Course unit title:	Control Engineering with Lab
Course unit code:	AEEE345
Type of course unit:	Compulsory
Level of course unit:	Bachelor (1st Cycle)
Year of study:	3
Semester when the unit is delivered:	6
Number of ECTS credits allocated :	6
Name of lecturer(s):	Dr. Lestas Marios
Learning outcomes of the course unit:	• Review Laplace Transform theory and define the block diagram representation of the open and closed-loop transfer function concept in engineering control systems. Appreciate the advantages of closed loop systems relative to open loop systems. • Derive the mathematical model of basic electrical, mechanical and hydraulic control systems. Introduce MATLAB and SIMULINK software tools. • Analyse the basic parameters of the closed-loop transfer function and the static characteristics of a control system. Determine experimentally and simulate the basic parameters of a DC Servo Motor Control System. • Examine the action of aperiodic signals in the transient-response analysis of first-, second- and higher-order control systems. Implement transient response analysis of first-order and second order control systems using MATLAB and SIMULINK. • Examine the action of the Proportional, Integral and Derivative Controllers on the static and transient characteristics of control systems. Model and simulate the effects of basic controllers on a DC Servo Motor Control using MATLAB and SIMULINK. • Interpret the meaning of stability of control systems in terms of the transfer function. Judge the stability of a closed-loop control system from the Routh-Hurwitch Criteria. • Draw Bode and Nyquist Plots. Judge the stability of a control system using the Phase and Gain margin criteria in frequency domain plots. • Interpret Root-locus design concepts and draw Root-Locus plots. Examine the effect of open-loop zeros and poles in Root-Locus Plots.
Mode of delivery:	Face-to-face
Prerequisites:	AMAT223, AMAT204, APHY112 — Co-requisites: None
Recommended optional program components:	None
Course contents:	• Introduction: Control Objective, Main Components a Control System, Open loop Systems, Closed Loop Systems, Control Design Procedure. • Derivation of Differential Equations for Electrical and Mechanical systems. • Laplace Transforms, Transfer Functions, Step Responses, Impulse Responses, Solution of Differential Equations. • Input-Output Stability, Poles, Zeros, Complex Numbers, Routh-Hurwitz Criterion. • Transient Response Characteristics, Percentage-Overshoot, Rise-Time, Steady State Response, Final Value Theorem. • Frequency Response, Bode Plots, Nyquist Stability Criterion, Phase Margins, Gain Margins.

	• Proportional Control Action, Phase Lead, Phase Lag Compensators, Integral Control Action. • Closed Loop Control Design using the Root Locus method.
Recommended and/or required reading:	
Textbooks:	• R.C. Dorf and R.H. Bishop, Modern Control Systems, Prentice Hall, 2017 • K. Ogata, Modern Control Engineering, Prentice Hall, 2009
References:	• G.F. Franklin, J.P. Powell and Enami-Naeini, Feedback Control of Dynamic Systems, Prentice Hall, 2014. • N.S. Nise, Control Systems Engineering, John Willey & Sons, 2015.
Planned learning activities and teaching methods:	• Students are taught the course through lectures (3 hours per week) in classrooms or lectures theatres, by means of traditional tools or using computer demonstration. • Auditory exercises, where examples regarding matter represented at the lectures, are solved and further, questions related to particular open-ended topic issues are compiled by the students and answered, during the lecture or assigned as homework. • Topic notes are compiled by students, during the lecture which serve to cover the main issues under consideration and can also be downloaded from the lecturer's webpage. Students are also advised to use the subject's textbook or reference books for further reading and practice in solving related exercises. Tutorial problems are also submitted as homework and these are solved during lectures or privately during lecturer's office hours. Further literature search is encouraged by assigning students to identify a specific problem related to some issue, gather relevant scientific information about how others have addressed the problem and report this information in written or orally. • Laboratory experiments are carried out in small groups and lab reports are required two weeks after the laboratory class resulting in a cumulative mark. • Students are assessed continuously and their knowledge is checked through tests with their assessment weight, date and time being set at the beginning of the semester via the course outline. • Students are prepared for final exam, by revision on the matter taught, problem solving and concept testing and are also trained to be able to deal with time constraints and revision timetable. • The final assessment of the students is formative and summative and is assured to comply with the subject's expected learning outcomes and the quality of the course.
Assessment methods and criteria:	• Assignments 5% • Tests: 20% • Laboratory Work: 15% • Final Exam 60%
Language of instruction:	English
Work placement(s):	No