COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF ELECTRONICS ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	2606004	**SEMESTER**	6
COURSE TITLE	Electronic Measurements – Sensors & ElectroMagnetic Compatibility		

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 (ECTS)**
Lectures	2	4
Laboratory	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*	Specialisation Course
PREREQUISITE COURSES:	None
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES (in English)
COURSE WEBSITE (URL)	http://measurements.teipir.gr

(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 this course module students possess advanced knowledge, skills and competences in the subject of Electronic Measurements, Sensors and EMC that enable them to:

1. select the appropriate signal conditioning circuits for measuring physical and other parameters via sensors,
2. select the appropriate ADC to read sensor measurements from respective digital reading systems and data loggers,
3. identify possible interference at measurement environment and propose mitigation techniques,
4. evaluate types of sensors considering the principle of operation, the signal conditioning circuits, accuracy, dynamics, their application fields as well as their calibration techniques,

5. analyze the signal conditioning circuits, the calibration method and the applications of a basic sensor (i.e. temperature, displacement, force, etc.),
6. use measurement data acquisition systems and develop corresponding applications in typical and graphical programming.

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…*
	…….

- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Working independently
- Team work

(3) COURSE CONTENT

Lectures

1. Introduction to electronic measurement systems and data acquisition.
2. OpAmp circuits for measurement systems, isolation amplifiers, V to I, V to F and C to F converters.
3. Interference and noise in measurement systems.
4. Temperature sensors, (principle of operation, signal conditioning and calibration)
5. Position sensors, (principle of operation, signal conditioning and calibration)
6. Stress and strain sensors, (principle of operation, signal conditioning and calibration)
7. Digital instrumentation and measurements. A/D converters and smart sensors.
8. Electronic instrument systems (oscilloscopes, generators, spectrum, network and distortion analyzers).
9. Instrument to computer interface IEEE 488. Graphical programming and virtual instruments.

Laboratory Experiments

1. Distortion analysis
2. Thermo-coupler temperature sensor
3. RTD temperature sensor
4. LVDT sensor
5. LVDC sensor
6. Hall sensor
7. Strain gauge sensor
8. Computer to instrument communication (GPIB)

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
Face-to-face, Distance learning, etc.</td><td>Face to face lectures</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students</td><td>• Use of electronic presentation with multimedia content in class,
• Student support through the course webpage and the departmental e-learning platform,
• Electronic communication of instructors and students, through the course webpage and by e-mail.
• Use of virtual multi-meters emulation software in the lab.</td></tr>
<tr><td>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</td><td>Lectures, Laboratory experiments and study.

<table><tr><th>Activity</th><th>Semester workload (hours)</th></tr><tr><td>Lectures</td><td>26</td></tr><tr><td>Study for lectures</td><td>26</td></tr><tr><td>Laboratory experiments</td><td>26</td></tr><tr><td>Report on lab experiments</td><td>26</td></tr><tr><td>Study and preparation for exams</td><td>16</td></tr><tr><td>Course Total</td><td>120</td></tr></table></td></tr>
<tr><td>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.</td><td>Student evaluation is performed in the language of instruction.

Final course grade =
Lectures part grade x 60% + Laboratory part grade x 40%,

Lectures part grade results from:
Final written exam on all taught material. The exam includes:
• Multiple choice questions,
• Development questions,
• Problem solving involving sensors and measurements.

Laboratory part grade results from:
• Written test on two groups of lab experiments.
• Reports on lab experiments.
• Oral grade from lab participation.</td></tr>
</table>

(5) ATTACHED BIBLIOGRAPHY

Essential reading

Lecture notes by the instructors

Recommended Books

1. NORTHROP, R. B. Introduction to Instrumentation and Measurements, CRC Press.
2. DOEBELIN, E.O., Measurement Systems, McGraw-Hill.
3. KLAASSEN, K. B., Electronic Measurement and Instrumentation, Cambridge University Press.

4. PALLAS-ARENY, R. and J. G. WEBSTER, Sensors and Signal Conditioning, Wiley.
5. FRADEN, J., Handbook of Modern Sensors, AIP.
6. KULARATNA, N., Modern Electronic Test and Measuring Instruments, IEE series.
7. BENTLEY, J.P., Measurement Systems, Longman.