



**HELLENIC REPUBLIC
UNIVERSITY OF THESSALY
SCHOOL OF ENGINEERING**

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

MSc.: «Science and Technology of Electrical and Computer Engineering»

STUDY GUIDE

PROGRAM OF GRADUATE STUDIES

«Science and Technology of Electrical and Computer Engineering»

Academic year 2022-23

June 2023

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1 Purpose of this guide

The Curriculum Guide is addressed to the graduate students of the Department as well as all those interested in the Program of Graduate Studies (P.G.S) and in the basic rules governing its operation. Its main objective is to provide accurate information about the education provided in the Program. Through its content, the student has the opportunity to be informed in detail about the objectives of the Department regarding the Program of Graduate Studies, the structure of the Program, the instructors, the available material and technical infrastructure, and the services that support its operation. The curriculum and a brief description of the course content help students to organize their studies properly and effectively. The curriculum guide is updated on an annual basis or on an ad hoc basis whenever appropriate.

The operation of the Graduate Studies Program is governed by the Internal Regulations of Operation of the P.G.S. and, specifically for matters of study, by the Regulations of Studies of the P.G.S.

2 Introduction

2.1 Brief presentation of the institution and department

The University of Thessaly was founded in 1984 with the Presidential Decree 83/1984, which was modified in 1985 with the P.D. 302/1985 and P.D. 107/86.

The University of Thessaly, like all Greek Universities, is a Public Entity, fully self-governing, under the supervision of the Ministry of Education and Religious Affairs in accordance with article 16 of the Constitution and current legislation.

The administrative bodies of the University are (based on law 4957/2022):

- The Governing Council.
- The Senate.
- The Rector.
- The Vice-Rectors.
- The Executive Director.

The administrative bodies of the School of Engineering are:

- The Dean.
- The Dean's Office.

The Department of Electrical and Computer Engineering (D.E.C.E.) of the School of Engineering of the University of Thessaly is located in Volos. It was founded in March 2000 as Department of Computer Engineering, Telecommunications and Networks and admitted its first students in September of the same year. In June 2013 it was renamed as Department of Electrical and Computer Engineering. The Department admits approximately 200 undergraduate and 50-60 graduate students every year.

Since its establishment, the Department's constant objectives are:

- The promotion of theory and technologies in the fields of Circuits, Electronics and Computer Architecture, Software and Computer Science, Telecommunications and Networks, and (after its renaming) Energy.
- The training and preparation, both through teaching and research, of engineers with all the necessary skills, both ethical and technological, that will allow them to successfully participate in graduate

programs, to support professionally the design and implementation of projects and to follow the developments in the constantly evolving fields mentioned above.

- The continuous production of new knowledge through cutting-edge research in the above fields, not only at national but also at international level, and the training of young researchers who will in turn promote science at national and international level.

To this end, at the undergraduate level, the Department covers the scientific subject of Electrical and Computer Engineering through a 5-year curriculum, offering a wide range of courses in the following main areas: (1) Foundations and Applications of Computer Science, (2) Software Engineering and Information Systems, (3) Computer Hardware and Architecture, (4) Signals, Telecommunications and Networks, and (5) Energy. Since 2019, by the Government Gazette 454/15.02.2019 issue B', the Diploma in Electrical and Computer Engineering awarded by the Department is recognized as a single and indivisible graduate degree (integrated master).

At the same time, the Department offers three separate graduate programs in the following subjects:

- Science and Technology of Electrical and Computer Engineering
(<https://www.e-ce.uth.gr/studies/postgraduate/science-and-technology-of-ece/?lang=en>)
- Smart Grid Energy Systems
(<https://www.e-ce.uth.gr/studies/postgraduate/smart-grid-energy-systems/?lang=en>)
- Applied Informatics
(<https://www.e-ce.uth.gr/studies/postgraduate/applied-informatics/?lang=en>)

Furthermore, the Department operates a Doctoral Studies Program which leads to the award of a doctorate (PhD) in Electrical and Computer Engineering.

The administrative bodies of the D.E.C.E. are:

- The Department General Assembly.
- The Head of Department.
- The Deputy Head of Department.

Infrastructure

Since the academic year 2021-22, the Department is housed in new facilities in Pedion Areos, in close proximity to the other departments of the School of Engineering.

The new building contains 1 large auditorium (260 seats), 2 smaller auditoriums (130 seats each) and 3 classrooms (55 seats each). In addition, it has 4 laboratories, 34 offices for teaching staff, additional offices for technical staff and the Secretariat, and 1 conference room.

2.2 Research activity of the department

A large part of the research work is carried out through separate research laboratories, in which post-doctoral researchers, doctoral candidates, postgraduate students and undergraduate students participate.

