HELLENIC REPUBLIC

UNIVERSITY OF THESSALY

SCHOOL OF ENGINEERING

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

POSTGRADUATE STUDY PROGRAM

STUDY GUIDE

of

Postgraduate Study Program

in

"Smart Grid Energy Systems"

(M.Sc. in Smart Grid Energy Systems)

Academic Year 2022-23

June 2023

Περιεχόμενα

1 Purpose of the Study Guide

The Study Guide of the Postgraduate Study Program in "Smart Grid Energy Systems" (Master of Science-M.Sc.) in "Smart Grid Energy Systems" of the Department of Electrical and Computer Engineering (E.C.E.) at the University of Thessaly (U.T.), is addressed to postgraduate students of the Department as well as anyone interested in the Postgraduate Studies and the basic rules governing its operation. Its main objective is to inform them accurately regarding the education provided in the program. Through its content, students have the opportunity to see in detail the objectives of the Department for the Postgraduate Studies Program, the program's structure, the instructors, the available technical infrastructure, and the provided services supporting its operation. The study program and the concise description of the course content help students organize their studies correctly and effectively. The study guide is updated on an annual basis or as needed.

For the operation of the Postgraduate Study Program, the Internal Operating Regulations of the Program apply, which are specified for study issues by the Study Regulations of the Program.

2 Introduction

2.1 Brief presentation of the Institution and the Department

The University of Thessaly was established in 1984 by P.D. 83/1984, amended in 1985 by P.D. 302/1985 and P.D. 107/86.

The University of Thessaly, like all Greek Universities, is a Legal Entity of Public Law, fully self-governed, under the supervision of the Ministry of National Education and Religious Affairs, according to the provisions of Article 16 of the Constitution and the applicable legislation. The Academic Bodies responsible for the administration, organization and functioning of the postgraduate study programs are: (based on L. 4957/2022):

- The Board of Directors
- The Senate
- The Rector
- The Vice-Rectors
- The Executive Director
- The Rectoral Council.

The administrative bodies of the School of Engineering are:

- The Dean
- The Deanship of the Faculty.

The Department of Electrical and Computer Engineering (E.C.E.) of the School of Engineering at the University of Thessaly is located in Volos. It was established in March 2000 as the Department of Computer, Telecommunications, and Network Engineering and accepted its first students in September of the same year. In June 2013, it was renamed the Department of Electrical and Computer Engineering (E.C.E.). The Department currently accepts approximately 200 undergraduate and 50-60 postgraduate students each year.

Since its establishment, the Department's steady objectives have been:

- The promotion of theory and technologies in the fields of Circuits, Electronics and Computer Architecture, Software and Informatics, Telecommunications and Networks, and (after its renaming) Energy.
- The education and preparation, through teaching and research, of Engineers with all the necessary moral and technological tools that will enable them to successfully participate in postgraduate study programs, support professionally the design and implementation of projects, and monitor developments in the constantly evolving aforementioned fields.
- The continuous production of new knowledge through cutting-edge research in the aforementioned fields, not only at the national but also at the international level, and the training of new researchers who, in turn, will promote science at a national and international level.

For this purpose, at the undergraduate level, the Department covers the scientific subject of Electrical and Computer Engineering through a 5-year study program, offering a wide range of courses in the following core areas:

1. Foundations and Applications of Computer Science
2. Software and Information Systems
3. Hardware and Computer Architecture
4. Signals, Telecommunications, and Networks, and
5. Energy.

Since 2019, with FEK 454/15.02.2019_B', the Diploma of Electrical and Computer Engineer awarded by the Department is recognized as an integrated M.Sc. Degree in the field of Electrical and Computer Engineering at Level 7 of the National and European Qualifications Framework

In addition, the Department offers three separate postgraduate programs in the following fields of study:

- Technology and Science of Electrical and Computer Engineering
- (https://www.e-ce.uth.gr/studies/postgraduate/science-and-technology-of-ece/)

- Smart Grid and Energy Systems
- (https://www.e-ce.uth.gr/studies/postgraduate/smart-grid-energy-systems/)

- Applied Informatics
- (https://www.e-ce.uth.gr/studies/postgraduate/applied-informatics/)

Furthermore, the Department operates a Doctoral Program (Ph.D.) leading to the award of a Doctoral Degree (Ph.D.) in Electrical and Computer Engineering.

