UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria
ACADEMIC YEAR	2020/2021
BACHELOR'S DEGREE (BSC)	ELECTRONICS ENGINEERING
SUBJECT	AUTOMATIC CONTROL
TYPE OF EDUCATIONAL ACTIVITY	B
AMBIT	50285-Ingegneria dell'automazione
CODE	02190
SCIENTIFIC SECTOR(S)	ING-INF/04
HEAD PROFESSOR(S)	SFERLAZZA ANTONINO Ricercatore a tempo determinato Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	9
INDIVIDUAL STUDY (Hrs)	144
COURSE ACTIVITY (Hrs)	81
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	THEORY OF SYSTEMS AND CONTROLS - Corso: INGEGNERIA MECCANICA THEORY OF SYSTEMS AND CONTROLS - Corso: MECHANICAL ENGINEERING
YEAR	2
TERM (SEMESTER)	2° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**SFERLAZZA ANTONINO** Monday 15:00 17:00 Ufficio del Docente o su M. Teams (4r406w2) Thursday 11:00 13:00 Ufficio del Docente o su M. Teams (4r406w2)

DOCENTE: Prof. ANTONINO SFERLAZZA

PREREQUISITES	Basic knowledge of mathematics and physics. In particular: Complex numbers, matrix algebra, differential equations. Fundamentals of electrotechnics.
LEARNING OUTCOMES	Knowledge and understanding. The course of Automatic Control is a basic course in the analysis of dynamical systems and the design of control systems for any kind of real systems. The student, at the end of the course, will have gained a new approach to address and solve engineering problems of considerable importance from the application point of view. This approach is based on the construction of a mathematical model of the system under study, the experimental validation of this model, on the identification and verification of different properties of the model also useful in order to determine the suitable techniques for the design of the control system, on the validation the performance of the control system by means of digital simulation experiments performed on a Personal Computer using appropriate software tools and, finally, on the experimental verification of the prototype using the rapid prototyping devices for the implementation of the controlling of the control system itself. Applying knowledge and understanding. The student will be able to use the acquired methodologies for the engineering study of real systems that can be described by mathematical models and linear time-invariant also to more inputs and outputs (MIMO). It will, also, be able to design controllers both in the time domain based on elementary correction networks by synthetic techniques and in the Laplace domain. Making judgments. The student will be able to check the properties of the model under study and, consequently, to assess the actions required to achieve the ultimate goals of his study are to build a control system to meet specific project assigned. Communication skills. The communication skills of the student will be highlighted by the oral exam. Learning ability. The course also aims to stimulate student interest in the systematic approach used in the treatment of the various topics covered by the course itself. The student will acquire the methodology of the study will definitely be able to face and solve complex problems in the workplace.
ASSESSMENT METHODS	The acquisition of the required skills and abilities will be ascertained by a written test and an oral test. The written test, lasting a total of 3 hours, tends to ascertain the possession of the foreseen skills, abilities and competences. In particular, its structure provides exercises that respect constraints such as to make them comparable with predetermined correction criteria. The vote will be expresses by considering the following criteria in order of importance: 1) the logic followed by the student in solving the question; 2) the correctness of the procedure identified for the solution of the question; 3) the adequacy of the proposed solution in relation to the competences that the student assumes has acquired at the end of the course. The maximum mark attributed to the written test is 30/30. If the student obtains a minimum score of 18/30 in the written test, he will be admitted to the oral test. During the oral exam the student will have to demonstrate: 4) to have reached a sufficient capacity of expression through the use of an correct language; 5) to have developed the concepts and skills that the student is assumed to have acquired at the end of the course showing a certain fluency in the exposition of the topics. After the oral test, the final score obtained in the written test will be increased up to a maximum of three scores if the student demonstrates that he has fully acquired the skills referred to in items 4) and 5), or will be decreased up to a maximum of three scores if the student does not demonstrate that he has fully acquired the competences mentioned in points 4) and 5). The exam is passed if at the end of the oral exam the student has achieved a minimum score of 18/30. In addition, the student who obtains a final score strictly above of 30/30 will receive the “lode”.
EDUCATIONAL OBJECTIVES	The course objectives are those of the study of real systems using an approach based on a mathematical model of the system. This model is used both to evaluate the dynamic behavior and by means of PC simulation software environment dedicated scheme, usually the Matlab-Simulink environment, is to define and evaluate important aspects of the real system of the same behavior from the definition and study of certain properties of the model, among which are of fundamental interest in the stability, controllability, the observability, the steady-state and transient behaviour. The mathematical model is also used for the design of a controller to associate with the real system so that the whole system is able to achieve predetermined performance.
TEACHING METHODS	Lectures, exercises in the classroom, exercises using Matlab-Simulink.

SUGGESTED BIBLIOGRAPHY	- Bolzern-Scattolini-Schiavoni, Fondamenti di controlli automatici 4/ed, McGraw Hill, 2008, ISBN: 9788838668821 - Appunti forniti dal docente.

SYLLABUS

Hrs	Frontal teaching
5	Introduction; Mathematical modeling
4	Study of linear and time-invariant models in time domain
2	Linearization, discretization and Lyapunov stability
2	Linear time invariant, discrete time models
2	Study of linear and time-invariant models in the Laplace domain
8	Model properties: reachbility, observability, stability
3	Stability analysis by quadratic functions and LMIs
6	Frequency responce, global links
4	Open loop and closed loop control systems
2	Nyquist criterion
4	Steady state and transient behaviour of tracking and regulation systems
3	Lead-lag-net based frequency domain control systems design
3	PID controllers
4	Root locus and Laplace domain control system design
4	State feedback control and LQR
4	State observers. Output feedback control

Hrs	Practice
4	mathematical modelling
6	Study of linear and time-invariant models in time, Laplace and frequency domain
2	Model properties: reachbility, observability, stability
2	Nyquist criterion
2	Steady state and transient behaviour of tracking and regulation systems
3	Lead-lag-net based frequency domain control systems design
2	PID controller design
3	Laplace domain control systems design
3	Output feedback control design
3	Generation of production code with simulink and embedded coder