Universitat de Lleida

DEGREE CURRICULUM

BIOTECHNOLOGY

Coordination: BACARDIT DALMASES, ANNA

Academic year 2022-23

BIOTECHNOLOGY 2022-23

Subject's general information

<table>
<tr><td>Subject name</td><td>BIOTECHNOLOGY</td></tr>
<tr><td>Code</td><td>102346</td></tr>
<tr><td>Semester</td><td>2nd Q(SEMESTER) CONTINUED EVALUATION</td></tr>
<tr><td>Typology</td><td>
<table>
<tr><th>Degree</th><th>Course</th><th>Character</th><th>Modality</th></tr>
<tr><td>Not informed</td><td>3</td><td>COMPULSORY</td><td>Attendance-based</td></tr>
</table>
</td></tr>
<tr><td>Course number of credits (ECTS)</td><td>6</td></tr>
<tr><td>Type of activity, credits, and groups</td><td>
<table>
<tr><th>Activity type</th><th>PRALAB</th><th>PRAULA</th><th>TEORIA</th></tr>
<tr><td>Number of credits</td><td>0.4</td><td>2.6</td><td>3</td></tr>
<tr><td>Number of groups</td><td>1</td><td>1</td><td>1</td></tr>
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</td></tr>
<tr><td>Coordination</td><td>BACARDIT DALMASES, ANNA</td></tr>
<tr><td>Department</td><td>COMPUTER SCIENCE AND INDUSTRIAL ENGINEERING</td></tr>
<tr><td>Teaching load distribution between lectures and independent student work</td><td>Lectures activities 60 hours
Independent study work 90 hours</td></tr>
<tr><td>Important information on data processing</td><td>Consult this link for more information.</td></tr>
<tr><td>Language</td><td>Catalan
Spanish</td></tr>
<tr><td>Distribution of credits</td><td>3 THEORY
2,6 PRAULA
0,4 PRALAB</td></tr>
</table>

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
BACARDIT DALMASES, ANNA	anna.bacardit@udl.cat	3	
SOLE FERRER, MARIA MERCE	mariamerce.sole@udl.cat	3	

Subject's extra information

It is **COMPULSORY** that the students bring the following elements of individual protection (EPI) to the practices at the laboratory.

- Laboratory gown from UdL
- Protection glasses
- Chemical protection gloves

They can be purchased through the shop Údels of the UdL:

C/ Jaume II, 67 baixos
Centre the Cultures i Cooperació Transfronterera

http://www.publicacions.udl.cat/

There will be a specific service for the *Campus Universitari d'Igualada*.

The use of other elements of protection (for example caps, masks, gloves of chemical or electrical risk, etc.) will depend on the type of practice to be done. In that case, the teacher will inform of the necessity of specific EPI.

Not bringing the EPI's described or not fulfilling the norms of general security that are detailed below imply that the student can not access to the laboratories or have to go out of them. The no realisation of the practices for this reason imply the **consequences in the evaluation** of the subject that are described in this course guide.

GENERAL NORMS OF SECURITY IN LABORATORY PRACTICES

- Keep the place of realisation of the practices clean and tidy. The table of work has to be free from backpacks, folders, coats...
- No short trousers or short skirts are allowed in the laboratory.
- Closed and covered footwear is compulsory in the laboratory.
- Long hair needs to be tied.
- Keep the laboratoy gown laced in order to be protected from spills of chemicals.
- Bangles, pendants or wide sleeves are not allowed as they can be trapped.
- Avoid the use of contact lenses, since the effect of the chemical products is much bigger if they enter between the contact lense and the cornea. Protection over-glasses can be purchased.
- No food or drink is allowed in the laboratory.
- It is forbidden to smoke in the laboratories.
- Wash your hands whenever you have contact with a chemical product and before going out of the laboratory.
- Follow the instructions of the teacher and of the laboratory technicians and ask for any doubt on security.

For further information, you can check the following document of the *Servei de Prevenció de Riscos Laborals de la UdL*: http://www.sprl.udl.cat/alumnes/index.html

Learning objectives

- Consolidate knowledge about cells and biomolecules.
- Know the different types of microorganisms involved in biotechnological processes.
- Understand the growth of microbial populations.
- Apply enzymatic kinetic equations and bacterial growth.
- Learn the most important biotechnological applications from the industrial point of view.
- Design, control and manage the most suitable system for waste water treatment.
- Determine the most sustainable technologies among different options in different industrial applications.

Competences

Basic

B01 That students have demonstrated to possess and understand knowledge in an area of study that starts from the base of general secondary education, and is usually found at a level that, although supported by advanced textbooks, also includes some aspects that imply knowledge coming from the vanguard of his/her field of study.

B02 That students know how to apply their knowledge to their work or vocation in a professional manner and possess the skills that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study.

B03 That students have the ability to gather and interpret relevant data (usually within their area of study) to make judgments that include a reflection on relevant social, scientific or ethical issues.

B04 That students can transmit information, ideas, problems and solutions to a specialized and non-specialized public.

B05 That students have developed those learning skills necessary to undertake further studies with a high degree of autonomy.

Transversal

CT1. To develop a proper understanding and oral and written expression of Catalan and Spanish.

CT3. To iImplement new technologies and technologies of information and communication.

CT5. To apply essential notions of scientific thinking.

General competences

CG3. To synthesize basic and technological subjects, which enable them to learn new methods and theories, and provide them with versatility to adapt to new situations.

CG4. To solve problems with initiative, make decisions, creativity, critical reasoning and to communicate and transmit knowledge, skills and abilities in the field of Industrial Chemical Engineering.

