Course guide
330106 - RA - Automatic Regulation

Last modified: 03/09/2026

Unit in charge: Manresa School of Engineering
Teaching unit: 750 - EMIT - Department of Mining, Industrial and ICT Engineering.

Degree: BACHELOR'S DEGREE IN ICT SYSTEMS ENGINEERING (Syllabus 2010). (Optional subject).
BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2016). (Optional subject).
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2016). (Compulsory subject).
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2016). (Optional subject).
BACHELOR'S DEGREE IN AUTOMOTIVE ENGINEERING (Syllabus 2017). (Optional subject).
BACHELOR'S DEGREE IN MINERAL RESOURCE ENGINEERING AND MINERAL RECYCLING (Syllabus 2021). (Optional subject).

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

LECTURER

Coordinating lecturer: LLUIS HERNANDEZ NAVARRO

Others: Primer quadrimestre:
SERGI GRAU TORRENT - Grup: 11, Grup: 13
LLUIS HERNANDEZ NAVARRO - Grup: 11, Grup: 12, Grup: 13

PRIOR SKILLS

Students are expected to have passed Mathematics I and II, Fhysics I and II, Introduction to Computing, Mechanical Systems, Electrical Systems, Electronic Systems and Industrial Control and Automation

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. Knowledge of frequency-domain analysis properties for designing feedback controllers for both continuous and discrete time systems.
2. Knowledge of space state techniques for modeling complex systems.
3. Modelling and simulating dynamic systems.
4. Knowledge applied to discrete time systems.
5. Ability to synthesize and solve problems related to the automatic control discipline.

Transversal:
6. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.
7. 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.
8. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.
08 GEN. GENDER PERSPECTIVE: An awareness and understanding of sexual and gender inequalities in society in relation to the field of the degree, and the incorporation of different needs and preferences due to sex and gender when designing solutions and solving problems.

TEACHING METHODOLOGY

- Face-to-face lecture sessions.
- Face-to-face practical work sessions.
- Independent learning and exercises.
- Preparation and completion of group activities subject to assessment.

LEARNING OBJECTIVES OF THE SUBJECT

This subject provides students with the necessary theoretical and practical knowledge to do the following:
- Build mathematical and simulation models corresponding to real systems and use them to study and analyse the dynamic behaviour of the systems.
-Design and implement analogue and digital controllers.
- Analyse and solve industrial-control problems.

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

Topic 1. MODELLING AND ANALYSIS OF DINAMIC SYSTEMS

Description:
1.1. Introduction and presentaction of the study cases
1.2. Tools for simulating mathematical models.
1.3. Temporal analysis of continuous dynamical systems
1.4. Frequency analysis of continuous dynamical systems
1.5. Discrete systems analysis

Specific objectives:
The ability to create unified mathematical models for various types of systems.
The ability to represent dynamical system using state space techniques.
The ability to use tools to simulate systems on the basis of their models.
The ability to define and calculate the time-response characteristics of a feedback system exposed to external signals and disturbances.
The ability to define and calculate the various frequency-response characteristics of a feedback system.
The ability to mathematically represent mixed (continuous and discrete) dynamical Systems.
The ability to understand the differences between a continuous system and a discrete system.

Related activities:
Lectures, laboratory practicals and examinations.

Full-or-part-time: 22h
Theory classes: 18h
Practical classes: 4h

Topic 2. CONTINUOUS CONTROL OF DYNAMICAL SYSTEMS

Description:
2.1. Command-following specifications
2.2. Analytical design of regulators
2.3. Frequential design of regulators

Specific objectives:
- The ability to define and recognise the effect of an external signal on P, I and D actions.
- The ability to forecast the effect of a change in any control action on the behaviour of a feedback system.
- The ability to calculate the parameters of PID controllers that modify the behaviour of physical systems in order to meet certain operation and disturbance specifications

Related activities:
Lectures, laboratory practicals and an examination.

Full-or-part-time: 19h
Theory classes: 15h
Practical classes: 4h

TOPIC 3. DESIGN OF DISCRETE CONTROL SYSTEMS

Description:
3.1. Introduction to digital controller
3.2. Command-following specifications
3.3. Analytical tuning

Specific objectives:
The ability to design and implement digital controllers for processes with continuous variables that meet command-following and rejection specifications.

Related activities:
Lectures, laboratory practicals and an examination.

Full-or-part-time: 19h
Theory classes: 15h
Laboratory classes: 4h

ACTIVITIES

1. Exams

Description:
Written activity in which the knowledge acquired up to the moment of the test is evaluated.

During the course, an individual assessment test (CON) will be carried out. At the end of the course, a comprehensive final exam covering the acquired knowledge (FIN) will be conducted.

Specific objectives:
At the end of the Automatic Regulation course, the student will have synthesized and consolidated the concepts and techniques worked so far.

Material:
Test statements
Documents for the entire course
Software

Delivery:
The grade obtained in the assessment test defines the CON variable (30%).
The grade obtained in the final exam defines the FIN variable (45%).

Full-or-part-time: 6h
Theory classes: 6h

2. Study of contents

Description:
The study of the contents is the individual or collective activity that leads to understanding and assuming the knowledge, vocabulary and techniques that are part of the contents of the subject

Material:
Main reference of the subject
Published teaching material

Full-or-part-time: 45h
Self study: 45h

3. Expositive class

Description:
These are in-person classes specifically dedicated to understanding the course content. In these sessions, exercises related to the theoretical contents presented will be solved and discussed.

Material:
Recommended basic bibliography
Collection of subject problems

Full-or-part-time: 36h
Theory classes: 36h

4. Laboratory practicals

Description:
These are in-person classes held in the laboratory specifically dedicated to problem-solving and the study of small projects.
They are carried out in groups of 2 people and in alternate weeks.
Both the prior preparation and the execution of the activity will be assessed.

Material:
Problem sheets handed out by the professor.

Delivery:
The degree to which the objectives of each problem or activity have been achieved will be assessed, taking into account the understanding of the work demonstrated by each student.

Upon completion of each activity, the work carried out will be evaluated and, where applicable, presented publicly. The sum of the grades obtained in these activities will constitute the LAB variable.

Full-or-part-time: 12h
Laboratory classes: 12h

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**.

Each student's final mark is obtained by weighting their marks on the following:
1. One control test (CON) performed throughout the course with a weight of 30%.
2. Continuous assessment in laboratory sessions, with a weight of 25%.
3. A final evaluation test (FIN) with a weight of 45%.

Note 1. If higher, the grade obtained in the FIN assessment will replace the grade obtained in the CON assessment.
Note 2. When the results of assessment activities corresponding to individual work are substantially lower than those obtained in group activities, students may be required to complete individually activities similar to those carried out in groups. The grade obtained in these individual activities will replace the original one.

EXAMINATION RULES.

Attendance and participation in laboratory sessions is compulsory.

BIBLIOGRAPHY

Basic:
- Nise, Norman S. Control systems engineering. 7th ed. Hoboken: John Wiley & Sons, 2015. ISBN 9781118800829.

Complementary:
- Bolzern, Paolo; Scattolini, Riccardo; Schiavoni, Nicola. Fundamentos de control automàtico. 3ª ed. Madrid: McGraw-Hill, 2008. ISBN 9788838664342.
- Ogata, K. Ingeniería de control moderna [on line]. 5ª ed. Madrid: Pearson Educación, 2010 [Consultation: 02/06/2022]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=1259. ISBN 9788483226605.