The administrative bodies of the Department of ECE are:

- The Assembly
- The Head
- The Vice-Head.

Infrastructure of the Department of ECE:

Starting from the academic year 2021-22, the Department is housed in new facilities located in the Areos Field in close proximity to the test of the departments of the School of Engineering. The new building includes 1 large amphitheater (260 seats), 2 smaller amphitheaters (130 seats each), and 3 classrooms (55 seats each). Additionally, it has 4 laboratories, 34 offices for teaching staff, additional offices for technical personnel and the Secretariat, and 1 meeting room.

2.2 Research Activities of the Department

A significant part of the research work is conducted through separate research laboratories, involving postdoctoral researchers, doctoral candidates, M.Sc. students, as well as undergraduate students. The Department has seven institutionalized (1-7) and two non- institutionalized research laboratories (8-9):

1 Electronics Laboratory
2 Circuits and Systems Laboratory
3 Intelligent Energy Strategy and Networks Laboratory
4 Telecommunications and Networks Laboratory
5 Computer Systems Laboratory
6 Data Structures and Processing Technologies Laboratory
7 Creative Learning Technologies
8 Distributed and Network Algorithms Laboratory
9 Signal Processing Laboratory.

3 Subject and Purpose of the M.Sc. Program

The Department of Electrical and Computer Engineering of the University of Thessaly has been organizing a Master of Science (M.Sc.) Program since 2018 titled "Smart Grid Energy Systems," leading to the award of a M.Sc. Degree in “Smart Grid Energy Systems” (FEK 2469/B/27.06.2018).

The competent bodies for the establishment, organization, and operation of the M.Sc. program are:

- The Senate of the University of Thessaly (S.U.)
- The Assembly of the Department (A.D.)
- The Coordinating Committee of the M.Sc. program (C.C.)
- The Postgraduate Studies Committee of the Institution (P.S.C.)
- The Director of the M.Sc. Program.

The object of the M.Sc. Program "Smart Grid Energy Systems" is to present and transfer advanced scientific, theoretical, and applied specialization for holders of an undergraduate (first cycle) degree from Greek or equivalent foreign institutions, in subjects related to the scientific field of the program. It aims to address the increased professional demands of the job market in relevant areas and to establish a suitable scientific background for further studies at a higher level as a result of research and deepening of knowledge in relevant scientific fields.

The goal of the M.Sc. Program titled "Smart Grid Energy Systems" is to provide candidates with:

- Specialized education for understanding the principles and technologies of power systems and electrical energy.
- Advanced education and training in subjects such as Modern Energy Systems, Smart Electric Energy Systems, Deregulation of Electric Energy, Energy Economics, Renewable Energy Sources, and Microgrids.

- Broad understanding of the issues and problems faced by professionals in relevant areas of electrical energy, as well as the necessary knowledge of methods to solve these problems.
- Deepening of knowledge and skills required in competitive work environments through further research and study.
- Essential knowledge and skills to make informed decisions in the constantly evolving and changing electric power industry.
- Necessary scientific knowledge and technical expertise in the development and optimization of evolving infrastructures in the field of smart grids.
- Ability to acquire specialized scientific knowledge and skills in subjects related to the scientific field of the program, in order to develop their ability to analyze and solve problems, as well as to make decisions and take initiatives in a local or international environment.
- Necessary scientific infrastructure to participate and pursue doctoral (Ph.D.) studies in relevant areas of power systems.

The M.Sc. Program provides specialized education for understanding the principles of scientific areas such as:

- Modern Energy Systems
- Generation, Transmission, and Distribution of Electrical Energy
- Operation and control of smart grids
- Distributed renewable energy sources
- Deregulation of electric energy
- Artificial Intelligence in Electric Energy Systems.

