COURSE OUTLINE

1. GENERAL

SCHOOL	AGRICULTURAL SCIENCES		
ACADEMIC UNIT	AGRICULTURE		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	AGR_200	**SEMESTER OF STUDIES**	2nd
COURSE TITLE	Physics – Agrometeorology		

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 course	2	
Total	5	
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (4).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	General background, special background, specialised general knowledge
PREREQUISITE COURSES:	There are no prerequisite courses.
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	-
COURSE WEBPAGE (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*

At the end of this course students will:

1. Have a grasp of concepts of physics related to the fields of agriculture in which they are engaged
2. Be trained in thermodynamics and heat transfer issues occurring in closed agricultural systems (greenhouses)
3. Understand the phenomena occurring in the lower atmosphere, the mechanisms that govern them, their importance in the growth and development of crops and be able to predict the production of crops using meteorological data
4. Understand energy and water balances at field and basin scales so that they can use their knowledge of micrometeorological and microclimate conditions to select suitable crop, crop location and crop practices in a given area

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*
	Showing social, professional and ethical responsibility and sensitivity to gender issues

Working independently	*Criticism and self-criticism*
Teamwork	*Production of free, creative and inductive thinking*
Working in an international environment	*……*
Working in an interdisciplinary environment	*Others…*
Production of new research ideas	*…….*

At the end of this course the student will have further developed the following skills (general skills):
1. Ability to demonstrate knowledge and understanding of essential data, concepts, theories and applications related to Physics.
2. Ability to apply this knowledge and understanding to solving problems related to the physics of the agricultural environment.
3. Ability to interact with others in problems of a natural or interdisciplinary nature.

Upon completion of this course, the student will develop the following general competencies:

-Ability to search for, analyze and synthesize data and information using the necessary technologies
-Adaptation to new situations.
- Decision making.
- Independent work.
- Free, creative and inductive thinking.

3. SYLLABUS

Theoretical part
1. Introductory Concepts of the Natural Environment, Identification of natural mechanisms that affect the climate of an area. Earth's Climate - Climate Change. General climate interactions with plants and animals. Impact of climate change on agriculture and the environment
2. Atmospheric Structure and Composition. Vertical Distribution of Air Pressure and Temperature, Areas, Mass and Thickness of the Atmosphere, General Forms of Hydrostatic Equation, Origin and Evolution of the Earth's Atmosphere
3. Thermodynamics of the atmosphere for phenomena related to meteorology and climatology. Temperature, relative and absolute humidity. Phase changes, Thermal expansion, Equation. Radiation flows, sensible heat, latent heat, ground heat.
4. Air Pollution. Atmospheric stability and adiabatic heat gradient, Dynamic temperature, Classification of temperature inversions, Meteorological mixing height, Gas pollutants and suspended particles. Transport of pollutants
5. Definition and properties of fluids. Mechanical behavior of solids and fluids. The fluid state. Density, pressure and temperature. Internal energy, enthalpy, entropy, special heat capacity. Fluid Compressibility - Viscosity. Fluid Dynamics - Navier Stokes Equations.
6. Environment and Radiation. Electromagnetic waves. Wavelength, frequency, absorption, reflection and refraction. Solar radiation. Thermal radiation. Radiation balance around and within farms
7. Heat Transfer. Heat transfer mechanisms in greenhouse and agricultural systems. Energy conservation principle. First and second thermodynamic positions;
8. Heat transfer by conduction. Fourier Law. General differential equation of treatment and solutions to various geometries.
9. Synchronous heat transfer. Physical and forced synagogue. Basic dimensional numbers. Empirical relationships for heat generation in agricultural systems.
10. Radiation heat transfer. Radiation and matter interaction. Black body, gray body. Radiation laws of the black body. Radiation exchange between inks and gray surfaces. Surface shape factor. Absorption-reflectivity-permeability.
11. Evapotranspiration. Rainwater retention (interception), surface trapping (depression), modern methods of estimation and forecasting, basic functions of meteorological phenomena (rain, dew, humidity).
12. Air pollution climatology and environmental pollution in agricultural areas. Environmental problems from agricultural activities. Basic principles, concepts, and environmental impact assessment process
13. Bioclimatic indicators (sensible temperature, discomfort, dryness). Frost protection. Meteorological phenomena adversely affecting agricultural production. Forecasting crop production using meteorological data.

Laboratory part
1. Space-Time Scales in Agrometeorology. Earth and Sun, Elements of Solar Geometry. Units of measurement and physical constants.

2. Meteorological instruments and sensors. Sensors for measuring temperature, humidity, pressure, solar radiation, wind speed, etc. Exposure and recording of measured parameters.
3. Automatic weather stations. Design of OMC network management station (EMS). Datalogger and analyzer (micro 4.5) experimental and micro region data. Operation of data acquisition networks by OMCs. Statistical processing of micro-meteorological parameters with Analyzer 4.5. Analysis of meteorological data to determine the climate of rural areas.
4. Potential Evapotranspiration. Actual Evapotranspiration. Water balance in the field. Water balance elements for assessing the microclimate of agricultural areas.
5. Mass diffusion and gas pollution micro-meteorology in agricultural areas. Point and non-point pollution of agricultural areas. Assessment by qualitative and quantitative criteria
6. Agro-climatic and atmospheric circulation models. Applications from their combined use to assess the potential impacts of climate change on Georgia.
7. Physical and agro-meteorological applications and exercises.

4. TEACHING AND LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to face lectures.
USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES *Use of ICT in teaching, laboratory education, communication with students*	Use of ICT (powerpoint) and panel in teaching. Physics Problem Solving Methodology. Exemplary solving exercises.
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.*	1. Course attendance - Participation in the classroom 2. Short Answer Questions 3. Solving laboratory exercises 4. Written final examination of all material including subjects requiring lengthy answers and / or multiple choice questions to be used for overall student assessment in conjunction with laboratory results. Minimum passing grade: 5. 5. All the above are taking place in Greek.

Activity	***Semester workload***
Lectures (3 contact hours per week x 13 weeks)	39
Laboratory course (2 contact hours per week × 7 weeks) with representative problem solving	14
Final examination (3 contact hours)	3
Study hours and preparation for the final exams	69
Course total	***125 hours total workload***

5. ATTACHED BIBLIOGRAPHY

1. H. D. Young και R. A. Friedman, 2012. Πανεπιστημιακή Φυσική με Σύγχρονη Φυσική, 2η Ελληνική έκδοση, Τόμος Γ': Θερμοδυναμική και Σύγχρονη Φυσική, Εκδόσεις Παπαζήση, ΑΘΗΝΑ. ISBN:9789600224733

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3. Δαλέζιος, Ν. 2015. Αγρομετεωρολογία. Ανάλυση και Προσομοίωση. (Ηλεκτρονικά Συγγράμματα 'Κάλλιπος'). ISBN: 978-960-603-134-2

4. Μπαλτάς Ε. 2013. Εφαρμοσμένη Μετεωρολογία. Εκδόσεις Ζήτη, Θεσσαλονίκη. ISBN:9789604563760

5. Mavi H. and Tupper G., 2004. Agrometeorology: Principles and Applications of Climate Studies in Agriculture. CRC Press. ISBN: 9781560229728