ECTS

Code	**Course**	**L**	**S**	**LAB**	**ECTS**
ECE_DE100	Diploma/Master Thesis (**Compulsory selection**)				30

L: Lectures, S: Seminars, LAB: Laboratory

FIELD OF SPECIALISATION: CYBER-PHYSICAL SYSTEMS

FIFTH YEAR

9th Semester: 30 ECTS

Code	Course	L	S	LAB	ECTS
	Group A				
ECE_EK901	Physical Sys. Modeling & Dig. Twins	0	0	0	0
ECE_CK802	Computer & Network Security	3	0	0	5
ECE_DK901	Adaptive Control & Reinforcement Learning	3	0	0	5
	Group B				
ECE_AK901	Communications Lab. II	3	0	2	5
ECE_AK902	Programmable Networks & Management	3	0	1	5
ECE_CK905	Internet of Things	3	0	0	5
ECE_DK902	Non Linear Systems & Control	3	0	0	5
	Courses from other fields of specialization, which have not already been chosen.				
ECE_DE100	Diploma/Master Thesis (**Compulsory selection**)				5
ECE_DE100	Diploma/Master Thesis (**Optional**)				5

10th Semester: 30 ECTS

Code	Course	L	S	LAB	ECTS
ECE_DE100	Diploma/Master Thesis (**Compulsory selection**)				30

L: Lectures, S: Seminars, LAB: Laboratory

DESCRIPTION OF COURSE UNITS

FIRST YEAR

1st semester

Code	**ECE_Y101**
Title	Single Variable Functions Calculus
Instructor	Kalantonis Tsiggelis
Credits	6 ECTS

Content:
Derivative and differential of a function. Inverse trigonometric and hyperbolic functions. Polar coordinates. Implicit functions, Parametric equations. Taylor expansion and Series. Indefinite integrals, Definite integral and its applications, Improper integrals. Basic concepts of Ordinary Differential Equations (ODEs), First order linear ODEs, Separation of variables, Bernoulli and Riccati ODEs. Series of numbers, Series of functions, Power series and Binomial series. Laplace transform.

Code	**ECE_Y104**
Title	**Linear Algebra**
Instructor	Daskalaki Tsiggelis
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	**ECE_Y106**
Title	**Introduction to Computers**
Instructor	Avouris Paliouras Sgarbas Valouxis Karavatselou Dilios Sintoris
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	**ECE_Y107**
Title	**Modern Physics**
Instructor	Kounavis
Credits	4 ECTS

Content:
THEORY OF RELATIVITY. Axioms. Inertial systems. The interferometer of Michelson. Time-length expansion. Galileo-Lorentz transformations. Relativistic generalization of Newton's 2nd law. Relativistic momentum. Relativistic work energy theorem. Applications of the Theory of Relativity and specialization in the GPS system.
QUANTUM THEORY OF LIGHT.
The emission of a black body – Empirical laws and their correlation – Classic interpretation – Plank's explanation.
SUNLIGHT INTERACTION. Photoelectric Phenomenon, Classical Interpretation, Interpretation of Einstein. Compton effect, classical and quantum interpretation.
PARTICLE NATURE OF MATTER. The electron, measurement of the ratio e/m, measurement of electronic charge. Model of the atom, original model of Thomson. Rutherford's experiments of scattering – Diameter of nucleus and model of the atom.
SPECTRA. Solid emission spectra and emission spectra of gas absorption – Empirical laws. Bor's model of the atom.
WAVES DE BROGLIE. Interpretation of the atom. The Davisson-Germer experiment. Diffraction of light and electrons from a slit. Principle of indeterminacy. Wave packets. Heisenberg Uncertainty.
INTERFERENCE OF LIGHT AND PARTICLES FROM TWO SLITS. I
Interferometers – Measurements and Experiments – EPR experiment. Quantum embrace.
INTRODUCTORY CONCEPTS FOR QUANTUM COMPUTERS.

Code	**ECE_Y108**
Title	**Applied Physics**
Instructor	Kounavis
Credits	4 ECTS

Content:
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.

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.

MAXWELL EQUATIONS.

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.

Code	**ECE_Y109**
Title	**Digital Logic**
Instructor	Antonakopoulos Fakotakis
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	**ECE_F210**
Title	**Foreign Language – English**
Instructor	Rizomilioti
Credits	3 ECTS

Content:
Electrical- electronic engineering: history, content • Electricity/electric current • Magnetic and electric circuits and components • Conductors • Electric power, generation, transmission and distribution • The computer • Telecommunications • Signal processing • The television • Research articles: 1. Robot appearance; 2. Sociable robots.

Code	**ECE_F220**
Title	**Foreign Language - French**
Instructor	Velissarios
Credits	3 ECTS

Content:
FRANÇAIS DE GÉNIE ÉLECTRIQUE ET ÉLECTRONIQUE I
1. Introduction aux ordinateurs
2. Électronique
3. Génie Électrique
4. Energie et Sources Alternatives d'Énergie
5. Electricité et Fourniture électrique
6. Pratique du français Académique

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

Content:
Grammatical and syntactic phenomena (Perfekt, Präteritum, Verben mit Prepositions, Infinitives, Finals, Adjective declension, Nominalization)
- Production of oral and written speech
- Comprehension of oral and written speech
- Correct pronunciation and expression

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

Content:
Grammatical and syntactic phenomena. Production of oral and written speech, vocabulary enrichment.

2nd semester

Code	**ECE_Y210**
Title	**Intoduction to the Science of Electrical Engineer**
Instructor	ECE Faculty Members (Coordinator : Konstantopoulos) Hatziantoniou Stavroulopoulos Bechlioulis
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.

Code	**ECE_Y211**
Title	**Electrical Circuits I**
Instructor	Bechlioulis Koussoulas
Credits	5 ECTS

Content:
Electrical circuits of lumped elements. Kirchhoff's Laws. Circuits elements: Resistor; Capacitor; Inductor. Signals.

Circuit simplifications and transformations. Thevenin equivalent. Circuit analysis: the node voltages and the mesh currents methods. RC/RL circuits. RLC and second order circuits. The response of higher order linear time invariant circuits. Sinusoidal steady state: Phasors, impedance, admittance, network functions, resonance.

Code	**ECE_Y212**
Title	**Calculus of Multivariable Functions and Vector Analysis**
Instructor	Kalantonis Tsiggelis
Credits	5 ECTS

Content:
Continuity at a point and in a region of multivariable functions. Partial derivative and differentiability of functions of several variables. Functional determinant and implicit functions. Taylor expansion. Extremum points and conditional extremum points. Vector Analysis. Dot, cross and mixed product of vectors. Curves in space, Frenet formulas, Surfaces, Hamilton operator, Directional derivative, Vector operators. Multiple integrals, curve and surface integrals, Green's, Gauss' and Stokes' theorems.