4 Learning Outcomes of the M.Sc. Program

The learning outcomes for each course of the program are provided in the corresponding course description. With regards to the learning outcomes of the M.Sc. program, upon successful completion of the requirements leading to the award of the Master of Science (M.Sc.) Degree in "Smart Grid Energy Systems," graduates of the program are expected to:

- Have a solid foundation in scientific areas such as Modern Energy Systems, Smart Electric Energy Systems, Deregulation of Electric Energy, Energy Economics, Renewable Energy Sources, and Microgrids.
- Possess specialized scientific knowledge and skills in subjects related to the program's field of study, enabling them to analyze and solve problems, make decisions and initiatives in a local or international environment.
- Have the necessary theoretical and computational background to conduct and present studies on energy-related topics relevant to the program's field of study.
- Have the skills of a specialized scientific workforce that can independently or as part of a team carry out a comprehensive energy study, or directly enter the job market and meet the increasing professional demand observed globally in the field of smart grids, both in the private and public sectors.
- Acquire the necessary knowledge and skills to participate in a work environment with real problems and provide solutions regarding the operation and control of modern electrical energy systems.
- Be able to critically evaluate and analyze the results of energy studies related to Smart Grids.

- Have the ability to work in a team environment, collaborate, present, and support a simple research activity to both experts and non-experts, and transfer specialized knowledge and skills related to the program's field of study.
- Be capable of conducting high-level research on topics related to the program's field of study and pursue doctoral programs directly related to the program's field of study.

5 Enrolment in the M.Sc. Program

5.1 Registration in the Postgraduate Program

The initial enrollment in the M.Sc. program takes place at the beginning of the academic semester, following a relevant decision by the Department's Assembly and an announcement by the Secretariat of the M.Sc. program. During the initial enrollment, the M.Sc. Students submit the following documents in addition to the documents they submitted with their application:

- Declaration of Personal Information (form provided by the Secretariat)
- Authenticated photocopy of the ID Card or Passport
- Birth Certificate (only for male students who wish to defer military service).

5.2 Registration Renewal - Course Declaration

Postgraduate students are required to renew their registration within the deadline announced by the Secretariat of the Postgraduate Program for each academic semester. The renewal is done electronically using specialized software (Electronic Secretariat), through the process of submitting the course declaration they will attend. The initial registration in the first semester is also completed by submitting the electronic course declaration. Violation of the registration deadline results in the loss of the opportunity to attend the current semester. In this case, a decision by the Department Assembly is required, following a proposal by the Coordinating Committee of the M.Sc. program, in order to continue the studies.

During the registration renewal, the postgraduate students selects the courses they intend to attend. The total number of credits for the courses to be attended per academic semester, excluding the M.Sc. thesis, cannot exceed thirty (30) ECTS.

Substitution or deletion of a course from the list of courses declared by the student is allowed within an exclusive deadline of three (3) weeks from the start of the courses. In this case, the deleted courses are considered never declared, they are not taken into account in the further progress of the student, and they do not create any obligation for the student. In any case, each student, after any cancellations, must have registered at least in one course (or M.Sc. thesis) in each semester of study.

A student who has not renewed his/her registration for two (2) consecutive semesters, is automatically deprived of his/her student status and is removed from the Postgraduate Program.

5.3 Academic Advisor

For each postgraduate student, a faculty member is appointed by the Coordinating Committee as an Academic Advisor who is responsible for monitoring and controlling the overall progress of the postgraduate student's studies.

The Academic Advisor supervises the study and research progress of the student, 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 recommends issues

concerning the student to the Department's Assembly. The student must inform the Academic Advisor about the progress of his/her studies and in particular about the final configuration of the courses in which he/she is enrolled each semester.

5.4 Course Attendance

The start and end dates of the courses in the M.Sc. program are determined within the framework of the annually defined Academic Calendar of the Institution, which are announced in a timely manner by the Secretariat of the M.Sc. program. The Department's Assembly, upon recommendation of the Coordinating Committee, may modify the start and end dates of the teaching course period for more effective program operation. The examination periods in January and June follow the Academic Calendar of the Institution. There is no examination period in September.

