

**1. General information**

Course: BIOCHEMICAL ENGINEERING
Type: CORE COURSE
Degree: 344 - CHEMICAL ENGINEERING
Center: 1 - FACULTY OF SCIENCE AND CHEMICAL TECHNOLOGY
Year: 3

Main language: Spanish
Use of additional languages:
Web site:

Code: 57725
ECTS credits: 6
Academic year: 2023-24
Group(s): 21
Duration: C2
Second language: English
English Friendly: Y
Bilingual: N

| Lecturer: ANA MARIA BORREGUERO SIMON - Group(s): 21 | | | | |
|---|--------------------|--------------|-----------------------------|--|
| Building/Office | Department | Phone number | Email | Office hours |
| Enrique Costa Novella/Despacho 12 | INGENIERÍA QUÍMICA | 6353 | anamaria.borreguero@uclm.es | Wednesday, Thursday and Friday from 10 to 11. Preferably make an appointment via email. |
| Lecturer: CARMEN MARIA FERNANDEZ MARCHANTE - Group(s): 21 | | | | |
| Building/Office | Department | Phone number | Email | Office hours |
| Enrique Costa Novella/Despacho 14 | INGENIERÍA QUÍMICA | 6351 | carmenm.fmarchante@uclm.es | Monday, Wednesday and Thursday: 12:30 a 13:30 h |
| Lecturer: ESTER LÓPEZ FERNÁNDEZ - Group(s): 21 | | | | |
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2. Pre-Requisites

Not established

3. Justification in the curriculum, relation to other subjects and to the profession

Subject belonging to Module 3 (Specific technology in Industrial chemistry). Biochemical engineering is concerned with the study, planning, design and operation of industrial chemical processes in which the transformation stage of raw materials is carried out through biochemical reactions (using different microorganisms) or enzymatic reactions. This type of process is very common in the chemical industry, food and beverage industry, drug production or environmental waste treatment.

4. Degree competences achieved in this course**Course competences**

| Code | Description |
|------|---|
| CB05 | Have developed the necessary learning abilities to carry on studying autonomously |
| E19 | Knowledge about material and energy balances, biotechnology, material transfer, separation operations, chemical reaction engineering, reactor design, and recovery and transformation of raw materials and energy resources. |
| E21 | Capacity for the design and management of 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, mass transference, kinetics of chemical reactions and reactors. |
| G04 | Ability to solve problems with initiative, decision making, creativity, critical reasoning and to communicate and transmit knowledge, skills and abilities in the field of Chemical Engineering. |
| G16 | Management capacity and information planning |
| G17 | Capacity for critical thinking and decision making |
| G18 | Synthesis capacity |
| G19 | Capacity for teamwork |
| G20 | Ability to analyze and solve problems |
| G21 | Ability to learn and work autonomously |
| G22 | Ability to apply theoretical knowledge to practice |

5. Objectives or Learning Outcomes**Course learning outcomes****Description**

- To have knowledge to adequately control the functioning of biotechnological processes.
- To have knowledge to design operations of conditioning of substrates and processing of products in biochemical processes.
- To have knowledge to design enzymatic reactors.
- To have knowledge to design industrial fermentors.
- To know how to select among several alternatives in a biotechnological process.

6. Units / Contents

Unit 1: Biochemical reactors

Unit 2: Enzyme reactors

Unit 3: Agitation and mixing

Unit 4: Aeration of Fermenters

Unit 5: Drying solids

Unit 6: Lyophilization

Unit 7: Esterification of Culture Media

Unit 8: Biotechnology processes of industrial interest

7. Activities, Units/Modules and Methodology

| Training Activity | Methodology | Related Competences (only degrees before RD 822/2021) | ECTS | Hours | As | Com | Description |
|--|--------------------------------------|---|---|------------|----|-----|-------------|
| Class Attendance (theory) [ON-SITE] | Lectures | CB05 E19 E21 G04 G16 G17 G18 G20 G22 | 1.4 | 35 | N | - | |
| Mid-term test [ON-SITE] | Assessment tests | CB05 E19 E21 G04 G16 G17 G18 G19 G20 G22 | 0.1 | 2.5 | Y | Y | |
| Laboratory practice or sessions [ON-SITE] | Practical or hands-on activities | CB05 E19 E21 G04 G16 G17 G18 G19 G20 G22 | 0.2 | 5 | Y | Y | |
| Problem solving and/or case studies [ON-SITE] | Project/Problem Based Learning (PBL) | CB05 E19 E21 G04 G16 G17 G18 G19 G20 G21 G22 | 0.6 | 15 | Y | Y | |
| Group tutoring sessions [ON-SITE] | Group tutoring sessions | CB05 E19 E21 G04 G19 G21 | 0.1 | 2.5 | N | - | |
| Study and Exam Preparation [OFF-SITE] | Self-study | CB05 E19 E21 G04 G16 G17 G18 G19 G20 G21 G22 | 3.6 | 90 | N | - | |
| Total: | | | 6 | 150 | | | |
| Total credits of in-class work: 2.4 | | | Total class time hours: 60 | | | | |
| Total credits of out of class work: 3.6 | | | Total hours of out of class work: 90 | | | | |

As: Assessable training activity

Com: Training activity of compulsory overcoming (It will be essential to overcome both continuous and non-continuous assessment).

