COURSE OUTLINE

(1) GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	ELECTRICAL AND COMPUTER ENGINEERING DEPT.		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**ECE_ELE760**	**SEMESTER**	**7**
COURSE TITLE	ADVANCED AUTOMATIC 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**
Lectures	3	
Seminars / Practice exercises		
Laboratory	1	
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (4).	4	5

COURSE TYPE *general background, special background, specialised, general knowledge, skills development*	Specialised, skills development
PREREQUISITE COURSES:	No. Students are advised to have already attended the course: Automatic Control Systems
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBSITE (URL)	https://www.ece.uop.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*

The course is a continuation and completion of the Automatic Control Systems course and includes automated control systems in real conditions in the industry with many inputs and outputs and changing processes. The main purpose of the course is to educate students in mechanical systems of automatic control (hydraulic, pneumatic, thermal) and to provide knowledge on optimal control, digital control, sample automatic control and Fuzzy logic control with examples and applications. In addition, the course aims to educate students in the analysis and automation of complex systems, multivariate systems and large-scale systems using computers. Finally, techniques for solving nonlinear automated control systems are taught.

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
- *Decision-making*
- Working independently
- Team Work
- Project planning and management
- Criticism and self-criticism
- Production of free, creative and inductive thinking

(3) SYLLABUS

Theory :

- Hydraulic, pneumatic and thermal automatic control systems: description, transfer functions, stability, etc., simulation with electrical systems and special applications.
- Sampling automatic control: sampling, pulse transfer function of simple and complex open and closed systems, stability, applications.
- State space analysis of control systems, their description in the vector space, applications of multivariate systems, applications in electrical circuits and mechanical systems.
- System optimization: optimization criteria, maximum entropy principle (MEP) mutual information principle (MIP), system controllability.
- Digital control systems with computers and algorithms.
- Non-linear control systems: phase level method, time and frequency responses, improvement of non-linear automatic control systems.
- Systems analysis with stochastic signals: response of automatic control systems to stochastic signals and behavioral analysis.

Laboratory :

- Data study of a closed control system - Find a characteristic of the preamplifier- Highlight of closed system error signal with operational amplifier
- Automatic DC servomotor position control - Study of dead zone, step response
- Automatic servo motor speed control using P, PI, PD and PID controllers
- Study of hydraulic position servo mechanization
- Electro-hydraulic speed control system study
- Study of Pneumatic Automatic control systems
- Study of robotic arms (hydraulic-electric)

- Modeling of natural systems using Matlab
- Design of P, PI, PD and PID controllers using Matlab
- System stability study with root geometry using Matlab

Attendance of laboratory exercises is mandatory.

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	Face to face in class and in the laboratory.
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	➢ Teaching in the classroom with ICT ➢ Laboratory Training with ICT ➢ Support of learning process through the e-Class platform ➢ Specialized software (Matlab or Octave) for design and dynamic simulation of automatic control systems and controller design. ➢ Use of the internet to find additional information about the course.
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 evaluation is done in the Greek language *Assessment of Theoretical Part:* Written final exam on the theoretical part of the course which includes solving exercises and problems of graded difficulty. *Evaluation of Laboratory Part:* Oral examination during laboratory exercises, written intermediate exam, written work Attendance of laboratory exercises is mandatory. The final grade results from the weighting of the theory and laboratory grades with weights of 70% and 30%, respectively.

Activity	***Semester workload***
Lectures	39
Lecture & bibliography study (at home)	40
Laboratory Exercises (in Lab)	13
Projects (homework)	13
Independent study (at home)	20
Course Total	***125 hours (5 ECTS)***

(5) ATTACHED BIBLIOGRAPHY

Suggested bibliography:

In Greek :

1. Α. Υφαντή, *Σύγχρονα θέματα συστημάτων αυτομάτου ελέγχου*, Εκδόσεις Ίων, 2005.
2. Κ. Καρύμπακα, Ε. Σερβετά, *Συστήματα αυτομάτου ελέγχου - Τόμος Ι*, Έκδοση Κ. Καρύμπακα, 1983.
3. Κ. Καρύμπακα, Ε. Σερβετά, *Συστήματα αυτομάτου ελέγχου - Τόμος ΙΙ*, Έκδοση Κ. Καρύμπακα, 1985.
4. Κ. Καρύμπακα, Ε. Σερβετά, *Συστήματα αυτομάτου ελέγχου - Τόμος ΙΙΙ*, Έκδοση Κ. Καρύμπακα, 2001.
5. Π. Ν. Παρασκευόπουλου, *Εισαγωγή στον αυτόματο έλεγχο*, Έκδοση Π. Παρασκευόπουλου, 2001.
6. Π. Ν. Παρασκευόπουλου, *Λυμένες ασκήσεις συστημάτων αυτομάτου ελέγχου*, Έκδοση Π. Παρασκευόπουλου, 1993.
7. Ν. Ι. Κρικέλη, *Εισαγωγή στον αυτόματο έλεγχο: Θεωρία και εφαρμογές*, Εκδόσεις Συμμετρία, 2000.
8. Π. Β. Μαλατέστα, *Συστήματα αυτομάτου ελέγχου - Τόμος Β*, Εκδόσεις Τζιόλα, 2010.
9. Ν. Πανταζή, *Πνευματικά συστήματα αυτόματου ελέγχου*, Εκδόσεις Ίων, 1992.
10. Α. Υφαντής, *Εργαστηριακές σημειώσεις Συστημάτων Αυτομάτου Ελέγχου ΙΙ*, Τεχνολογικό Εκπαιδευτικό Ίδρυμα Πάτρας, 2002.

In English :

1. K. Ogata, *Συστήματα αυτομάτου ελέγχου*, Εκδόσεις Φούντα, 2011.
2. R. T. Stefani, B. Shahian, C. Savant, C. J. Hostetter, *Συστήματα αυτομάτου ελέγχου*, Εκδόσεις Επίκεντρο, 2012.
3. R. C. Dorf, R. H. Bishop, *Σύγχρονα συστήματα αυτομάτου ελέγχου*, Εκδόσεις Τζιόλα, 2003.
4. K. Ogata, *Modern control engineering*, Prentice Hall, 1997.
5. K. Ogata, *State space analysis of control systems*, Prentice Hall, 1967.
6. N. S. Nise, *Control systems engineering*, Wiley, 2003.
7. MathWorks Inc., *Control system toolbox user's guide: Matlab*, www.mathworks.com, 2012.
8. MathWorks Inc., *Simulink toolbox user's guide*, www.mathworks.com, 2012.