

# DIGIT-Bio-TECH

2019-1-BG01-KA203-062371

M.Sc. PROGRAMME “GREEN BIOTECHNOLOGY AND ICT”

## SYLLABUS

### COURSE:

ENVIRONMENTAL BENEFIT FROM MODERN BIOTECHNOLOGY AND ICT APPLICATIONS

### AUTHORS:

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Academic work		Type	Number of classes
In-class work	Lectures		30
	Seminars		20
<b>Total in-class work</b>			<b>50</b>
Out-of-class work	Presentations		25
	Projects		20
	Self-guided library/database work		30
<b>Total out-of-class work</b>			<b>75*</b>
<b>Total of academic work</b>			<b>125</b>
<b>ECTS credits in-class work</b>			<b>2.0</b>
<b>ECTS credits out-of-class work</b>			<b>3.0</b>
<b>Total ECTS credits</b>			<b>5.0</b>
Nº	Grading		% of the grade
1.	Workshops/discussions of reports and papers		20 %
2.	Case studies		20 %
3.	Homework assignments and tests		10 %
4.	Exams		50 %

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\* One credit corresponds to 25 hours of work.

**Outline of the course**

This LO offers educational content that emphasizes on the tools for acceptability in a social context of microbial based technology. These technologies are biotechnology applications that help solving environmental problems in a sustainable way. The societal acceptability of benefits and risks imposed by modern microbial technology applications is given considering benefits vs. risks. Key features of this module are: risk perception and finding of possible solutions; the importance of thinking as a part of a broad strategy, the biorefinery concept as a broad-spectrum strategy. Moreover, a key feature is the identification and formulation of issues related to societal development and their placement into the processes and institutional systems. Special emphasis is given to the acceptance and diffusion of these new technologies and their impacts on socio-economy, biodiversity and sustainable agriculture, and public welfare.

Furthermore, this LO presents to the trainees updated materials helping them to critically evaluate problems and how to solve them. In addition to technical features related to the main plant and reactor configurations for biogas and bioethanol production, which complete the part related to renewable energies described in the basic section, the LO will give updated knowhow on the main bioplastics on the market and the use of biotechnology tools for their production. New technologies for the evaluation of the soil microbiota and how anthropogenic factors may influence the soil microbiota composition are examined. Moreover, the importance of bees for the whole ecosystem balance and how their collapse can be detrimental for the environment and for agriculture is discussed. New microbial technologies for the maintenance of bee health are described in order to stimulate the student interest towards new research topics and sustainability.

## **Educational goals**

The protection of the environment is a key topic for the future generations. Microorganisms and biotechnological approaches play a crucial role in this. Nowadays, renewable energy plays an important function in the sustainable development of a society. The exploitation of renewable energy can significantly contribute to reducing dependency on fossil fuels. Therefore, promoting innovative renewable applications and reinforcing the renewable energy market will contribute to preserving the ecosystem by reducing emissions at local and global levels. This will also contribute to the amelioration of environmental conditions, through a reduction in air pollution and greenhouse gases, by the replacement of conventional fuels with renewable energies. The protection of water and soil resources is another pivotal topic to guarantee a healthy environment to the future generations. Due to these reasons, the educational goals of this LO are to present the basics of the social framework regarding modern biotechnology tools acceptability through:

- the definition of sustainable bioenergy processes contributing to the reduction of the dependence from fossil fuels
- the use of microbial based processes for the exploitation of renewable energy processes
- the use of microbial based processes to clean the environment
- to see microbial based processes in a biorefinery cycle.

The progress in microbial biotechnology has been so quick in the last years that it is extremely important to deepen the preparation in the field. New technologies have partially or completely substituted the older ones and new training is envisaged. Moreover, the legislation across Europe has made new changes in the field of education necessary. Books are not updated, and students continue to learn old information. New tools for learning are therefore necessary. Thus, the educational goals of this LO are to outline new topics that are usually not considered by conventional teaching modules. The information given is focused on:

- new insights in biogas and bioethanol production
- bioplastics as a new sustainable way to replace petrol-derived materials
- new technologies for microbial based technologies
- alternatives strategies to solve problems and fight diseases in a sustainable way.

## **Expected outcomes**

### **Knowledge and Skills:**

As a result of the training students will be able to:

- know basic concepts underpinning the production of renewable energy in Europe
- know which microorganisms may be involved in biogas production
- understand the potential of using bioethanol as a biofuel and the main microorganisms used for bioethanol production (yeasts and bacteria)
- understand the potential of microorganisms for the decontamination of contaminated sites
- know and recognize the major benefits and issues of modern biotechnology
- highlight the main plant and reactor configuration for biogas production (anaerobic digesters)
- know and develop the main plant and reactor configuration for bioethanol production (fermenters inoculated with the target organisms)

- know the main bioplastics on the market (Starch derived plastics, PLA and PHB) and the use of biotechnology tools for their production;
- understand the importance of the study of the soil microbiota for the evaluation of soil health and how anthropogenic factors may influence the soil microbiota composition
- be in contact with new applications of microbial based technologies, the importance of bees for the whole ecosystem balance and how their collapse can be detrimental for the environment and for agriculture is discussed. New technologies for the maintenance of bee health will be discussed.

**Problem-solving skills:** Decision making, creative thinking, analytical, research and interpreting skills

**Digital competencies and skills:** strategic web and database searching; data analysis and presentation; data management and preservation; digital communication; networks and file management.

**Personal skills:** initiative and independence, time management, good oral and written communication skills, teamwork.

*Syllabus*

<b>№</b>	<b>Topic</b>	<b>Number of classes</b>
<b>1.</b>	<b>Unit 1 BL - Environmental benefit from modern biotechnology</b>	<b>25 h</b>
1.1	Renewable energy: biotechnology for biogas production.	2 h
1.2	Renewable energy: biotechnology for bioethanol production.	2 h
1.3	Benefits and Risks from Biotechnology Applications: Benefits vs. risks societal dispute. Risk acceptance. Risk Management. Social benefits of modern biotechnology.	3 h
1.4	Biotechnology for the remediation of contaminated sites. Wastewater.	3 h
1.5	Biotechnology for the remediation of contaminated sites: Contaminated soils.	3 h
1.6	Strengths and weaknesses of bioremediation technologies.	2 h
1.7	Seminars	10 h
<b>2.</b>	<b>Unit 2 AL – Modern biotechnologies for better life</b>	<b>25 h</b>
2.1	Renewable energy: advances in Biotechnologies for biogas production.	2 h
2.2	Renewable energy: advances in Biotechnologies for bioethanol production.	2 h
2.3	Biotechnology for bioplastic production: Main steps towards modern Bioplastics.	2 h
2.4	Biotechnology for bioplastic production: Starch-based plastics.	2 h
2.5	Biotechnology for bioplastic production: Polylactic acid plastics.	2 h
2.6	Biotechnology for bioplastic production: Polyhydroxyalcanoates.	2 h
2.7	Biotechnology for the remediation of contaminated sites. Microbial technologies for honeybee's health.	3 h
2.8	Seminars	10 h