Universidad de Alcalá

TEACHING GUIDE

Control Engineering I

Degree in
Industrial Electronics and Automatics Engineering

Universidad de Alcalá

Academic Year 2021/2022

2nd Year - 2nd Semester

Approved by the School Board on July 6, 2021

TEACHING GUIDE

Course Name:	**Control Engineering I**
Code:	**600010**
Degree in:	**Industrial Electronics and Automatics Engineering**
Department and area:	**Automática** **Systems Engineering and Automation**
Type:	**Compulsory**
ECTS Credits:	**6.0**
Year and semester:	**2nd Year, 2nd Semester**
Teachers:	Por definir
Tutoring schedule:	Consultar al comienzo de la asignatura
Language:	English

1. COURSE SUMMARY

The course of Control Engineering I aims to introduce students to the fundamental principles of the study and modeling of linear control systems in time domain and frequency. It serves, in turn, as a bridge to more advanced courses in the fields of automation, automation systems and robotic materials.

The course promotes understanding of the basic concepts of control seeking training for problem analysis, combining systematic methodologies with the approach and discussion of alternatives. Given the practical nature that the course has, a set of laboratory practices that will strengthen the fundamental theoretical aspects, using examples of actual control systems arise.

Prerequisites and Recommendations

For taking advance of the subject, it is required knowledge and skills of Linear Algebra and Differential Equations, Laplace and Fourier Transforms, Physics I, Physics II and Mechanical Systems, taught in the first year of the degree.

2. SKILLS

Basic, Generic and Cross Curricular Skills.

This course contributes to acquire the following generic skills, which are defined in the Section 3 of the Annex to the Orden CIN/351/2009:

en_TR2 - Knowledge in basic and technological subjects, which enables them to learn new methods and theories, and gives them versatility to adapt to new situations.

en_TR3 - Ability to solve problems with initiative, decision making, creativity, critical reasoning and to communicate and transmit knowledge, skills and abilities in the field of Industrial Engineering.

en_TR4 - Knowledge to carry out measurements, calculations, assessments, appraisals, appraisals, studies, reports, work plans and other similar works.

en_TR9 - Ability to work in a multilingual and multidisciplinary environment.

en_TRU1 - Capacity of analysis and synthesis.

en_TRU2 - Oral and written competencies.

en_TRU3 - Ability to manage information.

en_TRU4 - Autonomous learning skills.

en_TRU5 - Team work.

Professional Skills

This course contributes to acquire the following professional skills, which are defined in the Section 5 of the Annex to the Orden CIN/351/2009:

en_CI6 - Knowledge about the basics of automatisms and control methods.

Learning Outcomes:

The expected learning outcomes, expressed in the form of knowledge and skills and abilities that

students should have achieved are as follows:

RASEEA15. Explain concepts and signal system as well as its application to the context of automatic regulation or control.

RASEEA16. Manage the different existing mathematical tools for studying and analyzing systems.

RASEEA17. Modeling physical systems in time and space transformed.

RASEEA18. Analyze steady state behavior and a transient system.

RASEEA19. Draw the root locus of a control system and analyze it from their behavior.

RASEEA20. Represent the frequency response of a system and analyze their behavior by this answer.

RASEEA21. Analyze the stability of feedback systems.

RASEEA22. Basic design feedback control actions (P, I and D) and explain their functionality.

RASEEA23. Using the software necessary to simulate control systems.

3. CONTENTS

Contents Blocks	Total number of hours
B1: Introduction, basic components (signals and systems) and mathematical foundations. Types of systems. Signals and systems properties. Transformed domains.	8 hours
B2: Mathematical modeling of dynamic systems. Analogy systems. Linearization systems. External representation systems (transfer function block diagram, flowchart). Operations with blocks and simplifications. Feedback concept. MIMO.	10 hours
B3: Analysis of control systems in the time domain. Steady state error coefficients. Transitional arrangements, systems of first and second order. Stability.	12 hours
B4: Analysis of control systems in the frequency domain. The place of the roots: tracing rules and analysis. Adding zeros and poles. Bode. Nyquist plots. Nichols diagrams. Relative stability, frequency stability in closed loop. PID.	16 hours
B5: Modeling, simulation and practical systems analysis.	10 hours

4. TEACHING - LEARNING METHODOLOGIES. FORMATIVE ACTIVITIES.

4.1. Credits Distribution

Number of on-site hours:	58 hours (56 hours on-site +2 exams hours)
Number of hours of student work:	92
Total hours	150

4.2. Methodological strategies, teaching materials and resources

Theoretical sessions	Methodology: master classes where the teacher presents and explains the theoretical aspects, complemented by practical examples. Student participation will be encouraged from the very construction of the theoretical developments, pending resolution of the proposed practical examples and discussion of actual cases. Resources: blackboard, audiovisual media, internet, literature
Practical problem solving sessions	Methodology: lectures troubleshooting workshops combined with group and individual work. Small group discussion of the approach to problems and their relation to the theory. Written and oral presentation of alternative resolution. Sharing of proposed resolutions. Resources: blackboard, audiovisual, literature
Hands-on labs	Methodology: Working in groups of 3 persons maximum. Initial explanation and general discussion of practice, collaborative work in each group with the teacher's guide, management and good use of the material, obtaining results, interpretation and presentation. Resources: blackboard, audiovisual, instrumentation and laboratory equipment
Tutorials and seminars	Individual and / or group tutorials on the theoretical and practical contents of the subject
Non-contact activities	Troubleshooting and practices by applying theory, literature search, group work.

