Universitat Autònoma de Barcelona

2019/2020

Control and Instrumentation

Code: 100958
ECTS Credits: 6

Degree	Type	Year	Semester
2500253 Biotechnology	OT	4	0

Contact

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Use of Languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: Yes
Some groups entirely in Spanish: No

Prerequisites

It is necessary to know Catalan because the classes are in this language.

Also, the following subjects must have completed:

Bioprocesses Engineering Fundamentals

Bioreactors

Objectives and Contextualisation

Know different types of process control. Analysis of dynamic behavior of a process with and without control. Know different types of instrumentation used in bioprocesses.

Competences

- Describe the principles behind the design and functioning of bioreactors and calculate, interpret and rationalise the main parameters in transport phenomena and the matter and energy balances in bioindustrial processes.
- Learn new knowledge and techniques autonomously.
- Make an oral, written and visual presentation of ones work to a professional or non-professional audience in English or in one's own language.
- Read specialised texts both in English and ones own language.
- Reason in a critical manner
- Search for and manage information from various sources.
- Think in an integrated manner and approach problems from different perspectives.
- Use ICT for communication, information searching, data processing and calculations.
- Use the fundamental principles of mathematics, physics and chemistry to understand, develop and evaluate a biotechnological process.
- Work individually and in teams

Learning Outcomes

1. Calculate the dynamic behaviour of first- and second-order systems.
2. Describe the different types of feedback control and the effects they have on first- and second-order systems.
3. Describe the elements that make up a control loop based on biotechnological systems.
4. Explain the principles behind the instrumentation and monitoring of biotechnological processes.
5. Learn new knowledge and techniques autonomously.
6. Make an oral, written and visual presentation of ones work to a professional or non-professional audience in English or in one's own language.
7. Read specialised texts both in English and ones own language.
8. Reason in a critical manner
9. Search for and manage information from various sources.
10. Solve problems in different key aspects of bioindustrial processes.
11. Think in an integrated manner and approach problems from different perspectives.
12. Use ICT for communication, information searching, data processing and calculations.
13. Work individually and in teams

Content

Students will have access to the teaching material of the subject through the Moodle platform.

Lesson 1: Introduction. Definitions and concepts.

Lesson 2: Mathematical models developmentBioreactor modeling.

Lesson 3: Analysis of dynamic behavior of a process. In-out models. Nonlinear systems linearization. Laplace transforms. Solving linear differential equations using Laplace transforms. Transfer functions. Dynamic behavior of first and second order systems.

Lesson 4: Feedback control. Types of feedback control. Dynamic behavior of processes controlled by feedback. Effect of the different control actions. Stability analysis. Feedback control design.

Lesson 5: Other control systems. Control systems with a multiple loops. Feedforward control.

Lesson 6: Physical elements in a control system. Sensors and control valves.

Methodology

Theory and problems lectures: As you progress in the syllabus, problems of the subject will be considered and resolved.

Oral presentations of instrumentation: At the beginning of the course, instrumentation work will be assigned. The work will be done in groups with an oral presentation towards the end of the course.

Practical case seminar: An intensive seminar to solve problems and / or practical cases will be held.

Process simulation seminar: Three seminars will be held in the computer labs, simulating processes using Simulink of the MATLAB software. Subsequently, a work carried out in a group will be presented, with the discussion of the results obtained.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Oral exhibitions of instrumentation	3	0.12	5, 12, 9, 4, 6, 7, 11, 8, 13
Process simulation seminars	9	0.36	5, 12, 11, 8, 13
Seminar on case studies	3	0.12	11, 8, 10, 13
Theory and problems lectures	35	1.4	1, 2, 3, 4, 11, 8, 10
Type: Autonomous			
Preparation oral presentation of instrumentation	10	0.4	5, 12, 9, 4, 6, 7, 11, 8, 13
Process simulation work	6	0.24	5, 12, 11, 8, 13
Study of the basic concepts and resolution of the typical problems of control	82	3.28	5, 12, 9, 1, 2, 3, 4, 7, 11, 8, 10, 13

Assessment

Partial 1: Dynamic Process Behavior.

Partial 2: Dynamic behavior of processes with control. Instrumentation

Oral presentations of instrumentation: It will be evaluated on-site according to some barems that the student will have previously.

Simulation work: The work of the discussion of the results obtained in the simulation seminar will be evaluated.

Retake exam: If the resultant qualification of the tests carried out is less than 5/10, students can do a second exam of the the partial ones that have not been passed.To participate in the retake exam, the students must have previously been evaluated in a set of activities whose weight equals to a minimum of two thirds of the total grade of the subject. Therefore, students will obtain the "Not Evaluable" qualification when the assessment activities carried out have a weighting of less than 67% in the final grade.

A special distinction (MH) can be given from the 9/10 qualification with the limitation of up to 5% of MH of the total number of students enrolled.

Without prejudice to other disciplinary measures that may be considered appropriate, the irregularities (copy, plagiarism, deception, letting copy, etc.) committed by the students that may lead to a variation of the qualification of an evaluation activity will lead to suspend them with a zero.

The repeating students will have the same system of continuous evaluation.

For each evaluation activity, a place, date and time of review will be indicated. If the student does not appear, it will not be reviewed later.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Oral presentation of instrumentation	15%	0	0	5, 12, 9, 4, 6, 7, 11, 8, 13

Partial test 1	35%	1	0.04	5, 9, 1, 7, 11, 8, 10
Partial test 2	35%	1	0.04	5, 9, 2, 3, 7, 11, 8, 10
Simulation work	15%	0	0	12, 1, 8, 13

Bibliography

Stephanopulos G.

"Chemical Process Control: An introduction to theory and practice"

Prentice-hall (New Jersey), 1984

Ollero de Castro P., Fernández E.

"Control e instrumentación de procesos químicos"

Síntesis (Madrid), 1998

Romagnoli J.A., Palazoglu A.

"Introduction to Process Control"

Taylor & Francis Group (Boca Raton), 2006

Seborg D.E., Edgar T., Mellichamp D.A.

"Process Dynamics and Control"

J. Wiley (NY), 1989

Gòdia F., López-Santín J.

"Ingeniería Bioquímica"

Síntesis (Madrid), 1998