Code	**ECE_Y213**
Title	**Apllied Physics Laboratory**
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	**ECE_Y214**
Title	**Differential Equations and Complex Analysis**
Instructor	Markakis Tsiggelis
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	**ECEY_215**
Title	**Procedural Programming**
Instructor	Feidas Valouxis Kouretas Karavatselou Dilios Sintoris
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	**ECE_Y216**
Title	**Engineering Mechanics**
Instructor	(Papanikolaou)
Credits	4 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.

SECOND YEAR

3rd semester

Code	**ECE_Y320**
Title	**Electrical Circuits II**
Instructor	Kazakos Koussoulas Mandellos Tsipianitis
Credits	7 ECTS

Content:
Coupled Inductors. Transformers. T-equivalent. Reflection. Laplace Transform-Mathematical background. Laplace transform applications in circuit analysis. Convolution. Frequency response: natural modes, network functions. Two-ports. Circuit theorems. Graphs and electrical circuits. State variables in electrical circuits.

Code	**ECE_Y321**
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	**ECE_Y322**
Title	**Probability & Statistics**
Instructor	Daskalaki
Credits	4 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	**ECEY323**
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	**ECE_Y324**
Title	**Digital Circuits and Systems**
Instructor	Theodoridis Kouretas
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	**ECE_Y325**
Title	**Object Oriented Technology**
Instructor	Peppas Feidas Sintoris
Credits	3 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	**ECE_Y420**
Title	**Electromagnetic Fields I**
Instructor	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.

Code	**ECE_Y421**
Title	**Microelectronic Circuits and Devices**
Instructor	Kalivas Birbas A.
Credits	6 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	**ECE_Y422**
Title	**Power Circuits Analysis**
Instructor	Vovos P.
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	**ECE_Y423**
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	**ECE_Y424**
Title	**Communications Networks**
Instructor	Logothetis Denazis Karavatselou Mandelos
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 and 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 802.11 (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	**ECE_Y425**
Title	**Signals and Systems**
Instructor	Skodras
Credits	5 ECTS

Content:
This course offers the basic knowledge in continuous-time and discrete-time signals and systems. This is the prerequisite knowledge for the forthcoming courses as for example communications, signal and image processing, pattern recognition, etc. More specifically, the material covered in this course includes:

Continuous-time: Signals (periodic, non-periodic), Linear time invariant systems; Time-domain analysis (convolution); Frequency-domain analysis (Fourier transform – Fourier series exponential and trigonometric); Orthogonality of signals; Frequency response.

Discrete-time: Signals (periodic, non-periodic), Linear time invariant systems; Time-domain analysis (convolution); Frequency-domain analysis; Discrete-Time Fourier Transform (DTFT); Discrete-Time Fourier Series (DTFS); Sampling; Z-transform; System response; Frequency response

THIRD YEAR

5th semester

Code	**ECE_Y520**
Title	**Electromagnetic Fields II**
Instructor	Koulouridis
Credits	5 ECTS

Content:
Continuous Currents Electric Field. Definition, 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
Nature of the Electromagnetic Field. Base Theory. Basic energy relations. The Maxwell equations
Magnetostatic Field. Ampere's Law. Biot-Savart Law. Vector Dynamics. Induction. magnetic flux linkage. Magnetic forces. Magnetic Materials and Circuits Magnetostatic Field in Materials, Microscopic Approach. Macroscopic Approach. Boundary conditions. Magnetization.
Electromagnetic Induction. Faraday's Law. Moving Conductive rod. Time Constant magnetic field. Movement in a time-varying field. Dynamic magnetic field energy, definition of mutual inductance. Electromagnets.
Time-varying fields. Differential and integral form of Maxwell equations. Displacement current. Wave Equation. Diffusion Equation. Energy and Power Flow - The Poynting Theorem. Harmonic time dependence. Representation in time and in complex space. Helmholtz equations.

Waves and propagation. Planar waves Wave propagation in insulating and conducting media. Planar wave polarization. Skin effect. Group Speed. Propagation to arbitrary direction. Theorem of reciprocity
Reflection and refraction of wave fields. Fresnel equations. Parallel and vertical polarization. Reflection Law. Snell's Law. Critical angle. Total reflection, Brewster angle. Vertical and tangential strike on conductive and dielectric media. Propagation constants. Types of waves.
Introduction to Propagation Issues. Transmission Lines, Waveguides, Antennas.
Introduction to electromagnetic compatibility and safety issues.

Code	**ECE_Y521**
Title	**Integrated Electronics**
Instructor	Kalivas Birbas A. Gialelis
Credits	8 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	**ECE_Y522**
Title	**Numerical Analysis**
Instructor	Kalantonis Markakis Moustakas
Credits	3 ECTS

Content:
Root finding of a non-linear algebraic equation, Iterative solution methods for non-linear simultaneous algebraic equations. Gaussian elimination, Partial pivoting, Iterative methods Gauss-Seidel and over-relaxation, Algebraic eigenvalue problems. Numerical integration. Interpolation and 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 and shooting methods.

Code	**ECE_Y523**
Title	**Signal Processing**
Instructor	Skodras
Credits	4 ECTS

Content:
This course offers the basic knowledge in continuous-time and discrete-time signals and consists of the following parts: **Transforms** (Continuous and Discrete): Discrete Fourier Transform (DFT); Fast Fourier Transform (FFT); Fourier transform in two and more dimensions; Hartley transform; Hilbert transformation; Signal correlation.
Filtering: Analog filter basics; Frequency transformations; Finite impulse response (FIR) filter basics; Infinite impulse response (IIR) filter basics; Digital filter realisation; Digital filter implementation; Finite wordlength effects.
Stochastic Signals: Random variables basics; Moments; Stochastic processes; Stationarity and ergodicity; Stochastic processes in the frequency domain (power spectral density); White random processes; LTI filtering of stochastic signals.

Code	**ECE_Y524**
Title	**Communications Systems**
Instructor	Logothetis Tomkos Stylianakis Karavatselou Mandellos Hatziantoniou Christogianni
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 Amplitude 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.

Code	**ECE_Y525**
Title	**Electrical Power Systems**
Instructor	Alexandridis
Credits	5 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 communication 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.

6th semester

Code	**ECE_Y620**
Title	**Automatic Control Systems**
Instructor	Kazakos Thomopoulos Tsigganos
Credits	8 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	**ECE_Y621**
Title	**Electric Measuring Devices and Techniques**
Instructor	Birbas A., Koulouridis, Logothetis, Pyrgioti, Tomkos, Tsemperlidou
Credits	3 ECTS

Content:
General concepts of metering sensors (characteristics, precision classes, sensitivity,

classification, selection, etc.), transducers and measurement methodology and methodology, units and standards of measurement, measurement system construction.