The Department has seven institutional (1-7) and two non-institutional research laboratories (8-9):

1. Electronics Lab
2. Circuits and Systems Lab
3. Smart Energy Policy and Networks Lab

4. Telecommunications and Networks Lab
5. Computer Systems Lab
6. Data Structuring and Engineering Lab
7. Creative Technologies Learning Lab
8. Distributed and Network Algorithmic Lab
9. Signal Processing Lab

3 Objective and aim of P.G.S.

Since 2018, the Department of Electrical and Computer Engineering of the University of Thessaly has been offering a P.G.S. titled "Science and Technology of Electrical and Computer Engineering" which leads to the awarding of a Master of Science Degree titled "MSc in Science and Technology of Electrical and Computer Engineering". (Government Gazette 2469/τ.Β'/27.06.2018).

The pertinent bodies for the establishment, organization and operation of the P.G.S. are:

- The Senate of the University of Thessaly.
- The D.E.C.E. General Assembly. (G.A.)
- The Coordinating Committee of the P.G.S. (C.C.)
- The D.E.C.E Graduate Studies Committee (G.S.C.)
- The Director of the P.G.S.

The objective of the P.G.S. "Science and Technology of Electrical and Computer Engineering" is the high level scientific, theoretical and applied specialization of first-level degree holders from higher education institutions of Greece or similar institutions of foreign countries, in topics related to the subject matter of the program, in order to meet the increased professional demands of the labor market in relevant fields, and to formulate an appropriate scientific background for the continuation of studies at a higher level as a result of research and the deepening of knowledge in relevant scientific fields.

The aim of the MSc in "Electrical and Computer Engineering Science and Technology" is to provide candidates with:

- The necessary scientific knowledge for the (future) participation in PhD programs in fields related to Electrical and Computer Engineering.
- A deepening of the knowledge and skills required in competitive work environments, by conducting further research and study.
- The opportunity to acquire specialized scientific knowledge and skills on topics relevant to the program's subject matter, in order to develop their ability to analyze and solve problems and to take decisions and initiatives in a local or international environment.

The MSc provides specialized training in understanding the principles of the following scientific areas:

- Applications and Foundations of Computer Science.
- Software Engineering and Information Systems.
- Computer Hardware and Architecture.
- Signals, Telecommunications and Networks.

4 Learning Outcomes of P.G.S.

The learning outcomes for each course in the program are provided in the corresponding course description. In relation to the learning outcomes of the MSc in Science and Technology of Electrical and

Computer Engineering, upon successful completion of the requirements leading to the awarding of the MSc in Science and Technology of Electrical and Computer Engineering, graduates of the program:

- They possess cutting-edge knowledge in scientific areas such as: hardware technology of computer systems, software technology of computer systems, communications and network technology, advanced algorithms, signal processing, artificial intelligence, and applications of the above.
- They have acquired the necessary knowledge and skills to participate in a working environment with real problems, to suggest solutions - both conventional and innovative - to develop new strategies and new processes in relation to the design, operation, control and deployment of modern computer systems.
- They possess specialized scientific knowledge and skills in subjects relevant to the subject matter of the program in order to develop their ability to analyze and solve problems and to take decisions and initiatives in a local or international environment.
- They have the ability to analyze and critically evaluate new knowledge relevant to computer systems technology and applications, as well as the breadth of understanding and flexibility required to integrate knowledge and techniques from different disciplines.
- They have the ability to operate in a team environment, to collaborate, present and support a simple research activity to both experts and non-specialists and to transfer specialized knowledge and skills relevant to the subject matter of the program.
- They are able to conduct high quality research on topics relevant to the program's subject matter and to directly pursue PhD programs in areas relevant to the program's subject matter.

5 Participation in the P.G.S.

5.1 Enrollment in the P.G.S.

The initial enrollment in the P.G.S. of the Department takes place at the beginning of the academic semester, following a decision by the Department's General Assembly and an announcement by the Secretariat of the P.G.S.

At the time of initial registration, Graduate Students shall submit, in addition to the documents already submitted with their application, the following:

- Declaration of Personal Data (form available from the Secretariat).
- A certified photocopy of the identity card or passport.
- Validated Certificate of Birth (only for male students seeking deferment of enlistment).

5.2 Enrollment renewal – Course registration

Graduate students are required to renew their enrollment within the deadline announced by the P.G.S. Secretariat for each academic semester. The renewal is done electronically using dedicated software (Electronic Secretariat), through the process of registering for the courses they will attend. The initial enrollment in the first semester is also completed by submitting the online course registration. Failure to meet the enrollment deadline will result in the loss of the opportunity to attend the current semester. In this case, a decision of the G.A. is required for the continuation of the studies, following a proposal of the C.C.

