Course unit title:	Analysis and Design of Mechanical Control Systems		
Course unit code:	ME327		
Type of course unit:	Compulsory		
Level of course unit:	Bachelor (1st Cycle)		
Year of study:	3		
Semester when the unit is delivered:	6 (Spring)		
Number of ECTS credits allocated :	6		
Name of lecturer(s):	Dr. Marios Lestas		
Learning outcomes of the course unit:	1. Develop a background on the different methods and principles used in control engineering and automation. 2. Learn to apply classical control theory to the analysis and synthesis of controlled dynamic systems. 3. Practice the ability to comprehend fundamental scientific principles and engineering laws and develop analytical skills in order to formulate and solve engineering problems. 4. Provide a general academic background in order to adapt to technological advancement in the context of Mechanical Engineering and lays the foundations for further education. 5. Gain practical experience in the use of modern engineering instruments and reinforces understanding through computerized and other experimentation.		
Mode of delivery:	Face-to-face		
Prerequisites:	AMAT314	Co-requisites:	None
Recommended optional program components:	None		
Course contents:	• **Introduction:** list the goals of control systems, define a model, distinguish inputs and output, plant and process, open and closed loop system, transducer and actuator, list common control systems. • **Mathematical modelling of systems in classic control:** describe the modelling process, apply Laplace and Inverse Laplace transforms, partial fraction expansions, explain the concept of transfer function, distinguish system classes according to their time dependence, linearity, memory, Apply linearization to non-linear systems. • **Time response: Transient and steady state response:** explain how poles and zeroes are controlling the response of systems, describe the response of first , second and higher order systems, explain parameters of Second-Order Systems like: Natural Frequency and Damping Ratio. • **Reduction of multiple systems:** explain the concept and uses of block diagrams, apply block diagrams to cascade, parallel and feedback applications, explain the concept of feedback systems. • **Analysis of stability in systems:** define stability of a system, apply the Ruth-Hurwitz stability criterion to determine the stability of a system. • **Accuracy: Steady state errors:** explain the concept of steady state error, compute the steady state error for systems with disturbances. • **The use of root locus:** explain the root locus methodology, sketch the root locus of a system. • **Frequency domain analysis:** sketch the Bode plot of a system, compute the gain and phase margin of a system		

	• **Automation:** demonstrate an ability to perform design for automation and processes, describe cells and robots. • **Laboratory work**, where students can apply their gained knowledge and evaluate practical problems for better comprehension
Recommended and/or required reading:	
Textbooks:	N. S. Nise, ***Control Systems Engineering***, John Wiley & Sons, 6th edition, 2010. R. C. Dorf, R. H. Bishop, ***Modern Control Systems***, Prentice Hall, 12th edition, 2010.
References:	K. Ogata, ***Modern Control Engineering***, Prentice Hall, 5th edition, 2009. C. L. Phillips, R. D. Harbor, ***Feedback Control Systems***, Prentice Hall, 5th edition, 2013. M. Groover, ***Automation, Production Systems, and Computer-Integrated Manufacturing***, Prentice Hall, 3rd edition, 2007. K. Ogata, ***Discrete-Time Control Systems***, Prentice Hall, 2nd edition, 1995. F. Golnaraghi, B. Kuo, ***Automatic Control Systems***, Wiley, 9th edition, 2009.
Planned learning activities and teaching methods:	The taught part of course is delivered to the students by means of lectures, conducted with the help of computer presentations. Lecture notes and presentations are available through the web for students to use in combination with the textbooks. Furthermore, theoretical principles are explained by means of specific examples and solution of specific problems. Lectures are supplemented with laboratory work carried out with the supervision of a lab assistant. Here a demonstration of actual experimental problems takes place. Additionally, during laboratory sessions, students apply their gained knowledge and identify the principles taught in the lecture sessions.
Assessment methods and criteria:	• Assignments: 5% • Tests: 20% • Laboratory Work: 15% • Final Exam: 60%
Language of instruction:	English
Work placement(s):	No