The teaching of the courses is conducted according to the timetable announced by the Department's Secretariat. Attendance may include lectures, seminars, special lectures, workshops, individual and/or group assignments, oral and/or written examinations. The teaching of each postgraduate course lasts for 13 weeks.

The weekly teaching hours for each course are three (3). In addition to these hours, and for the coverage of laboratory needs, seminars, practical exercises, etc., additional hours may be added after a justified decision by Department's Assembly, upon recommendation of the Coordinating Committee.

M.Sc. students are required to attend lectures, laboratories, and any other activities specified by the instructor for each course continuously. Attendance in postgraduate courses is mandatory. Unjustified absences cannot exceed 20% of the total teaching hours.

The organization of the educational process of the M.Sc. program can be carried out either in person or by using modern distance learning methods through an approved platform by the university.

Issues arising regarding course attendance are evaluated at the discretion of the instructor and addressed on a case-by-case basis initially by the instructor and subsequently by the M.Sc. Director and the Coordinating Committee.

5.5 Examinations

Student examinations take place at the end of each academic semester. The examination periods in January and June follow the Academic Calendar of the Institution. There is no supplementary examination period in September.

In case a student fails an elective course, he/she is entitled to either repeat it or replace it with another one from the program. If the student fails twice 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 teaching staff of the same or another Department of the university with the same or related subject matter to that 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 M.Sc. program.

5.6 M.Sc. Thesis

The completion of the M.Sc. thesis, on a topic related to the scientific areas of the Program, is compulsory for the students of the M.Sc. program.

The process of undertaking the M.Sc. thesis by the M.Sc. student begins with an application to the Department's Assembly, stating the proposed title of the thesis and the proposed supervisor. The

application should include a preliminary research outline for the thesis. From the date of the Department's Assembly decision to undertake the M.Sc. thesis until its completion (research, data collection and analysis, thesis writing), a period of at least three (3) months should elapse.

After completing the writing of the thesis and with the concurring opinion of the Supervisor Professor, the student submits a copy of the thesis, at least in electronic format, to the members of the three-member examination committee. By majority decision of the examination committee, the M.Sc. thesis is either approved for public defense and examination or referred back for revision.

The defense of the thesis includes an oral presentation and elaboration of the thesis by the student to the members of the examination committee and an audience, with a question-and-answer session to enable the examination committee members and other attendees to form a clear understanding of the subject matter of the thesis and the student's ability to support it. The thesis is evaluated based on its research work, scientific methodology for obtaining results, presentation of a literature review, and the usefulness of the findings. The written and oral presentation style, as well as the student's responses to questions during the examination, are also evaluated. The grade for the thesis is calculated as the average of the examiners' grades. If the grade from the examination is non-passing, the examination committee determines a new evaluation date, at least three (3) months after the initial assessment. In the case of a second rejection, the candidate is removed from the M.Sc. program.

The final version of the M.Sc. thesis (with any corrections indicated by the examination committee) is submitted by the candidate, with the supervisor's agreement, to the Department's Secretariat in electronic format (PDF) and to the Library in both printed and electronic formats (PDF).

Details regarding the preparation and writing of the M.Sc. thesis are presented in the Regulations for the Preparation of M.Sc. Thesis.

5.7 Internship

There is no compulsory internship for the current M.Sc. program. The M.Sc. program supports and encourages the mobility of its students for internships abroad, utilizing 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 M.Sc. program, but the internship should not be part of or related to the student's thesis work. The program aims to develop the professional skills of students rather than their current research activities. The student can work in an institution involved in research, provided that the subject of the internship is determined by the needs and activities of the Host Institution and is not designed to serve as part of or related to the student's thesis work.

5.8 Calculation of Degree Grade

A postgraduate student is considered to hold the M.Sc. Degree upon fully completing his/her obligations as described in the Internal Operating Regulations of the M.Sc. program.