At the time of renewal of enrollment, the student selects the courses he/she intends to attend. The total number of credits of the courses to be attended per academic semester, excluding the Graduate Thesis, cannot exceed thirty 30 ECTS.

It is permitted to substitute or delete a course from the list of courses registered by the student within an exclusive period of three (3) weeks from the start of the course. In this case, the deleted courses are considered as never registered, are not taken into account in the further progress of the student, and do not create any kind of obligation for the student. Under no circumstances, however, may a student, after any cancellations, not be enrolled in any course per semester of study.

A student who has not renewed his/her enrollment for two (2) consecutive semesters shall be automatically deprived of his/her student status and shall be removed from the P.G.S.

5.3 Academic advisor

For each graduate student (G.S.), the C.C. appoints a faculty member of the C.C. as an Academic Advisor, who is responsible for monitoring and reviewing the general progress of the graduate student's studies.

The Academic Advisor supervises the study and research progress of the G.S., in accordance with the provisions of the Academic Advisor's Regulations. In particular, he/she monitors the progress of the student, advises him/her on academic, organizational or administrative matters and refers matters concerning the student to the C.C. The student must inform the Academic Advisor about the progress of his/her studies and in particular about the final composition of the courses in which he/she is registered each semester.

5.4 Course Attendance

The start and end dates of the courses of the MSc are determined within the framework of the annual Academic Calendar of the University, which are announced on time by the Secretariat of the P.G.S. The G.A., upon the recommendation of the C.C., may modify the start and end dates of the courses in order to make the operation of the program more efficient. The January and June examination periods follow the Academic Calendar of the University. There is no September examination period.

Courses are taught according to the timetable announced by the Department's Secretariat. Attendance may include lectures, seminars, special lectures, laboratories, individual and/or collective work, oral and/or written examinations. The duration of each graduate course is 13 weeks.

The weekly teaching hours of each course are three (3). In addition to these hours and to cover the needs of laboratories, seminars, practical exercises, etc., other hours may be added, following a substantiated decision by the G.A. on the recommendation of the C.C.

Students are required to attend all lectures, laboratories, and any activities scheduled by the teacher for each course. Attendance of graduate courses is compulsory. Unexcused absences may not exceed 20% of the total teaching hours.

The organization of the educational process of the P.G.S. may be carried out either face-to-face or through the use of modern distance learning methods using a platform approved by the university.

Problems arising in relation to the attendance of courses are evaluated at the discretion of the lecturer and are dealt with on a case-by-case basis, initially by the lecturer and subsequently by the Director of the P.G.S. and the C.

5.5 Examinations

The examination of students takes place at the end of each academic semester. The January and June examination periods follow the Academic Calendar of the University. There is no repeat examination period in September.

If a student fails an elective course, he/she is entitled to either repeat it or replace it with another course from the P.G.S. If a student fails twice (2) in the same course, he/she may request, by application to the Head of the Department within two weeks from the date of the announcement of the result, to be evaluated by a three-member committee consisting of the teaching staff of the same or another Department of the University in the same or related scientific domain as the subject of the course to be examined, in which the lecturer of the course may not participate. In case of non-submission of an application or rejection before the three-member committee, the student is removed from the P.G.S.

5.6 Graduate thesis

The completion of a Graduate Thesis (G.T.), on a topic related to the scientific areas of the program, is compulsory for the Graduate Students of the P.G.S.

The undertaking of the G.T. by a Graduate Student is initiated by an application by the student to the Department's G.A. in which the proposed title of the thesis and the proposed supervisor are indicated. The application shall be accompanied by a preliminary outline of the research for the thesis. From the date of the G.A.'s approval of the undertaking of the thesis until its completion (research, data collection and processing, preparation of the G.T.), a period of at least three (3) months shall elapse.

After the completion of the writing of the thesis and with the agreement of the Supervising Professor, the student delivers a copy of the thesis, at least in electronic form, to the members of a Three-member Examination Committee (T.E.C.). By a majority decision of the members of the T.E.C., the thesis is approved for public defense and examination, or the thesis is referred back.

The defense of the G.T. involves an oral presentation and elaboration of the thesis by the G.S. to the members of the T.E.C. and an audience, who ask questions to him/her, so that they may form a clear understanding of the subject of the thesis and the student's ability to defend it. The G.T. is assessed in terms of the research work, the scientific methodology used to obtain the results, the presentation of a literature review and the usefulness of the findings. The written and oral presentation and the G.S.'s answers to the questions during the examination will also be assessed. The grade of the G.T. is calculated as the average of the grades assigned by the examiners. In the event that the G.T. grade from the examination is failing, the T.E.C. will set a new assessment date at least three (3) months after the first examination. In case of a second rejection, the candidate shall be withdrawn from the P.G.S.

