TITLE: Agrometeorological and Hydrological Models

Course supervisor: Ioannis X. Tsiros, Professor

Teaching Staff:

I.X. Tsiros, *AUA Professor*

Dr N. Proutsos, *Senior Researcher,* Institute of Mediterranean Forest Ecosystems, Hellenic Agricultural Organization - DIMITRA

G.A. Karantounias, *AUA Emeritus Professor*

1. GENERAL INFORMATION

FACULTY/SCHOOL	PLANT SCIENCES		
DEPARTMENT	CROP SCIENCE		
LEVEL OF STUDY	POSTGRADUATE		
COURSE UNIT CODE		**SEMESTER**	2nd
COURSE TITLE	Agrometeorological and Hydrological Models		
INDEPENDENT TEACHING ACTIVITIES		**WEEKLY TEACHING HOURS**	**ECTS (CREDIT UNITS)**
Lectures and Laboratory exercises		5	5 ECTS
COURSE TYPE	Elective		
PREREQUISITE COURSES	-		
LANGUAGE OF INSTRUCTION	Greek		
THE COURSE IS OFFERED TO ERASMUS STUDENTS	Yes		
COURSE WEBSITE (URL)			

2. LEARNING OUTCOMES

Scope and Learning outcomes

Through their contact with extensive environmental model applications (characteristic case studies in a wide range of agricultural areas), students become familiar with both Agrometeorological and Hydrological models' basic concepts and general philosophy and gain experience in analyzing and interpreting models' results (outputs). In addition, students consider the crucial role and of simulation modeling as a tool for the rural sector's sustainability and development.

General Competences

- Search, analysis and synthesis of data and information, using the necessary technologies.
- Autonomous work on course's disciplines
- Teamwork

3. COURSE CONTENT

- Principles and philosophy of mathematical simulation modeling. Model conceptual representation, functional representation (fundamental environmental transport and chemical processes) and computational representation (prototype representation, forcing functions, numerical solution techniques).
- Agrometeorological and hydrological simulation and modeling. Overview. The hydrologic cycle and its components. The stochastic nature of hydrological processes. Rainfall as part of agrometeorological and hydrological models. Basic rainfall-runoff models in agricultural and forest areas. Snow and snowmelt in modeling. Infliltration. Governing equations. Approximate models and numerical methods. Surface runoff, storage and routing. Overland Flow Theory. Watershed Modeling Approaches. Simulating runoff with lumped models. Evapotraspiration models. Subsurface Water Flow Theory. Erosion and sedimentation

processes. Interrill processes, Rill erosion processes, channel processes. Interfacing the erosion model with the hydrological model. Water quality modeling, transport and chemical processes. Agronomic and crop processes and modeling.

- Model categories and classification. Selected models (see 'References). Overview and demonstrative applications.
- Applications of selected well known models (see 'References') in typical case studies of agricultural areas with emphasis on their main simulation parameters (weather and climate factors, soil and crop characteristics, cropping system management techniques, etc).

4. TEACHING ANDLEARNING METHODS—STUDENTS PERFORMANCE EVALUATION

MODES OF DELIVERY	Teaching in the classroom.
USE OF INFORMATION AND COMMUNICATION TECHNOLOGY	Learning process support through the online library. PowerPoint presentation of lectures.
COURSE DESIGN	

Activity	Semester work load
Lectures	40
Tutorial essays	20
Technical report on model application to a case study	35
Self-directed study	30
Course total ***(25 working hours per credit unit)***	**125**

STUDENT PERFORMANCE EVALUATION/ASSESSMENT METHODS	Performance evaluation is based on the preparation of essays and a full Technical Report on the application of simulation models in a case study.

5. SUGGESTED BIBLIOGRAPHY:

Papers, Books and Technical Reports:

- Ambrose, R., Tsiros, I., Wool, T. 2005. Modeling Mercury Fluxes and Concentrations in a Georgia Watershed Receiving Atmospheric Deposition Load from Direct and Indirect Sources, J. Air & Waste Manage. Assoc. 55, 547-558.
- Ambrose, R. and Wool T. 2017. The Water Analysis Simulation Program (WASP). Version 8. U.S. Environmental Protection Agency, Athens, Georgia, USA.
- Better Assessment Science Integrating Point and Non-point Sources (BASINS model). https://www.epa.gov/hydrowq/better-assessment-science-integrating-point-and-non-point-sources-basins
- Chapra S. C., Pelletier G. J. and Tao H. 2006. QUAL2K: A Modeling Framework for Simulating River and Stream Water Quality, Version 2.04: Documentation and Users Manual, Civil and Environmental Engineering Dept., Tufts University, Medford, MA., March 7, 2006, 101 p
- EPIC: A Crop & Soil Productivity Simulation Model**.** https://epicapex.tamu.edu/
- National Research Council, 1991. Opportunities in the Hydrologic Sciences, National Academy Press, Washington DC, USA
- The Soil & Water Assessment Tool (SWAT) Model. https://swat.tamu.edu/

Scientific Journals:

- Journal of the American Water Resources Association
- Journal of the Air and Waste Management Association
- Modelling & Software
- Ecological Modelling
- Water Resources Research
- Agricultural and Forest Meteorology
- Journal of Hydrology
- Hydrological Sciences Journal
- Hydrology and Earth System Sciences