AUTOMATIC SYSTEM CONTROL

1. GENERAL

SCHOOL	ENGINEERING		
SECTION	INFORMATICS & COMPUTER ENGINEERING		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE		**SEMESTER OF STUDY**	BP 8th, EY 8th
COURSE TITLE	AUTOMATIC SYSTEM CONTROL		

INDEPENDENT TEACHING ACTIVITIES *in case the credits are awarded in distinct parts of the course e.g. Lectures, Laboratory Exercises, etc. If the credits are awarded uniformly for the entire course, indicate the weekly teaching hours and the total number of credits*	**WEEKLY HOURS TEACHING**	**CREDIT UNITS**
Lectures	2	
Practice Exercises	1	
Laboratory	1	
Add rows if needed. The organization of teaching and the teaching methods used are described In detail at 4.	**4**	**5**

COURSE TYPE *Background, General Knowledge, Scientific Area, Development Skill*	Scientific Area, Skills Development
PREREQUISITES COURSES:	
LANGUAGE OF INSTRUCTION and EXAMINATION:	Greek
THE COURSE IS OFFERED TO ERASMUS STUDENTS	Yes (in English)
ONLINE COURSE PAGE (URL)	

2. LEARNING OUTCOMES

Learning Outcomes

The learning outcomes of the course are described, the *specific knowledge, skills and abilities* of *an appropriate level that students will acquire after the successful completion of the course.*

Consult Appendix A

- *Description of* the *Level of Learning Outcomes for each study cycle according to the European Higher Education Area Qualifications Framework*
- *Descriptors of Levels 6, 7 & 8 of the European Qualifications Framework* for *Lifelong Learning and Annex B*
- *Summary Guide for writing Learning Outcomes*
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Students should be able to:

- They have an in-depth understanding and application of the classic methods of analysis and design of automatic control systems.
- They model simple physical systems using mathematical tools.
- They use useful tools for description, analysis and design of SAE.
- Clarify the value of various mathematical tools in the development of SAE.

General Skills

Taking into account the *general competencies that* the *graduate must have acquired (as listed in* the *Diploma Supplement and listed below) which of them is the subject aimed at?*	
Search, *analysis* and synthesis *of data and information, using the necessary technologies* *Adapting to new situations Decision making* *Autonomous work* *Teamwork* *Working in an international environment*	*Project planning and management* *Respect for diversity and multiculturalism Respect for the natural environment* *Demonstration of social, professional and moral* skills *responsibility and sensitivity to gender issues Criticism and self-criticism* *Promotion of free, creative and inductive thinking*
Working in an interdisciplinary environment *Generating new research ideas*	

- Autonomous Work
- Teamwork
- Search, analysis and synthesis of data and information, using the necessary technologies and tools.

3. COURSE CONTENT

Theoretical Part

- Introduction to S.A.E.
- Mathematical Concepts: The basic signals.
- Laplace Transform.
- Laplace reverse transformation.
- Laplace transformation applications.
- Systems Description: Types of mathematical models.
- Allodifferential equations, transport function, impact response.
- Go from description to description.
- Tier diagrams.
- Examples of S.A.E.
- Systems Analysis in the Field of Time: An analytical expression of the temporal response of systems.
- First and second order systems.
- Comparison of the behavior of open and closed systems.
- System faults in the permanent state.
- Geometric Place of the Roots.
- Systems Analysis in the Frequency Field: Harmonic response.
- Correlation of harmonic and temporal response.
- Bode diagrams.
- Nyquist charts.
- Stability: Definition of Clogged-Inlet Barrier-Exit (FEFE) stability.
- Fefe stability criteria.
- Algebraic stability criteria FEFE (Routh, Hurwitz, continuous fractions), the Nyquist criterion.
- Systems Description: State equations, transition from description to description, equivalence of descriptions.
- Description of components and devices of automatic control systems.
- Description of S.A.E. practices
- Systems Analysis in the Realm of States: Solution of State Equations.
- Observability and controllability.
- Classic S.A.E. Design Methods: General, specifications.
- Design with amplifiers and with PID.
- Design with phase-advance, phase delay and delay-pre-phase pre-phase networks.

Laboratory Part

- Introduction to LABVIEW.
- Study and design of automatic control systems using the LABBVIEW CONTROL DESIGN TOOLKIT.
- PLC simulation using LADSIM software.
- PLC simulation using LOGIXPRO software.

