Please note that only the following courses are available in the English language

AGRICULTURAL UNIVERSITY OF ATHENS
Department of Biotechnology

COURSE DESCRIPTION FORM

			Check
Title:	ENZYME BIOTECHNOLOGY	*Compulsory*	yes
ECTS Credits:	5	*Elective*	
Course Code:	3350	*Semester*	7th
Lecturer:	Nikolaos Labrou lambrou@aua.gr,	*Autumn Term*	yes
Contact Details:	Evangelia Chronopoulou, exronop@aua.gr	*Spring Term*	-
	Anastasia Zerva, anazer@aua.gr		

*PREREQUISITES **(if any)***	*Course Code*
1.	
2.	
3.	

COURSE GOALS

This course aims at acquiring knowledge on:
1) Methods, techniques and instrumentation on enzyme purification at laboratory and large-scale.
2) Methods and techniques on enzyme immobilization and the application of immobilized enzymes
3) Methods and techniques on the application of enzymes in food industry.
6) Methods and techniques on the application of enzymes in chemical and pharmaceutical industry.
7) Analysis, evaluation and decision making on biocatalysis
8) Enzyme bioreactors

COURSE CONTENTS		*Total Hrs*
1.	Applied enzyme kinetics.	2
2.	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).	5
3.	Immobilized enzymes (methods and techniques, influence of immobilization on the enzyme's molecular and kinetic features).	4
4.	Enzyme applications in the food industry (starch, bakery, beer, wine, fruit juices, vegetable oils, cheese, lactose).	5
5.	Large-scale enzyme applications (paper, textiles, leather, home laundry detergents, animal food).	4
6.	Enzyme applications in the chemical industry (aminoacids, pesticides, oligosaccharides, chemicals, food supplements).	4
7.	Enzyme applications in the pharmaceutical industry (antibiotics, steroids, drugs against hyper cholesterolhaimia, HIV, hypertension, etc).	4
8.	Enzyme applications in the analysis (the enzymes as reagents and as markers, enzyme-lined immunosorbent assays, enzyme biosensors).	2
9.	Enzyme catalysis in organic solvents (applications in water-miscible and water-immiscible solvents, aromatic products, pesticides, triglycerides, peptides, insulin, aspartame, etc).	2
10.	Discovery of new enzymes.	2
11	Enzyme bioreactors	2

TEACHING METHOD		**EXAMINATION**	
			Weight
Hours			
Class	20	Written exam	50 %
Seminar	6	Orals	0 %
Collaboration with lecturer	4	Personal assignments	50 %
Laboratory	6	Group assignments	0 %
TOTAL Hours:	36	TOTAL:	100 %

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) Pandey, A., Webb, C., FERNANDES, M., Larroche, C., Enzyme Technology, Springer-Verlag New York, 2006.

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AGRICULTURAL UNIVERSITY OF ATHENS
Department of Biotechnology

COURSE DESCRIPTION FORM

			Check
Title:	Molecular Biology	*Compulsory*	X
		Elective	
ECTS Credits:	5	*Semester*	3rd
Course Code:	275	*Autumn Term*	X
Lecturer:	Professor Dimitra Milioni	*Spring Term*	
Contact Details:	dmilioni@aua.gr		

*PREREQUISITES **(if any)***	*Course Code*
1.	
2.	
3.	

COURSE GOALS

The aim of the course is to provide the student in-depth knowledge of the molecular basis of information flow from DNA to proteins and help them understand how the genes are regulated.

COURSE CONTENTS		*Total Hrs*
1.	DNA replication	6
2.	RNA synthesis and gene regulation	10
3.	mRNA translation and processing	10
4.	Structure of B-DNA. DNA is a double helix. Nucleic acids hybridize by base pairing. Supercoiling affects the structure of DNA	4
5.		

TEACHING METHOD

Hours

Class	30
Seminar	6
Collaboration with lecturer	
Laboratory	40
TOTAL Hours:	76

EXAMINATION

	Weight
Written exam	20%
Orals	40%
Personal assignments	40%
Group assignments	
TOTAL:	100%

SUGGESTED BIBLIOGRAPHY

Principles of Molecular Biology: Genes to Proteins (Burton E.Tropp)
GENES VIII
The Cell: A Molecular Approach

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AGRICULTURAL UNIVERSITY OF ATHENS
Department of Biotechnology

COURSE DESCRIPTION FORM

Title:	Recombinant DNA Technology		Check
		Compulsory	
ECTS Credits:	5	*Elective*	**X**
Course Code:	3200	*Semester*	**4th**
Lecturer:	Professor Manolis Flemetakis, mflem@aua.gr; Professor Dimitra Milioni,dmilioni@aua.gr;	*Autumn Term*	
Contact Details:		*Spring Term*	**X**

*PREREQUISITES **(if any)***

	Course Code
1. Molecular Biology	
2.	
3.	