The final version of the G.T. (incorporating any corrections suggested by the T.E.C.) is submitted by the candidate, with the agreement of the supervisor, to the Department's Secretariat in electronic form (pdf) and to the Library in bound hard copy and electronic form (pdf).

Details for the undertaking and writing of the G.T. are described in the Regulations for the Preparation of Graduate Theses and Dissertations.

5.7 Internship

There is no compulsory internship for this P.G.S. The P.G.S. supports and encourages the mobility of its students for internships abroad, making use of the Erasmus+ internship program in which the Department of Electrical and Computer Engineering participates. The subject of the internship abroad should be relevant to the student's field of study in the P.G.S., but the internship should not be part of

the graduate thesis. The program supports the development of students' professional skills and not their current research activity. The student may work in a research institution, only provided that the scope of the Internship is determined by the given needs and activities of the Host Institution and is not shaped to serve as part of a graduate thesis.

5.8 Calculation of degree grade

A graduate student is considered to hold the MSc. degree once he or she has fully completed the requirements as described in the regulations of the P.G.S.

The final grade of the degree is determined by the student's grades in the courses and the graduate thesis and is calculated as the weighted average of the grades of the six (6) graduate courses and the graduate thesis, taking into account the credit weight of each course. Specifically:

$$FINAL\ GRADE = \frac{\sum(CC U \times CG) + (TCU \times TG)}{\sum CCU + TCU}$$

Where: CCU = Course Credit Units

TCU = Thesis Credit Units

CG = Course Grade

TG = Thesis Grade

The final grade is calculated to two (2) decimal places. The Diploma shall bear a designation which, in descending order of assessment, is as follows: EXCELLENT from eight and fifty (8.50) to ten (10); VERY GOOD from six and fifty (6.50) to eight and forty-nine (8.49); GOOD from five (5) to six and forty-nine (6.49).

5.9 Suspension of studies

Graduate students may be granted, upon submission of an application to the G.A., a temporary suspension of studies, which may not exceed a total of two (2) academic semesters, starting from the beginning of the academic semester for which the application is submitted. During the period of suspension, the graduate student shall lose his/her student status. The period of suspension shall not be counted towards the minimum and maximum periods of regular study.

Requests for suspension of studies shall be considered on a case-by-case basis after at least one (1) semester of study has elapsed. Requests for suspension submitted after three (3) weeks from the start of classes will not be considered.

Upon expiration of the suspension, the student shall resume his/her studies immediately without an application and his/her name shall appear on the attendance records. Unjustified exceeding of the approved period of suspension will result in the immediate withdrawal of the candidate from the P.G.S.

5.10 Tuition Fees

For the attendance of the P.G.S., there is a total tuition fee of 2.000 € (250 € per registered course, 1.500 € for the total of the required 6 courses, and 500 € for the preparation of the M.D.E.).

The tuition fee is payable in one installment each semester, within an absolute deadline of three (3) weeks from the start of classes. Failure to pay the tuition fee on time will result in the student's exclusion from the examinations of the respective semester.

Graduate students who wish either to withdraw from the P.G.S. or to suspend their studies are entitled to a refund of the tuition fees paid in the current semester provided that no more than three (3) weeks have elapsed since the start of classes.

5.11 Free study

According to article 86 of Law 4957/2022, enrolled students of a Program of Graduate Studies may study free of charge, assuming there is a tuition fee, if they meet the financial or social criteria set by law. A prerequisite for the granting of the right to free tuition on the basis of economic or social criteria is the achievement of excellence in first-level studies, which corresponds at least to the attainment of a grade equal to or higher than seven and a half with a perfect score out of ten (7,5/10), provided that the evaluation of the basic degree presented for admission to the P.G.S. has been awarded in accordance with the ten-point scale of a higher education institution in the country, otherwise, this criterion is applied proportionally in accordance with the respective evaluation scale, if the degree has been awarded by a foreign institution.

The total number of students attending free of charge may not exceed the number corresponding to thirty percent (30%) of the total number of enrolled students per academic year. If the numerical calculation of the number of beneficiaries of exemption from tuition fees results in a decimal number, the number shall be rounded to the nearest whole number. If the number of beneficiaries of the exemption exceeds this percentage, the beneficiaries shall be selected in descending order until the number is reached.

Applications for free tuition per P.G.S. shall be submitted after the completion of the admission process of students to the P.G.S. and within a period of time determined by the Director of the P.G.S.

