UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria
ACADEMIC YEAR	2023/2024
BACHELOR'S DEGREE (BSC)	CYBERNETIC ENGINEERING
SUBJECT	AUTOMATIC CONTROL
TYPE OF EDUCATIONAL ACTIVITY	B
AMBIT	50285-Ingegneria dell'automazione
CODE	19385
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	AUTOMATIC CONTROL - Corso: ROBOTICS ENGINEERING AUTOMATIC CONTROL - Corso: INGEGNERIA ROBOTICA
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.
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 s 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 student will acquire the competence to discuss the analysis of linear systems and control systems in scientific contexts of intermediate technical level. With particular reference to linear systems and control systems in the frequency domain. 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	A written test of 2 hours, aimed at ascertaining the possession of the skills, abilities and competences envisaged. The stimuli, well defined, clear and uniquely interpretable, allow us to formulate the answer autonomously and are structured so as to allow their comparability. The written test is divided into two distinct parts. The first part can be the subject of an ongoing test. The topics deal with the whole program of the course and, in particular, on the specific topics covered during the exercises. Their structure provides open answers that respect constraints such as to make them comparable with predetermined correction criteria. The test is passed with a mark higher or equal to 18/30 in both parts of the test. In the case of an ongoing test, the vote of the first part is kept for a whole academic year, and the student will be able to sustain only the second part in the subsequent. The exam is completed with an oral test at the discretion of the teacher. During the oral examination the student is asked to answer at least 3 questions chosen among the topics of the course syllabus. The exam is designed to test the acquired knowledge, the planning and solving ability, the presentation skills and the use of appropriate technical language of the student. The assessment is based on the following grades: a) excellent (30-30 cum laude): excellent knowledge of the topics, excellent use of technical language, good analytical ability, the student is able to apply knowledge to solve the proposed problems; b) very good (26-29): good knowledge of the topics, good use of technical language, the student is able to apply knowledge to solve the proposed problems; c) good (24- 25): basic knowledge of the main topics, discrete use of technical language, limited ability to independently apply the knowledge to the solution of the proposed problems; d) satisfactory (21-23): the student knows the main topics but has not a full grasp of them, satisfactory use of technical language, poor ability to independently apply the acquired knowledge; e) sufficient (18-20): minimal knowledge of the main topics and basic use of technical language, very little or no ability to independently apply the acquired knowledge; f) insufficient: the student does not have a minimum acceptable knowledge of

	the contents of the topics covered in the course.The exam is passed with a grade higher than or equal to 18/30. Praise can only be granted if a score of 30/30 is achieved in both parts of the written test.
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
SUGGESTED BIBLIOGRAPHY	1) Dispense fornite dal docente; 2) Bolzern-Scattolini-Schiavoni, Fondamenti di controlli automatici 4/ed, McGraw Hill, 2008, ISBN: 9788838668821 3) Hernández-Guzmán, Victor Manuel, and Ramón Silva-Ortigoza. Automatic control with experiments. Cham, Switzerland: Springer, 2019. ISBN: 978-3-319-75803-9, DOI: 10.1007/978-3-319-75804-6

SYLLABUS

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

Hrs	Practice
4	Laplace transform: theory and exercises
2	mathematical modelling
8	Study of linear and time-invariant models in time, Laplace and frequency domain
1	Model properties: reachbility, observability, stability
2	Nyquist criterion
5	Lead-lag-net based frequency domain control systems design
2	sampled data control systems