COURSE OUTLINE

1. GENERAL

SCHOOL	Environment and Agricultural Engineering		
ACADEMIC UNIT	Department of Natural Resources Development & Agricultural Engineering		
LEVEL OF STUDIES	Master		
COURSE CODE	630042	**SEMESTER**	2nd
COURSE TITLE	Water Resources Systems Analysis		

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**
Lectures and laboratory exercises	3	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Specialised general knowledge
PREREQUISITE COURSES:	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	English
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes (English)
COURSE WEBSITE (URL)	https://oeclass.aua.gr/eclass/courses/5385/

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 goal of this course is to introduce participants to general concepts of systems analysis and systems engineering as they apply to the planning, design and operation of water resources systems. The course builds upon the general concepts of systems analysis, economic evaluation, and project planning and provides the necessary background for Computer-Aided Water Management and Control.

Advances in computing and information technology are revolutionizing how we manage our water resources. The goal of this course is to introduce participants to the linkage of computing, information technology, and practical aspects of water resources management. The course will describe general concepts of systems analysis and modeling, within a Decision Support System framework, as these models apply to the planning, design and operation of water resources systems. The use of computer models allows the water resources engineer to efficiently and effectively evaluate many alternatives and to promote improved decision-making. Students will apply simulation, optimization, and multi-criteria decision analysis models to example problems in water resources. The course will also discuss how emerging technologies such as evolutionary optimization, collaborative community-based modeling approaches, and collaborative sharing of information might be used to improve water resources management. While not all students will become model developers, it is important that all students understand the model development process. All students will be expected to effectively use the models presented in the course.

This course will concentrate on the traditional application of systems concepts to the planning design and operational planning of single reservoir systems using primarily deterministic hydrology. While reservoirs are only one many water resources management tools, they are an excellent "typical example" for applications of systems analysis concepts and are used in this course as a metaphor water resources systems in general.
By the end of the course you are expected to be able to:

1. Understand and apply the systems approach for analyzing basic water resources problems.
2. Understand the process of designing and applying simulation and optimization models for water resources management.
3. Understand the application of multi-criterion decision analysis techniques to water resources problems.
4. Develop operational guidelines for single and multi-purpose reservoirs.
5. Understand emerging technologies that are being applied in systems analysis.

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	*Project planning and management*
Adapting to new situations	*Respect for difference and multiculturalism*
Decision-making	*Respect for the natural environment*
Working independently	*Showing social, professional and ethical responsibility and sensitivity to gender issues*
Team work	*Criticism and self-criticism*
Working in an international environment	*Production of free, creative and inductive thinking*
Working in an interdisciplinary environment	*……*
Production of new research ideas	*Others…*
	…….

- Team work
- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Working independently
- Decision-making
- Respect for the natural environment
- Project planning and management
- Production of free, creative and inductive thinking

3. SYLLABUS

Week 1-2: Introduction to Water Resources Systems Analysis

- **Overview and Water Resources Systems Modeling:**
  - Modeling Methods for Evaluating Alternatives.
- **Basic Concepts of Modeling**
  - Basic Concepts of Simulation.
  - Reservoir Simulation.

Week 3-5: Basic Concepts of Modeling

- **Optimization Methods, Fuzzy Optimization and Data-Based Models:**
  - Basic Concepts of Optimization.
- **Collaborative model development:**

Week 6-7: Multi criteria decision analysis (MCDA).

- MCDA Software Overview Take home EXAM.
- Conflict Resolution – MCDA
- .MCDA Tradeoff

Week 7-8: Reservoir Operational Concepts

- **River Basin Planning Models**
  - Reservoir Operational Concepts.
  - Reservoir Operation: Demonstration of Various Models.

Week 9-10: Reservoir Operational Concepts

- Reservoir sizing (water supply, flood control, hydropower, environmental requirements, entertainment).
- Reservoir operation (water supply, flood control, hydropower, environmental requirements, entertainment).
- Stochastic operation analysis..

Week 11: Multiple Reservoir Systems

- River basin simulation models.

- River basin level planning (Project selection, dimensioning and prioritization)
- River basin level (simulation and optimization).

Week 12: Multi-objective Operational Concepts

- Multi-objective decision analysis
- Environmental requirements, Social-recreational requirements
- Co-utilization of surface water and groundwater

Week 13: FINAL EXAMS-PRESENTATIONS

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face & distance learning • Lecture-Based Learning • E-Learning • Internships and Work-Study Programs • Field Trips • Guest Lectures • Group Projects
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• Basic software (windows, word, excel, power point, web, etc) • Aua webmail • AV material • Powerpoint slides
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***
Lectures	24
project, essay writing	6
Waste industry Guest lecturer	
Field visits	
Course total	***30***

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.*	• **Final project:** Covering material from all of the course (35%). • **Homework:** Individual work (30%). • **Examinations:** They will include two exams during the course (35%).

5. ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- ***Loucks, D.P. and E.van Beek, 2005.*** *Water Resources systems Planning and Management,*
- ***Mays, L.W. and Yeou-Koung Tung,*** *Hydrosystems engineering and management, McGraw-Hill, Inc., N.Y., N.Y., 1992.*

- ***Fontane. D., 1986-2020.*** *Water Resources Systems Analysis. Class notes. Civil and Environmental Engineering Department, Colorado State University, Fort Collins, CO. U.S.A.*

- Related academic journals:

- ***Journal of Water Resources Management,*** *Springer., USA.*
- ***Journal of Water Resources Planning and Management,*** *American Society of Civil Engineers., USA.*
- ***Water*** *MDPI*