COURSE OUTLINE

(1) GENERAL

SCHOOL	ENGINEERING SCOOL		
DEPARTMENT	DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING		
LEVEL OF STUDIES	UNDER GRADUATE		
COURSE CODE	EEE.7-1.5	SEMESTER	6th
COURSE TITLE	RENEWABLE ENERGY SOURCES I		

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	4	5
Laboratory exercises	1	
Total	5	
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Special Background Course
PREREQUISITE COURSES:	NO
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek (official)
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES (English for Erasmus students)
COURSE WEBSITE (URL)	http://depelec.daidalos.teipir.gr/index.php?option=com_content&view=article&id=171:ape-2-gr&catid=15:mathimata&Itemid=127&lang=gr, www.powerelectronics.teipir.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*

The object of the course is to familiarize students with the utilization methods of renewable energy sources, which exist in the natural world, so that they will able to assess the related procedures in terms of technical, financial and social context, in the field of training as an Electrical Engineer of Higher Technological Education.

Upon completion of the course, students will have acquired:

1. Ability to recognize the need for renewable energy technologies and their role in energy demand, both in Greece and worldwide.
2. Ability to distinguish between sustainable energy sources and fossil energy sources with emphasis on wind and photovoltaic systems.
3. Knowledge of the operating principles of renewable energy production from various renewable sources, especially
4. Knowledge of security and operational requirements of autonomous and net connected renewable energy systems.
5. Ability to design simple small autonomous photovoltaic and wind energy systems.
6. Knowledge of operating principles of geothermal heat pumps.
7. Ability to compare the advantages and disadvantages of various renewable energy technologies and propose the best possible energy conversion system for a particular location.

More specifically, students will be able to:

1. give some basic definitions (power curve, Betz limit, stall and pitch regulation, I_V characteristics etc.)
2. understand basic concepts such as power production, efficiency, energy yield of various renewable energy systems for a specific site.
3. describe the main design concepts, main differences, and advantages of various renewable energy systems
4. describe the operation of hybrid systems (wind/diesel, wind/photovoltaic/diesel etc)
5. describe the effects various renewable energy systems have on environment.
6. describe several economical support schemes for renewable energy systems

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…*
	…….

The course aims at fostering the following capabilities:

- Project planning and management
- Independent work
- Teamwork
- Respect for the natural environment

(3) Course Content

A. THEORY

The theory part of the course consists of the following modules:

1st Module: Definition, Prospects, Benefits and Necessity of RES. European legislation on the promotion of RES. Legislation – Licensing: Current RES installations legislation and licensing in EU and Greece, pricing policy

2nd Module: Introduction to solar energy, solar geometry, geophysical characteristics and wind potential of an area.

3rd Module: Photovoltaics: Introduction to solar energy, solar geometry, photovoltaic effect, photovoltaic generators technologies, photovoltaic systems – autonomous/interconnected.

4th Module: Wind Turbines: Introduction to wind energy, wind characteristics, wind energy potential, types of wind turbines, wind farms.

5th Module: Hydropower: Introduction to hydropower, small hydropower systems, system resources, hydroelectric power plants technologies.

6th Module: Geothermal Energy: Introduction to geothermal energy, geothermal fields, space heating, electricity generation, shallow geothermal energy systems

7th Module: Biomass: Introduction to biomass, biomass potential, exploitation possibility, cogeneration.

8th Module: Solar thermal applications: Solar thermal power systems (household, centralized), energy generating systems, thermal energy storage.

B. LABORATORY

The Laboratory part of the course consists of the following separate modules:

1st Module: Information and Familiarization with the Lab and Equipment - Lab Regulations

2nd Module: Study of the electrical characteristics (V-I) of Photovoltaic Generator System

3rd Module: Dimensioning of an autonomous Photovoltaic Power Generator System

4th Module: Procession and assessment of Photovoltaic Generator System data

5th Module: Study of a Wind Generator Power System and its annual energy

6th Module: Study of a Hydroelectric Power Generator system and its annual energy

7th Module: Study of a Solar Energy Generating System and its annual energy

8th Module: Study of a Geothermal Energy Power System and its annual energy

9th Module: Study of a Biomass Energy Power System and its annual energy

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Lectures, laboratories , distance learning methods
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Teaching using ICT, Laboratory Education using ICT, Communication and Electronic Submission
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*	

Activity	*Semester workload*
Lectures	52
Course study	52
Laboratory Exercises	26
Preparation for Writing laboratory reports-homework	26
Personal study	24
Total Course	**180**

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.*	Evaluation Language : Greek English for Erasmus students **Theory** Final Written Exams: 100% **Laboratory** Final Written Exams:: 70% Team laboratory exercise report : 30% The grade of the course is 60% x Theory + 40% x Laboratory grades

(5) ATTACHED BIBLIOGRAPHY

1.
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3. *Bizionis B., Bizionis D., Alternative Energy Sources , 2014 ,Tziolas Publications , 2nd edition, ISBN: 978-960-418-309-8, Thessaloniki .*
4. *Kaldellis John. K. Kavadias Kosmas A . ,2001. Laboratory renewable forms of energy. STAMOULI Publishing Inc.ISBN: 960-351-345-8, Athens .*
5. *Charonis Panagiotis.1988. Passive Solar Greenhouses. Ion Publications. 1st edition. ISBN: 960-405-062-1,Athens .*
6. *Socrates Kaplanis , 2004. Renewable Energy Sources I , II , III , Ion Publications , 1st edition , ISBN: 960-411-429-8, 960-411-430-1, 960-411-431- X, Athens.*
7. *Asimakopoulos D ,. Arabatzis G. Aggelis - Dimakis A . , Kartalidis A . , Tsiligiridis C ., 2015. Renewable Energy - Resources and Technologies Sofia Pubications, 1st edition , ISBN: 978-960-6706-76- 9 Thessaloniki.*
8. *Fragiadakis . Photovoltaic Systems. Ziti Publicatios.*
9. *Neocleous , A. , Konstantinidis. 2003. Photovoltaic systems, Ion Publications .*
10. *Golding, W. 1955΄ The generation of Electricity by wind power΄, Spon Ltd.*
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12. *Kreith, F., Kreiderand, J., 2000 ΄Solar Heating and Cooling΄, Hemisphere Publishing Corporation.*
13. *D . Kanellopoulos , 2003. Wind Energy, Ion Publications.*