5. ASSESSMENT: procedures, evaluation and grading criteria

Preferably, students will be offered a continuous assessment model that has characteristics of formative assessment in a way that serves as feedback in the teaching-learning process.

5.1. PROCEDURES

The evaluation must be inspired by the criteria of continuous evaluation (Learning Assesment

Guidelines, LAG, art 3). However, in compliance with the regulations of the University of Alcalá, an alternative process of final evaluation is made available to the student in accordance with the Learning Assesment Guidelines as indicated in Article 10, students will have a period of fifteen days from the start of the course to request in writing to the Director of the Polytechnic School their intention to take the non-continuous evaluation model adducing the reasons that they deem convenient. The evaluation of the learning process of all students who do not apply for it or are denied it will be done, by default, according to the continuous assessment model. The student has two calls to pass the subject, one ordinary and one extraordinary.

Procedures:

The student has two calls, an ordinary and an extraordinary one for passing the subject. Students are offered a system of continuous evaluation that has characteristics of formative assessment, in order to serve feedback in the process of teaching and learning by students.

In ordinary examination session, students will follow a process of continuous assessment. Exceptionally, and due to justified reasons set out in the regulations published by the Centre's management, students can qualify for the final evaluation following the procedures and deadlines published in these regulations.

5.2. EVALUATION

Evaluation criteria

To meet the degree of acquisition of skills by students, skills, attitudes and values demonstrated by the student in accordance with the following evaluation criteria will be considered.

CE1: The student shows ability to solve mathematical problems in engineering.

CE2: The student shows ability to design control systems and industrial automation and industrial application.

CE3: The student shows ability, based on theoretical questions for the understanding and mastery of the basics of the general laws of various branches of engineering.

CE4: The student shows ability to combine theoretical aspects of control systems.

CE5: The student shows ability to apply the theoretical aspects through simulators related control systems.

Evaluation instruments

Evaluation Criteria defined above, is applied to the following assessment instruments:

Test Intermediate Evaluation (PEI 1), distributed throughout the semester, the weight of the final grade is 40%.
Test Intermediate Evaluation (PEI 2), at the end of the semester, the weight of the final grade is 40%.
Intermediate Evaluation Test (PEI3) at the end of the semester, with implementations on simulators, the weight of the final grade is 20%.
Final Assessment Test (ES) of theoretical and practical with a series of problems and / or issues that students will demonstrate their level of acquisition of the skills of the subject.

Qualification Criteria

This section quantifies the qualifying criteria for passing the subject

Ordinary call (Continuous Assessment):

The following table summarizes the relationship between skills, learning outcomes and assessment elements of this subject. Also the weight of each assessment instrument specified in the final grade:

Competence	Learning outcome	Evaluation Criteria	Assessment Tool	Weight in qualifying
TR2, TR3, TR4, TR9, CEI2-CEI4	RASEEA15-22	CE1-CE4	PEI1	40%
TR2, TR3, TR4, TR9, CEI2-CEI4	RASEEA15-22	CE1-CE4	PEI2	40%
TR2, TR3, TR4, TR9, CEI5	RASEEA 23	CE5	PEI3	20%

It is considered that the student has been submitted to the Continuous Assessment in the time it is presented to the first partial tests (PEC)

The student is considered Not Presented in the ordinary call if he didn't present at any partial test or work labs

Ordinary call (Final Evaluation):

Competence	Learning outcome	Evaluation Criteria	Assessment Tool	Weight in qualifying
TR2, TR3, TR4, TR9, CEI2-CEI4	RASEEA15-22	CE1-CE4	EF	80%
TR2, TR3, TR4, TR9, CEI5	RASEEA 23	CE5	PEI3	20%

Extraordinary call:

Competence	Learning outcome	Evaluation Criteria	Assessment Tool	Weight in qualifying
TR2, TR3, TR4, TR9, CEI2-CEI4	RASEEA15-22	CE1-CE4	EF	80%
TR2, TR3, TR4, TR9, CEI5	RASEEA 23	CE5	PEI3	20%

6. BIBLIOGRAPHY

6.1. Basic Bibliography

- Teaching materials prepared by the teacher for the subject, which will be provided to students directly (reprographic services or publications), or posting on the website of the subject.

- A. Rodríguez Nuñez, J. M. Bañón, T. Martínez Marín. "Sistemas de Control. Ejercicios resueltos". Servicio de publicaciones de la UAH. ISBN 84-8138-5441.

- K. Ogata, “Ingeniería de control moderna”, Prentice Hall. Cuarta Edición. ISBN: 970-17-0048-1

- C. B. Kuo, “Sistemas de Control Automático”, Prentice Hall, Séptima Edición. ISBN: 968-880-723-0

- R. C. Dorf, R. H. Bishop, “Sistemas de Control Moderno”, Prentice Hall, Décima Edición. ISBN: 84-205-4401-9

6.2. Additional Bibliography

- A. Moreno-Muñoz, “Trabajando con MATLAB y la Control System Toolbox”. Editorial RA-MA, ISBN 8478973478

- C. Platero. “Apuntes de Regulación Automática I”. Servicio de publicaciones EUITI-UPM. 2006.

- K. Ogata, “Problemas de Ingeniería de Control utilizando Matlab”, Prentice Hall, 1999.

- E. A. Puente. “Regulación Automática I”. Servicio de publicaciones ETS Ingenieros Industriales de Madrid, 1998.

Disclosure Note

The University of Alcalá guarantees to its students that, if due to health requirements the competent authorities do not allow the total or partial attendance of the teaching activities, the teaching plans will achieve their objectives through a teaching-learning and evaluation methodology in online format, which will return to the face-to-face mode as soon as these impediments cease.