Course Outline

CE0853 - Environmental Hydraulics

(1) Overview

Faculty	Engineering		
Department	Civil Engineering		
Level of Studies	First Cycle - 5 years - Diploma in Engineering		
Course Code	**CE0853**	**Semester**	8
Course Title	**Environmental Hydraulics**		

Teaching Activities *if credits are awarded for separate components of the course e.g. lectures laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits*	**Weekly Teaching Hours**	**ECTS**
Lectures	3	5
Laboratory Practice		
	3	**5**

Course Type *Select: general background, special background, specialised general knowledge, skills development*	Specialization Course (ME)
Prerequisite knowledge (courses):	Fluid Mechanics (CE0430) -- English level B2 or higher is required for Erasmus incoming students
Language (teaching):	Greek
Is the Course offered to Eramsus /International Students	Yes
Course webpage (e-class/URL)	https://eclass.uniwa.gr/courses/CIV217/

(2) Module Aims – Learning Outcome

Learning Outcome

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course.

- *Learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area*
- *Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning*

Learning the basic elements of development and application of numerical models in the scientific field of Environmental Hydraulics. Knowledge of the scope and the necessary parameters that must be included in a numerical model is extremely important. Upon completion of the course the student will be able to:

A) To determine the basic procedures for the transfer and mixing of pollutants in water recipients.

B) To develop and implement models of pollutant mixing.

C) To assess the quality of surface water.

D) To assess the environmental impact of the exploitation of water resources.

F) To assess the quality of surface water from anthropogenic activities.

G) To select the appropriate liquid waste disposal device.

H) To participate in water resources management projects.

General Skills

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), the course aims to effect the following skills

The course aims that the student acquires - practice the following general skills:

Search for, analysis of, and synthesis of data and information, implementing appropriate technologies

Independent work - Team work - Working in an international / interdisciplinary environment

Decision-taking

Proact free, creative and inductive thinking

(3) Module Syllabus

Overview of water flow in the environment; phenomena and processes related to such flows. Types and sources of pollution. Mass and heat transfer processes in surface water bodies (rivers, reservoirs, coastal waters). Balance equations for water and pollutants in surface water systems with instantaneous mixing. Piston flow and nominal retention time. Basic mixing mechanisms (advection, diffusion, dispersion). Fick's law. Turbulent diffusion. General formulation of the mass transport equation - special cases. Simulation of water quality. Turbulent buoyant jets (plane and round). Mixing in the near and far field. Flow and concentration fields. Stratification. Typical wastewater disposal systems (diffusers, multiple diffusers, rosettes etc.). Environmental and hydraulic design of Submerged pipe outfall system.

(4) Teaching and Learning Methodology – Assessment

Teaching method *Face to face in class, Distant learning, etc.*	Face-to-face in-class teaching. When needed, distance teaching (synchronous/asynchronous)
Use of ICT *Use of ICT in Teaching and Lab practice, communication with students, etc.*	Use of I.C.T. in Teaching and Student Communication
Teaching Breakdown *Lectures, seminars, lab practice, fieldwork, study and analysis of literature, tutorial workshops, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's hours of study per learning activity are accounted including the hours of nondirected study (according to ECTS principles).*	

Activity	***Study workload per semester***
In Class (/Distance) Teaching	39
Literature Study	45
Exercises / Paradigms	34
Project assignmenet / Essay	32
Total Activity	**150**

Student Performance Evaluation *Listing/description of the student's performance evaluation criteria / methods* *The evaluation criteria should be explicitly defined and communicated to the students*	Written examination, 2,5-hours Problem solving, Multiple choice test, Questions and Answers, Written Essay / Project The evaluation criteria are announced to the students well before the examination; weights per subject /exercise are explicitly indicated.

	The examination results (including total / parial grading) are announced on the web. Students may require to have access to their tests, they may ask for clarifications on mistakes, grading etc. The examination is in Greek for resident students. Erasmus students are examined in English.

(5) Suggested Literature

1. Advances in Environmental Fluid Mechanics, Dragutin T. Mihailovic & Carlo Gualtieri (Editors), ISBN 978-981-429-300-6. World Scientific, 2010

2. Diffusion Models of Environmental Transport, Bruce Choy & Danny D. Reible, ISBN 978-156-670-414-4. CRC Press, 1999.

3. Environmental Fluid Mechanics (Lecture Notes), Benoit Cushman-Roisin (2019). (http://www.dartmouth.edu/~cushman/courses/engs151/chapters.html).

4. Environmental Fluid Mechanics, H. Rubin & J. Atkinson, ISBN 978-082-478-781-3. CRC Press, 1999.

5. Environmental Fluid Mechanics. Memorial Volume in Honour of Prof. Gerhard H. Jirka. W. Rodi & M. Uhlmann (Eitors), ISBN 978-0-203-80396-7. CRC Press, 2012.

6. Environmental Hydraulics for Open Channel Flows, H. Chanson, ISBN: 0-7506-6165-8, Elsevier, 2004

7. Environmental Hydraulics. Vijay P. Singh & Willi H. Hager (Eitors), ISBN 978-90-481-4686-4, Springer-Science & Business Media, 1996.

8. Environmental Modeling Using MATLAB (2nd Edition), Ekkehard Holzbecher, ISBN: 978-3-642-22042-5. Springer-Verlag Berlin Heidelberg, 2012.

9. Free-Surface Flow: Environmental Fluid Mechanics, Nikolaos D. Katopodes, ISBN: 978-012-815-489-2. Butterworth-Heinemann, 2018.

10. Introduction to Environmental Engineering and Science (3rd Edition), Gilbert M. Masters & Wendell P. Ela, ISBN: 978-1-292-02575-9. Pearson, 2014.

11. Mixing and Dispersion in Flows Dominated by Rotation and Buoyancy. Herman J. H. Clercx & Gertjan F. Van Heijst (Eitors), ISBN 978-3-319-66886-4, Springer, 2018.

12. Mixing in Inland and Coastal Waters, H. B. Fischer, E. J. List, R. C. Y. Koh, J. Imberger and N. H. Brooks, ISBN 0-12-258150-4. Academic Press Inc. (USA), 1979.

13. Turbulent Jets and Plumes - A Lagrangian Approach, Joseph Hun-wei Lee & Vincent Chu, ISBN: 978-1-4615-0407-8. Springer US, 2003

14. Water Quality Modelling for Rivers and Streams, Marcello Benedini and George Tsakiris, ISBN: 978-94-007-5508-6. Springer, 2013

15. Water-Quality Engineering in Natural Systems, David A. Chin, ISBN: 978-0-471-71830-7. John Wiley & Sons, Inc., 2007.

16*. Environmental Stratified Flows, Roger Grimshaw, e-ISBN 978-0-306-48024-9, Springer, Boston, MA, 2002.