COURSE OUTLINE

(1) GENERAL

SCHOOL	ENGINEERING SCHOOL		
DEPARTMENT	DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING		
LEVEL OF STUDIES	UNDER GRADUATE		
COURSE CODE	EEE.8-1.9	SEMESTER	7th
COURSE TITLE	RENEWABLE ENERGY SOURCES II		

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	3
Exercises		
Total	3	
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*	Specialization 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 course aims to introduce the student to the various techniques of design, construction and methods of dimensioning energy systems from renewable energy sources .Upon completion of the course, students will have:

1. Ability to analyze wind and solar data of specific site
2. Knowledge of the technical characteristics and performance of electric power generation by wind, photovoltaic and other renewable energy systems.
3. Ability to analyze wind conditions, and wind farm layout possibilities of the particular site.

4. Ability to analyze solar conditions, and solar farm layout possibilities of the particular site.
5. Knowledge of security and operational requirements of wind.
6. Ability to perform basic calculations and analysis for grid connection of a wind turbine and photovoltaic plants.
7. Ability to design a wind conversion system, component, or process to meet desired needs.
8. Ability to design a photovoltaic system, component, or process to meet desired need.

More specifically:

1. Basic knowledge of solar energy, solar geometry and photovoltaic effect, different technologies and be able to calculate the energy efficiency and design of PV systems.
2. Knowledge of solar panels structure (the main criteria which declare the most effective type of solar panel).
3. Introduce the main characteristics -watt-hours, peak power- and criteria for selecting an appropriate inverter)
4. Be able to choose the correct cable cross section for each study.
5. Knowledge of transformers, electrical generation transmission and distribution systems.
6. Knowledge of fundamental Principles of Grounding of Lightning Protection Systems and the major importance for the whole installation.
7. Be able to know the quality regulations for mechanical equipment.
8. Be able to know about improving efficiency and reducing cost and familiarize with advancements in Wind Turbine Technology.
9. Analysis of Land - inshore - offshore wind farms.
10. Study of energy wind farms (Influence of surface barriers, factors that affect the speed and the direction of wind, variation of wind speed with height).
11. Ability to make a final technical-economical study.

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
- Search for, analysis and synthesis of data and information, with the use of the necessary technology

(3) Course Content

A. THEORY

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

1st Module: Analysis of specialized technical characteristics of photovoltaic generators and comparison techniques for optimal selection.
2nd Module: Analysis of the specific wind generator characteristics and comparison techniques for optimal selection.
3rd Module: Analysis of the special characteristics of inverters of low and medium voltage PV plants.
4th Module: Best & worst practice techniques when choosing a PV plant and a wind farm. Presentation of available materials and selection criteria (PV, inverter, dc & ac cables, etc.) to optimize the design of a PV park.
5th Module: Full study of photovoltaic installation connected to the grid.
6th Module: Full wind farm study connected to the grid.
7th Module: Design of a hybrid RES system with storage.
8th Module: Medium Voltage Substations: Electrical generation, transmission, and distribution systems in RES applications.
9th Module: Grounding and Lightning Protection System: Lightning conductors and grounding precautions, Lightning protection system design.
10th Module: Environmental benefits and impacts of RES applications.
11th Module: Legislation and licensing procedure for the installation of RES in Greece as well as the pricing policy.

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
Face-to-face, Distance learning, etc.</td><td>Lectures, distance learning methods</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students</td><td>Teaching using ICT, Laboratory Education using ICT, Communication and Electronic Submission</td></tr>
<tr><td>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</td><td>
<table>
<tr><th>Activity</th><th>Semester workload</th></tr>
<tr><td>Lectures</td><td>26</td></tr>
<tr><td>Exercises</td><td>13</td></tr>
<tr><td>Laboratory Exercises</td><td>26</td></tr>
<tr><td>Preparation for Writing laboratory reports-homework</td><td>26</td></tr>
<tr><td>Personal study</td><td>29</td></tr>
<tr><td>Total Course</td><td>120</td></tr>
</table>
</td></tr>
<tr><td>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</td><td>Evaluation Language : Greek
English for Erasmus students

<u>Theory</u>
Final Written Exams: 100%

<u>Laboratory</u></td></tr>
</table>

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.*	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

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2. *Kaldellis John. K. Kavadias Kosmas A . ,2001. Laboratory renewable forms of energy. STAMOULI Publishing Inc.ISBN: 960-351-345-8, Athens .*
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4. *Balarás K , Argyríou A , Karagiánnis F, 2006. Conventional and Renewable Energy Sources, Tekdotiki Publications. 1st edition , ISBN: 960-8257-23-9, Athens.*
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6. *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.*
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8. *Neocleous , A. , Konstantinidis. 2003. Photovoltaic systems, Ion Publications .*
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11. *Kreith, F., Kreiderand, J., 2000 ΄Solar Heating and Cooling΄, Hemisphere Publishing Corporation.*
12. *D . Kanellopoulos , 2003. Wind Energy, Ion Publications.*