COURSE OUTLINE: AUTOMATIC CONTROL SYSTEMS I

1. GENERAL

SCHOOL	Engineering		
DEPARTMENT	Electrical and Computer Engineering		
LEVEL OF STUDY	Undergraduate		
COURSE UNIT CODE	6.003	**SEMESTER**	6th
COURSE TITLE	**Automatic Control Systems I**		

COURSEWORK BREAKDOWN	**TEACHING WEEKLY HOURS**	**ECTS Credits**
Theory (Lectures)	3	3.5
Tutorial/Exercises	1	1
Laboratory	1	1.5
TOTAL	**5**	**6**

COURSE UNIT TYPE	Specialized knowledge/Skills development
PREREQUISITES	4.004 - Signals and Systems
LANGUAGE OF INSTRUCTION/EXAMS	Greek
COURSE DELIVERED TO ERASMUS STUDENTS	No
WEB PAGE (URL)	https://eclass.hmu.gr/courses/ECE190/

2. LEARNING OUTCOMES

Learning Outcomes

The course provides an introduction to the theory of automatic control for linear continuous-time systems. The course material covers the mathematical representation and analysis of dynamic systems in the time and frequency domains, as well as the fundamental tools and main methods for the analysis, design, and application of automatic control systems.

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

- Understand and recognize the structural elements of an automatic control system and the ways of mathematically describing and analyzing dynamic systems.
- Specify performance specifications and design criteria for an automatic control system.
- Understand and apply a series of analysis and synthesis tools such as step response plots, root locus diagrams, Bode plots, and Nyquist diagrams.
- Be familiar with and apply methods for designing PID controllers and Lead/Lag controllers.
- Utilize modern computational tools for the analysis and design of automatic control systems.
- Have a substantial understanding of the practical application of the above concepts through laboratory applications on real automatic control setups for a comprehensive understanding of theoretical concepts.

General Skills

The study and successful completion of the course contribute to the development of general skills related to:

- Research, analysis, and synthesis of data and information, utilizing necessary technologies.
- Promotion of free, creative, and inductive thinking.
- Bridging theoretical knowledge with practical skills.
- Adaptability to new situations.
- Decision-making.

3. SYLLABUS

Theoretical lectures

- Introduction to automatic control systems.
- Mathematical modeling of dynamic systems through differential equations - linearization of nonlinear systems.
- Step response plots - Laplace Transform - Transfer Functions.
- Dynamic response of first and second-order linear systems.
- Steady-state response - static errors of control systems.
- Properties of closed-loop systems.
- Analysis and synthesis of automatic control systems using the root locus method.
- Analysis and design of three-term controllers.
- Frequency response of automatic control systems - analysis through Bode and Nyquist diagrams.
- Stability analysis and design of lead/lag controllers in the frequency domain.

Laboratory exercises

1. Study and identification of a direct current motor servo mechanism.
2. Speed control of a servo mechanism.
3. Position control of a servo mechanism.

4. TEACHING METHODS - ASSESSMENT

MODE OF DELIVERY	In-Class Face-to-Face
USE OF INFORMATION AND COMMUNICATION TECHNOLOGY	▪ Use of ICTs in lecturing ▪ Use of ICTs in laboratory sessions ▪ Use of ICTs for the communication with students via the e-class platform
TEACHING ORGANIZATION	

Method description/Activity	Semester Workload
Lectures	52
Laboratory sessions	13
Report preparation	25
Tutorials	20
Non-guided personal study	75
Total Contact Hours	**180**

ASSESSMENT METHODS	All announcements for the course regulations and complementary reading material are posted on the course web page. The course grade incorporates the following evaluation procedures: 1. Written examination (65 %) • Problem solving • Multiple choice questions 2. Laboratory reports (35 %)

5. RECOMMENDED BIBLIOGRAPHY

-Recommended Bibliography:

- "Control Systems Engineering", N.S. Nise, 992 pages, Fountas, 2016. (*in Greek*)
- "Modern Control Systems", R.C. Dorf, R.H. Bishop, 1000 pages, Tziola, 2016. (*in Greek*)
- "Automatic Control Systems", B. Shahian, J.C. JR. Savant, G.H. Hostetter, T.R. Steafani, Epikentro, 2012. (*in Greek*)
- "Sistimata Automatoy Elegxou", P. Malatestas, Tziola, 2017. (*in Greek*)
- "Automatic Control Systems", B. Kuo, F. Golnaraghi, 764 pages, Ion, 2011. (*in Greek*)

Relevant Scientific Journals:

- IEEE Transactions on Automatic Control
- IEEE Transactions on Control Systems Technology
- International Journal of Control
- Automatica
- Control Engineering Practice
- Systems and Control Letters