COURSE GOALS

The aim of the course is to provide a thorough understanding of theoretical and practical understanding of basic and advanced molecular biology tools

COURSE CONTENTS

		Total Hrs
1.	Restriction endonucleases, cloning and vectors , nucleic acids isolation	5
2.	Blotting methods and applications, genomic and cDNA libraries	5
3.	Polymerase chain reaction	10
4.	Gene transfer methods to animal cells, Animal genetic engineering	10
5.		

TEACHING METHOD

Hours

Class	30	Written exam	20%
Seminar	7	Orals	40%
Collaboration with lecturer		Personal assignments	40%
Laboratory	40	Group assignments	
TOTAL Hours:	76	TOTAL:	100%

EXAMINATION

Weight

SUGGESTED BIBLIOGRAPHY

Principles of Gene Manipulation and Genomics

From Genes to Genomes: Concepts and Applications of DNA Technology

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AGRICULTURAL UNIVERSITY OF ATHENS
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COURSE DESCRIPTION FORM

			Check
Title:	Bioinformatics	*Compulsory*	yes
ECTS Credits:	5	*Elective*	no
Course Code:	3040	*Semester*	5
Lecturer:	Trias Thireou	*Autumn Term*	yes
Contact Details:	thireou@aua.gr	*Spring Term*	no

PREREQUISITES ***(if any)***	*Course Code*
1.	
2.	
3.	

COURSE GOALS

Understanding and practical application of basic principles, methodology and computer programs in bioinformatics. On completion the student will be able to follow advancements in the field as well as becoming fluent with every day research computer tools in Biotechnology.

COURSE CONTENTS		*Total Hrs*
1.	Biological Databases and database searching	15
2.	Pairwise and Multiple Sequence alignment	20
3.	Phylogenetic Analysis and HMM	10
4.	Structural Bioinformatics	10
5.	Genome handling and microarrays	10

TEACHING METHOD

Hours

Class	39		
Seminar			
Collaboration with lecturer			
Laboratory	26		
TOTAL Hours:	65		

EXAMINATION

	Weight
Written exam	
Orals	
Personal assignments	
Group assignments	100%
TOTAL:	100%

SUGGESTED BIBLIOGRAPHY

David Mount, "Bioinformatics: Sequence and Genome Analysis", Cold Spring Harbor Laboratory Press; 2nd edition (March 12, 2013)
Jonathan Pevsner, "Bioinformatics and Functional Genomics", Wiley-Blackwell; 2nd edition (May 4, 2009)
Jenny Gu, Philip E. Bourne, "Structural Bioinformatics", Wiley-Blackwell; 2nd edition (March 16, 2009)

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AGRICULTURAL UNIVERSITY OF ATHENS
Department of Biotechnology

COURSE DESCRIPTION FORM

			Check
Title:	MOLECULAR ENVIRONMENTOLOGY	*Compulsory*	**YES**
		Elective	**..**
ECTS Credits:	5	*Semester*	**8th**
Course Code:	2905	*Autumn Term*	**..**
Lecturer:	Nikolaos Labrou, Evangelia Chronopoulou, Anastasia Zerva	*Spring Term*	**X**
Contact Details:	lambrou@aua.gr		

*PREREQUISITES **(if any)***

	Course Code
1.	
2.	
3.	

COURSE GOALS

This course aims at acquiring knowledge on:
1. The main class of enzymes and on prediction of their catalytic activity.
2. The basic principles and key mechanisms of enzymatic catalysis.
3. The basic principles of kinetics of enzymatic reactions and the factors affecting the catalytic activity of the enzymes.
4. On the structural features of the enzymes and structure-catalysis relationships.
5. The analysis of kinetic data.
6. The principles of enzyme inhibition and the concepts of allosteric activator or inhibitor.
7. Enzymes that are molecular targets for drug design.
8. Detoxifying enzymes and enzymes that recognize and modify nucleic acids.
9. The principles of enzyme engineering and the modification of the enzyme molecule.
10. The principles of designing structural modifications on the enzyme molecule by applying biocomputing methods and recombinant DNA technology.
11. The principles of designing new forms of enzymes with desired catalytic and structural properties by applying evolutionary methods.
12. The development, through teamwork, of a scientific plan/presentation/essay by exploiting the gained knowledge and multidisciplinary scientific literature.
13. Designing research on molecular enzymology.

