

SCHOOL	FACULTY OF ENVIRONMENT		
ACADEMIC UNIT	FOOD SCIENCE AND TECHNOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	FST932	SEMESTER	7
COURSE TITLE	BIOREFINERIES DEVELOPMENT		
INDEPENDENT TEACHING ACTIVITIES <i>if credits are awarded for separate components of the course, e.g. lectures, laboratory exercise, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits</i>	WEEKLY TEACHING HOURS	CREDITS	
Lectures	3	5	
Total	3	5	
<i>Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).</i>			
COURSE TYPE <i>General background, special background, specialised general knowledge, skills development</i>	Specialised general knowledge		
PREREQUISITE COURSES:			
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes (Greek/English)		
COURSE WEBSITE (URL)			

LEARNING OUTCOMES

Learning Outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

- Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area
- Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B
- Guidelines for writing Learning Outcomes

Upon the successful completion of the course, the student will be able:

- To design food biorefineries
- To understand and perform techno-economic evaluation studies on biorefinery development
- To comprehend the basic principles and the practical applications of LCA
- To acknowledge the selection of the appropriate methodology and processes for biomass refining
- To familiarise with the principal terms of circular economy and bio-economy
- To outline the primary downstream separation and purification methods

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
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Others...
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- (1) Adapting to new situations
- (2) Decision-making
- (3) Working independently
- (4) Team work
- (5) Criticism and self-criticism
- (6) Production of free, creative and inductive thinking
- (7) Search for, analysis and synthesis of data and information, with the use of the necessary technology

SYLLABUS

Nowadays, biorefineries have emerged and developed in a similar manner to petroleum refineries. Renewable resources and particularly biomass, are employed as the onset feedstock in biorefinery processes. Agro-industrial waste and by-products streams, but also food waste constitute some of the most usual feedstock materials. Biorefineries target the generation of several products (chemicals, biopolymers, organic acids, antioxidants, biocolourants) to replace their conventional petroleum derived counterparts, within the transition from linear to circular economy and bio-economy. The course includes the presentation of novel approaches, employing chemical and biological processes, along with the implementation of optimising such processes, techno-economic assessment and life cycle assessment.

More specifically, during the lectures the following sections are covered:

- Renewable resources as feedstock materials
- Bioprocess design
- Pre-treatment technologies
- Downstream separation and purification methods
- Biorefinery design targeting multiple end products
- Types of biorefinery and examples
- Circular economy and bio-economy
- Introduction to techno-economic analysis
- Introduction to Life Cycle Assessment (LCA)

TEACHING and LEARNING METHODS - EVALUATION

<p>DELIVERY <i>Face-to-face, Distance learning, etc.</i></p>	Face-to-face	
<p>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY <i>Use of ICT in teaching, laboratory education, communication with students</i></p>	Use of information technology on data collection and information, in teaching and communication. Communication with students via web, e-mail, e-class and online folder sharing options etc.	
<p>TEACHING METHODS <i>The manner and methods of teaching are described in detail. Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc. The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</i></p>	<p>Activity</p>	<p>Semester workload</p>
	Lectures	117
<p>Total contact hours and training</p>	<p>117</p>	
<p>STUDENT PERFORMANCE EVALUATION <i>Description of the evaluation procedure Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short- answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i></p>	<p>Combined evaluation of writing examination (multiple-choice questionnaires, short-answer-questions) and written report-presentation.</p>	

ATTACHED BIBLIOGRAPHY

- Suggested bibliography:

Kamm, B., Gruber, P.R. and Kamm. M., **2010**. *Biorefineries-industrial processes and products: Status Quo and Future Directions*, Kamm, B., Gruber, P.R. and Kamm. M eds., Wiley VCH Verlag GmbH & Co. KGaA

Clark J., Deswarte F., **2015**. The biorefinery concept: an integrated approach. In *"Introduction to Chemicals from Biomass"*, Clark J. and Deswarte F. eds., West Sussex, U.K.