8.9 CE0823 – Dams and Appurtenant Hydraulic Structures

(1) GENERAL

SCHOOL	ENGINEERING SCHOOL		
ACADEMIC UNIT	CIVIL ENGINEERING DEPARTMENT		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**CE0823**	**SEMESTER**	**8**
COURSE TITLE	**Dams and Appurtenant Hydraulic Structures**		

INDEPENDENT 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**	**CREDITS**
	4	4
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).	**4**	**4**

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialization Course
PREREQUISITE COURSES:	Fluid Mechanics (CE0430) Hydraulics (CE0520)
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	No
COURSE WEBSITE (URL)	https://eclass.uniwa.gr/courses/CIV228/

(2) LEARNING OUTCOMES

Learning outcomes

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 are described.
Consult Appendix A

- *Description of the level of 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 and Appendix B*
- *Guidelines for writing Learning Outcomes*

The aim of the course is to help students understand the fundamental concepts of hydraulic structures with emphasis on dams, which are considered some of the most challenging civil engineering structures. The content includes an introduction to the design of a dam for water storage or irrigation purposes, for flood protection, and for energy production. The different sources of uncertainty in dam design (hydrologic, hydraulic, geological, structural, etc.) are discussed, as well as the relevant Greek legislation and Construction & Engineering Law and regulations. The implementation difficulties which pertain to the geology and seismicity of the area, the socio-environmental impacts of dam construction that must be taken into account, selection of the size and material

of the dam, required reservoir storage capacity, sediment management, and various other factors are also presented. Examples are given of large dams in Greece and abroad, and of the most important dam appurtenant hydraulic structures, such as river diversion works, outlet works, energy dissipators, flow weirs, spillways, etc.

Upon completion of the course, students will have acquired:

1. Basic knowledge of the uncertainties and implementation difficulties associated with the design of a dam.
2. Basic knowledge of the steps and procedures for the construction of a dam, according to the Construction & Engineering Law and relevant regulations.
3. In-depth knowledge and critical understanding of the appurtenant hydraulic structures.

Students will also be able to:

1. Identify the type of a dam, its various zones if it is a zoned type dam, and its appurtenant hydraulic structures of a dam.
2. Comprehend and review the content of a preliminary design report for a small dam

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?;.

Search for, analysis and synthesis of data and information, with the use of the necessary technology	*Search for, analysis and synthesis of data and information, with the use of the necessary technology*
Adapting to new situations	*Adapting to new situations*
Decision-making	*Decision-making*
Working independently	*Working independently*
Team work	*Team work*
Working in an international environment	*Working in an international environment*
Working in an interdisciplinary environment	*Working in an interdisciplinary environment*
Production of new research ideas	*Production of new research ideas*

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
- Decision-taking
- Independent work - Team work - Working in an international / interdisciplinary environment
- Project planning and management
- Respect natural environment - Social, professional and ethical responsibility

(3) SYLLABUS

1. Introduction to the design, construction and management of a dam (historical background, hydrologic and hydraulic uncertainty issues, complexity, most common types of dams, material selection, examples of dam failures, etc.).
2. Hydrologic analysis for the design of a dam (intensity-duration-frequency curves, return period, water balance, flood peak discharge, ecological flow, sediment flow, required storage capacity of the reservoir).
3. Hydraulic analysis for the design of a dam and its appurtenant hydraulic structures (river diversion works, outlet works, energy dissipators, flow weir, spillways).
4. Preliminary analysis and design of a small hydroelectric dam.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face in-class teaching. When needed, distance teaching (synchronous/asynchronous)
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Use of I.C.T. in Teaching and Student Communication

Use of ICT in teaching, laboratory education, communication with students	
TEACHING METHODS *The manner and methods of teaching are described in detail.* *Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc.* *The student's study hours for each learning activity are given as well as the hours of non- directed study according to the principles of the ECTS*	

Activity	***Semester workload***
In Class (/Distance) Teaching	52
Literature Study	35
Exercises / Paradigms	18
Project assignment / Essay	15
Course total	**120**

STUDENT PERFORMANCE EVALUATION *Description of the evaluation procedure* *Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open- ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	Language of evaluation: Greek 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 / partial grading) are announced on the web. Students may require to have access to their tests, they may ask for clarifications on mistakes, grading etc.

(5) ATTACHED BIBLIOGRAPHY

Greek Bibliography:

1. Μουτάφης, Ν., Βιντεοσκοπημένα μαθήματα: Υδραυλικές κατασκευές - Φράγματα, Τομέας Υδατικών Πόρων και Περιβάλλοντος, Εθνικό Μετσόβιο Πολυτεχνείο, 2014. (In Greek)
2. Νουτσόπουλος, Γ., Χριστοδούλου, Γ., Τ. Παπαθανασιάδης, Τ., Υδραυλική Ανοικτών Αγωγών, Εκδόσεις Φούντα, 2010. (In Greek)
3. Παπαντώνης, Δ.Ε., Μικρά Υδροηλεκτρικά Έργα, 456 σ., Εκδόσεις Συμεών, Αθήνα, 2008. (In Greek)
4. Τσόγκας, Χ.Ε., και Ε.Χ. Τσόγκα, Υδροδυναμικά Έργα – Φράγματα, Εκδόσεις ΙΩΝ, 2009. (In Greek)

Foreign Bibliography:

1. Chanson, H., The hydraulics of open channel flow, Elsevier, 2004.
2. Chow V.T., Open-Channel Hydraulics, McGraw Hill, 1959.
3. Novak, P., A.I.B. Moffat, C. Nalluri, and R. Narayanan, Hydraulic Structures, 4th edition, Taylor & Francis, 2007.
4. Chen Sheng-Hong, Hydraulic Structures [electronic resource: https://link.springer.com/book/10.1007%2F978-3-662-47331-3], Springer, 2015

Related academic journals:

1. Journal of Hydrology, Elsevier.
2. Journal of Hydrological Sciences, Taylor & Francis
3. Journal of Hydraulic Engineering, ASCE.