COURSE OUTLINE

1. GENERAL

SCHOOL	APPLIED BIOLOGY AND BIOTECHNOLOGY		
ACADEMIC UNIT	BIOTECHNOLOGY		
LEVEL OF STUDIES	BACHELOR OF SCIENCE		
COURSE CODE	**3350**	**SEMESTER**	7th (Winter)
COURSE TITLE	ENZYME BIOTECHNOLOGY		

INDEPENDENT TEACHING ACTIVITIES *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*	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	3	0.12
Practicals (lab work)	2	0.08
Group and/or individual works	1	0.04
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Scientific background / Skills development/ General and specialized knowledge
PREREQUISITE COURSES:	
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes (in English)
COURSE WEBSITE (URL)	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 Are
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 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 situationsDecision-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. SYLLABUS

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

DELIVERY *Face-to-face, Distance learning, etc.*	Face-to-face
USE OF INFORMATION	Power point presentations.

<table>
<tr><td>AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students</td><td>Discipline/subject specific software.
Email and internet platform (eclass).</td></tr>
<tr><td>TEACHING METHODS
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</td><td><table><tr><th>Activity</th><th>Semester workload</th></tr><tr><td>Lectures</td><td>39 h (1.56 ECTS)</td></tr><tr><td>Laboratory work</td><td>12 h (0.48 ECTS)</td></tr><tr><td>Group and/or individual works</td><td>13 h (0.52 ECTS)</td></tr><tr><td>Autonomous study</td><td>61 h (2.44 ECTS)</td></tr><tr><td>Total contact hours and training</td><td>125 h
(5 ECTS)</td></tr></table></td></tr>
<tr><td>STUDENT PERFORMACE EVALUATION
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 are accessible to students.

,</td><td>I) Written final examination (60%), based on the lectures offered, containing:
- Multiple choice questions
- Theoretical knowledge questions
- Problems based on lecture material

II) Laboratory exercises/practical (30%). A written report for every laboratory exercise is required (see below).
- The average of the exercise grades counts 30% in the overall score of the course.

III. Group and/or individual assignments (homework) (10%).</td></tr>
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5. ATTACHED 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