COURSE CONTENTS		*Total Hrs*
1.	*Module 1: Principles of enzymology* 1) Historical background. Nomenclature and classification of enzymes. Determination of enzyme activity. Enzyme function, active sites, cofactors, specificity 2) The basic principles and key mechanisms of enzymatic catalysis 3) Thermodynamics and structure-catalysis relationships	6
2.	*Module2: Enzyme kinetics* 1) The principles of enzyme kinetics and the factors affecting the catalytic activity. 2) Kinetic parameters and reaction equilibrium 3) The analysis of kinetic data, Michaelis-Menten equation and methods of plotting enzyme kinetics data 4) Effect of pH and temperature on enzyme stability and activity. 5) The principles of enzyme inhibition, types of inhibition and the concepts of allosteric activators or inhibitors. Reversible and irreversible inhibition (inactivation). Inhibition constants. Interaction of enzymes and xenobiotic compounds (drugs, insecticides, herbicides, etc.) 6) Multi-substrate enzyme reactions 7) Isotopes in enzyme reaction rate determination	10

3.	*Module 3. Enzyme engineering* 1) Molecular dynamics and mechanics, structural rearrangements and fluctuations of the enzyme molecule 2) The principles of designing structural modifications on the enzyme molecule by applying biocomputing methods and recombinant DNA technology 8) Paleoenzymology and reconstruction of ancient enzymes. Methods for high throughput screening of mutant enzymes 3) Molecular methods for *in vitro* directed and random mutagenesis. Principles and methods of *in vitro* molecular evolution 4) The principles of designing new forms of enzymes with desired catalytic and structural properties by applying evolutionary methods 5) High-throughput screening methods for enzyme selection 6) *De novo* design of new functional enzymes 7) Chemical modification of enzyme structure 8) Applications of engineered enzymes in agriculture, medicine, industry and environmental technologies. Enzymes for molecular biology (structure, mechanism, applications) 9) Hybrid enzymes, semisynthetic enzymes, artificial enzymes, catalytic antibodies and ribozymes 10) Enzyme nanomachines and multi-complex enzymes	12
4.	*Module 4: Enzyme applications* 1) Enzymes that recognize and modify nucleic acids 2) Enzymes as molecular targets for drug design 3) Enzymes as body's defense systems against xenobiotic compounds (oxygenases, transferases, hydrolases, etc.)	8

TEACHING METHOD

Hours

Class	20
Seminar	6
Collaboration with lecturer	4
Laboratory	6
TOTAL Hours:	36

EXAMINATION

	Weight
Written exam	50%
Orals	0%
Personal assignments	50%
Group assignments	..%
TOTAL:	100%

SUGGESTED BIBLIOGRAPHY

Yon-Kahn, Jeannine, Hervé, G. (2010) Molecular and Cellular Enzymology. Springer USA.
Hans Bisswanger (2011) Practical Enzymology, 2nd Edition, Wiley-Blackwell.

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AGRICULTURAL UNIVERSITY OF ATHENS
Department of Biotechnology

COURSE DESCRIPTION FORM

			Check
Title:	PLANT BIOTECHNOLOGY	*Compulsory*	**X**
ECTS Credits:	5	*Elective*	**..**
Course Code:	205	*Semester*	**8**
Lecturer:	Asst. Prof. Gerasimos Daras	*Autumn Term*	**..**
Contact Details:	gdaras@aua.gr	*Spring Term*	**X**

*PREREQUISITES **(if any)***	*Course Code*
1.	
2.	
3.	

COURSE GOALS

Upon successful completion of this course the students will acquire new knowledge and specific skills on the following subjects:

- Will gain knowledge on the major fields concerning the modification, transfer, expression and phenotypic appearance of the genetic information. The process of DNA transfer from any organism into plants.
- Creating new and novel traits in plants, or even features that are not found in plants.
- Using transgenic plants as bioreactors to produce substances with high added value.
- Creating transgenes in order to produce human proteins and vaccines.
- Using transgenics to provide service.
- Molecular agriculture and in production pluralism through plants, in general.
- Creation of transgenic plants as biofuels and remediation of polluted environments
- Will gain knowledge on genetic information transfer techniques and methods and on DNA analysis.
- Will have knowledge of procedures and practices of DNA and RNA analysis.
- Will learn to use techniques and methodologies for the certification and identification of genetically modified organisms (GMO).
- Will have knowledge of the processes and methods for applications of molecular analysis of transgenic plants.
- Will be capable to analyze, evaluate and decide on the applicability of techniques and methods for creating transgenic plants with molecular tools in any case scenario.

