COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF ENGINEERING		
ACADEMIC UNIT	DEPARTMENT OF ELECTRONICS ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	2607007	**SEMESTER**	7
COURSE TITLE	Intelligent Control Systems		

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	NO
COURSE WEBSITE (URL)	http://labpower.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 Intelligent Control Systems that enable them to:

1. Describe a discrete-time control system using basic block diagrams.
2. Design and construct an industrial analog controller in order to improve the characteristics of a given system.
3. Design and implement a digital controller for use in continuous or discrete-time systems.
4. Solve any combinational or sequential logic problems and implement the solution through the use of programmable logic controllers (PLCs).
5. Program logic controllers (PLC) for the implementation of solutions to given problems in continuous or discrete time systems.
6. Use a PC interface in order to monitor and control an industrial processes.

7. Design and implement intelligent building systems using the KNX platform.

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
- Production of free, creative and inductive thinking

(3) COURSE CONTENT

Lectures

1. Closed loop discrete-time systems (description and stability in the Z domain).
2. State variables, controllability and observability of a system in the state space.
3. Improvement / compensation schemes and design of controllers (PID, phase-lead, phase-lag)
4. Digital controllers to analog systems.
5. Programmable logic controllers (PLC).
6. Industrial controllers.
7. Remote control technologies.
8. Digital Control Applications
    a. monitoring / control of industrial processes,
    b. "Smart" buildings - building energy management systems - BMS ,
    c. management of renewable energy sources and control of PV.
9. Fuzzy logic and fuzzy control.
10. Robust and intelligent control:
    a. robotic arm motion,
    b. optimization of production lines.

Laboratory Experiments:

Exercises in the laboratory

1. Speed control. Controller compensation with PID.
2. Position control (Parallel compensation).
3. Temperature control flowing gas. Compensation with a PID.
4. Automation with PLC S7_200.
5. Level Control with PC and the NI-9008 card.
6. Use of a Robot to select objects.

Exercises over the Internet (http://labpower.teipir.gr)

1. Speed Control.
2. Fluid level Control.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to face lectures
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	• 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, • Virtual Lab experiments over the Internet.
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*	Lectures, Laboratory experiments, projects, study.

Activity	***Semester workload (hours)***
Lectures	26
Study for lectures	26
Laboratory experiments - projects	26
Report on lab experiments – group projects	26
Study and preparation for exams	16
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.*	Student evaluation is performed in the language of instruction. Final course grade = Lectures part grade x 60% + Laboratory part grade x 40% <u>*Lectures part grade:*</u> • Projects (2) (20%) • Final written exam (80%) Final written exam includes development questions and problem solving questions. <u>*Laboratory part grade:*</u> • Evaluation on each lab experiment and report (60%) • Evaluation on lab group projects and presentation (40%)

(5) ATTACHED BIBLIOGRAPHY

Essential reading

1. Papazacharia, Ch., Solution for PLC programming and installation, Athens, Greece.
2. Malatestas, P., Automatic Control Systems, Vol. A and B, Tziolas Eds., Thessaloniki, Greece, 2010.

Recommended Books

1. Dorf, R.C. and Bishop, R.H., Modern Control Systems, Prentice-Hall, 2000.
2. Kailath, T., Linear System Theory, Prentice-Hall, 1980.
3. Chen, C.-T., Linear System Theory and Design, HRW, 1981.
4. Ogata, K., Modern Control Engineering, Prentice Hall Inc., New Jersey, 1997.
5. Kuo, B.C., Automatic Control Systems, Prentice-Hall Inc., New Jersey, 1995.
6. Lecture Notes by the instructor (2011).