1. Measurement errors:
   a. absolute and relative error
   b. accuracy, correctness and discernment
   c. observation errors
   d. systematic errors
   e. accidental errors
2. Sensors and measuring instruments of various electrical, mechanical and other physical sizes:
   a) electrical quantities (voltage, current, resistance, induction, capacitance, power etc.)
   b) power and torque
   c) temperature
   d) position, distance, displacement, speed, acceleration, tilt, level.
   e) telecommunication measuring instruments (frequency and waveform generator, spectrum analyzer, vector signal analyzer, pedometer, etc.)
   f) other sensors and measuring instruments
3. Sensor signal conditioners (measuring bridges, power sources, multipliers, peak detectors, etc.), Non-linearity of sensors and measuring devices.
4. Amplifiers for weak signals (instrument amplifiers, isolation amplifiers, etc.), reference voltage generating circuits.
5. Comparison of analogue and digital measuring instruments.
6. Measurements to characterize the performance of a telecommunications system. Brief description of the structure of a telecommunications system and the phenomena that affect the quality of the received signal. Basic techniques for characterizing the quality of the received signal. Methods of measurement and evaluation: Eye diagrams, signal to noise ratio (SNR), bit / symbol error rate (BER / SER), quality factor (Q-factor) , error vector magnitude (EVM). Methods for correlating the estimated error rate with the other parameters (SNR, Q-factor, EVM).
7. Antennas: General approach to propagation issues, and antenna and link measurement issues.
8. Measurements from simulator: The method of simulation versus the analytical and numerical method. The importance of random numbers in simulation. Examples of generating random numbers. Presentation of simulation measurements. Confidence intervals. The Replication Method. The Batch Mean Method.

Code	**ECE_Y622**
Title	Microcomputers / Embedded systems
Instructor	Kalivas, Birbas M. Paliuras, Gialelis
Credits	4 ECTS

Content:

- Embedded systems models
- Embedded system specifications, low-power design and high-integration architectures
- Hardware for embedded systems, micro-computers family architectures, memory and peripherals
- Microprocessor command sets and programming models.
- Process control: Interfacing with analogue and digital environment, sample-and-hold, analog-to-digital, digital-to-analog converters, sensors, actuators
- Basic principles of real-time operating systems and real / critical system response time, real-time communication
- Parallel and serial communication principles, interruptions

- Intel 8085 and Arduino 8-bit architectures, applications

Laboratory exercises in the programming and interfacing of the above processors

Code	**ECE_Y623**
Title	**Electrical Machines**
Instructor	Mitronikas Tatakis Kampitsis
Credits	8 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.

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	**ECE_Y624**
Title	**Engineering Drawing**
Instructor	Vovos P. Tsemperlidou
Credits	4 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	**ECE_Y625**
Title	**Algorithms and Data Structures**
Instructor	Sgarbas Peppas Valouxis Dilios
Credits	4 ECTS

Content:

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

FOURTH YEAR

Code	**ECE_AK701**
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	**ECE_AK702**
Title	**Wireless Propagation**
Instructor	Koulouridis 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.

Code	**ECE_AK703**
Title	**Digital Communications I**
Instructor	Stylianakis
Credits	5 ECTS

Content:

Introduction, Signal Spectra and 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	**ECE_AK704**
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	**ECE_AK705**
Title	**Artificial Intelligence I**
Instructor	Sgarbas Peppas Christogianni
Credits	5 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	**ECE_AK707**
Title	**Electroacoustics**
Instructor	Moustakas Mourjopoulos Hatziantoniou Christogianni
Credits	5 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

Sound systems: electrical properties 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

Laboratory Exercises

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 and 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	**ECE_AK708**
Title	**Information Retrieval**
Instructor	Makris
Credits	5 ECTS

Content:

Introduction (user modeling, logical text representation, retrieval process)

1. Performance evaluation metrics ((recall, precision, average precision, R-precision, precision histograms, NDCG metric, harmonic median, user oriented metrics).
2. Modeling in Information Retrieval
3. Boolean models, fuzzy set model, extended boolean model, algebraic models (probabilistic models, latent semantic indexing model, topic models), probabilistic models (classical and linguistic models)
4. Information Retrieval on the World Wide Web and Its Specifics
5. Web Search Engines (crawler, indexer), HITS algorithm (Hyperlink-induced topic search), Google search engine (PageRank metric), SALSA algorithm, web search variants.
6. Indexing structures (inverted files, signature files, bitmaps).
7. Full indexing structures in main memory (suffix trees, suffix arrays, acyclic directed graphs (DAWG) for strings), and in secondary memory (supra-suffix array, prefix B-tree, string B-tree).
8. Compressing Texts and Indexing Structures
9. Applications of Machine Learning Algorithms to Corpora/Texts.

Code	**ECE_AK709**
Title	**Computer Graphics and Virtual Reality**
Instructor	Moustakas
Credits	5 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. Zbuffering. 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.

<u>*Laboratory Exercises*</u>

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	**ECE_AK710**
Title	**Biomechanics I**
Instructor	Athanasiou Deligiani Sakelarios, Apostolopoulos
Credits	5 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 and 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.

Code	**ECE_AK801**
Title	**Communications Laboratory I**
Instructor	Antonakopoulos Denazis Koulouridis Kotsopoulos Christogianni Hatziantoniou Karavatselou
Credits	5 ECTS

Content:
- Electromagnetic Wave Propagation Topics. Microwave power sources. Measurement of transport lines. Study of antenna characteristics. Electromagnetic wave parameters measurement.
- Information Transmission Topics. Analog and digital modulation. Modulation techniques. Spectrum analysis and characterization. Spread spectrum systems.
- Networking of telecommunication systems. Monitoring and analysis of packets and protocols in telecommunication systems. Design and implementation of telecommunication network topologies. Telecommunication network programming.

Code	**ECE_AK802**
Title	**Wireless and Mobile Communications Networks**
Instructor	Tomkos Kotsopoulos
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	**ECE_AK803**
Title	**Antennae Theory**
Instructor	Koulouridis Stylianakis
Credits	5 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	**ECE_AK804**
Title	**Teletraffic Theory and Queueing Systems**
Instructor	Logothetis
Credits	5 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: M/M/s – M(n)/m/s
- Markovian Delay (Queueing) Systems.
- Birth-Death Process.
- Open and Close Queueing Networks.
- Mean Value Analysis.
- Multi-Dimensional Traffic Models – Trunk Reservation System. The Erlang Multirate Loss Model (EMLM).
- Restricted availability.
- Overflow System – Equivalent Random Theory. Design of Alternative Routing.

- Traffic Simulation.
- Computer Implementation of Basic Teletraffic Formulas.

Code	**ECE_AK805**
Title	**Optical Communications**
Instructor	Tomkos
Credits	5 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	**ECE_AK806**
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	**ECE_AK807**
Title	**Introduction to Bioinformatics**
Instructor	Makris
Credits	5 ECTS

Content:
Part One: Introduction to the use of algorithms for the efficient management and storage of strings and biological data sequences. Accurate template matching algorithms (Boyer-Moore, Knuth-Morris-Pratt, Shift-Or, Multi-Template). Introduction to suffix tree and its applications. Sequence Alignment Algorithms for Alignment and Sequence Alignment. Search Algorithms in Sequence Databases (FASTA, BLAST, PROSITE).
Part Two: The Theoretical Basis of Molecular Design. Molecular Models and Biochemical Information. Structure-Based Drug Design. Open Problems.
Part Three: Clustering Techniques for predicting the behavior of biological molecules.

