COURSE OUTLINE

(1) GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	ELECTRICAL AND COMPUTER ENGINEERING DEPT.		
LEVEL OF STUDIES	Postgraduate		
COURSE CODE	**ENE_APP-101**	**SEMESTER**	**1**
COURSE TITLE	PRODUCTION AND SAVING OF ENERGY USING RES		

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	2	
Tutorial/Practical Exercises	1	
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (4).	3	6

COURSE TYPE *general background, special background, specialised, general knowledge, skills development*	Special Background, Specialized
PREREQUISITE COURSES:	No
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	eclass.uop.gr | 101: Παραγωγή – Εξοικονόμηση Ενέ...

(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 aim of the course "PRODUCTION AND SAVING OF ENERGY USING RES" for postgraduate students is to deepen their knowledge of the methods of utilizing Renewable Energy Sources for the production of energy as well as its conservation so that they are able to assess the relevant processes from the point of view of technical, economic but also social, in the context of their training. In particular, students are expected to develop personal skills, such as critical thinking, the ability to design research, oral presentation skills, as well as the ability to write scientific articles on matters of energy production and conservation through new type of PV systems for the utilization of solar potential as well as wind power. Special emphasis is also taken on the utilization and design of solar passive systems. These abilities, combined with the know-how and specialization of the students, will make them a highly attractive and competitive scientific staff, able to cope with the modern demands of the global labor market.

Learning results

Upon successful completion of the course, postgraduate students will be able to:

In terms of Knowledge:

1. To understand and recognize the need of use Renewable Energy Sources and the utilization of the energy produced from them as well as their role in the energy requirements of Greece and the rest of the World.
2. To know the structure and operation of the basic energy production systems from renewable energy sources.
3. To know the structure and principles of operation of new PV systems from new materials (Third generation PV systems such as organic PV, perovskite materials, DSSC etc.) and devices
4. To know the structure and mode of operation of modern passive solar systems.
5. To know the characteristics of modern wind turbines, the steps of placing a modern wind farm in an optimal way. Also know all the basic calculations for the presentation of a comprehensive application study of a wind farm.

In abilities level:
1. How to use tools to calculate expected electricity and to know methodologies for its optimization.
2. To study the diversity of dealing with third generation PV systems and to design possible indoor applications.
3. To know the structure, functional characteristics and the possibility of designing passive solar systems to save energy in buildings.
4. To know the structure, functional characteristics and the possibility of designing (dimensioning) wind farms.

In terms of Skills:
1. To understand and solve complex problems related to third generation PV systems.
2. To generalize the knowledge that is acquired and use it to solve problems they are not familiar with.
3. The ability to compare the advantages and disadvantages of various renewable energy technologies in energy production. Finally, to propose the best technological solution for a specific case of saving energy 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…*
	…….

- Decision making
- Work in an international environment
- Work in an Interdisciplinary environment
- Development of new research ideas
- Respect to the natural environment
- Criticism and self-criticism
- Promotion of free, creative and inductive thinking

(3) SYLLABUS

Lectures:
LESSON 1: Overview of electricity conversion devices using renewable sources and basic principles of operation.

LESSON 2: Advanced knowledge in theory of semiconductors and semiconductors of small dimensions. Energy bands of metal-semiconductor and semiconductor-semiconductor contacts.

LESSON 3: New technologies of Photovoltaic systems for their integration in buildings (first and second generation PV). Operating principles and applications.

LESSON 4: Photovoltaic systems of the third generation (transparent Photovoltaics). Development of dye-based (DSSC) and perovskite (PSC) PV technology. Operating principles and applications.

LESSON 5: Development of PV technology based on quantum-dot semiconductors (QSSC) and organic photovoltaics (OPV). Operating principles and applications.

LESSON 6: Energy saving technologies in buildings based on new type of glazing (low-e, smart windows, liquid crystals). Principles of operation of the devices.

LESSON 7: Thermal conversion of Solar Energy. Solar water heaters and hybrid systems. Heat exchangers.

LESSON 8: Technology of Thermal/Solar collectors.

LESSON 9: Energy balance, solar panel efficiency.

LESSON 10: Hybrid solar and thermal systems.

LESSON 11: Wind potential characteristics of an area. Maps and calculations of wind characteristics. Statistical analysis of wind potential.

LESSON 12: Wind turbines and their main types. Placement of wind turbines. Calculation of wind turbine power and energy gain.

LESSON 13: Siting and calculating the power and energy yield of wind farms. Hybrid systems electricity production.

(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*	Support of learning process through the platform “e-class” (slides ppt and communication). Helpful simulation programs
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	26 hours
Exercises (in classroom)	13 hours
Writingassignments	39 hours
Project	20 hours
Literature survey and analysis	52 hours
Course Total (25 workload hours per credit)	***125 hours (5 ECTS)***

STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple*	Language for students’ evaluation: Greek. Evaluation Method: Written exam (Short answer questions, solving

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.*	problems using software): 50% Elaboration of Works concerning the solution of combined applications in the proposed technologies: 50%.

(5) ATTACHED BIBLIOGRAPHY

1. Μπαλαράς Κ., Αργυρίου Α., Καραγιάννης Φ., Συμβατικές και Ήπιες Μορφές Ενέργειας , Εκδόσεις ΤΕΚΔΟΤΙΚΗ, 1ηέκδοση, ISBN: 960-8257-23-9, Αθήνα 2006.
2. Βόκας Γ., Αργυρίου Α., Θεοφύλακτος Κ., «ΑΠΟΘΗΚΕΥΣΗ ΚΑΙ ΕΞΟΙΚΟΝΟΜΗΣΗ ΕΝΕΡΓΕΙΑΣ», Κεφάλαια Αποθήκευσης και Παραγωγής Ενέργειας από ΑΠΕ συγγράμματος του ΠΜΣ ΤΕΙ Πειραιά-OPEN Univ., Ιούνιος 2002.
3. Αναστασιάδης Α., Βόκας Γ., «ΑΠΕ & Ευφυή δίκτυα», Σημειώσεις Θεωρία-Εργαστήριο, 2016.
4. Kreith, F., Kreiderand, J.΄Solar Heating and Cooling΄, Hemisphere Publishing Corporation, 2000.
5. 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.
6. Golding, W.΄The generation of Electricity by wind power΄, Spon Ltd (1955).
7. Δ. Κανελλόπουλος, Αιολική Ενέργεια, Εκδόσεις Ίων, 2003
8. Σ. Παπαθανασίου, "Ανανεώσιμες Πηγές Ενέργειας: Σύνδεση Εγκαταστάσεων Παραγωγής στα Δίκτυα Διανομής", ΕΜΠ, 2009.
9. Solar Photovoltaics: Fundamentals, Technologies and Applications (ThirdEdition) by Chetan Singh Solanki
10. Photovoltaic Solar Energy: From Fundamentals to Applications by Angèle Reinders, Pierre Verlinden, Wilfried van Sark and Alexandre Freundlich.