COURSE OUTLINE

1. GENERAL

SCHOOL	ENVIRONMENT AND AGRICULTURAL ENGINEERING		
ACADEMIC UNIT	NATURAL RESOURCES MANAGEMENT AND AGRICULTURAL ENGINEERING		
LEVEL OF STUDIES	GRATUATE		
COURSE CODE	106	SEMESTER	9^{o}
COURSE TITLE	RENEWABLE ENERGY TECHNOLOGIES		

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 and exercises	3	3
Lab exercises and class exercises	2	2
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*	Specialised general knowledge
PREREQUISITE COURSES:	Mathematics, Thermodynamics, Heat and Mass Transfer, Electrotechnics & Electrical Machines
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes (in English)
COURSE WEBSITE (URL)	

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 is a basic introductory course in renewable energy and related technologies.

The objectives of the course are to

- Document the necessity and exploitation of renewable energy sources.
- Present and analyze the various renewable energy technologies with numerous examples and system analyses.
- Enable the student to do preliminary design (sizing of renewable energy systems) especially on agricultural applications.

Through explanations of concepts and the use of practical examples and a series of laboratory exercises, students are assisted to develop the necessary skills to bridge the gap between knowledge and confidence as they learn to design renewable energy systems to meet specific energy requirements.

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 *Project planning and management*

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

- Autonomous Work
- Teamwork
- Promotion of free, creative and inductive thinking

3. SYLLABUS

Theory:
Introduction, Definitions.
Introduction to biomass. Biomass sources. Biomass collection and management. Thermodynamic conversion by combustion. Thermochemical conversion. Biochemical conversion. Cogeneration of heat and electricity. Biofuels for transport.
Production of heat and electricity from solar energy.
Direct production of electricity from solar energy – photovoltaic conversion. Types of photovoltaic systems and related components.
Wind and wind energy. Energy and power in the wind. Types of wind turbines, Aerodynamics of wind turbines. Autonomous machines and grid connected machines. Wind farms.
Hybrid systems electricity production.
Geothermal energy, Geothermal fields, Geothermal energy exploitation technologies for electricity production and space heating.
Hydropower and electricity production. Types of hydro-turbines. Hydroelectric plants. Hydrodynamic energy storage in pumped water.
Wave energy. Nature of wave energy. Production of mechanical and electrical power from wave energy. Types of machines.
Economics of renewable energy sources.

Laboratory:
Fuel production exercises from energy crops (two)
Exercises on the use of biofuels for the production of mechanical work, heat and electricity (three)
Exercises on the production of electricity with photovoltaics (three)
Exercises on wind energy (two)
Exercise on hybrid electricity generation system (one)

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	In class and at the lab		
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Specialised software		
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*	*Activity*	*Semester workload*	
	Lectures	75	
	Lab exercises	30	
	Individual assignments/exercises	20	

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*		
	Course total	*125*
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 exam with closed books and notes including true/false and short development questions. II. Written and oral final examination in solving exercises with open books and notes – delivery of group/individual assignments.	

5. ATTACHED BIBLIOGRAPHY

- Suggested bibliography:
- Related academic journals:

Gilbert M. Masters. Συστήματα Παραγωγής Ηλεκτρικής Ισχύος από Ανανεώσιμες Πηγές Ενέργειας. (Ελληνική μετάφραση). Εκδόσεις ΠΕΔΙΟ, 2016
Κ.Α. Μπαλαράς – Α.Α. Αργυρίου – Φ.Ε. Καραγιάννης. Συμβατικές & ήπιες μορφές ενέργειας. ΤεΚΔΟΤΙΚΗ 2006
Θ.Δ. Τσούτσος – Ι.Ν. Κανάκης. Ανανεώσιμες πηγές ενέργειας. Παπασωτηρίου 2013.