COURSE GUIDE: 2014-15

COURSE DETAILS

Name :	Laboratory of Bioprocess (UAL)		
Code :	70801206	Plan :	Master´s Degree in Chemical Engineering
Academic year :	2014-2015	Level :	Official master´s degree
Course :	3	Type :	Optional
Semester :	2		

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:			Support for teaching

LECTURER DETAILS

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ACTIVITIES ORGANIZATION

Planned activities for learning and workload distribution per activity (in hours)

I. STUDENT'S ACTIVITIES (In-class / Online)	• Seminars	0,0
	• Teaching group	22,5
	• Work group / small group	0,0
	Total In-class/Online time :	22,5

II. STUDENT'S AUTONOMOUS ACTIVITIES (not in-class)	•	52,5
	Total not in-class time :	52,5
TOTAL WORKING HOURS		52,5

ELEMENTS OF INTEREST FOR COURSE LEARNING
Justification of contents
Bioprocess Engineering is the modification or application of renewable raw materials to produce value-added products. Bioprocess Engineering currently has multiple applications in continuously developing areas such as pharmaceutical industry, the food and bioremediation among others. It is necessary then that future professionals have mastered the knowledge, skills and techniques necessary to design, carry out and analyze and discuss experiments concerning bioprocesses.
Other courses related
This subject is closely related to other subjects of the block of engineering processes and products listed in the memory of the master.
Minimum knowledge required to deal with the Course
It is recommended to have a good management of basic laboratory techniques such as preparation of solutions, good skills for report writing and use of computers. It is advisable to have acquired knowledge of the kinetics of the growth of microorganisms, basic operations in general and chemical reactors.

COMPETENCES
Generic competences
Generic competences of the University of Almeria CG4 - Carrying out appropriate research, undertaking design and directing the development of engineering solutions, in new or little-known environments linking creativity, originality, innovation and technology transfer. CB6 - Owning and understanding knowledge that can provide a base or opportunity to be original in the development and/or application of ideas, often in a context of research.
Other competences CT1- Working in a team developing social skills. CT4- Communicating scientific and technical concepts by using the most common audiovisual media, in order to develop oral communication skills.
Specific competences developed
CE1 – Applying mathematics, physics, chemistry, biology and other natural sciences´ knowledge, gained by study, experience, and practice, with critical reasoning to establish economically viable solutions to technical problems CE2 - Designing products, processes, systems and services of the chemical industry, as well as the optimization of others already developed, on the technological basis of the various areas of chemical engineering, comprehensive transport, operations of separation and chemical reaction, nuclear engineering, electrochemical and biochemical phenomena and processes.
LEARNING OJECTIVES/OUTCOMES
Designing experiments to fully perform a simple BioProcess, from raw materials to the product. Kinetic modeling of growth of micro-organisms, production of bioproducts, etc... by using computer tools. Interpreting and discussing the results of the experiments with existing literature and similar experiments performed by other students. Summarizing and explaining the results. Students will have all the required material in the lab in order to develop the full bioprocess from raw material to products and head towards the basic operation chosen at each time. Students will be able to model dynamic processes provided by mathematical software (Matlab, Sigmaplot, Mathcad, Excel, etc.). There will be computers in a specific room for this purpose. They will perform and discuss the results by comparison with other

similar experiments and by using available literature. Through oral presentation, students will learn how to summarize a brief discussion of results.

CONTENTS			
Module 1	PRACTICAL HANDS-ON TRAINING IN INDUSTRIAL BIOTECHNOLOGY		
Content	Disinfection and sterilization techniques. Preparation of culture media. Set-up and start-up of bioreactors.		
Learning system and methodology			
System	*Learning procedures and activities*	*Observations*	*Hours In-class/ Online*
Work group	Laboratory work		0,8
	Evaluation session		0,1
	Active lesson		0,1
Description of autonomous workload			
Reading, studying and autonomous work in the lab (preparation of solutions, sterilization and disinfection)			
Module 2	HANDLING OF MICROORGANISMS.		
Content	Generalities Preparation and maintenance of inoculum.		
Learning system and methodology			
System	*Learning procedures and activities*	*Observations*	*Hours In-class/ Online*
Work group	Active lesson		0,5
Work group	Laboratory work		0,5
Description of autonomous workload			
Laboratory work. To study.			
Module 3	**EVALUATION OF CRITICAL PARAMETERS IN BIOREACTORS.**		
Content	Introduction to chemical parameters in bioreactors. Monitoring of critical parameters in the laboratory. Comparison of bioprocesses with different values of critical parameters. Data treatment of critical parameters.		

Learning system and methodology			
System	*Learning procedures and activities*	*Observations*	*Hours In-class/ Online*
Work group	Active lessons		1,2
	Laboratory work		2,3
	Group presentations		0,2
	Evaluation session		0,1
	Processing data by using suitable software		1,0

Description of autonomous workload
Laboratory work. To study.

