

COURSE GUIDE: 2016-17

| COURSE DETAILS | | | |
|---|--------------------------|------------------------|---|
| Name : | Microalgae biotechnology | | |
| Code : | 70982216 | Plan : | Master in Industrial and Agroalimentary Biotechnology (7098). |
| Academic year : | 2016/17 | Level : | Official Master |
| Course : | 1 st | Type : | Optional |
| Semester : | 2 nd | | |
| TIME DISTRIBUTION IN ACCORDANCE WITH REGULATION | | | |
| ECTS : | 3 | In-class hours: | 22.5 |
| | | Not in-class hours: | 52.5 |
| | | Total time (in hours): | 75 |
| USE OF VIRTUAL PLATFORM: | | Yes. Teaching support. | |

| LECTURER 1 DETAILS | | | |
|--------------------|---|--------|-----------------|
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| Personal webpage | www.jfernand.es | | |
| LECTURER DETAILS | | | |
| Name | Diego López Alonso | | |
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| Personal webpage | - | | |

| ACTIVITIES ORGANIZATION | |
|--|--|
| <i>Planned activities for learning and workload distribution per activity (in hours)</i> | |
| I. STUDENT'S ACTIVITIES (In-class / Online) | <ul style="list-style-type: none"> <li style="display: flex; justify-content: space-between; align-items: flex-start; margin-bottom: 10px;"> • Seminars [Example] 0,0 <li style="display: flex; justify-content: space-between; align-items: flex-start; margin-bottom: 10px;"> • Teaching group [Example] 22.5 <li style="display: flex; justify-content: space-between; align-items: flex-start;"> • Work group / small group [Example] 0,0 |
| | <i>Total In-class/Online time :</i> 22.5 |

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1/7



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| II. STUDENT'S AUTONOMOUS ACTIVITIES (not in-class) | • | 52.5 |
| | <i>Total not in-class time :</i> | 52.5 |
| TOTAL WORKING HOURS | | 75 |

ELEMENTS OF INTEREST FOR COURSE LEARNING

Justification of contents

The aim of this subject is to apply the knowledge obtained in the core and compulsory subjects of itinerary 1 "Industrial Bioprocesses and Biotechnology" to the design of productive microalgae-based processes. The basics of microalgal growth is described and the most used culture systems are introduced. The concept of photobioreactor is also introduced as a necessity derived of the request of high productivity microalgal culturing and of the realization of the essential role played by light limitation in microalgal cultures.

Other courses related

- Fundamentos de Biorreactores
- Biología y Bioquímica Molecular
- Biología de Microorganismos
- Diseño e implementación de bioprocesos

Minimum knowledge required to deal with the Course

Mass and energy balances. Fundamentals of unit operations. Basic bioreactor design. Basic process design.

COMPETENCIES

General competencies

General objectives of the University of Almería

Conocimiento de una segunda lengua (Knowledge of a second language).

Habilidad en el uso de las TIC (Skills in the use of TICs).

Capacidad para aprender a trabajar de forma autónoma (Capacity for autonomous work).

Other general objectives

Understand knowledge, acquire knowledge. Apply knowledge.

(Comprender y poseer conocimientos Aplicación de conocimientos)

Specific competencies developed

The specific competencies developed as described in the study plan are CE4, CE5, CE6, CE9, CE13, CE22, CE23, y CE35 in the scope of industrial biotechnology.

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2/7



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LEARNING OBJECTIVES/OUTCOMES

- a) Using the knowledge of the specific area in the analysis of processes, the resolution of complex problems and the design of new processes
- b) Finding, analyzing, processing and presenting knowledge for an expert audience
- c) Development of critical capacities
- d) Applying knowledge from the area to the design and implementation of bioprocesses.
- e) Capability to critically assess the potential of new techniques in industrial biotechnology and ascertain its usefulness for the improvement of products and services
- f) Analyzing bioprocesses in order to devise improvements and bring about new solutions.

CONTENTS

| | |
|-----------------|---------------------------------|
| Module I | Basics of microalgal culturing. |
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|----------------|------------------------------------|
| Content | 1- Microalgae and its metabolites. |
|----------------|------------------------------------|

Learning system and methodology

| <i>System</i> | <i>Learning procedures and activities</i> | <i>Observations</i> | <i>Hours In-class/ Online</i> |
|--------------------------|---|---------------------|-------------------------------|
| Teaching group [example] | Master class/Seminar | | 2,0 |
| Work group [example] | Practical case [example] | | 0,0 |
| Seminars [example] | Lecture, debate [example] | | 0,0 |

Description of autonomous workload

Organize and complete the information supplied in-class. Answer questions and problems given in class. Review the information, study and assimilate the knowledge. Seek for tutoring in case of finding something unclear.

| | |
|----------------|--|
| Content | 2- Microalgal growth kinetics and mathematical models. |
|----------------|--|

Learning system and methodology

| <i>System</i> | <i>Learning procedures and activities</i> | <i>Observations</i> | <i>Hours In-class/ Online</i> |
|--------------------------|---|---------------------|-------------------------------|
| Teaching group [example] | Master class/Seminar | | 3,0 |
| Work group [example] | Practical case [example] | | 0,0 |
| Seminars [example] | Lecture, debate [example] | | 0,0 |

Description of autonomous workload

Organize and complete the information supplied in-class. Answer questions and problems given in class. Review the information, study and assimilate the knowledge. Seek for tutoring in case of finding something unclear.