The final grade of the M.Sc. Degree is determined by the performance of the student in the courses and the M.Sc. thesis, and it is calculated as the weighted average of the grades of the six (6) postgraduate courses and the thesis, taking into account the credit weight (ECTS) of each course. Specifically:

$$FINAL\ GRADE = \frac{\sum(C_{ECTS} x\ C_G) + T_{ECTS}\ x\ T_G}{\sum(C_{ECTS}) + T_{ECTS}}$$

Where:

C_{ECTS} = Course Credit Units (ECTS),

C_G = Course Grade,

T_{ECTS} = Thesis Credit Units (ECTS),

T_G = Thesis Grade

The grade of the M.Sc. Degree is calculated with accuracy to two (2) decimal places. The Deggre includes a classification, which, in descending order of evaluation, is as follows: EXCELLENT (ARISTA) from eight and fifty (8.50) to ten (10), VERY GOOD (LIAN KALOS) from six and fifty (6.50) to eight and forty-nine (8.49), GOOD (KALOS) from five (5) to six and forty-nine (6.49).

5.9 Suspension of Enrollment

Postgraduate students may be granted, upon submission of an application to the School of Management, 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 postgraduate 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 a student in the M.Sc. are examined on a case-by-case basis after the completion of at least one (1) semester of study. 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 petition and his/her name shall appear on the attendance records. Failure to justify exceeding the approved suspension time will result in the immediate removal of the candidate from the M.Sc. program.

5.10 Tuition Fees

For enrollment in the M.Sc. program, there is a tuition fee totaling 2,000€ (250€ per declared course, a total of 1,500€ for all the required 6 courses, and 500€ for the M.Sc. thesis).

The payment of the tuition fee is made in a single installment each semester, within an exclusive deadline of three (3) weeks from the start of classes. Failure to timely pay the tuition fee results in the student being barred from the exams of the corresponding semester.

Graduate students who wish to either withdraw from the M.Sc. program or suspend their enrollment are entitled to a refund of the tuition fees paid for the current semester, provided that no more than three (3) weeks have passed since the start of classes.

5.11 Free Tuition

According to article 86 of L. 4957/2022, registered students of a Postgraduate Study Program may study free of charge (if payment of tuition fees is foreseen), if they meet the legal financial or social criteria. A prerequisite for the granting of the right to free tuition on the basis of economic or social criteria is the fulfilment of the conditions for excellence in the first cycle of studies, corresponding at least to the possession of a grade equal to or higher than seven and a half with an excellent mark out of ten (7,5/10), provided that the evaluation of the basic degree presented for admission to the M.Sc. program has been awarded in accordance with the ten-point scale of a higher education institution (HEI) 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 who are eligible for free tuition cannot exceed thirty percent (30%) of the total number of enrolled students per academic year. If the numerical calculation of the number of beneficiaries exempt from tuition fees results in a decimal number, it is rounded to the nearest whole unit. If the number of beneficiaries exceeds the current percentage, the beneficiaries are selected in descending order until the quota is filled.

The submission of applications for free tuition for each M.Sc. program takes place after the completion of the student admission process to the program and within a timeframe determined by the Director of the M.Sc. program.

In addition to the provisions for free tuition, the M.Sc. program also offers the possibility of scholarships for M.Sc. candidates based on its financial capabilities. The additional scholarships are granted exclusively based on the academic performance of the M.Sc. candidates during their studies. The Department may request that M.Sc. scholarship recipients provide specific work within the framework of its various needs. The decision to grant scholarships and the corresponding amount is determined by the Department's Assembly following a recommendation from the Coordinating Committee.

5.12 Duration of studies

The minimum duration of study for the completion of the M.Sc. program in "Smart Grid Energy Systems" is two (2) semesters, while the maximum duration cannot exceed four (4) academic semesters.

During the program, students are required to attend postgraduate courses and complete an M.Sc. thesis

Upon a justified recommendation from the Academic Advisor or the Supervisor of the M.Sc. thesis of a student and upon their application, the Coordination Committee of the M.Sc. program may propose to the Department's Assembly an extension of the student's study time.