Code	**ECE_AK808**
Title	**Pattern Recognition**
Instructor	
Credits	5 ECTS

Content: (Not taught)

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	**ECE_AK809**
Title	**Digital Audio Technology**
Instructor	Moustakas Mourjopoulos Hatziantoniou
Credits	5 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	**ECE_AK810**
Title	**Speech and Natural Language Processing**
Instructor	Sgarbas Fakotakis Christogianni
Credits	5 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	**ECE_AK811**
Title	**3D Computer Vision and Geometry**
Instructor	Moustakas
Credits	5 ECTS

Content:
1. Introduction and basic concepts of geometric algorithms
2. Capability to express common problems with geometric terms and resolution using computational geometry algorithms
3. Mathematical background for the representation of 2D-3D data and geometric

primitives
4. Data structures and complexity analysis of computational geometry algorithms
5. Familiarization with object-oriented programming and computational geometry, 2D-3D representation libraries
6. Capability to generalize the acquired knowledge and apply it in problems of several scientific domains of Electrical and Computer Engineering

Laboratory Exercises

- Lab exercise 1: Introduction to geometry processing and programming in C++
- Lab exercise 2: Convex hulls
- Lab exercise 3: Sections
- Lab exercise 4: Triangulation
- Lab exercise 5: 3D bounding volumes and sections
- Lab exercise 6: Space partitioning
- Lab exercise 7: Linear programming
- Lab exercise 8: Application in 3D computer vision

Code	**ECE_AK812**
Title	**Digital Processing and Image Analysis**
Instructor	Berberidis
Credits	5 ECTS

Content:

- Introductory Concepts, Applications of Digital Image Processing and Analysis.
- Overview of 2D signals, image transformations.
- Basics of the digital image acquisition process.
- Image upgrade methods.
- Image restoration, presentation of basic techniques.
- Image compression (with - without loss).
- 3-D body reconstruction from 2D projections (images).
- Detection of contours.
- Define image areas.
- Description and representation of shapes.
- The basic structure of an image analysis and interpretation system. Aσ Basics of color theory and color image processing.

Laboratory Exercises

- Lab. 1: Image filtering in the frequency domain.
- Lab. 2: Quantum Image (Scalable and Vector).
- Lab. 3: Image Compression Using DCT Transformation.
- Lab. 4: Image Editing with Histogram Techniques.
- Lab. 5: Image Recovery (Reverse Filter Method and Wiener Method).
- Lab. 6: Detecting Outlines.

Project (*selection from list of topics*).

Code	**ECE_AK813**
Title	**Artificial Intelligence II**
Instructor	Moustakas Sgarbas Peppas Christogianni Mandellos
Credits	5 ECTS

Content:

- Non-monotonic logics
- Reasoning about Action
- Belief Change
- Planning
- Answer Set Programming
- Semantic Web Technologies (i.e. Description Logics, OWL)
- Neural networks.
- Peceptron, multi-level Perceptron.
- Error correction training.
- Reverse propagation of the error.
- Introduction to deep neural networks. Stability.
- Convergent neural networks

- Modern neural network architectures for deep learning
- Deep learning applications
- Solve problems with quantum computers
- Clustering and classification with quantum computers
- Quantum Principal Component Analysis
- Quantum neural networks
- Quantum analysis

Code	**ECE_BK701**
Title	**Electrical Power Systems Analysis**
Instructor	Konstantopoulos Vovos P.
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	**ECE_BK702**
Title	**High Voltages**
Instructor	Pyrgioti Tsemperlidou
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	**ECE_BK704**
Title	**Electrical Installations**
Instructor	Vovos P.
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	**ECE_BK705**
Title	**Power Electronics I**
Instructor	Tatakis Kampitsis
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	**ECE_BK706**
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	**ECE_BK707**
Title	**Thermal Plants**
Instructor	*To be appointed*
Credits	5 ECTS

Content:

Introduction to power generation devices and systems. Properties, state and balance, processes and cycles. Pure substances, phases, phase shift processes, property charts. Equations, Ideal gas. First Law of Thermodynamics (closed and open systems). Thermodynamic analysis of control volume, permanent flow processes, analysis of permanent flow devices in thermal networks. Second law of thermodynamics, efficiency coefficients, motionless. Carnot cycle and axioms, entropy, extrapolation, entropy growth principle, Balances. Heat Transfer by Action, Synthesis, and Radiation. Heat Transfer Problems, Alternators. Power cycles with air. Basic considerations, Otto, Diesel circles. The gas turbine cycle (Brayton) (Ideal, regeneration, reheating). Steam Power Generation Cycles - Power Plants (Power Plants). Ideal Rankine cycle, Rankine cycle with rejuvenation and regeneration. Complex circuits, cogeneration. Devices and fittings in thermal power plants (Stoves, Boilers, Superconductors, Steam Turbines, Condensers, Pumps, Regenerators, Steam Traps, etc.). Energy calculations. Example of steam generator thermal grid calculation. Refrigeration Cycles. Ideal and effective steam compression cooling cycle, heat pumps, absorption cooling, other cooling systems.

Code	**ECE_BK801**
Title	**Power Systems Control and Stability**
Instructor	Alexandridis Konstantopoulos Papadaskalopoulos
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	**ECE_BK803**
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	**ECE_BK804**
Title	**Electrical Power Systems Protection**
Instructor	Vovos P.
Credits	5 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	**ECE_BK805**
Title	**Control Techniques in Renewable Energy Sources**
Instructor	Alexandridis Konstantopoulos
Credits	5 ECTS

Content:
Introduction to Renewable Energy Sources (RES). High RES Penetration and Scattered Production. Individual wind turbines and wind parks. Photovoltaic systems and parks. Electricity storage systems - Batteries. Electronic Power Converters as Controlled Power Interfaces. Topology used in wind systems. Fixed speed technology. Variable pitch technology. Variable rotor-speed controllers and serial controller design with internal current loop: Dual power AM, AM or DC with DC interface, AM Generator with electronically varying rotor resistance. Real and reactive power control. Flap pitch control. Environmental impacts from the installation of wind systems and other RES. Connection to Internet.

Code	**ECE_BK806**
Title	**Dynamics and Control of Euler-Lagrange Systems**
Instructor	Alexandridis Papadaskalopoulos
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	**ECE_BK807**
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	**ECE_BK808**
Title	**Electric Motor Drive Systems II**
Instructor	Mitronikas
Credits	5 ECTS

Content:
Electric motor drive systems controlled by electronic power converters and applications of these - induction machines (state equations, operation in steady state condition, parameter measurement) - permanent magnet machines (bipolar model, steady state operation, parameter measurement) - inductive control and of modern motors (graduated, vector) - brushless DC motors (operation, modeling, control).

Code	**ECE_BK809**
Title	**Power Electronics II**
Instructor	Tatakis Kampitsis
Credits	5 ECTS

Content:
Construction and functional characteristics of power diodes and power transistors of BJT, MOSFET, IGBT, and GTO Thyristor as well as latest technology types of power transistors (MCT, IGCT, etc.).