COURSE CONTENTS		*Total Hrs*
1.	Principles of Gene manipulation	3
2.	Agrobacterium DNA transfer.	3
3.	DNA vectors and transgenic plants	3
4.	Tissue – Cell culture for DNA transfer	3
5.	Abiotic transformation methods – Electroporation	3
6.	Particle Bombardment and Gene-Biomolecules Transfer.	3
7.	Chemical and mechanical gene transfer in plants	3
8.	Gene Targeting and Mutagenesis	3
9.	Molecular improvement	3
10.	Transgene applications in Production and Services	3
11.	Transgenic plants resistant to herbicides, viruses, insects, bacteria, fungi.	3
12.	Modification of transgenic plants physiology	3
13.	Bioethics, Patent and Regulations	3

TEACHING METHOD		**EXAMINATION**	
			Weight
Hours			
Class	39	Written exam	65%
Seminar	..	Orals	..%
Collaboration with lecturer	60	Personal assignments	20%
Laboratory	26	Group assignments	15%
TOTAL Hours:	125	TOTAL:	100%

SUGGESTED BIBLIOGRAPHY	Biotechnology J. Plant Biotechnology J Nature Biotechnology
NOTES	Pdf files of presentation

AGRICULTURAL UNIVERSITY OF ATHENS
Department of Biotechnology

COURSE DESCRIPTION FORM

Title:	Bionanotechnology and Biosensors		Check
		Compulsory	**X**
ECTS Credits:	5	*Elective*	**..**
Course Code	3600	*Semester*	**5**
Lecturer:	Spyros Kintzios	*Autumn Term*	**X**
Contact Details:	skin@aua.gr	*Spring Term*	**..**

*PREREQUISITES **(if any)***	*Course Code*
1. ……	
2.	
3.	

COURSE GOALS

The course is the basic introduction to the scientific field of biosensors and nanotechnology and their applications in life sciences, as well as all affiliated techniques and methods used for the development, study and application of biosensors and nanotechnologies in modern analytical and diagnostic science, food safety and environmental monitoring..

The educational context aims to introducing students to the principles of nanotechnology, Biosensors, Electrochemistry and Microengineering, covering wide area of supplementary knowledge, including in-depth elements of microfluidics, photonics, biomolecular processes, molecular recognition, analytical chemistry and quality control.

It also refers to introductory principles and methodologies for designing and standardizing mircoelectromechanical systems (MEMS) and biosensors, carrying out analyses with high throughput systems, the use of expert systems, knowledge of materials used in MEMS and basic microengineering techniques (lithography, etching etc).

Finally, the course aims to provide to students a comprehensive review of the importance of biosensors and nanotechnology on modern analytical and diagnostic science and their contribution to the industry and service sectors. In parallel, it fosters the perspective career opportunities with specialization in analytical science with advanced methods.

Following the completion of the course, students will be able to:

- **Understand the principles of biosensors and nanotechnology, their affiliated technologies and fields of application.**
- Know the tools and techniques of microengineering and analysis based on different biosensor systems.
- Design basic MEMS.
- Carry out laboratory analyses using at least two different biosensor types.
- Apply skills and knowledge for seeking new technologies and utilize research results for designing novel biosensor-based analytical systems.
- Collaborate with other students in order to prepare and publicly present a plan of natotechnological and biosensor-based approaches to a real application/analytical need, having in parallel acquired oral and written presentation skills.

COURSE CONTENTS		*Total Hrs*
1.	Biosensors: A historical review. Principles of nanotechnology.	3
2.	Elements of electrochemistry. Cyclic voltammetry, voltammetry and chronoampeormetry. Electrochemical impedance spectrometry.	6
3.	Optical biosensors. Cell-based biosensors. Methods for immobilizing/entrapping biomolecules.	6
4.	Basic Microengineering technologies: lithography, imprinting, surface microenginnering, volume microengineering. Microelectromechanic Systems (MEMS) – Introduction to Microenginnering. Commercial applications. Microfludics for biological applications, protein separation and direct screening for disease agents.	6
5.	Artificial intelligence systems in biosensors.	3
6.	Application of MEMs in life sciences. DNA analysis. Application of microelectrode arrays. Application of biosensors in food safety and environmental monitoring. Application of biosensors in medicine and life sciences.Other applications of biosensors	6

TEACHING METHOD

Hours

Class	26
Seminar	..
Collaboration with lecturer	73
Laboratory	26
TOTAL Hours:	125

EXAMINATION

	Weight
Written exam	50%
Orals	..%
Personal assignments	..%
Group assignments	50%
TOTAL:	100%

SUGGESTED BIBLIOGRAPHY

F.S. Ligler, Optical Biosensors: Present & Future, Elsevier 2002

J.Y.Yoon, Introduction to Biosensors: From Electric Circuits to Immunosensors, Springer 2012

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