COURSE OUTLINE

1. GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
DEPARTMENT	ENVIRONMENTAL ENGINEERING		
LEVEL OF STUDIES	SECOND CYCLE, DIRECTION II		
COURSE CODE	**Η3ΥΠ**	**SEMESTER**	**7th**
COURSE TITLE	ECOLOGICAL ENGINEERING AND TECHNOLOGY II		

TEACHING ACTIVITIES *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.*	**TEACHING HOURS PER WEEK**	**ECTS CREDITS**
	5	5
Please, add lines if necessary. Teaching methods and organization of the course are described in section 4.		

COURSE TYPE *Background, General Knowledge, Scientific Area, Skill Development*	Background Scientific Area Skill Development
PREREQUISITES:	Aquatic Chemistry, Wastewater Management and Treatment Technologies I, Environmental Microbiology
TEACHING & EXAMINATION LANGUAGE:	GREEK
COURSE OFFERED TO ERASMUS STUDENTS:	NO
COURSE URL:	https://eclass.duth.gr/modules/document/?course=TMC223

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.

A) Knowledge-based

- Understanding the function and physicochemical processes of stabilization ponds on wastewater treatment.
- Understanding the function and physicochemical processes of constructed wetlands on wastewater treatment.

B) Skills/Competences acquired

- Ability to design stabilization ponds (facultative, anaerobic) for wastewater treatment.
- Ability to design maturation ponds for microorganism removal (disinfection) treated wastewater.
- Ability to design constructed wetlands (surface and subsurface flow) for wastewater treatment.

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
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

Production of new research ideas
Autonomous work Teamwork Respect for the natural environment Project design and management Working in an interdisciplinary environment

3. COURSE CONTENT

1. Natural wastewater treatment systems. Definitions, differences from the conventional systems, advantages-disadvantages, natural system types.
2. Stabilization ponds: Description, function, physicochemical processes, efficiency on pollutant removal (BOD, COD, N, P)
3. Design of facultative ponds and facultative aerated pond systems, examples.
4. Anaerobic ponds: Description, function, physicochemical processes, design, examples.
5. Maturation ponds: Description, function, pathogen removal, design, examples.
6. Constructed wetland (CW) systems: Types, plant species, performance in pollutant removal.
7. Free-water surface constructed wetland systems: Hydraulic design, required surface area, design
8. Horizontal subsurface flow constructed wetland systems: Hydraulic design, required surface area, design models for pollutant removal (BOD, COD, suspended solids, nitrogen, phosphorus, microorganism), examples.
9. Evapotranspiration of free water surface and subsurface flow constructed wetlands.
10. Models for organic pollutant removal (BOD, COD).
11. Removal models of suspended solids, nitrogen, phosphorus, microorganism.
12. Vertical flow constructed wetland systems: Description, function, design, examples.
13. Construction requirements, vegetation, cost, operation, maintenance and monitoring of CW systems.

4. LEARNING & TEACHING METHODS - EVALUATION

TEACHING METHOD *Face to face, Distance learning, etc.*	Face to face Classroom lectures using power-point overheads (uploaded in e-class) and blackboard-solved exercises. A book is distributed containing the theoretical part of the course and solved examples and exercises.
USE OF INFORMATION & COMMUNICATIONS TECHNOLOGY (ICT) *Use of ICT in Teaching, in Laboratory Education, in Communication with students*	Use of ICT in teaching and in communication with students.
TEACHING ORGANIZATION *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.*	

Activity	*Workload/semester*
Lectures	39
Laboratory Exercise	26
Teamwork (semi-annual lab project)	20
Bibliographic research & analysis	40

The supervised and unsupervised workload per activity is indicated here, so that total workload per semester complies to ECTS standards.	Semester work (individual)	20
	Project presentation	5
		150
STUDENT EVALUATION *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*	Assessment Language: Greek Short Answer Questions and Problem Solving (final written exam) 50% Teamwork semester project (lab project) 30% Mid-term examination (progress) 10% Semester project (individual) 10%	

5. SUGGESTED BIBLIOGRAPHY

1. Tsihrintzis V.A.., «Ecological Engineering and Technology, Volume 2: Natural Methods for Wastewater Treatment», Edition DUTH (In Greek).
2. Crites R.W. Joe Middlebrooks E., Bastian R.K. and Reed S.C., «Natural Wastewater Treatment Systems», 2nd Edition, Taylor & Francis Group, Boca Raton, USA. ISBN 978-1-4665-8327-6.
3. Kadlec, R. H. and Wallace, S. D., «Treatment Wetlands», 2nd Edition, Taylor and Francis Group, Boca Raton, USA. ISBN 978-1-56670-526-4.
4. Reed S.C., Crites R.W., and Middlebrooks E.J., (1995), «Natural Systems for Waste management and Treatment», 2nd Edition, McGrow-Hill, Inc., New York, USA.
5. Mara D.D., and Pearson H.W., (1987), «Waste Stabilization Ponds – Design Manual for Mediterranean Europe», World Health Organization, Regional Office for Europe, EU/ICP/CWS 053.
6. Dinges R., (1982), «Natural Systems for Water Pollution Control», Van Nostrand Reinhold Co., New York, USA.

ANNEX OF THE COURSE OUTLINE

Alternative ways of examining a course in emergency situations

Teacher (full name):	GEORGIOS D. GIKAS
Contact details:	ggkikas@env.duth.gr
Supervisors: (1)	YES
Evaluation methods: (2)	Written examination with distance learning methods, ensuring the integrity and reliability of the examination.
Implementation Instructions: (3)	

(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.