In addition to the provisions for free study, the P.G.S. also offers the possibility of scholarships to G.S. based on financial means. The additional scholarships are granted exclusively on the basis of the academic performance of the G.S. during the course of studies. The Department may ask G.S. scholars to undertake specific work within the framework of its needs. The decision to award scholarships and the corresponding amount shall be determined by a decision of the G.A. following a recommendation from the C.C.

5.12 Duration

The minimum duration of study for the completion of the P.G.S. "Electrical and Computer Engineering Science and Technology" is two (2) semesters, while the maximum duration cannot exceed six (6) academic semesters.

During the period of study in the P.G.S., students are required to attend graduate courses and complete a Graduate Thesis.

Upon the substantiated recommendation of the Academic Advisor or the Supervising Professor of a Graduate Student's Thesis and a relevant application, the C.C. of the P.G.S. may recommend to the Departmental G.A. an extension of the student's period of study.

The P.G.S. "Electrical and Computer Engineering Science and Technology" is offered to students either as a full-time program or, in special cases, as a part-time program, in accordance with the provisions of the Operating Regulations. Full-time and part-time students shall receive equivalent degrees.

The duration of study in the part-time program may not exceed twice the duration of the corresponding full-time program.

5.13 Infrastructure

For the operation of the P.G.S., the existing logistical infrastructure of the D.E.C.E. is utilized. The teaching of the courses and the required research activity of the P.G.S. is carried out in the facilities of the Department, which adequately cover the needs of the program in terms of the number of classrooms, laboratory, and research spaces with the required technical infrastructure for the uninterrupted operation of the program.

At the D.E.C.E of the School of Engineering of the University of Thessaly, there are both general and specialized laboratories to support the educational and research needs of the department.

Specifically, the two existing general-purpose laboratories are used for the operation of the P.G.S. They have the audiovisual infrastructure, modern distance learning infrastructure, and modern workstations that meet the requirements of the program. There is 10GbE networking and wireless network access available in the lab spaces for students and faculty.

In addition to these laboratories, the Department provides for use by the P.G.S:

- A specialized laboratory of Embedded Systems and CAD Tools.
- A specialized Electronics laboratory.
- Heterogeneous high-performance computing nodes.
- Embedded and IoT systems development platforms.
- Sufficient cloud computing infrastructure used both in education (in a significant number of courses and projects) and in research (electronics, big data, bioinformatics, telecommunications/networks, etc.) and providing capabilities for large-scale, demanding experiments, making use of virtual machine technology.
- A significant volume of software, both open source and closed source, for application development and education.

The Department has, in addition to its educational and research laboratories, research groups that maintain ongoing collaborations with other universities and research institutes in Greece and abroad, related to scientific areas of the broader field of Electrical and Computer Engineering.

5.14 Graduate Assistantship

The department expects graduate students to participate and assist in the undergraduate teaching work of the department as specifically directed by the faculty members: (i) in student tutoring and conducting tutorials and laboratory exercises, (ii) in correcting assignments, and (iii) in proctoring during examinations.

Through this participation in the activities of the Department, the M.F.'s academic identity is fulfilled and they are prepared for future careers in the field of education.

5.15 Rights and financial support of graduate students

Graduate students have all the rights and benefits provided by law for second-level students.

The University of Thessaly ensures that students with disabilities and/or special educational need access to the proposed texts and teaching.

Graduate students may participate in research projects and be remunerated for this. Graduate students may be granted remuneration from programs for the development of specialized scientific and technological services or other remuneration in accordance with the applicable provisions. The Department shall encourage the participation of G.S.'s in funded research projects, as well as external funding from various institutions (I.K.Y., etc.)

6 Quality assurance

6.1 Copyright and Plagiarism

The copyright of Graduate Theses or patent rights or commercial exploitation rights of the theses are determined by relevant decisions of the Ethics Committee of the University of Thessaly.

Any kind of plagiarism in coursework, publications, or writing of Graduate Theses, fabrication of research data, and unscientific conduct in general is prohibited. The Ethics Committee is responsible for informing the students of the P.G.S. and for imposing penalties where necessary. Detailed guidelines on this matter will be issued by the University Ethics Committee.

No graduate thesis will be submitted for defense unless it has first been checked by the online plagiarism prevention service of the Central Library of the University.

6.2 Program evaluation/quality control

A key obligation of all stakeholders in the operation of the P.G.S. is to ensure and continuously improve the educational quality of the program. For this purpose, the P.G.S. as a whole, as well as the individual courses will be systematically evaluated according to the proposed procedures and criteria established by the Internal Quality Assurance System of the University of Thessaly and at the same time contribute to its further improvement.