1. Static and dynamic behavior of semiconductor power elements, equivalent circuits, circuit analysis, safe operation area, treatment losses and intermittent losses, loss calculation methodologies.
2. Methodologies for driving semiconductor power components, electronic circuits generating driving pulses, studying and designing specific circuits of this kind.
3. Passive and Active circuits for protection against surges and surges (clamps), ignition and extinguishing aids (snubbers) of semiconductor power elements.
4. DC to DC converters, without isolating transformer, controlled by PWM technique, categorization, analysis and areas operation of basic topologies (Buck, Boost, Buck-Boost), voltage waveforms and currents, output characteristics.
5. Thyristor voltage drop converters (forced switching), electronic voltage regulator (Chopper), analysis of its operation, voltage and current waveforms, DC motor control, recovery power, ohmic load regulation, improved regulators topology S.T. forced transition.
6. DC to DC converters with PWM type with isolating transformer (Forward, Flyback, Push-Pull, Half-Bridge, Full-Bridge), analysis and areas operating, voltage and current waveforms, output characteristics, applications in pulse generators, other industrial applications (services

uninterruptible power supply, battery chargers, operating devices renewable energy sources, telecommunications and satellite applications, etc.).
7. Tuning Converters, categorization, Semi-tuned Converters DC to DC, zero-current or zero-current switching techniques voltage, full and half wave topologies, applications (telecommunications, electronic devices, etc.).
8. Special topologies of inverters ST. in S.T. and ST. in E.T., Applications.

Code	**ECE_BK810**
Title	**Biomechanics II**
Instructor	Athanasiou Deligianni Sakelarios Apostolopoulos
Credits	5 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.

Code	**ECE_BK811**
Title	**Energy Design & Air Conditioning of Buildings**
Instructor	*To be appointed*
Credits	5 ECTS

Content:
Climate, building and energy. Heat transfer to the building shell. Thermal comfort open and closed spaces. Thermal comfort conditions and indicators. Necessary ventilation. Thermal protection of the building. The shell of the building and its energy behavior. Thermal balance. Thermal revenues and losses. Heat insulation materials. Heat capacity of structural elements. Thermal insulation of a building. Regulation energy efficiency of buildings. Energy saving in buildings. Requirements for heating and cooling of buildings. Thermal and cooling loads. Heat management, role of thermal mass. Sunbathing and sun protection of buildings. Energy principles building design. Microclimate conditions, orientation, building use, conventional and advanced materials and energy saving systems. Liabilities Solar systems for natural heating of buildings. Physics systems and techniques cooling of buildings. Modern methods of calculating the energy behavior of buildings and building components. Heating - cooling systems. Properties of moist air. Psychometry. Most air Mollier diagram - Psychometric map. Processes moist air treatment. Air conditioning systems and applications. Air conditioning industrial and residential areas. Heat pumps and their cycles of operation.

Code	**ECE_BK812**
Title	**Renewable Energy Sources**
Instructor	Konstantopoulos Vovos P.
Credits	5 ECTS

Content:
The energy problem: Historical background, current energy sources, new sources energy, prospects, the greek energy problem. Biomass energy. Geothermal energy. Fuel cells. Wind energy: Basic theory, characteristic sizes, wind system, indicative calculation. Solar power: Solar radiation, solar panels. Thermal solar systems. Thermal units solar systems. Photovoltaic effect, solar cells, characteristic sizes, specifications. Batteries, types, charging, discharging. Use of inverters of Power in Renewable Energy Sources. Design of photovoltaic systems. Economic analysis of energy systems.

Code	**ECE_CK701**
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	**ECE_CK702**
Title	**Operating Systems**
Instructor	Fidas Valouxis
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. Inuction to the Unix operating system.

Code	**ECE_CK703**
Title	**Data Bases**
Instructor	Avouris Peppas Sintoris
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	**ECE_CK704**
Title	**Microcomputers and Microsystems**
Instructor	-
Credits	5 ECTS

Content: (not taught)

- 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	**ECE_CK705**
Title	**Digital Signal Processing**
Instructor	Paliouras
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.

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 Laboratory 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	**ECE_CK706**
Title	**Advanced Analogue/Digital Integrated Circuits and Componets**
Instructor	Kalivas Birbas A. Birbas M.
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	**ECE_CK707**
Title	**Integrated Circuits Design I**
Instructor	Theodoridis Paliouras Kouretas
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	**ECE_CK708**
Title	**Photoelectronic Devices**
Instructor	-
Credits	5 ECTS

Content: (not taught)

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.

Code	**ECE_CK709**
Title	**Introduction to Quantum Electronics**
Instructor	Paspalakis
Credits	5 ECTS

Content:

Code	**ECE_CK801**
Title	**Advanced Programming Techniques**
Instructor	*To be appointed*
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	**ECE_CK802**
Title	**Internet Programming**
Instructor	Avouris Fidas Sintoris
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	**ECE_CK803**
Title	**Advanced Microcomputers Systems**
Instructor	-
Credits	5 ECTS

Content: (not taught)

- 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	**ECE_CK804**
Title	**Data Mining and Learning Algorithms**
Instructor	Makris Megaloikonomou
Credits	5 ECTS

Content:

1. Introduction
2. Preprocessing and Data Compression
3. Classification Algorithms
4. Clustering Algorithms
5. Association rule discovery algorithms
6. Bayesian networks, neural networks.
7. Web Mining
8. Spatial Data Mining
9. Temporal Data Mining
10. Data Mining from sequences

Code	**ECE_CK805**
Title	**Distributed Real-time Embedded Systems**
Instructor	Gialelis Koubias
Credits	5 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_CK806**
Title	**Linear and Combinatorial Optimization**
Instructor	Daskalaki Peppas Valouxis
Credits	5 ECTS

Content:

Modeling optimization problems with linear programming techniques. Simplex algorithm. Duality Theory. Complementary relaxation. Dual - Primal Simplex Algorithm. Sensitivity analysis. Integer programming. Branch & Bound Method. The knapsack problem. The problem of the street vendor. Square Programming. Modeling techniques using integer variables. The Simplex algorithm for networks. Transport and transhipment problems. Internal point method. Networking flows Problems.

