a) General			
School	ENGINEERING		
Academic unit	MECHANICAL ENGINEERING		
Level of studies	Undergraduate		
Course code	MM907Y01	*Semester*	7
Course title	**Renewable (soft) energy sources**		

Independent teaching activities	*Weekly teaching hours*	*ECTS*
Lectures	3	5.5
Laboratory exercises	2	

Course type	Knowledge deepening/consolidation
Course category	Compulsory for Direction 1 & 2
Prerequisite courses	-
Language of instruction and examinations	Greek / English
Is the course offered to Erasmus students	Yes
Course website (url)	https://moodle.uniwa.gr/course/view.php?id=185

b) Learning outcomes and general competences

b1. Learning outcomes

Upon successful completion of this course, the student will be able to:

- Identify the main parts of a wind turbine as well as their functionality
- Measure wind speed and wind direction for a given location
- Assess the quality and main characteristics of wind potential
- Determine the wind energy generated by a wind turbine
- Measure solar irradiance for a given location
- Assess the quality and main characteristics of solar potential
- Select a solar water heater or an array of solar collectors for covering consumer thermal needs
- Determine the main dimension of a photovoltaic installation
- Design and size a farming greenhouse
- Assess the quality of energy potential associated with different types of biomass
- Determine the main dimensions of an anaerobic bioreactor
- Identify the main characteristics of biofuels
- Assess the quality of hydro potential
- Determine the dimensions of a small hydroelectric plant
- Assess the geothermal energy potential for a given location
- Suggest appropriate applications for the exploitation of available geothermal energy
- Identify the main characteristics of marine energy potential
- Undertake techno-economic evaluation of renewable (soft) energy sources applications
- Determine the social and environmental impacts from the use of renewable (soft) energy sources

b2. General competences

- Search for, analysis and synthesis of data and information with the use of the necessary technology
- Working independently
- Team work
- Working in an international environment
- Working in an interdisciplinary environment
- Respect for the natural environment
- Project planning and management

<table>
<tr><td colspan="3">c) Syllabus</td></tr>
<tr><td colspan="3">Theory: Wind turbines, types of turbines, subsystems of turbines, operational performance, wind potential measuring instruments, wind potential assessment, energy generation of wind turbines, wind parks, solar energy, theoretical and experimental determination of solar irradiance, solar collectors, solar energy applications for the coverage of thermal loads, photovoltaic phenomenon, photovoltaic energy generation, introduction to farming greenhouses, systems of biomass exploitation – energy from biomass, biofuels, assessment of hydro potential, small and large hydropower plants, introduction to geothermal energy, tidal and wave energy.
Lab: Study of wind turbine operation, wind potential measurements, energy efficiency of wind turbines, solar irradiance measurements, energy performance analysis of flat plate-concentrating solar collectors, photovoltaic panels' connections and energy efficiency, recording of operational data of photovoltaic cells, simulation of solar-based farming greenhouses' energy performance, study of operational parameters of a small hydropower plant, simulation of a bioreactor energy performance, design of geothermal energy applications.</td></tr>
<tr><td colspan="3">d) Teaching and learning methods - Evaluation</td></tr>
<tr><td>Delivery</td><td colspan="2">Face - to - face (classroom, working groups, lab)</td></tr>
<tr><td>Use of information and communications technology</td><td colspan="2">- Multimedia applications
- MS Teams/Moodle/eclass
- Site visits</td></tr>
<tr><td rowspan="7">Teaching methods</td><td>Activity</td><td>Semester workload</td></tr>
<tr><td>Lectures</td><td>39</td></tr>
<tr><td>Tutorials</td><td>15</td></tr>
<tr><td>Laboratory exercises</td><td>20</td></tr>
<tr><td>Computational exercises</td><td>6</td></tr>
<tr><td>Individual work</td><td>76</td></tr>
<tr><td>Course total</td><td>156</td></tr>
<tr><td>Student performance evaluation</td><td colspan="2">For the theoretical part of the module: a) Evaluation by means of short, follow-up "tests", at the end of the lectures – 20%, b) Participation in individual and/or group assignments and site visits – 20%, c) Two-hour written exam (60% or up to 100% for the students that have not participated in a) and b)). Written exams include: Short-answer questions (not limited to multiple choice) (40%), and solving application problems (60%).
For the lab part of the module, individual and/or group assignment for each lab exercise and exam (written or oral) on the subject of each lab exercise or unit. Final exam covering all taught material. The theoretical part of the module holds 60% of the final grade weight, and the lab part holds 40%, while in any case, the theory final grade should be greater or equal to three (3) and the lab final grade should greater or equal to four (4).</td></tr>
<tr><td colspan="3">e) Suggested bibliography</td></tr>
<tr><td colspan="3">1. Καλδέλλης Ι. Κ. (2005). Διαχείριση της Αιολικής Ενέργειας (2η Έκδοση). Εκδ. Αθ. Σταμούλης. ISBN: 9603515760.
2. Καλδέλλης Ι. Κ., Καββαδίας Κ. Α. (2001). Εργαστηριακές Εφαρμογές Ήπιων Μορφών Ενέργειας.Εκδ. Αθ. Σταμούλης. ISBN: 9603513458.
3. Kaldellis J. K. (Ed) 2012. "Comprehensive Renewable Energy/Volume II: Wind Energy", Elsevier B.V. ISBN 978-008-087-872-0.
4. 4. Buresch M., 1983. Photovoltaic Energy Systems. Mc-Graw Hill New York /0070089523</td></tr>
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5. 5. Παπαντώνης Δ., 2001, *Μικρά Υδροηλεκτρικά Έργα*. Συμεών/9607888235.