COURSE OUTLINE

1. GENERAL

SCHOOL	ENVIRONMENT AND AGRICULTURAL ENGINEERING		
ACADEMIC UNIT	NATURAL RESOURCE DEVELOPMENT & AGRICULTURAL ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**51**	**SEMESTER**	6^{TH}
COURSE TITLE	MEASUREMENTS AND SENSORS		

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	3
LABORATORY EXERCISES	1	1
TOTAL	4	4
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:	• MATHEMATICS I • MATHEMATICS II • MATHEMATICS III • PHYSICS • ELECTROTECHNICS-ELECTRICAL MACHINES
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	GREEK
IS THE COURSE OFFERED TO ERASMUS STUDENTS	NO
COURSE WEBSITE (URL)	To be constructed

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*

Upon successful completion of the course, the student(s) will:

- have acquired basic knowledge of the principles of operation, the instrumentation of measurement sensors and their applications in measurements in the field of agriculture.

- be able to design the procedures for sampling, as well as to design and perform measurements in natural or artificial systems
- be able to evaluate and statistically process measurement results, as well as to analyse and evaluate errors.
- have the ability to assess the effect of systematic errors arising from instrumentation and material tolerances in a device or measurement system.
- have the ability to evaluate random errors and the methods required for their estimation.
- be able to identify possible interferences in a measurement environment and to propose techniques to reduce them.
- be able to operate basic electronic instruments and use them appropriately for the measurement of basic electrical quantities.
- be able to design a simple measuring device.
- be able to evaluate types of sensors by considering their operating principle, adaptation circuits, their accuracy characteristics, their dynamic characteristics, their fields of application and their calibration techniques.
- be able to evaluate a basic measuring device and identify the possible causes of errors and tolerances.
- be able to select appropriate adaptation circuits for the purpose of measuring physical and other quantities through sensors.
- be able to select appropriate A/D circuits for the purpose of reading sensor measurements from corresponding digital data reading and recording systems
- be able to analyse the adaptation circuits, the method of clarification and calibration and the applications of sensors for basic physical quantities (temperature, pressure, flow, humidity, pH, conductivity, displacement, force, etc.)
- be able to design experiments, analyse physical patterns that rule systems and calculate physical properties and parameters.
- be able to program in an environment suitable for visualisation and measurement processing.
- be able to use measurement data collection systems and develop corresponding applications in both classical and graphical programming environments.

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…*
	…….

Research, analysis and synthesis of data and information, using the necessary theoretical knowledge and established technologies.

Application of theoretical knowledge in practice.

Ability to work both independently and in teams.

Working in an interdisciplinary environment.

Decision-making.

Promotion of free, creative and deductive thinking.

3. SYLLABUS

Introduction. Basic principles of metrology. Sensors and transducers. Measuring devices. Static and dynamic characteristics of measuring instruments and systems. Measurement errors. Accuracy and reliability of measurements. Noise and grounding of reference. Filters. Calibration of measuring instruments. Passive and active sensors. Balance methods. DC and AC bridges. Measurement of electrical quantities. Polymeters. Sensors for measuring temperature and related quantities. Sensors for measuring humidity and moisture content of soil, substrates, fruits and other bio-materials. Length measurement. extensometers and LVDT. Measurement of force and related quantities. Pressure measurement. Measurement of body velocity. Doppler effect meters. Radars. Ultrasonic meters. Anemometers. Flowmeters. Rotameters. Acceleration measurement. Accelerometers. Bimorphs. Energy absorbing materials. Measurement of optical variables. Photometry. Chromatometry. Advanced optical measurement methods. Remote sensing. Measurement of chemical quantities and ISFETs. Measurement of pH, electrical conductivity and chemical composition. Digital transducers. Computer-based measurement systems. Data imaging and recording. Signal regulation and interfacing. Sensor networks. Data collection and processing systems.

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	✓ Use of ICT in teaching and communication with students ✓ Laboratory education
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	90
Laboratory practice	30
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.*	1. Written Examination (Conclusion on Theory): 100% 2. Technical laboratory reports: 40%. 3. Oral Examination in laboratory environment: 60%.

5. ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

- Additional suggested bibliography:

1. Sensors for Measurement and Control, Konstantinos Kalovrektis & Nikolaos Katevas, TZIOLA PUBLICATIONS, THESSALONIKI 2014.
2. Electrical Measurements and Sensors, Kostas Kalaitzakis & Eftihis Koutroulis, KLIDARITHMOS PUBLISHINGS, ATHENS 2010.
3. Measurement Systems, John B. Bentley, ION PUBLICATIONS, ATHENS 2009
4. Measurement and sensor technology, A.Gasteratos-S.Mouroutsos-I.Andreadis, TSOTRAS PUBLICATIONS, 2013.
5. Laboratory Exercises Brochure.