

COURSE: BIOTECHNOLOGY

SUBJECT MATTER: Biotechnology
MODULE: Process and Product Engineering
PROGRAM: Master in Chemical Engineering

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GENERAL FEATURES*

Type: Optional

Duration: Semestral

Semester/s: 2

Number of ECTS credits: 3

Language/s: English, Catalan, Spanish.

DESCRIPTION

SHORT DESCRIPTION AND JUSTIFICATION (of the meaning of the course in relation to the studies. Between 100 and 200 words)

Although the use of biotechnology is very old, obtaining antibiotics, first, and the application of gene recombination techniques, have expanded their field of applications. Biotechnology consists of the application of microorganisms, cells and enzymes to obtain goods and services and constitutes a field of work in great expansion. Consequently, the subject aims to train the student in basic and fundamental knowledge that will allow the understanding, design and management of processes with microorganisms, so applications, models, identification, simulation and control of this type of processes are presented. . In addition, some bioengineering concepts are presented, such as cell culture, tissue engineering, biomaterials and medical devices.

COMPETENCES (of the course placed in relation to the pre-assigned competences in the subject matter)

CB6 – The student has knowledge and understanding of what constitutes a basis or an opportunity to be original by developing and/or applying ideas, often in a research context.

CB7 - The student can apply their knowledge and their ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to his/her field of study.

CB8 - The student is able to integrate knowledge and handle complexity involving judgments based on incomplete or limited information, including issues on social and ethical responsibilities linked to the application of his/her knowledge and judgments.

CT5 - The student is able to assess the impact of Chemical Engineering in the sustainable development of society.

CE2 - The student can design products, processes, systems and services for the chemical industry as well as optimize other already developed, on the technological basis the various areas of Chemical Engineering, involving processes and transport phenomena, separation operations and reactor engineering, both chemical and nuclear, electrochemical or biochemical.

CE4 - The student has the ability to solve problems that are unfamiliar, incompletely defined, and have contradictory specifications, considering the possible methods of solution, including the most innovative, selecting the most appropriate, being able to correct implementation and evaluating the different design solutions.

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PREVIOUS REQUIREMENTS * (modules, subject matters, courses or knowledge necessary for the follow-up of the subject. State previous courses required to be completed)

The competencies of the fundamental module.

CONTENTS (List the content of the course, with up to two level detail)

1. Introduction to Biotechnology.
 - a. Historical development
 - b. Applications.
2. Basic concepts in biotechnology
 - a. Microorganisms and multicellular organisms
 - b. Cell types
 - c. Metabolism
3. Bioreactors and bioprocesses
 - a. Biotechnology vs. Chemistry. Competition/alternatives/new possibilities.
 - b. Applications: use of enzymes and cells. Reactions, equipment and processes. Metabolic routes and metabolites. Anaerobic and aerobic processes. Genetic engineering.
 - c. Industrial Biotechnology. Culture media. Equipment and processes.
4. Biomedicine. Cell culture, tissue engineering, biomaterials and medical devices. Ethics and regulatory in drug development.

METHODOLOGY

LEARNING ACTIVITIES * (Complete the table relating activities, workload in ECTS credits, and competences.)

| Learning Activities | ECTS Credits | Competences |
|--|--------------|-------------------------|
| Lectures | 0.5 | CB6, CB7, CB8, CE2, CE4 |
| Case and Problem-Solving Sessions | 0.5 | CB6, CB78, CE2, CE4 |
| Seminars | 0.1 | CG1 |
| Personal Study | 1.8 | CB6, CB7, CB8, CE2, CE4 |
| Assessment Tasks (Exams, Continuous Assessment...) | 0.1 | CB6, CB7, CB8, CE2, CE4 |
| TOTAL | 3 | |

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TEACHING METHODOLOGY (justify the teaching methodology in relation to the competences and course contents. Between 100 and 200 words)

The students will have in advance the content of the classes grouped by blocks. Master classes will be combined with individual and group discussions. Cases applied on topics of interest to the biotechnology sector will be worked on and discussed. Scientific articles aligned with the lectures will be discussed in class. Topics of interest in modern biotechnology will be presented by groups. There will be follow-up activities during the course to follow the progress of the student.