Code	**ECE_CK807**
Title	**Network Architecture**
Instructor	Serpanos
Credits	5 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	**ECE_CK808**
Title	**Telecommunication Electronics and High Frequencies**
Instructor	Kalivas
Credits	5 ECTS

Content:
Features of High Frequency (RF) Receivers, Lighter Design Parameters, Noise Indicator, Nonlinearities, Dynamic Receiver Range.
Phase –Locked Loops (PLLs) and their design parameters. Loop stability, analogue and digital phase, Voltage Controlled Oscillators (VCO). PLL applications in telecommunications (composite frequencies, modifiers, phase recovery and timing subsystems).
Analysis, design of high frequency receiver (RF, IF) amplifiers with emphasis on low noise.
High frequency (RF) transmitter power amplifiers. Adaptation for maximum transmission power.
Analysis, design of circuits of mixed and analog multipliers.
FM, PM Modulator / Modulator Implementation Circuits.
Examples of high frequency systems for wireless applications

Code	**ECE_CK809**
Title	**Integrated Circuits Design II**
Instructor	Theodoridis Paliuras Kouretas
Credits	5 ECTS

Content:
- *Sequential Circuit Design*: Static Sequential Circuits, Design of latches and flip-flops, Dynamic Sequential Circuits, Synchronizers, Wave Pipelining.
- *Digital Circuit Timing:* Timing Circuit Sorting, Contemporary Design, Self-timing Circuits, Clock Distribution.
- *Data Handling Subsystems:* Adders / Subtractors, "1" / "0" Detectors, Comparators, Counters, Boolean Logic Operators, Error Detection / Correction Codes, Sliders, Multipliers, Parallel Architectures.
- *Memory Subsystems and Table Structures Table:* Static Random Access Memory (SRAM), Dynamic Random Access Memory (DRAM), Read Only Memory (ROM), Serial Access Memory, Data Interface Memory, Programmable Structures.
- *Special Purpose Subsystems:* Power Distribution, Clock Circuits & Clock Distribution, Input / Output Circuits
- *Digital Integrated Circuit Design Strategies:* Full custom and variants. Design with pre-designed cells. Table type structures. FPGA technology. Design methodologies and design flows.

Code	**ECE_CK810**
Title	**Nanoelectronics**
Instructor	-
Credits	5 ECTS

Content: (not taught)
Students after successful completion of the course:

- Know the sequential steps and chemical processes used to construct the ohmic contacts of an electronic device. They understand what a lift-off is and what the conditions for a successful lift-off are.
- They know how conductive channels are made between the ohmic contacts of an electronic device by techniques such as optical lithography and liquid chemical etching.
- Understand the differences between isotropic, anisotropic and selective chemical etching.
- Understand the techniques of shaping electronic device surfaces.
- They know how to apply the technique of building and sacrificing materials to build a micro bridge.
- Understand the different techniques of controlled etching.
- Understand the different methods of making a T-shaped gate less than 100 nanometers long with bilayer or trilayer resists.
- They can describe in detail how the self-alignment method is applied to the manufacture of MOSFETs, MESFETs and MODFETs of Nanoelectronics.
- They are aware of the advantages and disadvantages of Optical Lithography, Electron Beam Lithography and Nano Print Lithography.
- Understand and can design a III-V HEMT that operates at very high frequencies.
- They know what the mechanics of energy bands are and can design III-V HEMTs with Type-I (straddling), Type-II (staggered) and Type-II (broken-gap lineup) interfaces.
- They know what modulation doping is and what d-doping is.
- They know how to apply the laws of quantum mechanics to two-dimensional systems, quantum wires and single-dimensional nanotransistors.
- They know how to prove and apply the Landauer type.
- They know what quantum ballistic transfer is of a nanotransistor conduction electrons and the quantization of resistance.

In particular, students through the lectures of the course acquire knowledge on modern methods of nanoelectronics construction and understanding the phenomena of ballistic quantum transfer of conductors in nanometer-sized devices and circuits. They are also taught to apply the Landauer formula and to calculate the current flowing through a nanotransistor and the quantization of the resistance.

Code	**ECE_CK811**
Title	Cryptography
Instructor	-
Credits	5 ECTS

Content: (not taught)
The subject of the course is the field of cryptography and cryptanalysis, and in particular the mathematical background governing the respective cryptographic protocols. Desired, sometimes contradictory, design goals will be outlined, and the principles of traditional and modern cryptographic protocols will be explored, with emphasis on encryption, digital signature, and more specialized protocols, such as, the commitment protocols. The connection of cryptography to the fields of algorithm design and computational complexity will also be analyzed. The general topics of the course are:

- Cryptographic protocols
- Recipient-sender interaction
- Keys - managing them
- DES - other Block Ciphers
- Secure False Number Sequences
- Public key cryptography
- Digital signatures - sender certification
- Legal issues

Code	**ECE_CK812**
Title	**Machine Learning**
Instructor	-
Credits	5 ECTS

Content: (not taught)

- Basic Concepts of Probability.
- Learning Algorithms to solve equations and improve emotions.
- Algorithm analysis. Comparison techniques.
- Neural Networks, special structures and their education (education).
  -Case examination, decision making, classification (classification).
  -Bayesian techniques. Estimation of statistics using neural networks and learning algorithms.
  -Creation of implementations of random variables with a specific distribution. Classic methods. Methods based on transformations and neural networks. Method with GANs (generative adversarial network): Pairs of competing creator / separator neural networks (generator / discrete) and their implementation with neural networks. Creating synthetic images.
  -Random parameter estimation, Bayesian techniques, application in image recovery and other related problems.
- Grouping (clustering): K-means, Gaussian mixtures, Method expectation / maximization. Thoughts on solutions with neural networks.
- Cores (kernels) and vector spaces. Mercer cores, Basic problem approach of nonlinear functions with cores. Comparison with corresponding techniques based on neural networks.
- Reduction of data dimension. Decomposition of unique value. Main ingredient analysis. Main ingredients based on kernels. Dimension reduction with help of neural networks.
- Factorization of positive matrices, Factorization of tensors. Examples.
- Modern problems and methods of solving with neural networks and learning algorithms.

Code	**ECE_CK813**
Title	**Optoelectronic and Photonic Technology**
Instructor	Kalivas Tomkos
Credits	5 ECTS

Content:

Code	**ECE_CK814**
Title	**Satellite Technologies**
Instructor	Kostopoulos
Credits	5 ECTS

Content:

Code	**ECE_DK701**
Title	**State-Space Linear System Analysis**
Instructor	Kazakos
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	**ECE_DK702**
Title	**Applied Optimization**
Instructor	Papadaskalopoulos
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	**ECE_DK703**
Title	**Introduction to Robotics**
Instructor	Bechlioulis
Credits	5 ECTS

Content:
Introduction to robotics. Types of robots and applications. Fundamental concepts of robotics (position and orientation of rigid bodies, frames, homogeneous transformations, Denavit-Hartenberg). Forward kinematics. Inverse kinematics. Differential kinematics and singularities. Trajectory generation. Static and dynamic model analysis (Jacobian matrix, Newton-Euler and Lagrange models). Identification of robot model parameters. Basic robot control schemes (joint control, end-effector control, computed torque control, resolved acceleration control, force control).

Code	**ECE_DK801**
Title	**Digital Control**
Instructor	Kazakos Tsipianitis
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	**ECE_DK804**
Title	**Industrial Automation**
Instructor	*To be appointed*
Credits	5 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.
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	**ECE_DK806**
Title	**Robust Control**
Instructor	Bechlioulis
Credits	5 ECTS

Content:
Vector spaces and linear operators. Optimization and Linear Matrix Inequalities (LMIs). Transfer functions and matrices. State space representation. Bode and Nyquist diagrams. Modeling the uncertainty. Singular values of multi-variable systems. Robust stability and response of uncertain systems. Lyapunov stability. Kalman-Yakubovich-Popov Lemma. The state and output feedback H2 και H∞ robust control design. Integral quadratic constraints.

