INSTITUTO POLITÉCNICO DE BRAGANÇA

Course Unit	Bioprocess Engineering			Field of study	Biotechnology		
Master in	Chemical Engineering			School	School of Technology and Management		
Academic Year	2019/2020	Year of study	2	Level	2-2	ECTS credits	6.0
Type	Semestral	Semester	1	Code	6362-354-2102-00-19		

Workload (hours)	162	Contact hours	T	TP	PL	TC	S	E	OT	O
			30	-	30	-	-	-	-	-

T - Lectures; TP - Lectures and problem-solving; PL - Problem-solving, project or laboratory; TC - Fieldwork; S - Seminar; E - Placement; OT - Tuturial; O - Other

Name(s) of lecturer(s): Ricardo Frederico Pereira Dias

Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:
1. Know the different cell growth kinetics and different enzyme kinetics
2. Know how to design homogeneous and heterogeneous bio-reactors
3. Distinguish the different steps from a typical separation process in biotechnology and the unit operations typically used in each step

Prerequisites

Before the course unit the learner is expected to be able to:
Licentiate degree in Chemical Engineering, Biochemical Engineering or Biological Engineering.

Course contents

Enzimes; Cell growth; Bioreactors; Bioseparations

Course contents (extended version)

1. Enzimes
   - Enzyme kinetics, inhibition and deactivation
   - Effect of conditions on enzyme reaction rate
   - Methods used in the immobilization of enzymes
   - Effect of immobilization on enzymes reaction rate.
2. Cell growth
   - Yields in cell growth: overall and instant yields; theoretical and observed yields
   - Production kinetics in cell growth.
   - Kinetics of substrate uptake in cell culture.
3. Bioreactors
   - Batch reactor, fed-batch reactor, chemostat and plug flow reactor.
4. Bioseparations
   - Main steps in a classical bioseparation process departing from a given fermentation broth.
   - Filtration in the presence of compressible and incompressible filter cakes
   - Effect of the shape of the cells on the performance of filtrations
   - Filtration with centrifugation
   - Liquid-liquid extraction using two water phase systems
   - Electrodialyses
   - Isoelectric focusing
   - Cell disruption

Recommended reading

1. J. E. Bailey, D. F. Ollis, Biochemical engineering fundamentals, 2nd edition, McGraw-Hill, 1996.
2. H. W. Blanch, H. S. Clark, Biochemical engineering, CRC Press, 1997.
3. P. A. Belter, E. L. Cussler, W. Hu, Bioseparations – Downstream processing for biotechnology, John Wiley & Sons, 1988.

Teaching and learning methods

The exposition of the fundamental notions from each of the topics outlined in the programme, relating the theory with some practical examples, will be carried out in the theoretical-practical classes. The experimental works will be performed in the laboratory classes, the reports of the referred works being then written.

Assessment methods

- Alternative 1 - (Regular, Student Worker) (Final, Supplementary, Special)
   - Reports and Guides - 60%
   - Final Written Exam - 40%

Language of instruction

English

Electronic validation

Ricardo Frederico Pereira Dias	Hélder Teixeira Gomes	Simão Pedro de Almeida Pinho	Paulo Alexandre Vara Alves
06-11-2019	08-11-2019	18-11-2019	18-11-2019