7 Lecturers in the P.G.S.

Since the establishment of the MSc, the lecturers of the MSc are internal members (Faculty, Laboratory Teaching Staff) of the Department of Electrical and Computer Engineering of the University of Thessaly and external collaborators, all of them possessing a doctoral degree, as listed below:

Faculty:

1. Athanasios Korakis, Professor
2. Antonios Argyriou, Associate Professor
3. Aspasia-Kalliope Daskalopoulou, Associate Professor
4. Gerasimos Potamianos, Associate Professor
5. Georgios Karakonstantis, Associate Professor
6. Georgios Stamoulis, Professor
7. Dimitrios Katsaros, Associate Professor
8. Dimitrios Rafailidis, Associate Professor
9. Emmanouil Vavalis, Professor
10. Ioannis Moundanos, Associate Professor
11. Michael Vassilakopoulos, Professor
12. Nestor Evmorfopoulos, Associate Professor
13. Nikolaos Bellas, Professor
14. Spyridon-Gerasimos Lalis, Professor
15. Christos Antonopoulos, Associate Professor
16. Christos Sotiriou, Associate Professor

Laboratory Teaching Staff:

1. Hariklia Tsalapata

Collaborating Instructors:

1. Konstantinos Anagnostou, Professor, Department of Informatics and Telecommunications, UTH
2. Georgios Foulas, Professor, Department of Informatics and Telecommunications, UTH

8 Course schedule

In order to obtain the Master's degree in "Electrical and Computer Engineering Science and Technology", the student must successfully complete six (6) Graduate Courses, which correspond to a total of forty-five (45) credits, distributed over two (2) semesters, and a Graduate Thesis, which corresponds to fifteen (15) credits. The total number of credits (ECTS) required for the granting of the M.Sc. degree is sixty (60). The structure of the program and the content of the courses of the MSc are in accordance with international standards.

By decision of the Department's G.A., a member of the Department's faculty is appointed as the Scientific Supervisor for each course of the P.G.S. The Scientific Supervisor for each course of the P.G.S., in collaboration with the lecturers of the course, is responsible for the implementation of the academic calendar, the quality of notes and books, the participation of the G.S., the organization of workshops, lectures and tutorials that pertain to the subject in order to implement the course in the best possible way. In addition, in the event of non-implementation of part or all of a course, he or she will ensure that it is made up for in a satisfactory manner.

The courses of the P.G.S. are divided into compulsory and elective (Compulsory [C] or Elective [E]). The structure of the program and the titles of the graduate courses per semester with their credit units (ECTS) are presented in the following tables:

CURRICULUM

Fall Semester

S/N	Course	ECTS	C/E
1	Advanced Software Engineering	7,5	E
2	Big Data Mining	7,5	E
3	Computational Methods For Electromagnetics	7,5	E
4	Advanced Distributed Computing	7,5	E
5	Wireless Sensor Network Programming	7,5	E
6	Advanced Computer Architecture	7,5	E
7	Advanced Topics in Speech and Language Processing	7,5	E
8	Principles of Solid-State Physics	7,5	E
9	Advanced Topics in CAD Algorithms	7,5	E
10	Bioinformatics	7,5	E
11	Special Topics	7,5	E

Spring Semester

S/N	Course	ECTS	C/E
1	Wireless Mobile Communications	7,5	E
2	Logical Foundations for Intelligent Agents	7,5	E
3	Computer Vision	7,5	E
4	Algorithm Technologies	7,5	E
5	Low Power Design	7,5	E
6	Asynchronous Circuit Design	7,5	E
7	Advanced Topics in Artificial Intelligence	7,5	E
8	Advanced Topics in System Software	7,5	E
9	Parallel and Internet Programming	7,5	E

10	Estimation and Detection Theory	7,5	E
11	Dependable Systems	7,5	E
12	Design Thinking in Computer Science	7,5	E
13	Special Topics	7,5	E

Graduate Thesis

S/N	Course	ECTS	C/E
1	Graduate Thesis	15	C

A subset of the electives in the curriculum may be offered each semester, depending on the preferences of the enrolled students and the resources of the program. In any case, this subset must be sufficient to - as a minimum - exceed the course registration requirements of full-time students.

Students are required to choose 4 of the available courses in the first semester (30 ECTS) and 2 of the available courses in the second semester (15 ECTS). In the second semester, in addition to the courses, students are required to choose a topic for a graduate thesis (15 ECTS).

The language of instruction of the MSc is Greek or English. The language of the Graduate Diploma Thesis is Greek or English.

A brief description of the content of the courses of the P.G.S. is as follows:

Advanced Software Engineering

This course covers advanced software engineering topics. It is intended for people who have already completed a course on the fundamentals of software engineering. The topics covered in the course are specification extraction processes, distributed systems design, component-based systems, software evolution, feature-based design, critical systems, software cost estimation, process improvement, and software management.