The M.Sc. program " Smart Grid Energy Systems " is offered to students either as a full-time program or, in special cases, as a part-time program, according to the provisions of the Internal Operating Regulations of the program. Full-time and part-time students receive equivalent degrees.

The duration of studies in the part-time program cannot exceed twice the duration of the corresponding full-time program.

5.13 Infrastructure

The existing infrastructure of the Department of Electrical and Computer Engineering is utilized for the operation of the M.Sc. program. The teaching of courses and the required research activities of the proposed M.Sc. program take place in the facilities of the Department, which adequately meet the program's needs in terms of classrooms, laboratory, and research spaces, equipped with the necessary infrastructure for the smooth operation of the program.

The Department of Electrical and Computer Engineering at the Engineering School of the University of Thessaly operates both general-purpose laboratories and specialized ones to support the educational and research needs of the department.

Specifically, for the operation of the Study Program, the two existing general-purpose laboratories are used, which have audiovisual infrastructure, modern distance learning infrastructure, and modern workstations that meet the program's requirements. There is 10GbE networking available in the laboratory spaces, and there is access to wireless network for students and instructors.

In addition to these laboratories, the Department has at its disposal, and the M.Sc. makes use of, the following:

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

In addition to educational and research laboratories, the Department has research groups that maintain continuous collaborations with other academic institutions and research institutes in Greece and abroad, related to scientific areas and activities of the Electrical Engineer and Computer Engineer.

5.14 Supplementary Work of Postgraduate Students

The department expects postgraduate students to participate and assist in the undergraduate educational activities of the Department by supporting faculty members according to specific instructions, including:

i. Assisting students and conducting tutorials and laboratory exercises,
ii. Correcting assignments, and
iii. Supervising exams.

Through this participation in the department's activities, the integration of the academic personality of postgraduate students is achieved, preparing them for future careers in the field of education.

5.15 Rights and Financial Support of Postgraduate Students

Postgraduate students have all the rights and benefits provided by the legislation for second cycle students.

he University of Thessaly ensures that students with disabilities and/or special educational needs have accessibility to the proposed texts and teaching.

Postgraduate students can participate in research programs and be remunerated for their contributions. Postgraduate students may receive compensation from programs that provide specialized scientific and technological services or other forms of remuneration, in accordance with the applicable regulations. The department encourages the participation of postgraduate students in funded research programs, as well as external funding from various foundations (such as IKY, etc.).

6 Quality Assurance

6.1 Intellectual Property Rights and Plagiarism

The intellectual property rights (Copyright) of M.Sc. Thesis, or patents rights or commercial exploitation rights of the thesis are determined by relevant decisions of the Ethics Committee of the University of Thessaly.

Any kind of plagiarism in coursework, publications or writing of M.Sc. thesis, fabrication of research data and unscientific behavior in general is prohibited. The Ethics Committee is responsible for informing the

students of the M.Sc. and for imposing penalties where necessary. Detailed guidelines on this matter will be issued by the University Ethics Committee.

No postgraduate thesis will be submitted for support unless it has first been checked by the online plagiarism prevention service of the Central Library of the Institution. Αξιολόγηση / έλεγχος ποιότητας Προγράμματος

6.2 Program evaluation / quality control

The basic obligation of all stakeholders in the operation of the M.Sc. is to ensure and continuously improve its educational quality. For this purpose, the M.Sc. 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 Teaching staff of the M.Sc. Program

Since the establishment of the M.Sc., the teaching staff of the M.Sc. are internal members. (Faculty, EDIP) of the Department of Electrical and Computer Engineering of the University of Thessaly and external collaborators, all of them holders of a Ph.D. Degree, as follows:

Faculty members of the department of ECE:

1. Dimitrios Bargiotas, Professor, Department of Electrical and Computer Engineering, University of Thessaly
2. Fotios Plessas, Professor, Department of Electrical and Computer Engineering, University of Thessaly
3. Eleftherios Tsoukalas, Professor, Department of Electrical and Computer Engineering, University of Thessaly

External Collaborators:

1. Spyridon Gavanoudis, External Collaborator, HEDNO S.A.
2. Panagiotis Gkonis, External Collaborator, Assistant Professor, General Department, National and Kapodistrian University of Athens
3. Maria Karasimou, External Collaborator, University of Thessaly
4. Alexandra Boussia, External Collaborator, University of Thessaly
5. Marina Tsili, External Collaborator, Director of Strategy, Planning, and System Development of ADMIE S.A.

