Course guides
820228 - REGA - Automatic Regulation

Last modified: 19/06/2020

Unit in charge: Barcelona East School of Engineering
Teaching unit: 707 - ESAII - Department of Automatic Control.

Degree: BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Compulsory subject).

Academic year: 2020 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: BEATRIZ FABIOLA GIRALDO GIRALDO

Others: Primer quadrimestre:
BEATRIZ FABIOLA GIRALDO GIRALDO - M11, M12, M13, M14, M15, M16
JOSÉ MARÍA HUERTA SÁNCHEZ - M11, M12, M13, M14, M15, M16
ABEL TORRES CEBRIAN - M13, M14, M15, M16

Segon quadrimestre:
JOSÉ MARÍA HUERTA SÁNCHEZ - T11, T12, T13, T14

PRIOR SKILLS

Electrical systems, mechanical systems, Mathematics

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CEEIA-25. Model and simulate systems.

Transversal:
2. TEAMWORK - Level 3. Managing and making work groups effective. Resolving possible conflicts, valuing working with others, assessing the effectiveness of a team and presenting the final results.
3. 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 expositive methodology by 20%, an individual class work (problems) by 10%, teamwork (laboratory) by 10%, and individual and group work non-attendance by 60%.

LEARNING OBJECTIVES OF THE SUBJECT

At the end of the course the student will be able to:
1. To acquire basic skills in modeling dynamic systems.
2. To define and know how to apply the general methods of systems analysis.
3. To define and know how to apply the general methods of designing control systems in continuous time.
4. To know how to configure and tune different types of controllers used in the industry.
5. Teamwork.
6. Manage information resources in the field of control systems.

STUDY LOAD

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

Total learning time: 150 h

CONTENTS

1. Introduction to feedback control systems

Description:
Introduction. Examples of control systems. Loop systems open and closed. Definitions and terminology of control systems. Classification of control systems. Signals (Systems) of continuous and discrete time. Transducers and conditioners signal. Advantages and disadvantages of feedback system.

Full-or-part-time: 10h
Theory classes: 3h
Practical classes: 2h
Self study : 5h

2. Models of dyanmic systems

Description:
Dynamic system concept. Invariant linear systems in time (LTI). Transfer function of linear systems. Linearization of physical systems. Electrical, mechanical and electro-mechanical systems: servomotors. Models of block diagrams. Simplifying of block diagrams. Models of signal flow graphs. Transfer functions using Mason's rule. Model of state variable. Transformation of transfer function to state variable and vice versa. Simulation of systems.

Full-or-part-time: 30h
Theory classes: 7h 30m
Laboratory classes: 2h
Self study : 20h 30m

3. Analysis of time domain systems

Description:
Standard input signals. Calculating of the time response of systems using the convolution integral. Calculating the time response of systems using Laplace transform. First order systems. Second-order systems. Specifications functioning (transient response). Systems higher than second order. Resolution of the state equation. Location of poles in the plane s, and analysis of the transient response. The steady-state error.

Full-or-part-time: 30h
Theory classes: 9h
Laboratory classes: 3h
Self study : 18h

4. Stability of linear systems

Description:
The concept of stability. Stability criterion of Routh-Hurwitz. Special cases. Relative stability. Stability in state space.

Full-or-part-time: 20h
Theory classes: 6h
Laboratory classes: 2h
Self study : 12h

5. Root locus method

Description:
Concept of the root locus. Application of the root locus method to the analysis and design of control systems.

Full-or-part-time: 10h
Theory classes: 3h
Laboratory classes: 2h
Self study : 5h

6. Controllers

Description:
P, I, PI, PD and PID controllers. Modifications of the standard PID controller: PID controller with approximate derivative action.
Integral action "antiwindup". Controllers with two degrees of freedom: PI-D and I-PD controller.
Empirical and analytical tuning of controllers.
Controller by state vector feedback: controllability concept.

Full-or-part-time: 40h
Theory classes: 10h 30m
Laboratory classes: 3h
Self study : 26h 30m

GRADING SYSTEM

Partial controls (2): 30%
Last control: 40%
Practices: 15%
Others test/projects: 10%
Generic competition "Teamwork": 5%

In this subject will schedule a reassessment. The students will be able to access the re-assessment test that meets the requirements set by the EEBE in its Assessment and Permanence Regulations (https://eebe.upc.edu/ca/estudis/normatives-academiques/documents/eebe-normativa-avaluacio-i-permanencia-18-19-aprovat-je-2018-06-13.pdf)

EXAMINATION RULES.

The written tests take place within the class schedule.
Practical tests carried out in the laboratory.

BIBLIOGRAPHY

Basic:
- Dorf, Richard C.; Bishop, Robert H. Sistemas de control moderno. 10ª ed. Madrid [etc.]: Prentice Hall, cop. 2005. ISBN 8420544019.
- Ogata, Katsuhiko. Ingeniería de control moderna [on line]. 5ª ed. Madrid: Pearson Educación, cop. 2010 [Consultation: 10/06/2020]. Available on: http://www.ingebook.com/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=1259. ISBN 8420536784.

Complementary:
- Kuo, Benjamin C. Sistemas automáticos de control. 9ª ed. México: Compañía Editorial Continental, 1991. ISBN 9682611393.
- Lewis, Paul H.; Yang, Chang. Sistemas de control en ingeniería. Madrid [etc.]: Prentice Hall, cop. 1999. ISBN 8483221241.