AGRICULTURAL UNIVERSITY OF ATHENS
School of Food, Biotechnology and Development
Department of Biotechnology

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

AGRICULTURAL UNIVERSITY OF ATHENS
School of Food, Biotechnology and Development
Department of Biotechnology

COURSE DESCRIPTION FORM

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

*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

AGRICULTURAL UNIVERSITY OF ATHENS
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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	0 %
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
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COURSE DESCRIPTION FORM

			Check
Title:	Molecular Ecology and Adaptation		
		Compulsory	**X**
ECTS Credits:	5	*Elective*	
Course Code:	3625	*Semester*	**1**
Lecturer:	Associate Professor Anna Kourti	*Autumn Term*	**X**
Contact Details:	akourti@aua.gr	*Spring Term*	**..**

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

COURSE GOALS

The aim of the "Gene and the Environment" course is the understanding of environmental (external) cues and the response of organisms through dynamic changes in expression, e.g. induction or/and repression, of various genes. Special emphasis is given on the interaction between genes and the environment which affects the growth of organisms.

COURSE CONTENTS		*Total Hrs*
1.	Genetics of animal behaviour. Genetic analysis of behaviour. Genetics of human behaviour.	9
2.	Adaptation behaviour-insect diapause. Genetic and molecular approach of diapause. Regulation of diapause and types of gene expression.	6
3.	Stress proteins and their role in diapause. Gene responses of plant organisms in light and mechanical stimuli. Molecular response mechanisms in abiotic stresses. Molecular adaptation.	6
4.	Biological clocks. Biological rhythms and adaptation. Circadian rhythms. Clock genes in Drosophila. Circadian clocks of insects. Molecular study of circadian systems in various organisms. Circadian and photoperiodic clocks.	9
5.	Environmental pollution and response of organisms. Molecular mechanisms of interaction between plants and microorganisms.	6

LABORATORY EXERCISES (Number of credits**:** 2)
COURSE GOALS**:** The aim of the laboratory exercises is the methodology of analysis and strategy of molecular responses of organisms in various environmental signals.
COURSE CONTENTS:

1. Observation of the biological cycle of the insect *Sesamia nonagrioides* (Lepidoptera: Noctuidae) in the lab.

2. RNA isolation from *Sesamia nonagrioides*.

3. cDNA construction.

4.Directions for the design of degenerated promoters for gene isolation.

4. Familiarization with bioinformatics (via the Internet) for the analysis of genes and proteins.

5. The National Centre of Biotechnology Information (NCBI). GenBank file structure [‘the CDS characteristic’ (CDS future)].

6. Basic Local Alignment Search Tool, BLAST, as a method of discovery of sequence similarity. Prediction methods using DNA sequences.

7. Prediction methods using protein sequences. Protein identity using the ExPASy server of the Swiss Institute of Bioinformatics.

8. Physical properties of proteins based on sequence [(Compute pI/MW & ProtParam (ExPASy)]. Motifs and patterns.

9. Environmental effect on the developmental pattern of model plant *Arabidopsis thaliana*. Methods for plant RNA isolation.

10. Reverse transcription reaction and tracking of gene expression dynamics using semi-quantitative PCR.

TEACHING METHOD

Hours

Class	36
Seminar	..
Collaboration with lecturer	..
Laboratory	24
TOTAL Hours:	60

EXAMINATION

	Weight
Written exam	75..%
Orals	25..%
Personal assignments	..%
Group assignments	..%
TOTAL:	100%

SUGGESTED BIBLIOGRAPHY

From genes to animal behaviour
Principles of animal behaviour

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COURSE DESCRIPTION FORM

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

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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COURSE DESCRIPTION FORM

			Check
Title:	Recombinant DNA Technology	*Compulsory*	**X**
ECTS Credits:	4	*Elective*	
Course Code:	3200	*Semester*	
Lecturer:	Professor Polydefkis Hatzopoulos, Associate Professor Anna Kourti, Associate Professor Manolis Flemetakis, Associate Professor Dimitra Milioni	*Autumn Term*	
Contact Details:	akourti @aua.gr; dmilioni@aua.gr; mflem@αua.gr; phat@aua.gr.	*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
Seminar	7
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 Gene Manipulation and Genomics

From Genes to Genomes: Concepts and Applications of DNA Technology

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COURSE DESCRIPTION FORM

			Check
Title:	ANIMAL BIOTECHNOLOGY		
		Compulsory	**YES**
ECTS Credits:	5	*Elective*	**NO**
Course Code:	175	*Semester*	**9th**
Lecturer:	Associate Professor Eleni Douni	*Autumn Term*	**YES**
Contact Details:	douni@aua.gr Tel: 210 5294372	*Spring Term*	**NO**

