COURSE OUTLINE

(1) GENERAL

SCHOOL	School of Environment		
ACADEMIC UNIT	Department of Environment		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**247KEY**	**SEMESTER**	**8**
COURSE TITLE	Natural Wastewater Treatment Systems and Waterways		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
Theory-Lectures	2	
Exercises	1	
Total credits		5

COURSE TYPE	Special background
PREREQUISITE COURSES:	Environmental chemistry
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes (tutorials)
COURSE WEBSITE (URL)	http://www.env.aegean.gr/studies/undergraduate-degree/curriculum/ecological-engineering-i/

(2) LEARNING OUTCOMES

Learning outcomes
Knowledge - To describe pollutants removal mechanisms in natural treatment systems - To recognize the role of hydrology, soil, vegetation and microbiology in natural treatment systems - To describe different types of natural treatment systems and the field of their application **Skills** - To distinguish the appropriateness of each natural system for the treatment of different wastewater - To calculate basic operational parameters of natural systems such as hydraulic retention time, evapotranspiration and pollutants removal rate **Competence** - To design natural systems for wastewater and storm water treatment by using simple equations
General Competences
- Search for, analysis and synthesis of data and information, with the use of the necessary technology - Decision-making - Respect for the natural environment - Team work

(3) SYLLABUS

1. Introduction - Natural wastewater treatment systems
2. Horizontal flow constructed wetlands
3. Vertical flow constructed wetlands
4. Design of constructed wetlands
5. Applications of constructed wetlands for wastewater treatment
6. Constructed wetlands for sewage sludge treatment
7. Pond systems
8. Design of wastewater ponds
9. Land treatment systems
10. Design of land treatment systems
11. Natural systems for storm water treatment
12. Bioretention basins
13. Design of bioretention basins

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face to Face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Power point, use of e-mail
TEACHING METHODS	

Activity	*Semester workload*
Lectures	26
Exercises	13
Team assays	20
Literature analysis	70
Course total	***129***

STUDENT PERFORMANCE EVALUATION	Language of evaluation: Greek A. Compulsory mid-semester examination (40%) - Multiple choice questionnaires - Short-answer questions - Problem solving B. Compulsory final examination (40%) - Multiple choice questionnaires - Short-answer questions - Problem solving C. Two team assays (20%)

(5) ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

1. Αγγελάκης, A.N., Tchobanoglous, G., 1995. Υγρά Απόβλητα-Φυσικά συστήματα Επεξεργασίας και Ανάκτηση, Επαναχρησιμοποίηση και Διάθεση εκροών", Πανεπιστημιακές Εκδόσεις Κρήτης, ISBN 960-7309-95-2
2. Crites R.W. Joe Middlebrooks E., Bastian R.K. and Reed S.C., 2014. Natural Wastewater Treatment Systems, 2nd Edition, Taylor & Francis Group, Boca Raton, USA. ISBN 978-1-4665-8327-6.
3. Kadlec, R.H., Wallace, S.D., 2009. Treatment wetlands, 2nd Edition, CRC Press, USA ISBN 978-1-56670-526-4
4. Mangangka, I.R., Liu, A., Goonetilleke, A., Egodawatta, P. 2016. Enhancing the Storm Water Treatment Performance of Constructed Wetlands and Bioretention Basins, Springer Verlag, Singapore ISBN 978-981-10-1659-2

- Related academic journals:

1. Ecological Engineering, Elsevier
2. Water Research, Elsevier
3. Bioresource Technology, Elsevier
4. Science of the Total Environment, Elsevier
5. Environmental Science and Pollution Research, Springer