Course guide
820130 - TCEE - Control Techniques

Last modified: 04/06/2026

Unit in charge: Barcelona East School of Engineering
Teaching unit: 709 - DEE - Department of Electrical Engineering.

Degree: BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Compulsory subject).

Academic year: 2026 **ECTS Credits:** 6.0 **Languages:** Catalan

LECTURER

Coordinating lecturer: JOSE MATAS ALCALA

Others:
Primer quadrimestre:
JUAN CRUZ VAQUER - Grup: T11, Grup: T12, Grup: T13
JOSE MATAS ALCALA - Grup: T11, Grup: T12, Grup: T13

Segon quadrimestre:
JUAN CRUZ VAQUER - Grup: M11, Grup: M12, Grup: M13
JOSE MATAS ALCALA - Grup: M11, Grup: M12, Grup: M13

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. Understand automatic regulation and control techniques and their application to industrial automation.

Transversal:
4. EFFECTIVE USE OF INFORMATI0N RESOURCES - Level 3. Planning and using the information necessary for an academic assignment (a final thesis, for example) based on a critical appraisal of the information resources used.

TEACHING METHODOLOGY

The course uses master classes by 70%, problem analysis in a 20% and work with Matlab by 10%.

LEARNING OBJECTIVES OF THE SUBJECT

To study the control of feedback systems, while introducing input-output relationships in the electric and electromechanical systems, along with the time-domain response.

STUDY LOAD

Type	Hours	Percentage
Hours small group	15,0	10.00
Self study	90,0	60.00
Hours large group	45,0	30.00

Total learning time: 150 h

CONTENTS

Theme 1. Type of systems and modelling of systems

Description:
The most common types of physical systems are described and the principles for developing its mathematical modelling are exposed. Also, the equivalence between the different systems is explained.

Specific objectives:
The identification of physic systems
The modelling of systems
The understanding of the equivalence between systems.

Full-or-part-time: 4h 30m
Theory classes: 2h
Laboratory classes: 0h 30m
Self study : 2h

Theme 2. Feedback systems.

Description:
The concept of feedback systems is introduced, its representation, dynamical properties, stability and response to perturbations are described.

Specific objectives:
Understanding of the achievements of feedback systems
Understanding the main properties of feedback systems

Full-or-part-time: 5h 40m
Theory classes: 2h
Laboratory classes: 1h
Self study : 2h 40m

Themes 3 to 5. Transient response of 1rst and 2nd order systems. Analysis of steady state errors.

Description:

The transient response of first and second order systems for different kind of inputs. The steady state response is also analyzed.

Specific objectives:
Understand to which parameters depend the transient response of first and second order systems.
Understand le sources of error at steady state and the ways to improve it.

Full-or-part-time: 36h
Theory classes: 12h
Practical classes: 4h
Self study : 20h

Themes 6 and 7. Root locus. Design of controllers in the LGR domain

Description:
The analysis of the evolution of the roots of a system due to feedback is carried out using the root locus method. Controllers as P, PD, PI, PID, lag and lead are designed using the root locus.

Specific objectives:
Calculate the root locus.
Design feedback controllers using the root locus.

Full-or-part-time: 28h 32m
Theory classes: 3h 12m
Practical classes: 2h
Self study : 23h 20m

Themes 8 and 9. Bode and Nyquist diagrams

Description:
Calculate de Bode diagram and understand the stability criteria using the Nyquist diagram.

Specific objectives:
Calculate de Bode diagram.
Understand the stability criteria in the frequency domain.

Full-or-part-time: 17h
Theory classes: 6h
Laboratory classes: 1h
Self study : 10h

Theme 10. Design in the frequency domain of compensators

Description:
The controllers P, PI, lead and lag are designed in the frequency domain

Specific objectives:
The design of feedback controllers in the frequency domain

Full-or-part-time: 34h
Theory classes: 12h
Laboratory classes: 2h
Self study : 20h

GRADING SYSTEM

Any academic fraud, plagiarism or use or possession of unauthorised means in an assessment activity leads to a mark of zero (0) for the affected test or assignment. Furthermore, in accordance with the University's regulations, if disciplinary proceedings are initiated the subject is recorded as "Pending Assessment" until a decision is reached. These incidents are managed in accordance with the **Action Framework for Academic Integrity in Assessment at the UPC**.

The evaluation will be conducted through the assessment by the teacher, with the following weights assigned to the evaluated activities:
First partial exam: 33%, Second partial exam: 30%, Third partial exam: 19%, Laboratory practice: 18%.
This subject will not have a re-evaluation exam.
It is compulsory to carry out the practices to pass the course.

EXAMINATION RULES.

The attendance to the laboratory sessions is mandatory.

BIBLIOGRAPHY

Basic:
- Kuo, Benjamin C. Sistemas de control automático. México: Prentice Hall Hispanoamericana, 1996. ISBN 9688807230.
- Ogata, Katsuhiko. Ingeniería de control moderna [on line]. 5a ed. Madrid [etc.]: Pearson Educación, cop. 2010 [Consultation: 16/06/2020]. Available on: http://www.ingebook.com/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=1259. ISBN 9788483226605.
- Gomáriz, Spartacus [et al.]. Teoría de control : diseño electrónico [on line]. Barcelona: Edicions UPC, 2000 [Consultation: 16/06/2020]. Available on: http://hdl.handle.net/2099.3/36214. ISBN 8483012669.

Complementary:
- Ogata, Katsuhiko. Problemas de ingeniería de control utilizando MATLAB. Madrid: Prentice Hall Iberia, 1999. ISBN 8483220466.