

## COURSE OUTLINE

### 1. GENERAL

<b>SCHOOL</b>	SCHOOL OF ENGINEERING		
<b>DEPARTMENT</b>	ENVIRONMENTAL ENGINEERING		
<b>LEVEL OF STUDIES</b>	5 <sup>TH</sup>		
<b>COURSE CODE</b>	15ΣΤΥ4Ν	<b>SEMESTER</b>	SUMMER
<b>COURSE TITLE</b>	Applied Thermodynamics		
<b>TEACHING ACTIVITIES</b> <i>If the ECTS Credits are distributed in distinct parts of the course e.g. lectures, labs etc. If the ECTS Credits are awarded to the whole course, then please indicate the teaching hours per week and the corresponding ECTS Credits.</i>	<b>TEACHING HOURS PER WEEK</b>	<b>ECTS CREDITS</b>	
	6	5	
<i>Please, add lines if necessary. Teaching methods and organization of the course are described in section 4.</i>			
<b>COURSE TYPE</b> <i>Background, General Knowledge, Scientific Area, Skill Development</i>	Scientific Area		
<b>PREREQUISITES:</b>			
<b>TEACHING &amp; EXAMINATION LANGUAGE:</b>	Greek, English		
<b>COURSE OFFERED TO ERASMUS STUDENTS:</b>	YES		
<b>COURSE URL:</b>	<a href="https://eclass.duth.gr/courses/TMC231/">https://eclass.duth.gr/courses/TMC231/</a>		

### 2. LEARNING OUTCOMES

<p><b>Learning Outcomes</b> <i>Please describe the learning outcomes of the course: Knowledge, skills and abilities acquired after the successful completion of the course.</i></p> <p>The course's aim is to introduce students to the fundamental principles and calculations regarding a range of renewable energy technologies, to comprehend:</p> <ul style="list-style-type: none"> <li>• the variations of solar energy and the photovoltaic power generation</li> <li>• the wind speed distributions and operation of wind turbines</li> <li>• the autonomous RES power systems</li> <li>• the types, the compositions and the energetic uses of biomass and biofuels</li> </ul> <p>and to be able to perform the fundamental calculations, for:</p> <ul style="list-style-type: none"> <li>• solar radiation and its conversion to power</li> <li>• wind energy conversion to power</li> <li>• the power and efficiency of geothermal cogeneration</li> <li>• the power and efficiency for biomass co-generation through combustion and gasification</li> <li>• biogas production and biogas based cogeneration</li> <li>• the economics of photovoltaics, wind turbines and biomass conversion technologies</li> </ul> <p><b>General Skills</b> <i>Name the desirable general skills upon successful completion of the module</i></p> <p><i>Search, analysis and synthesis of data and information, ICT Use</i> <i>Adaptation to new situations</i> <i>Decision making</i> <i>Autonomous work</i></p> <p><i>Project design and management</i> <i>Equity and Inclusion</i> <i>Respect for the natural environment</i> <i>Sustainability</i> <i>Demonstration of social, professional and moral responsibility and</i></p>
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*Teamwork*

*Working in an international environment  
Working in an interdisciplinary environment  
Production of new research ideas*

*sensitivity to gender issues*

*Critical thinking  
Promoting free, creative and inductive reasoning*

Autonomous work.

### 3. COURSE CONTENT

1. Energy balances and climate emergency
2. Solar radiation
3. Photovoltaics operation and economics
4. Wind turbines operation and economics
5. Autonomous RES power systems
6. Geothermal sources and geothermal cogeneration
7. Biomass types, potential and composition
8. Biomass combustion, combustion-based cogeneration and economics
9. Biomass gasification, gasification-based cogeneration and economics
10. Biogas production, uses and economics

### 4. LEARNING & TEACHING METHODS - EVALUATION

<b>TEACHING METHOD</b> <i>Face to face, Distance learning, etc.</i>	Face to face	
<b>USE OF INFORMATION &amp; COMMUNICATIONS TECHNOLOGY (ICT)</b> <i>Use of ICT in Teaching, in Laboratory Education, in Communication with students</i>	Calculation sheets and communication with students.	
<b>TEACHING ORGANIZATION</b> <i>The ways and methods of teaching are described in detail. Lectures, Seminars, Laboratory Exercise, Field Exercise, Bibliographic research &amp; analysis, Tutoring, Internship (Placement), Clinical Exercise, Art Workshop, Interactive learning, Study visits, Study / creation, project, creation, project. Etc.  The supervised and unsupervised workload per activity is indicated here, so that total workload per semester complies to ECTS standards.</i>	<b>Activity</b>	<b>Workload/semester</b>
	Lectures	36
	Tutoring	36
	Exercises	78
	Total	150
<b>STUDENT EVALUATION</b> <i>Description of the evaluation process  Assessment Language, Assessment Methods, Formative or Concluding, Multiple Choice Test, Short Answer Questions, Essay Development Questions, Problem Solving, Written Assignment, Essay / Report, Oral Exam, Presentation in audience, Laboratory Report, Clinical examination of a patient, Artistic interpretation, Other/Others  Please indicate all relevant information about the course assessment and how students are informed</i>	Two written exams, in Greek or English, at the middle of the semester and at the end of it, on half of the course content each. Exams refer to problem solving.	

### 5. SUGGESTED BIBLIOGRAPHY

1. Class material.

## ANNEX OF THE COURSE OUTLINE

### Alternative ways of examining a course in emergency situations

<b>Teacher (full name):</b>	Costas Athanasiou
<b>Contact details:</b>	+30 25410 79 316 (+30 6937 657 128)
<b>Supervisors: (1)</b>	YES
<b>Evaluation methods: (2)</b>	On-line written exams.
<b>Implementation Instructions: (3)</b>	Ten versions of two problems are uploaded to e-class and the students have upload the solutions, still to e-class within a specific time. Students are monitored by camera, during the exams, through Microsoft Teams.

(1) Please write YES or NO

(2) Note down the evaluation methods used by the teacher, e.g.

- *written assignment* or/and exercises
- written or oral examination with distance learning methods, provided that the integrity and reliability of the examination are ensured.

(3) In the **Implementation Instructions** section, the teacher notes down clear instructions to the students:

a) in case of **written assignment and / or exercises**: the deadline (e.g. the last week of the semester), the means of submission, the grading system, the grade percentage of the assignment in the final grade and **any other necessary information**.

b) in case of **oral examination with distance learning methods**: the instructions for conducting the examination (e.g. in groups of X people), the way of administration of the questions to be answered, the distance learning platforms to be used, the technical means for the implementation of the examination (microphone, camera, word processor, internet connection, communication platform), the hyperlinks for the examination, the duration of the exam, the grading system, the percentage of the oral exam in the final grade, the ways in which the inviolability and reliability of the exam are ensured and any other necessary information.

c) in case of **written examination with distance learning methods**: the way of administration of the questions to be answered, the way of submitting the answers, the duration of the exam, the grading system, the percentage of the written exam of the exam in the final grade, the ways in which the integrity and reliability of the exam are ensured and any other necessary information.

There should be an attached list with the Student Registration Numbers only of students eligible to participate in the examination.