8. Evaluation criteria and Grading System

| Evaluation System | Continuous assessment | Non-continuous evaluation* | Description |
|---|-----------------------|----------------------------|---|
| Practicum and practical activities reports assessment | 10.00% | 10.00% | The elaboration of practice memoirs in the classroom is included. |
| Mid-term tests | 65.00% | 0.00% | The progress tests go into the evaluation option. |
| Laboratory sessions | 15.00% | 15.00% | The realization of laboratory practices is an activity. |
| Assessment of problem solving and/or case studies | 10.00% | 10.00% | Solving problems or global cases is done. |
| Final test | 0.00% | 65.00% | |
| Total: | 100.00% | 100.00% | |

According to art. 4 of the UCLM Student Evaluation Regulations, it must be provided to students who cannot regularly attend face-to-face training activities the passing of the subject, having the right (art. 12.2) to be globally graded, in 2 annual calls per subject, an ordinary and an extraordinary one (evaluating 100% of the competences).

Evaluation criteria for the final exam:

Continuous assessment:

The criteria indicated in each of the training activities and the percentages of the evaluation system shall apply. To approve the subject in each of the sections will require a minimum of a 4.0/10 and the average must be equal to or greater than 5.0/10.

Non-continuous evaluation:

Evaluation criteria not defined

Specifications for the resit/retake exam:

They follow the same criteria as in the ordinary.

Specifications for the second resit / retake exam:

The character of compulsory realization, the minimum note, and the recoverable character is maintained as in the ordinary call.

9. Assignments, course calendar and important dates

| Not related to the syllabus/contents | |
|--|-------|
| Hours | hours |
| Class Attendance (theory) [PRESENCIAL][Lectures] | 35 |
| Mid-term test [PRESENCIAL][Assessment tests] | 2.5 |
| Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities] | 5 |
| Problem solving and/or case studies [PRESENCIAL][Project/Problem Based Learning (PBL)] | 15 |
| Group tutoring sessions [PRESENCIAL][Group tutoring sessions] | 2.5 |
| Study and Exam Preparation [AUTÓNOMA][Self-study] | 90 |
| Global activity | |

| Activities | hours |
|--|-------|
| Class Attendance (theory) [PRESENCIAL][Lectures] | 35 |
| Mid-term test [PRESENCIAL][Assessment tests] | 2.5 |
| Laboratory practice or sessions [PRESENCIAL][Practical or hands-on activities] | 5 |
| Problem solving and/or case studies [PRESENCIAL][Project/Problem Based Learning (PBL)] | 15 |
| Group tutoring sessions [PRESENCIAL][Group tutoring sessions] | 2.5 |
| Study and Exam Preparation [AUTÓNOMA][Self-study] | 90 |
| Total horas: 150 | |

| 10. Bibliography and Sources | | | | | | |
|---|---|---------------------------------------|----------|----------------------|------|-------------|
| Author(s) | Title/Link | Publishing house | City | ISBN | Year | Description |
| Okafor, N. y Okeke B.C | Modern Industrial Microbiology and Biotechnology | CRC Press - Taylor & Francis Group | American | 9781138550186 | 2017 | |
| Shuler, M.L | Chemical Engineering Problems in Biotechnology | Institute of Chemical Engineers | | 0-8169-0469-3 | 1989 | |
| Stuedler, S., Werner, A., Cheng, J.J | Solid State Fermentation: Research and Industrial Applications. | Springer | | 3030236757, 97830302 | 2019 | |
| Kato, S., Horiuchi, J. y Yoshida, F. | Biochemical engineering: a textbook for engineers, chemists and biologists. | Wiley-VCH Verlag GmbH & Co. KGaA, cop | | 978-3-527-33804-7 | 2015 | |
| B. Atkinson, F. Mavituna | Biochemical engineering and biotechnology handbook | Macmillan Publishers Ltd. | U.K. | 0-333-33274-1 | 1983 | |
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| Kent, J. A.; Bommaraju, T.; Barnicki, S. D. | Handbook of Industrial Chemistry and Biotechnology | Springer | | 978-3-319-52287-6 | 2017 | |
| Kirk y Othmer | Enciclopedia de Tecnología Química | Limusa S.A | | 968-18-5576-0 | 1998 | |
| Scragg, A | Biotecnología para Ingenieros: sistemas biológicos en procesos tecnológicos | Limusa S.A | | 978-968-18-4708-1 | 2008 | |