Module 4	APLICATION OF DIFFERENT CULTURE SYSTEMS FOR THE PRODUCTION OF METABOLITES.
Content	Systems for the production of metabolites. Experimentation with different culture systems for the production of metabolites.

Learning system and methodology			
System	*Learning procedures and activities*	*Observations*	*Hours In-class/ Online*
Work group	Active lectures		0,5
	Laboratory work		2,0
	Group presentations		0,2

Description of autonomous workload
To study. Data collection on the lab.

Module 5	APPLICATION OF BIOCATALYSIS
Content	Biocatalysts. Generalities. Processes that use biocatalysts.

Learning system and methodology			
System	*Learning procedures and activities*	*Observations*	*Hours In-class/ Online*

Work group	Active lectures		0,5
	Laboratory work		1,5
Description of autonomous workload			
To study. Laboratory work. Completion of tasks.			

Module 6	DETERMINATION OF KINETIC PARAMETERS.
Content	Kinetic parameters and models. Determination of kinetic parameters from experimental data.

Learning system and methodology			
System	*Learning procedures and activities*	*Observations*	*Hours In-class/ Online*
Work group	Active lectures		0,5
	Laboratory work and Computer´s lab work.		2,0
Description of autonomous workload			
To study. Data collection in the lab. Analysis of experimental data.			

Module 7	DOWNSTREAM PRODUCTS OF INTEREST.
Content	Industrial process for obtaining bioproducts. Design and implementation of a laboratory-scale bioprocess.

Learning system and methodology			
System	*Learning procedures and activities*	*Observations*	*Hours In-class/ Online*
Work group	Active lectures		0,5
	Group presentations		0,2
	Laboratory work		3,0
	Evaluation session		0,1
Description of autonomous workload			
To study. Data collection in the lab.			

Module 8	IMPLEMENTATION OF ANALYTICAL TECHNIQUES FOR MONITORING AND OPTIMIZATION OF BIOPROCESS AND ANALYSIS OF CRITICAL DATA.
Content	Analytical techniques. Implementation of analytical methods for monitoring bioprocesses. Critical analysis of the data and bioprocess optimization.

Learning system and methodology

System	*Learning procedures and activities*	*Observations*	*Hours In-class/ Online*
Work group	Active lectures		0,5
	Group presentations		0,1
	Laboratory work		2,0
	Completion of works		1,5
	Discussion and sharing		0,4
	Evaluation session		0,2

Description of autonomous workload

Preparation of reports

Analysis of data.

EVALUATION SYSTEM

Assessment criteria

System (E1): Presentation of works and activities. It will contribute 70% of the final grade according to the following criteria:

- Students must demonstrate that it has been able to plan and to carry out a desired simple Bioprocess from raw material to product, modeling the processes required, provable through classroom work, through attendance and participation. The maximum score in this sense will be obtained if students attend to working sessions, actively participate and have a dynamic attitude to laboratory work and the processing of data, which will be correct and tight, up to a maximum of 4 points.
- To demonstrate the competence of the students for the synthesis and presentation of the obtained results there will be a presentation using audiovisual media, obtaining in this way a maximum rating of up to 3 points.

System (E2): Tests written. It will provide a 30% of the final grade according to the following criteria:

Written tests will be preferably used to demonstrate that the student performs a continuous study during the development of the subject, being able to divide them along the course in the form of small tests of content. It will be awarded up to a maximum of 3 points.

Marking system

	Activity	*(Number of hours)*	*Percentage*
I. STUDENT 'S ACTIVITIES (In-class/Online)	• Teaching group	0	0%
	• Work group/ small group	22,5	55%
II. STUDENT'S AUTONOMOUS ACTIVITIES (Autonomous work)	• Individual work or group work	52.5	45%

Assessment instruments

- Test / initial diagnostic interview.
- Self-assessment (individual and group) of the process.
- Observations of the process.
- Final evaluation of reports, papers, projects, etc.
- Final tests (written or oral).
- Student portfolio.
- Memory.
- Final self-evaluation of the student.

Monitoring mechanisms

- Attendance to tutorials
- Attendance and participation in seminars
- High and access to the virtual classroom
- Delivery of activities in class
- Delivery of activities in tutorials
- Delivery of activities in virtual classroom

BIBLIOGRAPHY

Recommended bibliography

- Biochemical engineering and biotechnology handbook *(Atkinson, B.)* – (basic)
- Bioprocess Engineering Principles *(Doran, Pauline M.)* – (basic)
- Manual of Industrial Microbiology and Biotechnology *(DEMAIN, A.)* – (basic)

The chemical reactor omnibook *(Levenspiel, Octave)* – (basic)
Bibliography existing in the library of the University of Almeria
Universidad de Almeria /Catalogo

WEB ADRESSES
• http://lms.ual.es/webct/urw/lc5122011.tp0/applicationframework/images/index.html • http://almirez.ual.es/screens/mainmenu2_spi.html