

COURSE OUTLINE

1. GENERAL

SCHOOL	APPLIED BIOLOGY AND BIOTECHNOLOGY		
DEPARTMENT	BIOTECHNOLOGY		
STUDY LEVEL	BACHELOR OF SCIENCE		
COURSE CODE	3350	SEMESTER	7 th (Winter)
COURSE TITLE	ENZYME BIOTECHNOLOGY		
INDEPENDENT TEACHING ACTIVITIES <i>if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, 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	ECTS	
Lectures	3	1,56	
Practicals (lab work)	2	0,48	
Group and/or individual works		0,52	
Autonomous study		2,44	
<i>TOTAL ECTS</i>		5	
COURSE TYPE <i>general background, special background, specialised general knowledge, skills development</i>	Scientific background / Skills development/ General and specialized knowledge		
PREREQUISITES:			
LANGUAGE:	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes (in English)		
COURSE WEB PAGE	https://oeclass.aua.gr/eclass/courses/331/		

2. 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

This course aims at acquiring knowledge on:

- 1) Enzyme catalytic and structural diversity, contribution to biotechnology and the links of enzyme biotechnology with economic and entrepreneurship development.
- 2) The decisive contribution of enzymes to the existence of every day products and services.
- 3) Methods, techniques and instrumentation of enzyme downstream processing at laboratory- and large- scale.
- 4) Methods and techniques on enzyme immobilization and its applications
- 5) Methods, techniques and instrumentation on the application of enzymes in food industry.
- 6) Methods, techniques and instrumentation on the application of enzymes in chemical and pharmaceutical industry.
- 7) Fundamental and specific roles of enzyme classes on the application level, for the production of specific products or services provided.
- 8) The analysis, evaluation and decision making on the suitability and applicability of enzymes for the implementation of products or services.
- 9) Co-operation with other colleagues for drawing studies/ plans, requiring the use of enzyme technology and the ability to accessing online various libraries & scientific journals.

10) Co-operation with other colleagues for the development of an analytical protocol/essay for the qualitative and quantitative analysis of a specific biological sample using multidisciplinary scientific literature.

General Competencies

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
.....
Others...*

- 1) Retrieve, analyze and synthesize data and information, with the use of necessary technologies.
- 2) Adapt to new situations.
- 3) Make decisions.
- 4) Work autonomously.
- 5) Work in teams.
- 6) Create new research ideas.
- 7) Advance free, creative and causative thinking

3. COURSE CONTENT

- 1) Enzyme discovery technologies (metagenomics, functional genomics, microbiome)
- 2) Enzyme production (heterologous/native systems)
- 3) Downstream processing/enzyme purification technology (classification of enzymes and enzyme sources, the purification protocol, solid-liquid separation, cell disintegration, low purification stage / fractionation, high purification stage / chromatographic techniques, enzyme formulation and quality control, examples on enzyme purification).
- 4) Immobilized enzymes (methods and techniques, influence of immobilization on molecular and kinetic features).
- 5) Enzyme bioreactor (classification, principles, kinetics, applications).
- 6) Environmental applications of enzymes (bioremediation, biofuels production)
- 7) Enzyme applications in the food industry (starch, bakery, beer, wine, fruit juices, vegetable oils, cheese, lactose).
- 8) Large scale enzyme applications (paper, textiles, leather, home laundry detergents, animal food).
- 9) Enzyme applications in the chemical industry (aminoacids, pesticides, oligosaccharides, chemicals, food supplements).
- 10) Enzyme applications in the pharmaceutical industry (antibiotics, steroids, drugs against hyper cholesterolhaimia, HIV, hypertension, etc).
- 11) Enzyme applications in analysis (enzymes as reagents and as markers, enzyme-linked immunosorbent assays, enzyme biosensors).
- 12) Enzyme catalysis in organic solvents (applications in water-miscible and water-immiscible solvents, aromatic products, pesticides, triglycerides, peptides, insulin, aspartame, etc).
- 13) Enzymatic degradation of plastics and bioplastics.
- 14) Enzymes in polymers synthesis.

4. TEACHING and LEARNING METHODS – EVALUATION

TEACHING METHOD <i>Face-to-face, Distance learning, etc.</i>	Face-to-face
USE OF INFORMATICS AND COMMUNICATIONS TECHNOLOGIES <i>Use of ICT in teaching, laboratory education, communication with students</i>	Power point presentations. Discipline/subject specific software. Email and internet platform (eclass).

<p style="text-align: center;">TEACHING ORGANISATION</p> <p><i>The manner and methods of teaching are described in detail.</i></p> <p><i>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.</i></p> <p><i>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>	<table border="1"> <thead> <tr> <th style="text-align: center;">Activity</th> <th style="text-align: center;">Semester workload</th> </tr> </thead> <tbody> <tr> <td>Lectures</td> <td style="text-align: center;">39 h</td> </tr> <tr> <td>Laboratory work</td> <td style="text-align: center;">12 h</td> </tr> <tr> <td>Group and/or individual works</td> <td style="text-align: center;">13 h</td> </tr> <tr> <td>Autonomous study</td> <td style="text-align: center;">61 h</td> </tr> <tr> <td>Total contact hours and training</td> <td style="text-align: center;">125 h (5 ECTS)</td> </tr> </tbody> </table>	Activity	Semester workload	Lectures	39 h	Laboratory work	12 h	Group and/or individual works	13 h	Autonomous study	61 h	Total contact hours and training	125 h (5 ECTS)
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<p>STUDENT EVALUATION</p> <p><i>Description of the evaluation procedure</i></p> <p><i>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</i></p> <p><i>Specifically-defined evaluation criteria are given and if and where are accessible to students.</i></p>	<p>I) Written final examination (50%), based on the lectures offered, containing:</p> <ul style="list-style-type: none"> - Multiple choice questions - Theoretical knowledge questions - Problems based on lecture material <p>Group and/or individual assignments (homework) account up to 10% of the final grade</p> <p>II) Laboratory exercises/practical (50%). A written report for every laboratory exercise is required (see below).</p> <ul style="list-style-type: none"> - The average of the exercise grades counts 50% in the overall score of the course. 												

5. BIBLIOGRAPHY

-Suggested bibliography:

- 1). Y.D. Clonis, *Enzyme Biotechnology*, Crete University Press, Heraklion, Crete, Greece, 3rd revised edition, 2013.
- 2). K. Buchholz, V. Kasche, U.T. Bornscheuer, *Biocatalysis and Enzyme Technology*, Wiley-VCH Verlag GmbH, Germany, 2005.
- 3). G. Walsh, *Proteins: Biochemistry and Biotechnology*, John Wiley & Sons Ltd., Chichester, UK, 2002.

-Relevant scientific journals:

Biotechnology and Bioengineering.
 Industrial Biotechnology.
 Biocatalysis and Biotransformation.
 Journal of Biotechnology.
 Journal of Chemical Technology and Biotechnology.
 Enzyme and Microbial Technology.
 Journal of Molecular Recognition.
 Nature Biotechnology.
 Protein Expression and Purification.
 Nature Biotechnology.
 International journal of biological macromolecules
 Frontiers in Bioengineering and Biotechnology