8 Course Program

To obtain the M.Sc. Degree in "Smart Grid Energy Systems", students are required to successfully complete six (6) graduate courses, totaling forty-five (45) credits, distributed over two (2) semesters, as well as an M.Sc. thesis worth fifteen (15) credits. The total number of credits (ECTS) required for the M.Sc. Degree is sixty (60). The program structure and course content of the M.Sc. Program are in accordance with international standards.

By decision of the Department's Assembly, a faculty member of the Department is appointed as the Academic Coordinator for each course in the M.Sc. Program. The Academic Coordinator, in collaboration with the course instructors, is responsible for implementing the academic calendar, ensuring the quality

of course materials and books, student participation, and organizing laboratories, lectures, and tutorials related to the subject, with the aim of implementing the course in the best possible way. Additionally, in case part or all of a course cannot be delivered, the Academic Coordinator ensures its replacement or makeup.

The courses in the M.Sc. Program are categorized as compulsory or elective (Compulsory [C] or Elective [E]). The program structure, course titles, and their credit units (ECTS) per semester are presented in the following tables:

Analytical Curriculum of Studies

Winter Semester

No	Code	Course	ECTS	Compulsory / Elective
1.	ECE6110	Energy Economics	7,5	C
2.	ECE6120	Power System Analysis	7,5	C
3.	ECE6130	Distributed Generation	7,5	C
		Option: *One of the following two courses*		
4.	ECE6140	Artificial Intelligence in Power Systems	7,5	E
5.	ECE6150	Telecommunications in Smart Grids	7,5	E
		TOTAL CREDITS for semester	**30**	

Spring Semester

No	Code	Course	ECTS	Compulsory / Elective
1.	ECE6210	Deregulation of the Electricity Market	7,5	C
		Option: *One of the following two courses*		
2.	ECE6220	Design and Operation of Smart Grid Power Systems	7,5	E
3.	ECE6230	Measurements, Control and Power Electronics	7,5	E

No	Code	M.Sc. Thesis	ECTS	Compulsory / Elective
1	ECE6300	M.Sc. Thesis	15	C
		TOTAL CREDITS for semester	**30**	
		TOTAL CREDITS for program	**60**	

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 cover at least the course declaration requirements of full-time students.

Courses are taught in Greek or English (depending on the requirements of the subject and the students' background).

The writing of the M.Sc. thesis can be done in Greek or English.

A brief description of the content of the M.Sc. courses is as follows:

Energy Economics (ECE6120):

Economics and Economy, supply and demand curves, production capacity curve and market function, cost and supply. Balance and imbalance in the market and general concepts of micro and macro economics. Perfect competition and pure monopoly. Energy economy, fuel and energy content. Economic factor led design and demand management based on information from market systems. Bridging information technology and energy infrastructure.

(https://www.e-ce.uth.gr/studies/postgraduate/smart-grid-energy-systems/courses/ece6110/)

Power Systems Analysis (ECE6120):

Power System Analysis, Load Flow Analysis. Symmetric and asymmetric fault analysis. Protection and reliability of Electric Power Systems. Economic Dispatch. Operation and Control analysis. Modelling of dynamic systems. Automatic Generation Control. Real and Reactive power control. Compensation in power systems. Stability, dynamic stability, transient stability. Efficient and flexible transmission networks.