- PID controllers.
- Identification of control systems using BODE diagrams.
- The inverse pendulum problem

4. TEACHING AND LEARNING METHODS - ASSESSMENT

HOW TO DELIVER *Face-to-face, Remote education , etc.*	Face-to-face (in class)
USE OF TECHNOLOGIES INFORMATION AND COMMUNICATIONS *Use of ICT* in *Teaching, in Laboratory Training, in Communication with students*	Use of slides during the educational process and during laboratory practice to demonstrate the exercises to the students. Use of specialized software.
TEACHING ORGANIZATION *The way and methods of teaching* are described *in detail.* *Lectures, Seminars, Laboratory Exercise, Field Exercise, Bibliography* Study & Analysis, *Tutorial, Practice* (placement), *Clinical Practicum*, *Art Workshop*, *Interactive teaching*, *Educational visits*, *Project preparation, Writing of work / assignments*, *Artistic creation, etc.* *The student's study hours for each learning activity as well as* the *hours of unguided study* are listed *so that the total workload at semester level corresponds to ECTS standards*	<table><tr><th>Activity</th><th>Workload Semester</th></tr><tr><td>Lectures</td><td>26</td></tr><tr><td>Practice exercises</td><td>13</td></tr><tr><td>Laboratory Exercises</td><td>13</td></tr><tr><td>Assignments</td><td>21</td></tr><tr><td>Independent Study</td><td>52</td></tr><tr><td>**Course Total** (25 hours of load working per credit unit)</td><td>**125**</td></tr></table>
STUDENT EVALUATION *Description of the evaluation process* *Assessment Language, Assessment Methods, Formative or Inferential*, *Multiple Choice Test, Short Answer Questions*, *Essay Development Questions, Problem Solving, Written Assignment*, Report */Report, Oral Exam, Public Presentation, Laboratory Work, Clinical Patient Examination, Artistic Performance,* Other / *Other* *Explicitly defined* assessment *criteria* are indicated and *if and where they are accessible to students.*	Theoretical section evaluation (60%) I. Written final exam (40%) Ii. Project participation (20%) Laboratory Practical Exercises I . Individual or group (up to a maximum of 3 persons) exposure to any laboratory exercise It includes a description of the exercise, presentation of measurements, presentation of results (calculations, diagrams, etc.) and formulation of conclusions. (10%) Ii. Weekly oral examination on the subject of the laboratory exercise to be performed (15%) Iii. Final written exam (10%)

5. RECOMMENDED-BIBLIOGRAPHY

- Suggested Bibliography :

1. A. Veloni, D. Kandris, Automatic Control Systems, Tziola Publications, 2017.
2. A. Veloni, Automatic Control Systems – Analysis and Simulation, Tziola Publications, Thessaloniki 2011.
3. P. Malatestas, Automatic Control Systems, Volume B, and. Tziola, Thessaloniki 2001.
4. P. Malatestas, Exercises in Automatic Control Systems, Volume B, and. Tziola, Thessaloniki2007.
5. R. Village R., R. Bishop, Modern Automatic Control Systems, And. Tziola, Thessaloniki 2003.
6. A. Veloni - A. Palamides, Control Systems Problems: Formulas - ,Matlab® and Solutions, CRC Press, USA 2011.
7. Ogata, Katsuhiko: "Modern Control Engineering (5th Edition)", Prentice-Hall, Inc., 2009 (ISBN: 0-13-615673-8) (Main Textbook).
8. Goodwin, Graham, Graebe Stefan, Salgado, Mario: Control System Design", Prentice-Hall, Inc., 2001 (ISBN: 0-13-958653-9).
9. Astrom, Karl and Murray, Richard: Feedback Systems: An Introduction for Scientists and Engineers", Princeton University Press, 2008 (ISBN: 0-691-13576-2).

- Related websites :

1. Control Tutorials for Matlab, Carnegie Mellon
2. Control Engineering Virtual Library, University of Cambridge
3. Scientific American
4. IEEE Control Systems Society
5. Journal of IFAC, the International Federation of Automatic Control, Elsevier
6. IEEE Spectrum
7. IEEE Transactions on Automatic Control
8. SIAM Journal On Control and Optimization
9. Systems & Control Letters, Elsevier
10. MIT's OpenCourseWare

- Related scientific journals :

1. http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=37
2. http://www.ieeecss.org/publications/csm
3. http://www.controleng.com/magazine.html