

COURSE OUTLINE

1. GENERAL

SCHOOL	ENGINEERING		
DEPARTMENT	ENVIRONMENTAL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	ΣΤ6ΥΠ	SEMESTER	6
COURSE TITLE	SOLID WASTE MANAGEMENT AND TECHNOLOGY I		
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:	ANALYTICAL CHEMISTRY, PHYSICAL AND BIOCHEMICAL PROCESSES, ENVIRONMENTAL MICROBIOLOGY, TRANSPORT PHENOMENA, FLUID MECHANICS		
TEACHING & EXAMINATION LANGUAGE:	GREEK, ENGLISH (FOR ERASMUS STUDENTS)		
COURSE OFFERED TO ERASMUS STUDENTS:	YES		
COURSE URL:	https://eclass.duth.gr/courses/TMC327/		

2. LEARNING OUTCOMES

Learning Outcomes <i>Please describe the learning outcomes of the course: Knowledge, skills and abilities acquired after the successful completion of the course.</i>																
<ul style="list-style-type: none"> The results of the course are the familiarization of students with topics of design of solid waste management systems with emphasis on municipal solid waste (MSW). The skills acquired by the students are to be able to: <ul style="list-style-type: none"> design a collection-transfer system of MSW, process a mass / energy balance in an individual unit of processing / disposal of MSW, understand the physicochemical and biochemical processes within each unit of management of MSW, make a preliminary basic design of an integrated MSW system. <p>Also, additional skills acquired are to be able to implement the basic solid waste characterization laboratory analyzes.</p>																
General Skills <i>Name the desirable general skills upon successful completion of the module</i>																
<table border="0"> <tr> <td><i>Search, analysis and synthesis of data and information, ICT Use</i></td> <td><i>Project design and management</i></td> </tr> <tr> <td><i>Adaptation to new situations</i></td> <td><i>Equity and Inclusion</i></td> </tr> <tr> <td><i>Decision making</i></td> <td><i>Respect for the natural environment</i></td> </tr> <tr> <td><i>Autonomous work</i></td> <td><i>Sustainability</i></td> </tr> <tr> <td><i>Teamwork</i></td> <td><i>Demonstration of social, professional and moral responsibility and sensitivity to gender issues</i></td> </tr> <tr> <td><i>Working in an international environment</i></td> <td><i>Critical thinking</i></td> </tr> <tr> <td><i>Working in an interdisciplinary environment</i></td> <td><i>Promoting free, creative and inductive reasoning</i></td> </tr> <tr> <td><i>Production of new research ideas</i></td> <td></td> </tr> </table>	<i>Search, analysis and synthesis of data and information, ICT Use</i>	<i>Project design and management</i>	<i>Adaptation to new situations</i>	<i>Equity and Inclusion</i>	<i>Decision making</i>	<i>Respect for the natural environment</i>	<i>Autonomous work</i>	<i>Sustainability</i>	<i>Teamwork</i>	<i>Demonstration of social, professional and moral responsibility and sensitivity to gender issues</i>	<i>Working in an international environment</i>	<i>Critical thinking</i>	<i>Working in an interdisciplinary environment</i>	<i>Promoting free, creative and inductive reasoning</i>	<i>Production of new research ideas</i>	
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Specialized knowledge of solid waste legislation
 Specialized knowledge on the design of solid waste management systems, with emphasis on municipal solid waste, which includes the subsystems: Collection, storage, transport (haul), transfer, treatment (but not disposal with much detail).
 Specialized knowledge of the basic laboratory characterization analytical tests for solid waste

3. COURSE CONTENT

1. European and Greek solid waste legislation. Municipal solid waste and special streams. Definitions. Management of MSW in Greece and in the EU
2. Mass and energy balances in MSW systems.
3. Production and composition / characteristics of solid waste. Physical and chemical composition.
4. Collection-storage systems.
5. Transfer-transport systems
6. Recycling by source separation. Material sorting and recovery facilities.
7. Anaerobic Digestion Systems. Design principles. MBT with anaerobic digestion
8. Aerobic Composting Systems. Design principles. MBT with aerobic digestion.
9. Mechanical and biological pretreatment. Bio-drying. Principles & Design.
10. Mechanical and biological pretreatment. Pre-processing for RDF / SRF production. Principles & Design.
11. Thermal treatment. Principles & Design
12. Final Disposal of Solid Waste and Residues at Landfills.
13. Basic solid waste economics. Life Cycle Analysis and Environmental Impacts on MSW Management. - Greenhouse gases according to IPCC.

Laboratory sessions

1. Sampling, moisture, shredding, volatile solids in muffle furnace, pH
2. Elemental analysis (weights, calibration curve, elemental analysis and derivation of empirical formula).
3. Calorific value with bomb type calorimeter - Comparison of measurement value with theoretical calculations.
4. Aerobic microbial respiration or Biochemical Methane Potential tests

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>	Use of ICT during teaching and communication with students. Laboratory education.	
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. 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	80
	Design exercises	34
	Literature review	
	Individual projects	30
	Project presentation	0
	Field trips	6
	Course total	150
STUDENT EVALUATION <i>Description of the evaluation process</i>	Formative	

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

An optional intermediate exam will be realized with a weight of 50% to the overall weight. The final exam will have a weight of 50%, or 100% if a student did not take part or did not pass during the intermediate test.

All exams will be realized with open notes / books in class

Laboratory reports

The course includes four solid waste laboratories, realized in student groups, in which reports will be submitted per group. The grade of the laboratory reports will have a weight of 30% in the final grade of the course. Attendance at all workshops is mandatory. (Absence is justified only with a doctor's note, and the specific laboratory that was missed must be replaced with presence in another group).

Students must submit all the laboratory reports per group (and must receive a pass grade in each of them) as well as be present in all laboratories in order to participate in the final exams.

5. SUGGESTED BIBLIOGRAPHY

1. Διαχείριση και Μηχανική Στερεών Αποβλήτων, Δ. Κομίλης (Εκδόσεις Τζιόλας 2020). (in Greek)
2. Timely notes and articles appearing in e-class.

ANNEX OF THE COURSE OUTLINE

Alternative ways of examining a course in emergency situations

Teacher (full name):	Dimitrios Komilis
Contact details:	dkomilis@env.duth.gr
Supervisors: (1)	YES
Evaluation methods: (2)	Exams by distance. Laboratory exercises presented as recorded videos. Laboratory reports submitted electronically.
Implementation Instructions: (3)	<p>The examination in the course will be initiated with the entrance of all students into the platform and then a multiple choice test will be realized via eclass.</p> <p>The test will be performed using Microsoft Teams and E-class. The link will be sent to students via eclass exclusively to the institutional accounts of those who have registered in the course and have accepted the terms of distance education.</p> <p>Students will have to log into the examination room through their institutional account, otherwise they will not be able to participate.</p> <p>They will also take part in the examination with a camera which they will have it turned on during the whole examination. Before the start of the exam, students will demonstrate their ID card and face to the camera, so that they can be identified by the examiner.</p>

(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.