Specific competences

CE4. To apply the principles of fundamental knowledge of general chemistry, organic and inorganic chemistry and their applications in engineering.

CE19. To calculate material and energy balances, biotechnology, material transfer, separation operations, chemical reaction engineering, design reactors, and valorize and transform raw materials and energy resources.

CE21. To design and manage applied experimentation procedures, especially for the determination of thermodynamic and transport properties, and modeling of phenomena and systems in the field of chemical engineering, systems with fluid flow, heat transfer, material transfer operations, kinetics of chemical reactions and reactors.

Subject contents

1. Introduction to biotechnology

- What is biotechnology?
- Historical evolution of biotechnology
- Biotechnology applications

2. Microorganisms of biotechnological interest

- Industrial microbiology
- Characteristics of living organisms
- Microorganisms as Cells
- Microorganisms as industrial applications

3. Microorganisms for industrial use in biotechnology

- Yeasts
- Funghi
- The bacteria
- Actinomycetes
- The seaweed
- The virus
- Enzymes
- Hybridomas
- Cell cultures

4. Kinetics of microbial processes

- Introduction
- Modeling the kinetics of cell growth
- Mass balances for ideal bioreactors

5. Fermentation processes

- Introduction
- Cell growth
- Metabolism
- Catabolic routes
- Anabolic pathways
- Amphibious routes
- Control or inhibition of microorganisms

6. Design of bioreactors and mass transfer

- Introduction
- Bioreactor configuration
- Bioreactor Design Features
- Specific design considerations
- Stages of mass transfer
- Mass transfer equations

- Determination of volumetric mass transfer coefficients
- Effect of scale jumps on mass transfer

7. Biotech products processing

- Introduction
- Rupture of cells
- clarification
- concentration
- purification
- Ultrapurification
- Sequence of stages

8. Measurement, monitoring, modeling and control of biotech products

- Introduction
- Measurements generally accepted as standards
- Non-standardized monitoring techniques
- Control

9. Blue biotechnology

- Sewage treatment
- Organic sludge treatment
- Solid waste treatment
- Treatment of emitted gases
- Soil treatment
- Groundwater treatment

10. Red biotechnology

- Antibiotic production

11. White biotechnology

- Citric acid production
- Gluconic acid production
- Lactic acid production
- Enzyme production

12. Green biotechnology

- Introduction
- Plant cell biotechnology
- Plant cell culture techniques

Methodology

- Theory in classes of large groups: Expositive classes by the professor, with the explanation of the concepts, materials and work plan.
- Approach and resolution of problems in the classroom
- For each module exercises will be proposed individually and autonomously, which will be evaluated by the professor.
- Group work will be carried out using the Flipped Classroom methodology.
- Integrator Project

- The project coordinator will monitor the tasks to be submitted, as outlined in the timeline provided at the beginning of the course.

- All the subjects involved in the project will be registered jointly. In the circumstance that the students might

have passed more than 50% of the subjects involved in the project, they will be allowed to write an equivalent project focused on the subject they are currently taking.

Students also have the responsibility to reinforce their knowledge autonomously, based on the teaching material provided and / or recommended by the teacher.

Development plan

Week	Methodology	Units	Attendance hours	Autonomous working hours
1	Master class Problems	Unit 1. Fundamentals of biotechnology	4	6
2	Master class Problems	Unit 2. Microorganisms of biotechnological interest	4	6
3	Master class Problems	Unit 3. Microorganisms for industrial use in biotechnology	4	6
4	Master class Problems	Unit 4. Kinetics of microbial processes	4	6
5	Master class Problems	Unit 5. Design of bioreactors and mass transfer	4	6
6	Master class Problems	Unit 6. Biotech products processing	4	6
7	Master class Problems	Unit 7. Measurement, monitoring, modeling and control of biotech products	4	6
8	Flipped classroom	Aplication of units 1 to 7.	4	6
9		Evaluation		
10	Master class Problems Flipped classroom	Unit 8. Blue biotechnology Biological Water Treatment	4	6
11	Master class Problems Flipped classroom	Unit 9. Red biotechnology Biological Water Treatment	4	6
12	Master class Problems Flipped classroom	Unit 10. White biotechnology Biological Water Treatment	4	6
13	Master class Problems Flipped classroom	Unit 11. Green biotechnology Biological Water Treatment	4	6
14	Flipped classroom	Presentation of group work	4	6
15	Flipped classroom	Presentation of group work	4	6

16		Evaluation		
17				
18				
19		Referral exam		

Evaluation

In the middle of the semester there will be a partial eliminatory test (E1) that will correspond to the subject taught during this first part. At the end of the semester there will be another test (E2) also eliminatory with the rest of contents. There will also be a note of exercises and presentations (P), note of the integrating project (PI) and a note of assessment of the teacher (A).

The final grade will be:

NF = 0.70 ((E1 + E2) / 2) + 0.10 P + 0.20 PI

To be able to apply it, a minimum of 3 is required in the partial elimination exams.

Anyone who has not passed the course at the first opportunity will be able to take a final recovery exam (ER) that will include the exam (s) that have not been passed. The final grade of the subject will be calculated with the same formula.

The E1, E2, and ER tests will be carried out on the dates set by the Study Directorate.

Note: in case the student does not develop the project or equivalent work, the mark of the subject will be Not attended.

Bibliography

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Metcalf & Eddy. Ingenieria de aguas residuales: Tratamiento, vertido y reutilización. 3a. Madrid: McGraw Hill, 1995. ISBN 84-481-1607-0.

Ramalho, R.S. Tratamiento de aguas residuales. Barcelona: Reverté, 1996. ISBN 8429179755.