Big Data Mining

Introduction to Data Mining. Fundamentals, languages and architectures of Data Mining Systems, description of concepts, characterization and comparison. Large Scale File Systems and Map-Reduce. Data Mining from Large Data Sets: Similar Object Search, Data Stream Mining, Link Analysis, Frequent Elementary Sets, Clustering, Internet Advertising, Recommendation Systems. Algorithms for specialized problems of Data Mining in Parallel and Distributed Systems.

Computational Methods for Electromagnetics

This course introduces the numerical methods applied to the simulation of EM systems and the mathematical theory behind these solutions. The second part of the course discusses the parallelization of these methods and their practical application to specific problems.

Advanced Distributed Computing

The course focuses on presenting the theory and practice of data processing in modern parallel and distributed processing environments, such as those in the cloud. In particular, it presents computing architectures such as Hadoop and Spark, deals with issues of (ultimate) data consistency and indexing on data in distributed systems. It also presents resource allocation and elasticity algorithms in data center environments, and finally presents the best known consensus algorithms in such environments such as Paxos and Raft.

Wireless Sensor Network Programming

The aim of the course is to provide an in-depth introduction to the programming of wireless sensor network systems. The following topics are covered: introduction to wireless sensor networks and their applications, special features and limitations, self-organization and routing approaches, main programming issues, overview of operating systems and middleware. The course is organized around a series of tasks for the incremental development of a (simple) middleware with support for dynamic installation, execution, communication and uninstallation of applications written for a virtual machine that also needs to be implemented. In addition, each student presents to the class a scientific article assigned by the instructor.

Advanced Computer Architecture

The course focuses on recent developments in computer architecture with emphasis on parallel implementations. The teaching is based on a review of the most recent literature and evaluation of the proposed solutions. Architectures for mobile device processors with a focus on low-power processing are also considered.

Advanced Topics in Speech and Language Processing

The course focuses on the basic concepts of voice and sound processing, with particular emphasis on the human voice, namely its production, perception, representation, encoding, synthesis, and recognition. Also covered is the processing of general acoustic signals, and in particular music signals. In summary, the course covers the following areas: (i) Introduction to digital voice processing, (ii) Review of basic digital signal processing knowledge, (iii) Fundamental concepts of human voice production and sound propagation in the human vocal tract, (iv) Hearing, acoustic models, and speech perception, (v) Time-domain voice processing methods, (vi) Frequency-domain representations, (vii) Homomorphic voice processing and cepstrum, (viii) Linear prediction analysis of voice signals, (ix) Voice signal parameter estimation algorithms, (x) Digital coding of speech signals, (xi) Voice and audio coding in the frequency domain, (xii) Speech synthesis from text, (xiii) Automatic speech recognition using hidden Markov models and natural language understanding, (xiv) Feature extraction and musical signal recognition, (xv) Basic computational tools in Matlab (including the MIR toolbox) that implement the above, (xvi) Brief introduction to the Hidden Markov Model toolbox (HTK).

Principles of Solid-State Physics

The course examines the structure and principles of operation of semiconducting elements. Starting from the basic principles of solid-state physics, it analyzes the operation of diodes and transistors and then discusses the most widely used models and how they relate to analytical expressions.

Advanced Topics in CAD Algorithms

This course includes the presentation of modern algorithms that refer to some part of the IC design process. Each year the course focuses on a different point in order to meet the needs of the students and new developments in science.

Bioinformatics

Introduction to molecular biology, restriction site mapping, regulatory motifs in DNA sequences, profiling, pattern finding, genomic rearrangements and approximate algorithms, DNA sequence alignment and dynamic programming, gene discovery, gene expression analysis, evolutionary trees and hierarchical clustering, non-coding RNA, human biological databases, introduction to PERL programming language.

Special Topics

This course aims to cover special topics or research issues that arise and do not appear in the general list of courses.

Wireless Mobile Communications

The aim of the course is to introduce students to the broad research field of wireless telecommunications with special emphasis on mobile telecommunications. Students will be taught basic concepts such as demodulation and modulation and channel propagation mechanisms. Advanced concepts such as channel coding and information theory are also included in the course. Emphasis is placed on new technologies such as multiple antenna systems (MIMO) and cognitive radio systems. Students also have the opportunity to learn concepts related to cellular networks, LTE, WLAN, OFDM, etc.

Logical Foundations for Intelligent Agents

We consider various logical axiomatizations - temporal logics, modal logics, action logics, judicial and temporal logics, etc. - which are used A) for generating executable formal specifications of agent systems and studying system-level properties B) for representing knowledge and the reasoning process of each agent and studying its behavior C) for formal specification and the study of an agent system at the level of interaction between agents.

