COURSE OUTLINE

(1) GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	ELECTRICAL AND COMPUTER ENGINEERING DEPT.		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**ECE_ENE_920**	**SEMESTER**	**9TH**
COURSE TITLE	SPECIAL TOPICS IN RENEWABLE ENERGY SOURCES		

INDEPENDENT TEACHING ACTIVITIES *if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	3	5
Seminars / Practice exercises	1	
Laboratory		
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (4).		

COURSE TYPE *general background, special background, specialised, general knowledge, skills development*	SPECIALISED , SKILLS DEVELOPMENT
PREREQUISITE COURSES:	No. Students are advised to have already attended the course: PHOTOVOLTAIC SYSTEMS AND APPLICATIONS
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	https://www.ece.uop.gr/

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- *Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning*

and Appendix B

- *Guidelines for writing Learning Outcomes*

In the course, the student seeks to become familiar with the methods of utilizing Renewable Energy Sources that exist spontaneously in the natural environment so that he/she is able to assess the relevant processes from a technical, economic and social point of view, in his training as an Electrical Engineer. Upon completion of the course, students will have: 1. The ability to recognize the need of using Renewable Energy Sources and their role in the energy requirements of Greece and the rest of the world. 2. Knowledge of the structure and mode of operation of the main energy production systems from renewable energy sources. 3. Knowing the steps of locating a wind farm in an optimal way in a region. He/she will know all the basic calculations for presenting a comprehensive study application of a wind farm. 4. How to use tools to calculate the expected electricity and to know its optimization methodologies. 5. The possibility of designing (dimensioning) a small autonomous energy wind system. 6. Knowledge of the safety and operation requirements of an autonomous and network-connected renewable system. 7. Knowledge of the structure, functional characteristics and the possibility of designing (dimensioning) Hydroelectric systems. 8. Knowledge of the structure and

functional properties of geothermal heating pumps. 9. The knowledge of the structure, the functional characteristics and the possibility of designing (dimensioning) a biomass unit. 10. The knowledge of the structure, the functional characteristics and the possibility of the design (dimensioning) of solar thermal power plants. 11. The possibility of comparing the advantages and disadvantages of the various technologies of renewable energy sources. Finally, the possibility to propose the best technologically advanced solution for a specific case of energy saving from RES.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology	*Project planning and management*
Adapting to new situations	*Respect for difference and multiculturalism*
Decision-making	*Respect for the natural environment*
Working independently	*Showing social, professional and ethical responsibility and sensitivity to gender issues*
Team work	*Criticism and self-criticism*
Working in an international environment	*Production of free, creative and inductive thinking*
Working in an interdisciplinary environment	*……*
Production of new research ideas	*Others…*
	…….

Upon completion of the course, students will have: 1. The ability to recognize the need to use Renewable Energy Sources and their role in the energy requirements of Greece and the rest of the world. 2. The ability to analyze electrical data from the use of wind turbines. 3. To know all the basic calculations for the presentation of a comprehensive application study of a system using RES. 5. To use tools to calculate the expected energy and to know its optimization methodologies and finally the ability to suggest the best technologically advanced solution for a specific case using RES.

(3) SYLLABUS

The subject of the theoretical part of the course consists of the following sections which are developed in thirteen teaching weeks:

1st Section: Definition, Perspectives, Benefits and necessity of RES. European RES promotion legislation.

2nd Section: Introduction to the wind potential of an area.

3rd Section: Introduction of wind energy, types of Wind Turbines, location and calculation of energy efficiency of wind farms. Hybrid power generation systems.

4th Section: Introduction to hydroelectric power, small hydroelectric systems, technologies of hydroelectric plants. Location and calculation of energy efficiency of a small Hydroelectric project.

5th Section: Geothermal Energy, introduction to geothermal energy, geothermal fields, Geothermal heat exchangers, low-depth geothermal systems.

6th Section: Biomass, Introduction to Biomass, Prospects and Benefits of Biomass, Possibility of Exploitation, Technologies. Garbage biomass and waste fuel.

7th Section: Solar Thermal Applications, Solar thermal energy systems (domestic, central), energy production systems, thermal energy storage.

8th Section: Wave energy. Nature of wave energy. Production of mechanical and electrical power from wave energy. Types of machines.

9th Section: Environmental advantages and implications of RES applications.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to face in class

USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	View slides. View computer animations to describe the time evolution of photovoltaic phenomena. Demonstration of laboratory experiments at the time of teaching. Informational material to the eclass.
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS*	
STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	I. Written final examination (100%) II. Optional written assignments (10%) III. Optional problem solving (10%)

Activity	***Semester workload***
Lectures.	39
Problem solving.	13
Project	23
Study of literature and material exist to the eclass	50
Course Total	***125 hours (5 ECTS)***

(5) ATTACHED BIBLIOGRAPHY

- *Suggested bibliography:*

1. Kreith, F., Kreiderand, J.΄Solar Heating and Cooling΄, Hemisphere Publishing Corporation, 2000.
2. In Greek: Ασημακόπουλος Δ., Αραμπατζής Γ., Αγγελης–Δημάκης Α., Καρταλίδης Α., Τσιλιγιρίδης Γ., Ανανεώσιμες Πηγές Ενέργειας-Δυναμικό και Τεχνολογίες, Εκδόσεις σοφί, 1η έκδοση, ISBN: 978-960-6706-76-9, Θεσσαλονίκη 2015.
3. Golding, W.΄The generation of Electricity by wind power΄, Spon Ltd (1955).