COURSE OUTLINE

1. GENERAL

SCHOOL:	Engineering		
ACADEMIC UNIT:	Industrial Design and Production Engineering		
LEVEL OF STUDIES:	Undergraduate		
COURSE CODE:	**8009**	**SEMESTER**	**9**
COURSE TITLE:	Renewable Sources of Energy		
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY TEACHING HOURS**	**ECTS CREDITS**
Theory (Lectures)		3	3
Laboratory		1	2
		4	**5**
COURSE TYPE:	Special background, skills development		
PREREQUISITES COURSES:	No		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek / English upon selected by foreign students		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes		
COURSE WEBSITE (URL)			

2. LEARNING OUTCOMES

Learning Outcomes

Upon successful completion of the course students are expected to have acquired the following skills:

- Description of reasons for the necessity of using RES
- Description of the methods of using solar energy and solar cells
- Analysis of photovoltaic manufacturing technologies and their use in everyday applications.
- Description of ways to use the energy of sea waves.
- Analysis of wind energy uses.
- Description of basic principles of geothermal and biomass.
- Analysis of hybrid power generation systems.

The aim is to acquaint students and engineers of other specialties with all the systems that can produce energy and gentle ways of producing energy.

General Competences

The general skills that are expected to be acquired during the course are:

1. Search, analysis and synthesis of data and information, using the necessary technologies.
2. Adaptation to new situations.
3. Decision making.

4. Autonomous work-Group work.
5. Working in an international environment.
6. Work in an interdisciplinary environment.
7. Production of new research ideas.
8. Project design and management.
9. Exercise criticism and self-criticism.
10. Promoting free, creative and inductive thinking
11. Search, analysis and synthesis of data and information, with the use of internet technologies and bibliographic research and networking.
12. Decision making, through the elaboration of solutions and options for the elaboration of assigned tasks and exercises.
13. Autonomous work, through the elaboration of individually performed tasks and exercises. Design and management of projects, through the undertaking and elaboration of integrated tasks (project).

3. SYLLABUS

1. SOLAR ENERGY - SOLAR CELLS
1.1.Introduction
1.1.1. Solar Geometry
1.1.2.Solar map.
1.1.3. Solar radiation and its components.
1.2. Renewable Technology and Applications in Greece
Commitment of solar energy
1.2.1.1. Utilization of Solar Energy in Greece
1.2.1.2. Passive Building Design
1.2.2. Solar radiation
1.2.2.1 Solar radiation outside the earth's atmosphere.
1.2.3.2.Solar radiation on the ground surface.
1.2.3.4. Angle of incidence of sunlight
1.2.3.Solar radiation at an inclined plane
1.2.3.1. Hourly solar radiation at an inclined plane
1.2.3.2 Annual solar radiation at an inclined level

2. PHOTOVOLTAIC SYSTEMS
2.1.Characteristic curve and operating point of a photovoltaic cell
2.2.Types of photovoltaic cells
2.3.Silicon (Si) photovoltaic cells
2.3.1.T thin film photovoltaic cells
2.3.2. Other technologies
2.4.Main construction details of a photovoltaic cell
2.5.Photovoltaic frame and construction details
2.6.Photovoltaic array
2.6.1 Support and orientation of photovoltaic panels
2.6.2 Connecting frames and creating arrays
2.6.3 Construction details
2.7.Photovoltaic Systems

2.7.1 Categories of photovoltaic systems
2.7.2 Inverter / voltage converter
2.7.3 Charge controller / regulator
2.7.4 Electric Battery
2.7.5 Control panel
2.8.Specifications and guarantees
2.9.Cost of photovoltaic investments
2.10.Life cycle of photovoltaic panels
2.10.1 Production of photovoltaic panels
2.10.2 Recycling of photovoltaic panels
2.11.Advantages and disadvantages of photovoltaic systems
2.12.The situation on a global scale
2.13. The situation in Greece
2.14. Development perspectives

3. SEA WAVE ENERGY
3.1. Wave energy
3.1.1 Energy from the Sea Waves
3.1.2.Tidal energy
3.2.Historical Survey of Wave Energy
3.3. Energy from waves
3.4.1. Types of wave energy exploitation
3.4.2 Advantages of wave energy
3.4.3 Disadvantages of wave energy
3.4.Wave energy recovery devices depending on the generation
3.4.1. First generation devices
3.4.2.Second generation devices
3.4.3 Third generation devices
3.5. Main Types of Wave Energy Exploitation Systems
3.5.1 Offshore Facilities
3.5.2 Facilities Near The Mainland
3.5.3 Offshore Facilities
3.5.4.Pelamis
3.5.5Known Floating systems
3.6.The effects of wave energy on the environment
3.6.1 Abduction of wave energy
3.6.2 Charge on pollutants
Disagreement with other uses of the sea
3.6.4 Visual nuisance from the coast
3.7.Marine potential and Marine energy
3.7.1 Tidal or Sea Currents
3.7.2 Exploitation of Tidal or Marine Currents
3.7.2.1 Exploitation of Sea Currents
3.7.2.2 Tidal Dams
3.7.3.Wave Energy
3.7.4 Exploitation of Wave Energy
3.7.5 Surface Temperature Difference - Ocean Bottom
3.7.6 Exploitation of the Temperature Difference Surface - Bottom of the Oceans
3.7.7 Difference of Water Salinity or Osmotic Energy
3.7.8 Exploitation of water salinity difference or Osmotic energy
3.7.9 Assessment of Theoretical Marine Potential

4. WIND ENERGY

4.1 Wind Energy
4.2.Wind generators: Categorisation, Types
4.3. Wind Turbine Evaluation Parameters
4.4. Utilisation of Wind Energy in Greece

5. GEOTHERMIE-BIOMASS
5.1.3 Geothermal Energy
5.1.1 Domestic Uses of Geothermal
5.1.2 Geothermal energy in Greece
5.1.3 Geothermal Applications
5.1.2. Energy from Biomass

6. APPLICATIONS OF RES

4. TEACHING and LEARNING METHODS – EVALUATION

DELIVERY	Face-to-face
USE OF INFORMATION AND COMMUNICATION TECHNOLOGY	Use of ICT in Teaching Learning process support through e-class Use of computer programs (PPT, GNU OCTAVE, R) in lectures. Utilisation of the HEAL-LINK system for access to the international bibliography - specialised journals of the subject. Communication with students via e-class and e-mail.
TEACHING METHODS	

Method description / Activity	***Semester Workload***
Lectures	39
Laboratory work	26
Paper and journal study	10
Non-guided personal study	75
Course Total (30h/ECTS)	**150**

STUDENT PERFORMANCE EVALUATION	**Language of Assessment** Greek / English **Description** Final exams with several type of questions such as multiple choice, short-answer questions and problem solving. The assessment criteria are announced to students at the beginning of the semester and are published on the course webpage in the e-Class platform.

5. ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

1. Gilbert M. Masters, E SBN: 978-960-546-743-2

- Related academic journals:

- All IEEE, Elsevier, Springer, Oxford University Press, Kluver Verlag etc