COURSE OUTLINE

(1) GENERAL

SCHOOL	ENGINEERING		
ACADEMIC UNIT	ELECTRICAL AND COMPUTER ENGINEERING DEPT.		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**ECE_K560**	**SEMESTER**	**5**
COURSE TITLE	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*	Special background
PREREQUISITE COURSES:	There are no prerequisite courses. However, students should have sufficient knowledge of Physics, Electrical and Electronic Circuits and Electrical Machines and possess the necessary mathematical background.
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 main goal of the course is to introduce the students to the basic concepts of automatic control systems and the practical issues regarding the analysis and design of physical systems. In this context the various control methods and techniques, as well as the basic building blocks of a typical system are presented. In addition, the behavior of the individual components of the different types of physical systems, as well as issues related to the stability of linear control systems, are examined. The coexistence of the above knowledge in combination with a number of examples and laboratory exercises aims to give students an acquaintance with useful applications of automatic control systems.

Learning Outcomes

Upon successful completion of the course the student will be able to:

At the knowledge level

- design of block diagrams using individual component blocks for the composition of control systems
- recognize and capture the flow of information in the form of signal flow graphs
- apply methods for modeling and analysis of the physical components of different types of physical systems
- determine the transfer function of simple dynamic systems
- determine the response of simple dynamic systems in the time and frequency domain
- study the stability of control systems.

At the skills level

- familiarize with the analysis and design of automatic control systems
- be trained in using methods and techniques to study the behavior of automatic control systems
- be trained in using specialized software tools for designing and studying automatic control systems

At the level of abilities

- select the proper components for designing an automatic control system considering the functional and non-functional requirements
- to solve practical problems that appear during automatic control systems design
- to use specialized software tools for designing and studying automatic control systems
- to evaluate the properties, the capabilities and the features of an automatic control system

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
- Independent Work
- Teamwork
- Promotion of free, creative and inductive thinking

(3) SYLLABUS

The course covers key topics in the classical automatic control systems theory, as well as useful applications. It includes the description and behavior of the basic building blocks, the fundamental study methods in analysis and design of the automatic control systems, as well as their behavior in time and frequency domain.

The course includes the following thematic areas:

Lectures

- Fundamentals of automatic control systems, design principles and various performance assessment criteria
- Analysis of different types of physical systems with emphasis on their components and the physical laws of their operation

- Review of the necessary mathematical background
- Analysis of linear systems, linearization techniques, systems analysis in the frequency domain, transfer functions
- Block diagram models
- Signal-flow graph models
- Feedback and its effect on the characteristics of the systems
- Steady-state error for standard test signals
- The concept of stability and stability criteria
- The root locus method
- Frequency response methods - Bode diagrams
- Nyquist diagrams
- Nichols chart

Laboratory exercises

- Introduction to the units of a D.C. servo system - Speed control system with armature or field control of a D.C. servo system (Open loop system).
- Operational amplifier as comparator- Speed control system with armature or field control of a D.C. servo system (Closed loop control system).
- Closed loop speed control system – Effect of Gain on speed change for load change.
- Introduction to Matlab (variables, functions, plots, matrices, arrays, polynomials)
- Modeling dynamic systems using Matlab (transfer function, pole-zero model, partial fractions form, state space)
- System response in the time domain and in the frequency domain using Matlab (Bode diagram, Nyquist diagram, Nichols chart, impulse response and step response). Stability analysis using Matlab.

(4) TEACHING and LEARNING METHODS - EVALUATION

<table>
<tr><td>DELIVERY
Face-to-face, Distance learning, etc.</td><td>Face-to-face in-class lecturing</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students</td><td>• Use of slides in electronic form (ppt).
• Lecture notes posted on the e-Class platform.
• Laboratory training using appropriate devices and specialized software (Matlab, Octave)
• Support of learning process through e-class platform.
• Use of e-mail to communicate with students</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>
<table>
<tr><th>Activity</th><th>Semester workload</th></tr>
<tr><td>Lectures</td><td>39</td></tr>
<tr><td>Study of lectures and bibliography</td><td>39</td></tr>
<tr><td>Laboratory Exercises (in Lab)</td><td>13</td></tr>
<tr><td>Lab exercises and problem solving</td><td>19</td></tr>
<tr><td>Preparation for exams</td><td>15</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Course Total</td><td>125 hours (5 ECTS)</td></tr>
</table>
</td></tr>
<tr><td>STUDENT PERFORMANCE EVALUATION</td><td>• Written Final Examination (WFE) on the theoretical part of the course based upon solving exercises and problems</td></tr>
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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.*	of graduated difficulty. The partial grade points corresponding to each query are listed. • Evaluation of laboratory exercises and assignments. Deliverables in electronic form and oral and/or written evaluation (ELE) on their content. • The final grade of the course is calculated as 0.7xWFE + 0.3xELE. • The examination process and the evaluation criteria are publicly available to the students through e-Class. • Language of evaluation: Greek

(5) ATTACHED BIBLIOGRAPHY

- *Suggested bibliography:*

- Dorf Richard C., Bishop Robert H., Σύγχρονα Συστήματα Αυτομάτου Ελέγχου, 13η έκδοση, Εκδόσεις ΤΖΙΟΛΑ, 2017.
- Π. Β. Μαλατέστας, Συστήματα αυτομάτου ελέγχου, 2η έκδοση, Εκδόσεις ΤΖΙΟΛΑ, 2017.
- Βελώνη Α., Κανδρής Δ., Συστήματα Αυτομάτου Ελέγχου, Εκδόσεις Α. ΤΖΙΟΛΑ & ΥΙΟΙ Α.Ε, 2017.
- K. Ogata, Συστήματα αυτομάτου ελέγχου, 5η έκδοση, Εκδόσεις ΦΟΥΝΤΑ, 2011.
- R. T. Stefani, B. Shahian, C. Savant, C. J. Hostetter, Συστήματα αυτομάτου ελέγχου, 4η έκδοση, Εκδόσεις Επίκεντρο, 2012.
- Norman S. Nise, Συστήματα Αυτόματου Ελέγχου, Norman S. Nise, 7η έκδοση, Εκδόσεις ΓΡΗΓΟΡΙΟΣ ΧΡΥΣΟΣΤΟΜΟΥ ΦΟΥΝΤΑΣ, 2016
- Α. Υφαντή, Εργαστηριακές σημειώσεις συστημάτων αυτομάτου ελέγχου Ι, Τεχνολογικό Εκπαιδευτικό Ίδρυμα Πάτρας, 2002.
- MathWorks Inc., Control system toolbox user's guide: Matlab, www.mathworks.com, 2012.
- MathWorks Inc., Simulink toolbox user's guide, www.mathworks.com, 2012.

- *Related academic journals:*