*PREREQUISITES **(if any)***	*Course Code*
1. None	

COURSE GOALS

The course is a basic introductory course on concepts of animal biotechnology, genetic engineering technologies in animal organisms and the applications arising in the agricultural and biomedical field.
This course aims to introduce students to the basic technologies of animal biotechnology for the understanding and application of genetic engineering technologies related to the creation of transgenic animals, gene targeting for gene inactivation, modification and conditional gene expression, as well as to the identification of mutations by genetic analysis.
It also refers to basic concepts and methodologies for the generation of biotechnological products such as monoclonal antibodies, recombinant proteins, vaccines and latest technologies related to animal cloning, stem cell biology, regenerative medicine, gene therapy, animal cell culturing, cryopreservation, assisted reproduction, genotypic analysis and diagnosis of diseases in order for the student to obtain a comprehensive insight into the applications of Biotechnology in Animal husbandry and biomedicine.
Finally, the aim of the course is the understanding of the importance of biotechnological technologies based on the use of animal organisms for the identification of gene function and the development of innovative approaches and biotechnological products with applications in diagnosis and treatment.

COURSE CONTENTS		*Total Hrs*
1.	Introduction to Functional Genomics and Animal Biotechnology technologies - Physiology of Reproduction in Mammals	3
2.	Genetic engineering technologies for the generation of transgenic animals - Biopharming – Applications of transgenic technologies	3
3.	Site-directed mutagenesis by gene targeting technologies– Creation of knockout animals	3
4.	Modifications of the eukaryotic genome with the Cre / loxP system – Zinc finger nucleases	3
5.	Conditional genetic modifications – Spatial and temporal control of inducible gene expression and modifications	3
6.	Forward Genetics : From phenotype to gene identification by genetic analysis – Random mutagenesis and Genetic Mapping	3
7.	Animal Cloning Methods - Applications in farming and biotechnology - Bioethics	3
8.	Stem Cells and their applications - Gene Therapy - Vectors – Applications	3
9.	Review of the Immune System of Mammals	3
10.	Monoclonal Antibodies - Vaccines	3
11.	Methods for the production of recombinant proteins - Animal Cell Culturing	3
12.	Techniques for Genotypic Analysis and Diagnosis of Diseases	3
13.	Cryopreservation – Assisted Reproduction Technologies - Bioethics in Animal Biotechnology	3

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TEACHING METHOD

Hours

Class	3
Seminar	
Collaboration with lecturer	
Laboratory	2
TOTAL Hours:	5

EXAMINATION

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

SUGGESTED BIBLIOGRAPHY

ANIMAL BIOTECHNOLOGY "MODELS IN DISCOVERY AND TRANSLATION". VERMA A.S., SINGH A. 2014. ISBN:978-0-12-416002-6

NOTES

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COURSE DESCRIPTION FORM

Title:	Bioinformatics		Check
		Compulsory	..
ECTS Credits:	5	*Elective*	X
Course Code:	3040	*Semester*	7
Lecturer:	Professor Elias Eliopoulos, Lecturer Trias Thireou	*Autumn Term*	X
Contact Details:	eliop@aua.gr thireou@aua.gr	*Spring Term*	..

*PREREQUISITES **(if any)***	*Course Code*
1. Computer Programming	
2. Biochemistry	
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	20
2.	Simple and Multiple Sequence alignment	20
3.	Phylogenetic Analysis and HMM	12
4.	Molecular Visualisation and Modelling	12
5.	Genome handling and microarrays	12

TEACHING METHOD

Hours

Class	39
Seminar	6
Collaboration with lecturer	10
Laboratory	21
TOTAL Hours:	76

EXAMINATION

	Weight
Written exam	60%
Orals	..%
Personal assignments	40%
Group assignments	0%
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)

NOTES

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COURSE DESCRIPTION FORM

			Check
Title:	EVOLUTION		
		Compulsory	X
ECTS Credits:	5	*Elective*	..
Course Code:	1960	*Semester*	6
Lecturer:	Professor Elias Eliopoulos	*Autumn Term*	..
Contact Details:	eliop@aua.gr	*Spring Term*	X

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

COURSE GOALS

- Have a knowledge of the history, the theories and the analytical methods of the evolution of the species theory.
- Have knowledge of the species evolution from the beginning of the planet Earth until now.
- Be able to comprehend the mechanisms of Evolution in phenotypic and molecular level and classify the species according to their phenotypic and molecular homology.
- To learn of methods and techniques that are used for the study of evolutionary mechanisms as well as the formation of evolutionary trees.
- Be able to distinguish basic and specific roles of various evolutionary processes at molecular level.
- To acquire knowledge on the primate and human evolution .
- Be able to apply, analyze, evaluate and decide on the applicability of methodology on species relationship at molecular or phenotypic level.
- To be able to collaborate with this fellow students to create written work and oral presentation on the application of the evolution theory on the living world, as well as the ability for online access and retrieval of information from electronic libraries and scientific journals.

