UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Developments and Analyses of Bioprocesses

2526-1-F0803Q042

Aims

The course will treat typical issues of a research and development department of a bioindustrial plant. In particular, the effects of choices made during process development on the cost of the instrumentation required and the timing of operations will be evaluated.

Knowledge and understanding
The student will gain knowledge of the basics of the organization of an industrial plant; the strategies for optimizing operations and the effects of variations in number / sizing of machinery on the process flow
Applying knowledge and understanding
At the end of the course, the student should be able to apply the acquired knowledge to the design of a plant for the industrial production of a commodity of biotechnological relevance by proposing the best solutions to optimize the process chosen as a case-study.
Making judgements
Students should be able to critically process what they have learned in order to correctly identify the critical points of the developing process. The planned exercises in critical discussion of the literature, discussions during the analysis of case studies, and the project required for the final exam contribute to the achievement of these skills.
Communication skills
Use of an appropriate scientific/chemical vocabulary and ability in oral reports. It is emphasized that the writing of an original project and its oral exposition are an integral part of the examination.
Learning skills
At the end of the teaching the student will be able to work out an autonomous production process using professional design and management software. The student will be able to consult the literature on the topics covered and will be able to apply the knowledge acquired with what will be learned in teachings related to industrial production in the biotechnology, food and chemical fields.

Contents

1. Recalls on bioreactor structure and fermentative strategies
2. Case-studies exposition
3. Experimental data practical collection
4. Introduction to managing softwares
5. Development of original process layout for the production of commodity

Detailed program

1. Recalls on bioreactor structure and fermentative strategies.
- The Bioreactor
-Components
- Classical feeding strategies
- Control of main parameters
- Data monitoring and storage
- Performances evaluation
- Process flow: from master cell bank to finite product

2. Case-studies exposition
Analysis of a real case study.

3. Experimental data collection (lab practicals).

4. Introduction to managing softwares (computer lab practicals)
- Process management and simulation
- Integrated process design
- Choice of the equipment size
- Production cycle and scheduling
- Cost assessment and economical evaluation
- Debottlenecking
- Waste management

5. Development of original process layout for the production of commodity (computer lab practicals)

Prerequisites

Background. Microbiology and fermentation chemistry are strongly suggested.
Prerequisites. None

Teaching form

Classroom lectures (18 lessons, 35 hours, 5 ECTS): will give the framework to the main issues and will consist on:

- a part in the *delivery mode* (didactic delivery, DE) focused on the presentation-illustration of content, concepts, scientific principles, which will provide the introductory framework for the various topics covered in the teaching, this is equivalent to approximately 50% of the total number of hours.
- a part in the* interactive mode* (interactive didactics, DI), which includes integrative teaching interventions,

short interventions made by the students, additional demonstrations of practical applications of the content of the delivery part, analysis of case studies, and application exercises, approximately 50% of the total number of hours.. In-depth study of real cases on specific topics in collaboration with biotechnology companies is planned.
All activities are conducted live.

Practical sessions- (4 activities, 10 hours, 1 ECTS): will yield the students a core of experimental data and parameters.
Real case studies will be examined also with the contribution of biotech industries.
Attendence is mandatory

The course will be taught in the Italian language

Textbook and teaching resource

As a learning aid, slides will be available at the e-learning platform of the course, together with registration of records of lessons held.
Bibliography available at the e-learning platform.
Reports and research articles
Operative manual for the software SuperPro Design
Elaboration of experimental data

Textbooks.
For general subjects: Basic Biotechnology - C. Ratledge & B. Kristiansen eds- Cambridge Press

Semester

Second semester

Assessment method

No partial tests are planned. Written test with a compulsory oral exam.
The written test will consist of a project work, i.e. the writing of an original project for the development of a production process, elaborated from a simple idea or from the analysis of an existing case, supplemented by experimental data collected by the student, which will allow the assessment of the student's communication and problem solving skills. The oral interview consists of a discussion of the presented paper and assesses the student's self-reflection and critical thinking skills on topics related to the course.

Office hours

Contact: on demand by email request to the lecturer

Sustainable Development Goals

AFFORDABLE AND CLEAN ENERGY | INDUSTRY, INNOVATION AND INFRASTRUCTURE | RESPONSIBLE CONSUMPTION AND PRODUCTION