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3/7



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| Content | 3- Evaluation of light availability in microalgal cultures. | | |
| Learning system and methodology | | | |
| <i>System</i> | <i>Learning procedures and activities</i> | <i>Observations</i> | <i>Hours In-class/ Online</i> |
| Teaching group [example] | Master class/Seminar | | 3.0 |
| Work group [example] | Practical case [example] | | 0,0 |
| Seminars [example] | Lecture, debate [example] | | 0,0 |
| Description of autonomous workload | | | |
| Organize and complete the information supplied in-class. Answer questions and problems given in class. Review the information, study and assimilate the knowledge. Seek for tutoring in case of finding something unclear. | | | |

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| CONTENTS | | | |
| Module II | Photobioreactor design and scale-up. | | |
| Content | 4- Transport phenomena in microalgal cultures: CO ₂ and O ₂ exchange and carbon equilibria. | | |
| Learning system and methodology | | | |
| <i>System</i> | <i>Learning procedures and activities</i> | <i>Observations</i> | <i>Hours In-class/ Online</i> |
| Teaching group [example] | Master class/Seminar | | 3.0 |
| Work group [example] | Practical case [example] | | 0,0 |
| Seminars [example] | Lecture, debate [example] | | 0,0 |
| Description of autonomous workload | | | |
| Organize and complete the information supplied in-class. Answer questions and problems given in class. Review the information, study and assimilate the knowledge. Seek for tutoring in case of finding something unclear. | | | |
| Content | 5- Transport phenomena in microalgal cultures: heat exchange and pressure drops. | | |
| Learning system and methodology | | | |
| <i>System</i> | <i>Learning procedures and activities</i> | <i>Observations</i> | <i>Hours In-class/ Online</i> |
| Teaching group [example] | Master class/Seminar | | 2.0 |
| Work group [example] | Practical case [example] | | 0,0 |
| Seminars [example] | Lecture, debate [example] | | 0,0 |

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4/7



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| Description of autonomous workload | | | |
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| Organize and complete the information supplied in-class. Answer questions and problems given in class. Review the information, study and assimilate the knowledge. Seek for tutoring in case of finding something unclear. | | | |
| Content | 6- Industrial photobioreactors and biomass harvesting systems. (2,0) | | |
| Learning system and methodology | | | |
| <i>System</i> | <i>Learning procedures and activities</i> | <i>Observations</i> | <i>Hours In-class/ Online</i> |
| Teaching group [example] | Master class/Seminar | | 2.0 |
| Work group [example] | Practical case [example] | | 0,0 |
| Seminars [example] | Lecture, debate [example] | | 0,0 |
| Description of autonomous workload | | | |
| Organize and complete the information supplied in-class. Answer questions and problems given in class. Review the information, study and assimilate the knowledge. Seek for tutoring in case of finding something unclear. | | | |

| CONTENTS | | | |
|--|---|---------------------|-------------------------------|
| Module III | Molecular Genetics Applied to Microalgae. | | |
| Content | 7.- Genetics engineering of microalgae. | | |
| Learning system and methodology | | | |
| <i>System</i> | <i>Learning procedures and activities</i> | <i>Observations</i> | <i>Hours In-class/ Online</i> |
| Teaching group [example] | Master class/Seminar | | 7.5 |
| Work group [example] | Practical case [example] | | 0,0 |
| Seminars [example] | Lecture, debate [example] | | 0,0 |
| Description of autonomous workload | | | |
| Organize and complete the information supplied in-class. Answer questions and problems given in class. Review the information, study and assimilate the knowledge. Seek for tutoring in case of finding something unclear. | | | |

| EVALUATION SYSTEM | |
|---|--|
| Assessment criteria | |
| The evolution of the student will be assessed continuously by the individual resolution of questions and short problems given in class and through other activities assigned to the student such as the search of specific information o microalgal strains or culture systems and the briefing and finding key points in case-studies. | |

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Marking system

| | <i>Activity</i> | <i>(Number of hours)</i> | <i>Percentage</i> |
|---|-------------------------------------|--------------------------|-------------------|
| I. STUDENT 'S ACTIVITIES (In-class/Online) | • Seminars [example] | | % |
| | • Teaching group [example] | | 50 % |
| | • Work group/ small group [example] | | % |
| II. STUDENT'S AUTONOMOUS ACTIVITIES (Autonomous work) | • Individual work [example] | | 50 % |

Assessment instruments

1. Resolution of class questions and problems (10%)
2. Evaluation of a compulsory report of a class assignment (design of a PBR with certain given conditions) (40%)
3. Written final exam (1.5 h, 50% final marks)

Note: 1+2 make up to 50% of the final marks.

Monitoring mechanisms

- Individual tutoring.
- Use of virtual classroom
- Attending and participating in activities and information exchange.
- Solving of questions and problems in class, tutoring sessions or trough the virtual classrrom.
- Evaluation of class work and virtual-class work.
- Commenting in the web Disqus.

BIBLIOGRAPHY

Recommended bibliography

- Algal culturing techniques. (Robert Arthur Andersen) - Basic
- Microalgae, Mass Culture Methods (in Encyclopedia of Industrial Biotechnology: Bioprocess, Bioseparation, and Cell Technology) (EmilioMolina Grima, Jose María

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Fernández Sevilla, Francisco Gabriel Acién Fernández) – Basic

Advanced, theme-specific bibliography can be found at the end of each lesson.

Bibliography existing in the library of the University of Almeria

<http://almirez.ual.es/search/e?SEARCH=BIOTECNOLOGIA>

WEB ADRESSES

Course web:

<http://www.ual.es/~jfernand/MBio70411204/MBio70411204/Main.html>

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