Course unit title:	Modern Control Systems Analysis		
Course unit code:	AEEE431		
Type of course unit:	Technical Elective		
Level of course unit:	Bachelor (1st Cycle)		
Year of study:	4		
Semester when the unit is delivered:	7,8		
Number of ECTS credits allocated :	6		
Name of lecturer(s):	Dr. Lestas Marios		
Learning outcomes of the course unit:	• Review matrix algebra, eigenvalues and eigenvectors, state variables, state-space equations. • Realise state space transfer functions, canonical forms, and transformation of system models. • Understand state space models, feedback controller design and optimal control of dynamic control systems. • Solve the linear time-invariant state equations. • Compute the state-transition matrix of linear time-invariant control systems. • Appraise linearization of non-linear systems. • Analyse feedback controller design in dynamic control systems using state observer design, optimal control and Linear Quadratic Regulator (LQR) concepts. • Appraise the notion of Cotrollability, Observability, and Liapunov stability in modern control systems. • Familiarise with robot programming languages and CAD simulations packages for robotic applications • Develop the state space models of dynamic control systems and apply pole placement via state feedback techniques.		
Mode of delivery:	Face-to-face		
Prerequisites:	AEEE345, AMAT223, AMAT204, APHY112	Co-requisites:	None
Recommended optional program components:	None		
Course contents:	• State space models of dynamic control systems: Review of matrix algebra, eigenvalues and eigenvectors. State variables. State-space equations. Linearization of non-linear systems. State space realisation of transfer functions. Canonical forms. Transformation of system models. • Linear time-invariant systems: Solution of linear time-invariant state equations. state-transition matrix. Cayley-Hamilton theorem. Controllability and Observability. Liapunov Stability. • Feedback Controller Design and Optimal Control: Pole placement with state feedback. State Observers. Optimal Control Design. Linear Quadratic Regulator (LQR) design.		
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. • The Essentials of Linear State-Space Systems, by J. Dwight Aplevich, 1st Ed. Wiley Text Books (1999).
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. • 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 10% • Tests: 30% • Final Exam 60%
Language of instruction:	English
Work placement(s):	No