

COURSE OUTLINE

1. GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
DEPARTMENT	ENVIRONMENTAL ENGINEERING		
LEVEL OF STUDIES	8 TH SEMESTER		
COURSE CODE	15HY1N - K1	SEMESTER	SUMMER
COURSE TITLE	Fundamentals of Energy Systems		
TEACHING ACTIVITIES <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>	TEACHING HOURS PER WEEK	ECTS CREDITS	
	6	5	
<i>Please, add lines if necessary. Teaching methods and organization of the course are described in section 4.</i>			
COURSE TYPE <i>Background, General Knowledge, Scientific Area, Skill Development</i>	Scientific Area		
PREREQUISITES:			
TEACHING & EXAMINATION LANGUAGE:	Greek, English		
COURSE OFFERED TO ERASMUS STUDENTS:	YES		
COURSE URL:	https://eclass.duth.gr/courses/TMC360/		

2. LEARNING OUTCOMES

Learning Outcomes

Please describe the learning outcomes of the course: Knowledge, skills and abilities acquired after the successful completion of the course.

The course's aim is to introduce students to the integrated systems for power and heating/cooling generation and cogeneration, and to comprehend:

- the architecture these systems, and
- the architecture and the operation principles of fuel cells

as well as the ability to thermodynamically analyze these systems and to perform the fundamental calculations of fuel cells.

General Skills

Name the desirable general skills upon successful completion of the module

*Search, analysis and synthesis of data and information,
ICT Use*

Adaptation to new situations

Decision making

Autonomous work

Teamwork

Working in an international environment

Working in an interdisciplinary environment

Production of new research ideas

Project design and management

Equity and Inclusion

Respect for the natural environment

Sustainability

Demonstration of social, professional and moral responsibility and sensitivity to gender issues

Critical thinking

Promoting free, creative and inductive reasoning

Autonomous work.

3. COURSE CONTENT

1. Multistage gas turbines
2. Multistage steam turbines
3. Steam turbines with regeneration

4. Combined gas and steam turbines
5. Cogeneration cycles
6. Cooling processes with compressed vapors
7. Gas cycles for cooling
8. Absorption cooling processes
9. Introduction to fuel cells
10. Solid Oxide Fuel Cells
11. Protons Exchanging Membranes Fuel Cells
12. Combined Cycles with Fuel Cells

4. LEARNING & TEACHING METHODS - EVALUATION

TEACHING METHOD <i>Face to face, Distance learning, etc.</i>	Face to face	
USE OF INFORMATION & COMMUNICATIONS TECHNOLOGY (ICT) <i>Use of ICT in Teaching, in Laboratory Education, in Communication with students</i>	Calculation sheets and communication with students.	
TEACHING ORGANIZATION <i>The ways and methods of teaching are described in detail. Lectures, Seminars, Laboratory Exercise, Field Exercise, Bibliographic research & analysis, Tutoring, Internship (Placement), Clinical Exercise, Art Workshop, Interactive learning, Study visits, Study / creation, project, creation, project. Etc.</i> <i>The supervised and unsupervised workload per activity is indicated here, so that total workload per semester complies to ECTS standards.</i>	Activity	Workload/semester
	Lectures	36
	Tutoring	36
	Exercises	78
	Total	150
STUDENT EVALUATION <i>Description of the evaluation process</i> <i>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</i> <i>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.
2. Thermodynamics for Engineers, Cengel Yunus A., Boles Michael A

ANNEX OF THE COURSE OUTLINE

Alternative ways of examining a course in emergency situations

Teacher (full name):	Costas Athanasiou
Contact details:	+30 25410 79 316 (+30 6937 657 128)
Supervisors: (1)	YES
Evaluation methods: (2)	On-line written exams.
Implementation Instructions: (3)	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.