

## COURSE OUTLINE

### 1. GENERAL

<b>SCHOOL</b>	Of ENGINEERING		
<b>DEPARTMENT</b>	ENVIRONMENTAL ENGINEERING		
<b>LEVEL OF STUDIES</b>	7 <sup>th</sup> LEVEL		
<b>COURSE CODE</b>	<b>TMC330</b>	<b>SEMESTER</b>	6th Semester
<b>COURSE TITLE</b>	ENERGY EFFICIENCY IN BUILDINGS – ENERGY AUDITS		
<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>	BACKGROUND, SKILL DEVELOPMENT		
<b>PREREQUISITES:</b>	Mathematics, Heat Transfer Phenomena, Fluid mechanics, Physics of the Atmosphere		
<b>TEACHING &amp; EXAMINATION LANGUAGE:</b>	GREEK		
<b>COURSE OFFERED TO ERASMUS STUDENTS:</b>	NO		
<b>COURSE URL:</b>	<a href="https://eclass.duth.gr/courses/TMC330/">https://eclass.duth.gr/courses/TMC330/</a>		

### 2. LEARNING OUTCOMES

<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>																
The course aims at: <ul style="list-style-type: none"> <li>Familiarization with the Greek and European energy legislation for buildings</li> <li>Comprehension of the main principles and systems of energy efficiency at buildings</li> <li>Comprehension of the main principles of energy assessment calculations</li> <li>Familiarization with elaboration of an energy assessment report</li> <li>Familiarization with performing an energy audit at buildings and systems</li> </ul>																
<b>General Skills</b> <i>Name the desirable general skills upon successful completion of the module</i>																
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- Respect for the natural environment
- Promoting free, creative and inductive reasoning

### 3. COURSE CONTENT

- Building energy consumption fundamentals: Analysis per activity, per building category, etc.
- Building energy policy: European and national energy legislation – Building energy efficiency regulation (KENAK), Technical Guides of TEE.
- Energy efficiency and rational use of energy in buildings: envelope, heating – cooling systems, heat recovery systems, cogeneration systems.
- Artificial lighting: Energy savings at lighting systems, lighting control.
- Building Energy Management Systems (BEMS). Low energy consumption appliances.
- District heating / cooling of building complexes / settlements
- Users energy behavior
- Calculation of energy performance of buildings: basic principles, energy balance, energy requirements for space heating-cooling-DHW-lighting, energy consumption, heat transfer equations, thermal insulation calculations. National – European principles for the energy performance of buildings.
- Energy audit procedure : Buildings, Systems
- Energy study report: specifications
- Buildings energy certification and energy rating
- Buildings' energy performance software: Energy audits – energy study.
- Energy calculation software (structure, inputs, databases, energy efficiency scenario design etc.)
- Examples of energy design report for different building categories
- Measurement of thermal performance of buildings, thermal performance of boiler / burner Measures for energy renovation of buildings and systems
- Developing an energy audit / energy study report

### 4. LEARNING & TEACHING METHODS - EVALUATION

<p><b>TEACHING METHOD</b> <i>Face to face, Distance learning, etc.</i></p>	Face to face, Distance learning (in emergency situations)	
<p><b>USE OF INFORMATION &amp; COMMUNICATIONS TECHNOLOGY (ICT)</b> <i>Use of ICT in Teaching, in Laboratory Education, in Communication with students</i></p>	Use of ICT in Teaching, in Exercises /Laboratory Education, in Communication with students	
<p><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.</i></p>	<p><b>Activity</b></p>	<p><b>Workload/semester</b></p>
	Lectures	40
	Student Assignments	40
	Literature study and analysis	5
Preparation of semester assignment	55	

<p>The supervised and unsupervised workload per activity is indicated here, so that total workload per semester complies to ECTS standards.</p>	<p>Presentation of assignment</p>	<p>10</p>
	<p><b>Total</b></p>	<p><b>150</b></p>
<p><b>STUDENT EVALUATION</b> Description of the evaluation process</p> <p>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</p> <p>Please indicate all relevant information about the course assessment and how students are informed</p>	<p>Students' evaluation is based on:</p> <ul style="list-style-type: none"> <li>• Written examination (Questions of free text and multiple choice)(60% of marks) and</li> <li>• Obligatory semester assignment (40%)</li> </ul> <p>The evaluation criteria are posted on the course website (e-class)</p>	

## 5. SUGGESTED BIBLIOGRAPHY

The section of 'Energy Efficiency in buildings' is covered by the following textbooks / books:

1. Structures Physics and Environmental Design of Buildings, Papamanolis N. (2016), Kallipos

and the following textbooks:

- Guide of energy efficiency in residential buildings
- Energy efficiency technologies at buildings
- Energy behavior of consumers – Energy efficient equipment

The 'Energy Audits ' section is covered by the following textbooks / books:

- Teachers' notebooks (uploaded at course website)
- Guide for Energy Audit of Buildings
- Guide of techniques and instruments for energy measurements
- Technical Guides of the Technical Chamber of Greece (TOTEE )

## ANNEX OF THE COURSE OUTLINE

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

<b>Teacher (full name):</b>	Argiro Dimoudi, Professor
<b>Contact details:</b>	adimoudi@env.duth.gr
<b>Supervisors: (1)</b>	NO
<b>Evaluation methods: (2)</b>	➤ written examination with distance learning methods, provided that the integrity and reliability of the examination are ensured.
<b>Implementation Instructions: (3)</b>	

(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.