COURSE OUTLINE

1. GENERAL

SCHOOL	School of Environment and Agricultural Engineering		
ACADEMIC UNIT	Development of Natural Resources and Agricultural Engineering		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	2035	**SEMESTER**	6th
COURSE TITLE	AGRICULTURAL MICROMETEOROLOGY		

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	3	5
Laboratory exercises	2	
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*	Special background
PREREQUISITE COURSES:	None
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES (In English)
COURSE WEBSITE (URL)	

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 subject of the course is an analysis of the microclimatic conditions around and within agricultural holdings. In more detail, the radiation balance around and inside the plant as a result of the effect of vegetation is examined and analysed. The radiation regime in crops is also analysed as a result of the effect of the topographic relief (slope, orientation, etc.) and the relevant equations are developed. Subsequently, laminar, and turbulent flow over natural surfaces, the related equations of motion and continuity, and their applications are described. Additionally, the flow approaches near the ground surface are analysed, as well as the anemometric regime in and above the crop. Emphasis is placed on the momentum, mass and heat exchange processes in the atmosphere-plant-soil system (SPAC), as well as the mathematical methods of approaching the phenomena. Furthermore, the transfer of heat to the soil and its temperature regime are also analysed. The energy balance in crops and the methods of measuring flows on and within the plant canopy are presented in detail.

The course provides a comprehensive overview of the micrometeorological and microclimatic conditions of typical crops in the Greek area, as well as urban vegetation in structured tissue. It also analyses the techniques and organisation of micrometeorological measurements, as well as the methods of displaying their spatiotemporal changes. The

objective of the course is to analyse hydrological parameters and processes, including evaporation, evapotranspiration, precipitation, water retention, interception, and water surface trapping. Additionally, the course will cover methods of estimating and forecasting evapotranspiration, as well as models and their implementations related to microclimatic conditions.

The laboratory exercises aim to consolidate the basic concepts of agricultural micrometeorology and to enable the students to become proficient in the management of the relevant parameters. They also aim to gain experience and familiarity with the concepts of agricultural micrometeorology and its applications in production processes.

On successful completion of the course the student will be able to

- Understand the microclimatic behaviour of the atmosphere in and around major crops.
- Analyse energy, momentum, and mass exchanges in the plant environment and in the vegetation-soil-atmosphere system (SPAC).
- Know the techniques for measuring microclimatic/micrometeorological parameters and their visualisation
- Analyse the main processes affecting the water balance of crops (evapotranspiration, volatilisation, surface capture, retention, etc.)
- Know how to use micrometeorological and microclimatic models

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…*
	…….

3. SYLLABUS

- Crop microclimates. Penetration and radiation regime in the plant canopy. Optical properties and structure of horticultural crops. Shortwave and longwave radiation in crops.
- Configuration of the radiation regime in sloping agricultural areas of different orientation. Derivation of radiation balance equations and applications.
-Laminar and turbulent flow regimes over natural surfaces. Derivation and applications of the equations of motion and the continuity equation.
- Semi-empirical and empirical approaches to near-surface flow. The wind regime above and within the canopy.
- Momentum, mass, and heat exchange in the atmosphere-plant-soil system. Aerodynamic approach to mass and heat transfer. Eddy covariance method. Bowen Ratio method. Effect of atmospheric stability-instability conditions.
- Heat transfer to the ground. Analytical, semi-analytical and numerical approaches to heat wave propagation and soil temperature estimation.
of the ground.
- Plant Energy balance. Net Radiation flux , Sensible and Latent heat flux, Soil heat fluxes. Measurement of fluxes over and into a crop.
- Micrometeorology-Microclimatology of characteristic crops of the Greek area. Micrometeorology-Microclimatology of vegetation in urban areas.
Study of the relationship between urban greenery and the built environment.
- Evaluation of micrometeorological parameters and study of their spatial-temporal distribution in vegetated areas of the urban environment.
- Micrometeorological instruments. Installation and data recording methods. Data acquisition systems for automatic monitoring, transmission, reception, and processing of micrometeorological

parameters.
- Hydrological deficits on small spatial-temporal scales: Evaporation - Evapotranspiration, Precipitation water retention (interception, surface trapping).
- Evapotranspiration. Modern assessment and forecasting methods.
- Micrometeorological-microclimatic models: Structure

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	The teaching methodology employed in the classroom involves active student participation through interactive question and answer sessions.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *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*	
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.*	The laboratory examination is part of the: - Written final examination (short answer or multiple choice or a combination thereof) - A written laboratory examination consisting of a written computational test. - Identification of micrometeorological instrument characteristics in laboratory and field

Activity	***Semester workload***
Lectures	26
Lab exercises	26
Field works	25
Autonomous Study	48
Course total	***125***

5. ATTACHED BIBLIOGRAPHY

- Monteith, J., & Unsworth, M. (2013). Principles of environmental physics : plants, animals, and the atmosphere. Academic Press.
- Allen, R. G., Pereira, L. S., Raes, D., & Smith, M. (1998). Crop evapotranspiration Guidelines for computing crop water requirements-FAO Irrigation and drainage paper 56. FAO, Rome, 300(9), D05109.
- Foken, T., & Napo, C. J. (2008). Micrometeorology (Vol. 2). Berlin: Springer.