



# Course guide

## 820130 - TCEE - Control Techniques

Last modified: 14/06/2023

**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:** 2023    **ECTS Credits:** 6.0    **Languages:** Catalan, Spanish

### LECTURER

**Coordinating lecturer:** JOSE MATAS ALCALA

Primer quadrimestre:  
JOSE MATAS ALCALA - Grup: T11, Grup: T12, Grup: T13

**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 INFORMATION 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

The evaluation will be conducted through the assessment by the teacher, with the following weights assigned to evaluated activities: First partial exam: 28%, Second partial exam: 33%, Third partial exam: 22%, Laboratory practice: 17%.

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

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### Basic:

- 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](http://www.ingebook.com/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=1259). ISBN 9788483226605.
- Kuo, Benjamin C. Sistemas de control automático. México: Prentice Hall Hispanoamericana, 1996. ISBN 9688807230.
- 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.