

Course Unit	Technology of Biocatalysts	Field of study	Engineering and related techniques
Master in	Biotechnological Engineering	School	School of Agriculture
Academic Year	2020/2021	Year of study	1
Type	Semestral	Semester	2
Level	2-1	ECTS credits	5.0
Code	5010-509-1206-00-20		
Workload (hours)	135	Contact hours	T 25 TP - PL 25 TC - S - E - OT 4 O -

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

Name(s) of lecturer(s) Clementina Maria Moreira dos Santos

#### Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:

1. Knowledge about the sources, functions and enzyme use in the industry.
2. Knowledge about the methodologies for the characterization and control of the enzymatic activity.
3. Valuation of the process of enzyme immobilization, stability, functionality and type of reactors used in immobilization.
4. Knowledge about enzymes used in industry.

#### Prerequisites

Before the course unit the learner is expected to be able to:

Possess knowledge in chemistry, in particular in the specialty of biochemistry.

#### Course contents

General aspects of biocatalysts. Commercial sources of enzymes: microbiane, plants, animals. Stability and stabilization of biocatalysts. Immobilization. Characteristics of immobilized biocatalysts. Industrial applications. Analytical applications. Medical applications.

#### Course contents (extended version)

1. Introduction. General properties of enzymes. Classification and nomenclature.
2. Structure of enzymes. Functions. Stability of proteins.
3. Reversible denaturation. Irreversible denaturation or desactivation. Operational stability.
4. Immobilization of biocatalysts. Methods of immobilization (solid supports and cross linking).
5. Biocatalysis in non conventional solvents. Kinetics.
6. Reactors. Discontinuous and continuous reactors.
7. Industrial applications. Animal feeding and feeds. Detergents. Foods and drinks.
8. Analytical applications. Medical applications. Pharmaceutical industry. Antibiotic production.

#### Recommended reading

1. S. M. Bhatt, Enzymology and Enzyme Technology, 2014, S Chand
2. K. Buchholz, V. Kasche, U. T. Bornscheuer, Biocatalysts and Enzyme Technology, 2012, 2nd Edition, Wiley-Blackwell
3. S. Shanmugam, T. Sathishkumar, M. Shanmugaparakash, Enzyme Technology, 2012, 2nd Edition, I. K. International Publishing House
4. Wolfgang Ahle, Enzymes in Industry – Production and Applications, 2004, Wiley
5. P. C. Engel, Enzymology Labfax, 1996, Academic Press;

#### Teaching and learning methods

Lessons with resource the equipped classrooms with datashow. Practical lessons in the lab and resolution of some exercises. Bibliographical research using the resources in IPB.

#### Assessment methods

1. Regular students - (Regular) (Final, Supplementary, Special)
  - Laboratory Work - 30% (Reports. Seminar.)
  - Final Written Exam - 70% (Final written exam, with all contents of theoretical and practical lessons.)
2. Student worker - (Student Worker) (Final, Supplementary, Special)
  - Work Discussion - 30% (Seminar.)
  - Final Written Exam - 70% (Final written exam, with all contents of theoretical and practical lessons.)

#### Language of instruction

1. English
2. Portuguese

#### Electronic validation

Clementina Maria Moreira dos Santos	Maria da Conceição Constantino Fernandes	Paula Cristina Azevedo Rodrigues	Maria José Miranda Arabolaza
03-11-2020	06-11-2020	06-11-2020	06-11-2020