(Bio)chemical process design and control

Lecturers
Philippe BOGAERTS (Coordinator) and Benoît HAUT

Course mnemonic
CHIM-H530

ECTS credits
4 credits

Language(s) of instruction
English

Course period
Second term

Campus
Solbosch

Course content

Part 1 (B. Haut) :

- Lectures: Kinetic models for bioreactors and ideal reactors, introduction to water bioepuration, beer production, scale up of cell culture systems, fed-batch and chemostat systems.
- Problem to solve in a group: design of a process for the elimination of a micropollutant (Bisphenol A) in a waste water.
- Synthesis of a scientific paper related to operations found in the production of beer. Oral presentation of this synthesis in front of the other students.

Part 2 (Ph. Bogaerts) : Control of a CSTR : basic principles; Control of a batch exothermic reactor; Control of time delay and minimum phase processes; Feedforward control; Control of MIMO (multiple inputs multiple outputs) systems.

Objectives (and/or specific learning outcomes)

To develop the ability to use multidisciplinary notions already acquired during various courses (reactor engineering, unit operations, environmental technologies, microbiology, transport phenomena, ...) for the resolution of concrete problems related to the design of a bioreactor.

To address control structures well suited to chemical and biotechnological processes and to illustrate them on practical case studies.

Teaching method and learning activities

Part 1 (B. Haut): lectures with PowerPoint slide shows, exercises, group problem (but with question and answer sessions), presentation of the synthesis of a scientific paper. All the material for this part of the course is available on the TIPs website (www.tips-ulb.be).

Part 2 (Ph. Bogaerts): lectures with PowerPoint slideshows, exercise sessions on PC.

Contribution to the teaching profile

This course helps to train students to :

- reformulate complex engineering problems in order to solve them (simplifying assumptions, reducing complexity) ;
- collaborate in a (multidisciplinary) team ;
- conceive, plan and execute a research project, based on an analysis of its objectives, existing knowledge and the relevant literature, with attention to innovation and valorization in industry and society.

References, bibliography and recommended reading

Coulson et Richardson's Chemical Engineering (Volume 3 : Chemical and Biochemical Reactors & Process Control), D. G. Peacock and J. F. Richardson, 3rd edition, 1994, Butterworth-Heinemann.

Course notes

Podcast and Université virtuelle

Other information

Place(s) of teaching

Solbosch

Contact(s)

Ph. Bogaerts : 3BIO-BioControl (Biosystems Modeling and Control); email: philippe.bogaerts@ulb.be

B. Haut : TIPs department - Transfers, Interfaces, Processes; email: benoit.haut@ulb.be

Evaluation method(s)

Other

Evaluation method(s) (additional information)

Part 1 (B. Haut): oral examination (/4) + score for the problem (/3) + score for the presentation of the synthesis of an scientific paper (/3).

Part 2 (Ph. Bogaerts): oral examination without preparation (/10).

Determination of the mark (including the weighting of partial marks)

Final score = score of part 1 + score of part 2.

Main language(s) of evaluation

English

Programmes

Programmes proposing this course at the Brussels School of Engineering

MA-IRMA | Master of Science in Chemical and Materials Engineering | finalité Professional/unit 2