Computer Vision

The course focuses on the fundamental problems of computer vision, namely the extraction of useful information from images and video, describing the most important mathematical models and algorithms for this purpose, as well as selected applications. In summary, it covers the following areas: Introduction to computer vision. Image formation and physics. Review of basic concepts of digital image processing. Feature detection and matching. Segmentation. Feature-based alignment. Structure by motion. Visual flow. Image stitching. Computational photography. Stereoscopic matching. Three-dimensional reconstruction. Image rendering. Object and scene recognition. Selected applications of computer vision.

Algorithm Technologies

Graphs and Leda. Complexity Theory - Approximate Algorithms. Introduction to Geometric Algorithms. Introduction to Geometric Structures. External Memory Algorithms and Cache-oblivious Algorithms. Introduction to Bioinformatics Algorithms. Advanced Hash Structures. Van emde Boas Trees. Random Algorithms.

Low Power Design

The course includes a general overview of techniques for designing low power and low energy circuits. The first part of the course covers the classical techniques and the second part presents the current trends in the field through the presentation of research papers.

Asynchronous Circuit Design

The course deals with the design of microprocessors (and large-scale digital circuits in general) using custom techniques at the physical and circuit level. It includes placement of building cells and routing of interfaces, power and clock distribution, extraction of parasitic elements, timing analysis at the circuit and physical level, dynamic and static power consumption, noise and signal integrity analysis, analysis of reliability problems, design under statistical parameter variations. An important part of the course covers the application of modern optimization techniques to the design of microprocessors under specifications.

Advanced Topics in Artificial Intelligence

The course teaches topics from the area of artificial intelligence and more specifically the area of machine learning and knowledge mining. The following topics are presented: Knowledge discovery process, categorization, interference, clustering, mining association rules and frequent patterns, feature selection, discretization, data preprocessing methods. Students are introduced to libraries of machine learning algorithms in JAVA and Python and learn about the knowledge extraction tool WEKA.

Advanced Topics in System Software

The course aims to expose students to advanced system software issues, beyond the scope of the topics usually covered in undergraduate courses. More specifically, it will analyze: Specific operating system requirements for parallel systems, heterogeneous systems, embedded systems, and systems with real-time response requirements. Support for virtualization; power consumption management. Role of system software at the user level. Memory management at the user level. Security issues. Modern file systems (journaling, distributed file systems, file systems for high performance applications). Reliability issues. Approximate computing and system software support. In addition to the lectures, the course includes a review and presentations of the current literature. Students also carry out a series of compulsory programming projects extending the functionality of real system software in relation to the issues addressed in the course.

Parallel and Internet Programming

Introduction to parallel and network algorithms and computation on modern supercomputers and general-purpose network arrays. Design and programming of parallel and network distributed numerical and non-numerical algorithms. Synchronization, workload/load balancing, synchronization, communication cost and scaling problems. Analysis, evaluation, and behavior prediction of parallel algorithms and computations. Programming using MPI, PVM, OpenMP, and parallel MATLAB.

Estimation and Detection Theory

The course deals with topics from estimation and detection theory, with particular emphasis on applications to problems in telecommunications and wireless networks. The course includes a review of probability theory, examination of binary hypothesis criteria, estimation of parameter values based on measured empirical data that have random components. The goal of the course is for students to use the tools of probability and signal processing to estimate signals and parameters and detect events from data.

Dependable Systems

The course aims to develop knowledge for the design of reliable computer systems to operate efficiently under various operating conditions. It covers: (i) Sources and types of faults, (ii) Metrics for evaluating reliable systems, (iii) Fault detection techniques, (iv) Processor debugging techniques, (v) Memory debugging techniques, (vi) Circuit and architectural level design techniques, (vii) Software debugging techniques, (viii) Advanced debugging and security techniques, (viii) Advanced security techniques.

Design Thinking on Computer Science

The course aims to develop knowledge and skills for design thinking, a deeply anthropocentric design process that aims to introduce solutions that respond more directly to real users through a process of problem exploration, empathic definition, ideation, prototyping, and evaluation. The method is applicable to a wide range of problems related to entrepreneurship and/or social entrepreneurship. The course has a theoretical and practical component. In the theoretical part, participants understand the

concepts, methods, and good practices of design thinking. In the practical part, they apply theory to design solutions to real problems.

9 Validity and amendments

The C.C. of the P.G.S. may recommend to the Department's G.A. the modification of articles of the present Study Guide, following the relevant proposals of those involved in the program, taking into account the Internal Regulations of Operation of the P.G.S. and the Regulations of Studies of the P.G.S.