Code	**ECE_DK807**
Title	**Intelligent Control**
Instructor	Bechlioulis Groumpos
Credits	5 ECTS

Content:
Introduction to classic and intelligent control systems. Intelligent control systems and artificial intelligence. Artificial neural networks: introduction, structures, training, applications. Introduction to fuzzy logic. Fuzzy control systems: introduction, theory, applications. Neuro-fuzzy control: theory, design, applications. Reinforcement learning control. Stochastic and evolutionary algorithms. Optimization of intelligent control systems based on genetic algorithms.

Code	**ECE_DK808**
Title	**Robotic Systyems I**
Instructor	Bechlioulis
Credits	5 ECTS

Content:

FIFTH YEAR

Code	**ECE_AK901**
Title	**Laboratory of Communications II**
Instructor	Antonakopoulos Denazis Koulouridis Kotsopoulos Karavatselou Hatziantoniou Christogianni
Credits	5 ECTS

Content:

Electromagnetic Wave Propagation: Doppler and radar effect. Wireless channel and losses. Channel Loss Study Models. Field measurements

Information Transmission: DSL protocol. Channel Estimation and Noise Transfer Function Estimation. Synchronization Techniques. Transmission Error Detection and Correction Codes.

Telecom Systems networking: Parts of a modern communications system. Access to the microwave signal. Mobile system. System management.

Code	**ECE_AK902**
Title	**Programmable Networks and 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	**ECE_AK903**
Title	**Multimedia Communications**
Instructor	Logothetis (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	**ECE_AK904**
Title	**Broadband Networks – Optical Networks**
Instructor	Logothetis Stylianakis Tomkos
Credits	5 ECTS

Content:

Introduction

Orthogonal Frequncy Division Multiplexing (OFDM).

Applications of OFDM – Wireless Networks – Power Line Systems.

ATM Technology. B-ISDN Protocol Reference Model (PRM) – ATM PRM. Asynchronous Transfer Mode – An Overview – ATM Network Interfaces - Protocol Layers – Traffic Services Categirioes – Statistical Multiplexing in ATM Networks **–** Principles of ATM Switching.

Synchronous Digital Hierarchy (SDH): architecture of Transmission Systems.

Multi-Protocol Label Switching (MPLS). Packet Switching and 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	**ECE_AK905**
Title	**Personalised Telemedicine and Biomedical Systems**
Instructor	*To be appointed*
Credits	5 ECTS

Content:

- **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	**ECE_AK906**
Title	**Software & Programming in High Performance Systems**
Instructor	Gallopoulos Dermatas Hatzidoukas
Credits	5 ECTS

Content:

Serial and parallel programming. Computational Power Limits on Serial Computers, Moore's Law. Parallel programming. Parallelization of serial computations. Laws of Amdahl and Gustafson. Multi-unit hardware, Flynn sorting. Computer Networks, Multi-Core CPUs, GP-GPUs. Computational models: Message-Passing, Shared-Memory, Accelerators. Implementations: openMPI (message passing interface), POSIX threads, OpenMP, openACC. Debugging. Examples of simple implementations in gcc and PGI compilers. Implementation of stochastic optimization algorithms (simulated annealing, genetic algorithms, swarm algorithms) in parallel processing machines. Deep-Learning Neural Networks Training. Big-Data Parallel Processing: Recommender Systems, Gene Sequence Analysis. Laboratory Excercises:

• Lab 1. Matrix Operations. Serial and parallel implementation in openMPI, pthreads, openMP. Performance measurement.

• Lab 2. Simulated annealing and swarm optimization. Finding extreme values in Discontinuous Multivariable Functions. Implementation in pthreads, openMP.

• Lab 3. Parallel implementation of genetic algorithms. Implementation in openMP

• Lab 4. Solution of the travelling salesman problem with random search and genetic algorithms. Implementation in openMP and openMPI.

• Lab 5. Recommender system for movies. Implementation in openMPI and openMP.

• Lab 6. Construction of a Similarity Finding System in a Flu Virus Gene Sequence. Implementation in openMP and openACC.

• Lab 7. Development of an automated clustering of influenza virus gene sequences. Implementation in openMP and openACC.

(Laboratory exercise titles and objects are in dicative and may change.)

Code	**ECE_AK907**
Title	**Quantum Computers**
Instructor	Kounavis Sgarbas
Credits	5 ECTS

Content:

Code	**ECE_AK908**
Title	**WEB Services**
Instructor	-
Credits	5 ECTS

Content: (not taught)

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	**ECE_BK901**
Title	**Electrical Economy**
Instructor	Vovos P. Papadaskalopoulos
Credits	5 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	**ECE_BK902**
Title	**Advanced Control of Electric Machines**
Instructor	Alexandridis Mitronikas
Credits	5 ECTS

Content:
Models Overview: DC Motor, Asynchronous Motor (AM), Synchronous Motor (SM). Conventional and Advanced PID Engine Control of DC Motor. Current Model for AM and Transformation to the Synchronous Rotating dq Reference System. Linear and complete nonlinear AM model. Dynamics and flow estimation in AM. Balance points. AC Three-Phase Motor Vector Control Principle. Direct and Indirect Vector Control. Torque and torque control of AM. Stability analysis and advanced control techniques. Vector control and control techniques for SM with permanent magnet. Analysis of serial controllers with internal loop current. Controlled power inverters: Analysis on the modern rotating dq reference system, models and input characteristics (segmentation ratio). Modeling control and stability with integrated topology of electronic power inverters in an advanced machine driver control system.

Code	**ECE_BK903**
Title	**Renewable Energy Sources II**
Instructor	-
Credits	5 ECTS

Content: (not taught)
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.

Code	**ECE_BK904**
Title	**Electrical Insulation Technology and Nanostructured Dielectrics**
Instructor	Svarnas
Credits	5 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	**ECE_BK905**
Title	**Analysis and Design of Electric Machines with Finite Elements**
Instructor	Mitronikas
Credits	5 ECTS

Content:
Purpose of finite element simulation - applications - Maxwell equations - electrostatic, magnetostatic and magnetodynamic analysis - thermal analysis - boundary conditions - material properties - linear and nonlinear models - modeling of permanent magnets - analytical solution - numerical solution – solution with finite elements - analysis in two and three dimensions - transitional solution problems - integration methods - architecture software analysis packages finite elements - applications in known types of electric motors.

Code	**ECE_BK906**
Title	**Power Electronics with Modern Semiconductor Techonogies**
Instructor	Kampitsis
Credits	5 ECTS

Content:

Code	**ECE_CK901**
Title	**Software Technology**
Instructor	Xenos Pavlidis Thramboulidis
Credits	5 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	**ECE_CK902**
Title	**Computer and Network Security**
Instructor	Serpanos Vlachos
Credits	5 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	**ECE_CK903**
Title	**Parallel Processing**
Instructor	*To be appointed* Valouxis
Credits	5 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.