ASSESSMENT

ASSESSMENT METHODS * (Complete the table relating assessment methods, competences, and weight percentage in the course qualification)

| Assessment methods | Weight | Competences |
|----------------------------------|--------|-----------------------------------|
| Final Exam | 40% | CB6, CB7, CB8, CE2, CE4, CG1, CT5 |
| Continuous Assessment Activities | 20% | CB6, CB7, CB8, CE2, CE4 |
| Reports and Presentations | 30% | CB6, CB7, CB8, CE2, CE4 |
| Participation | 10% | E4 |

LEARNING OUTCOMES (Explanation of the student's achievements that allow the assessment of competences, relating them to the competences and the assessment methods)

- The student must demonstrate knowledge that gives him the base or opportunity to be original in the development and / or application of ideas [CB6].
- The student must know how to apply the knowledge acquired and his ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to his area of study [CB7]
- The student must demonstrate ability to integrate knowledge and face the complexity of making judgments based on information that, being incomplete or limited, includes reflections on the social and ethical responsibilities linked to the application of their knowledge and judgments [CB8].
- The student must know how to design, manage, perform and present a project and capacity to assess the impact of Chemical Engineering on the sustainable development of society [CG1, CT5].
- The student must know how to design products, processes, systems and services of the chemical industry, as well as the optimization of others already developed, taking as a technological base the various areas of chemical engineering,

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- comprehensive processes and transport phenomena, separation operations and engineering of chemical, nuclear, electrochemical and biochemical reactions [CE2].
- The student must have the ability to solve problems that are unfamiliar, incompletely defined, and have competing specifications, considering the possible methods of solution, including the most innovative ones, selecting the most appropriate one, and being able to correct the implementation, evaluating the different design solutions [CE4]

QUALIFICATION (Explanation of the qualification system)

The evaluation of the subject will consider the qualifications of the Follow-up Activities (AS), of the Works and presentations (TP), of the Participation (P) and of the final exam (EF). The qualification of the follow-up activities (AS, 20% of the final grade) will be calculated as a simple average of the activities carried out, consisting in the resolution of a questionnaire in the middle of the subject, which will evaluate the knowledge acquired during the lectures, and a report at the end of the subject, which will evaluate the ability of synthesis and analysis of the articles studied. The presentation of follow-up activities is mandatory in order to be able to take the final exam. Otherwise the student must contact the teacher to recover the activities not delivered (which will be scored with a maximum score of 5/10) The qualification of the Works and Presentations (TP, 30% of the final grade) will correspond to the evaluation of the articles presented and discussed in class (10%), the presentation of one of the thematic frontiers of Biotechnology proposals (10%) and the questions asked to the classmates during these presentations (10%). The presentation of all the activities is mandatory in order to be able to take the final exam. Otherwise the student must contact the teacher to recover the activities not delivered (which will be scored with a maximum score of 5/10) The qualification of the participation (P, 10% of the final grade) is awarded by the teacher at the end of the course taking into account the level of participation that the student has had in the overall of the activities of the subject and especially in the discussion of exercises and cases. The final exam (EF, 40% of the final grade) aims to assess the synthesis of the subject. The final grade (CF) of the subject will be calculated with the following formula: $CF = 0.40 EF + 0.2 AS + 0.3 TP + 0.1 P$. If the student obtains a grade lower than 4.0 (being 10 the maximum score) in the final exam, you can not pass the subject, being your final grade only the exam. In the second call, the final grade will be obtained by substituting the note of the final exam and of the controls for the note of the exam in the second call ($CF = 0.6 \text{ Exam} + 0.3 TP + 0.1 P$.) In subsequent calls, the final grade will be that of the examination in said call.

ASSESSMENT OF THE COMPETENCES (Describe the grading system for each competence in relation with the assessment tasks)

The evaluation of the competences is carried out through specific items of the different evaluation methods used.

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BIBLIOGRAPHY (Recommended and accessible to the student.)

- Professor's Slides
- Scientific papers delivered by the professor.
- M.L. Shuler, F.Kargi, "Bioprocess Engineering: Basic Concepts", 2nd Ed. Prentice-Hall, 2002.
- J.E. Bailey, D.F.Ollis, "Biochemical Engineering Fundamentals" 2nd Ed., 1986, McGraw Hill.
- H. Lodish. A. Berk, Molecular Cell Biology. 7th Ed. WH Freeman, 2012

DOCUMENT HISTORY

PREVIOUS REVISIONS (Indicate date and author / s, first the most recent one)

CURRENT REVISION (Indicate date and author / s)

February 26th 2019, Dr. Jordi Martorell