

Course Unit	Production of Biomass and Bioenergy	Field of study	Engineering and related techniques
Master in	Biotechnological Engineering	School	School of Agriculture
Academic Year	2023/2024	Year of study	1
Type	Semestral	Semester	2
Workload (hours)	135	Contact hours	T - TP - PL - TC - S - E - OT - O -
		Level	2-1
		Code	5010-784-1204-00-23
		ECTS credits	5.0

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) Maria Sameiro Ferreira Patrício, Vitor Manuel Ramalheira Martins

#### Learning outcomes and competences

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

1. Integrate the systems of production of different energy cultures in sustainable systems of production, that produce good of high value added with a minimum of impact in the environment.
2. Identify/understand different technologies to conversion of biomass (combustion, gasification, pyrolysis, fermentation and anaerobic digestion).
3. Know the different biofuels and its production.
4. Know the chemical products obtained from renewable resources.

#### Prerequisites

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

The students will have to possess knowledge in biology, biochemistry, physics and microbiology.

#### Course contents

Biomass: concepts and definitions. Types of biomass. Solid, liquid and gaseous biofuels. Processes of transformation and use of the energy of the biomass: physical-chemical and biological processes. Economic situation, factors and potential in Portugal. Environmental and economic aspects of bioenergy production.

#### Course contents (extended version)

1. Energy: concept and definition. Power. Efficiency. Biomass: concepts and definitions.
2. Types of biomass. Solid biomass: forest residues.
3. Energy cultures, residues of cultures of tempering and tropical climate.
4. Environment and economic aspects of the bioenergy production.
5. Economic situation, factors and potential in Portugal.
6. Physical processes and transformation in order to obtain energy.
7. Thermochemical processes and transformation in order to obtain energy.
8. Chemical processes and transformation in order to obtain energy.
9. Biochemical processes and transformation in order to obtain energy.
10. Liquid biofuels: biodiesel, bioethanol, methanol. Processing.
11. Gaseous biofuels. Concept. Processing.
12. Chemical products obtained from renewable resources.

#### Recommended reading

1. Bassam, N. El. , 2010. Handbook of Bioenergy Crops: A Complete Reference to Species, Development and Applications. Earthscan, London, UK,
2. Glaze A. N. , Nikaido, H. , 1995. Microbial biotechnology: Fundamentals of applied microbiology. W. H. Freeman and Company. U. S. A.
3. Kumar et al (eds. ) 2019. Refining Biomass Residues for Sustainable Energy and Bioproducts Technology, Advances, Life Cycle Assessment, and Economics. Elsevier.
4. Madigan, M. T. , Martinko, J. M. , Parker, P. , 2003. Biology of microorganisms. Prentice-Hall, Inc. London, England.
5. Obemberger, I. ; Thek, G. , 2010. The Pellet Handbook: The Production and Thermal Utilisation of Biomass Pellets. Earthscan, London, UK

#### Teaching and learning methods

Theoretical lessons: based in expositive and interrogative methods supported by audiovisuals. Theoretical-practical lessons: resolution of exercises. Practical lessons: based in the use of the demonstrative and active methods and application of laboratory protocols. Tutorial/personal study: reading of the bibliography and other texts existing in the libraries of the IPB. Quizzes.

#### Assessment methods

1. Continuous Assessment - (Regular, Student Worker) (Final)
  - Presentations - 30% (Oral presentation focused on a topic related with the curricular unit. Quizzes)
2. Final Assessment - (Regular, Student Worker) (Final)
  - Final Written Exam - 70% (Final written exam on both theoretical and practical contents)
3. Recourse - (Regular, Student Worker) (Supplementary, Special)
  - Final Written Exam - 100% (Final written exam on both theoretical and practical contents)

#### Language of instruction

1. English
2. Portuguese

#### Electronic validation

Maria Sameiro Ferreira Patrício, Vitor Manuel Ramalheira Martins	Clementina Maria Moreira dos Santos	Rui Miguel Vaz de Abreu	Maria Sameiro Ferreira Patrício
18-01-2024	18-01-2024	23-01-2024	23-01-2024