(https://www.e-ce.uth.gr/studies/postgraduate/smart-grid-energy-systems/courses/ece6120/)

Distributed Generation (ECE6130):

Fundamental technologies for distributed energy generation using conventional and non conventional fuel. Units for power co-generation, internal combustion engines, microturbines and fuel cells. Renewable energy sources, energy storage systems. Autonomous and hybrid systems. Economic, Environmental and operational factors of distributed generation. Power Quality of distributed energy generation. Connectedness of distributed generation units to distribution networks. Influence of distributed generation on the design and operation on the generation, transmission and distribution power networks. Microgrids and smart grids.

(https://www.e-ce.uth.gr/studies/postgraduate/smart-grid-energy-systems/courses/ece6130/)

Artificial Intelligence in Electric Power Systems (ECE6140):

Artificial intelligence methods, development and implementation. Artificial neural networks, learning. Fuzzy logic and fuzzy systems. Expert systems design and implementation. Application of AI methods on energy systems for load prediction, load flow study, fault diagnosis, economic dispatch, frequency and voltage control.

(https://www.e-ce.uth.gr/studies/postgraduate/smart-grid-energy-systems/courses/ece6140/)

Telecommunications in Smart Grids (ECE6150):

Structures of the interconnected high voltage power stations of the current power systems. Data transmission and communication infrastructure of smart grids. Monitoring and control requirements for efficient operation of transmission and distribution networks. Smart grid communication methods. Wireless communication: Wi-Fi, WiMax, mobile communication (satellite), Bluetooth, ZigBee. Wired communication: optical fibre, communication via transmission lines (PLC_ Power Line Communications, BPL- Broadband over Power Line).

(https://www.e-ce.uth.gr/studies/postgraduate/smart-grid-energy-systems/courses/ece6150/)

Deregulation of the Electricity Market (ECE6210):

Forms of electricity market Deregulation/Liberalization. Electricity market Deregulation in the United States. Electricity market Deregulation in Europe. Electricity market Deregulation in Greece. Problems and impacts of electricity market Deregulation. Design and challenges of the electricity industry in the future.

(https://www.e-ce.uth.gr/studies/postgraduate/smart-grid-energy-systems/courses/ece6210/)

Design and Operation of Smart Grid Power Systems (ECE6220):

Prospects for the development, design and implementation of smart grids. Smart grid architecture, technology, demand response. Price based energy exchange. Advanced measurement systems and smart devices. Renewable energy sources and their integration in the grid. Microgrids and their importance on the control and stability of power systems. Technologies, Progress and Impact of Integration of Electric Vehicles on the Network, Simulation, monitoring and control of the smart distribution grid. Advanced sensor technology, communication and information technology for the monitoring and control of the grid. Stability assessment of smart grids.

(https://www.e-ce.uth.gr/studies/postgraduate/smart-grid-energy-systems/courses/ece6220/)

Measurements, Control, and Power Electronics (ECE6230):

Measurements and Control: Introduction to sensors, basic principles and technical characteristics of sensors, sources of error, analog and digital sensors. Measurement errors. Measurement of voltage, current and resistance. Measurement of temperature, pressure and deformation. Disturbances and noise in measurement systems. Measuring Amplifiers. Processing measurement signals. Signal generators. A/D converters. D/A converters. Sampling, holding and multiplexing circuits. Basic control concept. Micro controllers. Programmable Logic Controllers. Industrial networks and SCADA systems.

Power electronics: Power Diodes. Power transistor (Bipolar and MOSFET). Thyristors. IGBT. Single Phase and Three Phase Rectifiers. Alternating Voltage Regulators. Switching DC-DC Converters. Voltage Source Inverters and Current Source Inverters. Control of DC motors. Control of Three-Phase Induction Motors. Uninterruptible Power Supplies and Voltage Stabilizers.

(https://www.e-ce.uth.gr/studies/postgraduate/smart-grid-energy-systems/courses/ece6230/)

9 Validity and Amendments

The Coordinating Committee. of the Postgraduate Program may propose to the Department's Assembly amendments of the articles of this Study Guide, following relevant suggestions of those involved in the program, taking into account the Internal Regulations of Operation and the Regulations of Studies of the Postgraduate Program.