Code	**ECE_CK904**
Title	**Interactive Technologies**
Instructor	Avouris Moustakas Sintoris
Credits	5 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	**ECE_CK905**
Title	**Internet of Things**
Instructor	Denazis
Credits	5 ECTS

Content:
1. Introduction to the Internet of Things - IoT.
2. Basic concepts - fields of application.
3. Models, Architecture and Technologies for IoT.
4. The IoT Protocol Stack - Application Level Protocols.
5. Application-level protocols for devices with limited resources.
6. Cloud Computing.
7. System development using IoT technologies.
8. System Design - Case Study.
9. Basic Sensory Structures for IoT and Interfaces.
10. Interconnection of IoT devices.
11. Communication protocols for IoT-Zigbee, Bluetooth / Smart Bluetooth, PLC (Powerline Communications), disadvantages- advantages.
12. Sensor Networks, RFIDs and their combination, RFID Sensor networks - enabling technologies for IoT.
13. Examples of IoT applications (healthcare, smart home, smart cities etc.)

Code	**ECE_CK906**
Title	**Integrated Systems Design**
Instructor	Theodoridis Paliuras
Credits	5 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	**ECE_CK907**
Title	**High Speed Electronics**
Instructor	Kalivas Birbas M.
Credits	5 ECTS

Content:

Design issues and basic systems concepts for high-speed signaling, modern integration technologies.

Design of high-speed digital basic building blocks (inverters, gates, flip-flops), speed optimization and consumption.

High-speed interconnections, modeling of interface lines.

Receiver circuits (preamplifiers, clocked comparators, limiters), distributed circuits.

Jitter noise and other sources of noise, jitter effect on performance.

Timing / Data Recovery (CDR) circuits, PLL for CDR applications.

Damping amplifiers, bandwidth enhancement techniques.

Multiplexers.

Code	**ECE_CK908**
Title	**Modern Network Security Applications**
Instructor	Serpanos Vlachos
Credits	5 ECTS

Content:

- Introduction to Network Security, Attacks on Network Security, Attacks aimed at disrupting the services provided.

Description of basic services and security mechanisms.

- TCP / IP and DoS Attacks vulnerabilities: IP Spoofing, SYN Flooding, and DoS attacks.
- DNS and DNS Cache Poisoning attacks.
- Public key cryptography and RSA26 algorithm.
- Suggestions from cyber attacks: Packet filtering (Linux) and proxy server Firewalls.
- PGP, IPSec, SSL / TLS, and Tor protocols
- Malicious Malware: Viruses and Worms
- Port and Vulnerability Scanning, Packet Sniffing, Intrusions Detection and Attack Test (Penetration Test) on network systems.
- Attacks on the Domain Name System (DNS) and Address Resolution protocol.
- Protocol (ARP)
- Bots, Botnets, DDoS Attacks, and DDoS Attack Mitigation technologies.
- Presentation and analysis of malicious software can be found on the Internet.
- Attacks of denial of service on the Internet and ways to deal with them.

Code	**ECE_DK901**
Title	**Adaptive Control and Reinforcement Learning**
Instructor	Bechlioulis
Credits	5 ECTS

Content:
Models and parametrization of dynamical systems. Lyapunov stability theory. Online parameter identification based on the steepest descent and the least squares methods (robustness analysis). Adaptive pole placement control. Model reference adaptive control. Adaptive PID control. Adaptive control of nonlinear dynamical systems. Robust adaptive control of uncertain dynamical systems based on neural networks.

Code	**ECE_DK902**
Title	**Non Linear Systems and Control**
Instructor	Kazakos
Credits	5 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	**ECE_DK903**
Title	**Optimal Control**
Instructor	Alexandridis
Credits	5 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	**ECE_DK904**
Title	**Robotic Systems II**
Instructor	Bechlioylis
Credits	5 ECTS

Content:

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 ECE Department. These courses are listed in the following tables. All courses of the fifth year (semester 9) can also be selected (if they have not be selected during the 5-year studies towards the Diploma in Electrical & Computer Eng.) 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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Division of *Division of Electric Power Systems*
Electrical & Computer Engineering Building, East Wing
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Members:

Prof. **J. Mourjopoulos** (Associate Director, Divison A)
Prof. **V. Paliuras** (Division C)

COURSES OF DOCTORAL PROGRAM

AUTUMN SEMESTER

A/A	Code	Course	Credits	Instructor
1	22MM002	Digital Processing System Architecture/Arithmetic	3	Paliuras
2	22MM003	Computer and Network Security	3	Serpanos
3	22MM008	Software Technology and Applications	3	-
4	22MM012	Special Topics on Human-Computer Interaction – Intr. to Cooperation Tech.	3	Avouris
5	22MM015	Parallel Distribution Processing and Applications	3	Paliuras
6	22MM022	Low-Power Electric Motors – Structure and Control	3	Mitronikas
7	22MM026	Advanced System of Electrical Transmission and Electrical Energy Distribution	3	Vovos P,
8	22MM028	Techno-economic Design of Telecom Networks	3	Stylianakis

SPRING SEMESTER

A/A	Code	Course	Credits	Instructor
1	22MM010	Architecture of High-Speed Networking Systems	3	Serpanos
2	22MM011	Industrial Computer Systems	3	Gialelis Koubias
3	22MM013	Special Topics on Telecommunications Electronics	3	Kalivas
4	22MM018	Systems in Integrated Circuits		Theodoridis
4	22MM019	Digital Processing Systems	3	Paliuras
5	22MM023	Reliability	3	Pyrgioti
6	22MM024	Data Bases and Knowledge Bases	3	Avouris Sintoris
7	22MM027	Quantum Information Processing	3	Sgarbas
8	22MM029	Advanced Control Technologies in Wind Systems	3	Alexandridis

POSTGRADUATE STUDIES

Specialised Programs

A list of Specialised (Master) Programs offered at the Department of Electrical & Computer Engineering is given below.

A/A	Master Program	Website	Director
1	**Applied Optoelectronics**	www.upatras.gr/el/node/7819	*From Material Science Dept.*
2	**Biomedical Engineering**	www.biomed.upatras.gr	K. Moustakas
3	**Green Electric Power and the Advanced Network Infrastructure for its Management and Economy**	greenpower.upatras.gr	A. Alexandridis
4	**Human-Computer Interaction**	hcimaster.upatras.gr	N. Avouris
5	**Integrated Hardware and Software Systems**	www.ics.ece.upatras.gr/osyl	V. Paliuras
6	**Processing Systems of Information and Machine Learning**	xanthippi.ceid.upatras.gr/dsp	*From Computer Engineering & Informatics Dept.*
7	**Space Technologies, Applications and Services**	star.uoa.gr	*From Informatics & Telecommunications Dept. of Kapodistrian Univ. of Athens*

Appendix

A: Division of Telecommunication & Information Technology
B: Division of Electric Power Systems
C: Division of Electronics & Computers
D: Division of Systems and Control

Directory of Faculty

Name	Position	Division	Telephone	Email address
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**Head of the Department.*

Directory of Professors Emeriti

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Directory of Laboratory Teaching Staff (E.DI.P)

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