COURSE CONTENTS		*Total Hrs*
1.	Evolutionar theories. History of the Evolution theory. Definitions, Classifications.	6
2.	History of Evolution of Species	6
3.	Mechanisms of Evolution	10
4.	Evolution of Species	6
5.	Molecular Evolution	10
6.	Protein Evolution	6
7.	Phylogenetics Analysis	6
8.	Human Evolution	6
9.	Cases and Arguments in Evolution	6
10.	Chromosome comparisons	5

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TEACHING METHOD

Hours

Class	29
Seminar	10
Collaboration with lecturer	10
Laboratory	18
TOTAL Hours:	67

EXAMINATION

	Weight
Written exam	60%
Orals	..%
Personal assignments	40%
Group assignments	..%
TOTAL:	100%

SUGGESTED BIBLIOGRAPHY

Protein Evolution Paperback – November 19, 2007 by Laszlo Patthy (Author) ISBN-13: 978-1405151665 ISBN-10: 1405151668 Edition: 2nd

Evolution by N.H. Barton, D.E.G. Briggs, J. A. Eisen, D B. Goldstein, N. H. Patel, 2007, ISBN 978-087969684-9

NOTES

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COURSE DESCRIPTION FORM

Title:	Physics for Life Sciences		Check
		Compulsory	**X**
ECTS Credits:	5	*Elective*	**..**
Course Code:		*Semester*	**1**
Lecturer:	Associate Professor Michael Karpouzas, Assistant Professor Kostas Bethanis, Assistant Professor Nikolaos Alvertos	*Autumn Term*	**X**
Contact Details:	+30210 5294221, mkarp@aua.gr	*Spring Term*	**..**

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

COURSE GOALS

The course is the basic introduction in Physics. The course material aims to introduce students to the principles of Physics that constitute necessary background for the study of more advanced subjects such as Physical Chemistry, Biophysics, Biochemistry and generally Science and its applications, It focuses on areas of Physics that are related to Biotechnology. It also teaches basic methods of experimental measurements and statistical analyses of experimental data that are necessary for scientific study.

COURSE CONTENTS		*Total Hrs*
1.	Fluid Mechanics (fluid statics; intermolecular interactions, surface tension, capillary action, fluid dynamics, viscosity, real fluids)	9
2.	Thermodynamics (temperature, thermal equilibrium, calorimetry, heat transfer, kinetic model of an ideal gas, heat capacities, phases of matter, 1st law of thermodynamics, thermodynamics processes, internal energy, enthalpy, the 2nd law of thermodynamics, entropy, Gibbs free energy)	10
3.	Optics (geometric optics and optical instruments, reflection, refraction, polarization, diffraction)	10
4.	Atomic – Nuclear physics (atomic line spectra and energy levels, continuous spectra, wave-particle duality, introduction to quantum mechanics, atomic structure, properties of nuclei, nuclear structure, radiation, radiochronology, biological effects of radiation)	10
5.	Laboratory exercises	28

TEACHING METHOD

Hours

Class	39
Seminar	10
Collaboration with lecturer	48
Laboratory	28
TOTAL Hours:	125

EXAMINATION

	Weight
Written exam	70%
Orals	10%
Personal assignments	
Group assignments	20%
TOTAL:	100%

SUGGESTED BIBLIOGRAPHY

J. Newman, Physics of the Life Sciences, Springer 2008

H. Young, University Physics, Addison-Wesley 1992

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COURSE DESCRIPTION FORM

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

*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.

NOTES

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COURSE DESCRIPTION FORM

Title:	PLANT BIOTECHNOLOGY		Check
		Compulsory	**X**
ECTS Credits:	5	*Elective*	**..**
Course Code:	205	*Semester*	**8**
Lecturer:	Professor Polydefkis Hatzopoulos	*Autumn Term*	**..**
Contact Details:	phat@aua.gr, +30 210 5294321	*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

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TEACHING METHOD

Hours

Class	39
Seminar	..
Collaboration with lecturer	60
Laboratory	26
TOTAL Hours:	125

EXAMINATION

	Weight
Written exam	65%
Orals	..%
Personal assignments	20%
Group assignments	15%
TOTAL:	100%

SUGGESTED BIBLIOGRAPHY

Biotechnology J.
Plant Biotechnology J
Nature Biotechnology

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Pdf files of presentation

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COURSE DESCRIPTION FORM

			Check
Title:	Bionanotechnology and Biosensors		
		Compulsory	**X**
ECTS Credits:	5	*Elective*	**..**
Course Code	3600	*Semester*	**5**
Lecturer:	Professor Spyros Kintzios	*Autumn Term*	**X**
Contact Details:	+30210 5294292, 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.

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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

NOTES

COURSE OUTLINE

1. GENERAL

SCHOOL	FOOD, BIOTECHNOLOGY AND DEVELOPMENT		
ACADEMIC UNIT	BIOTECHNOLOGY		
LEVEL OF STUDIES	BACHELOR OF SCIENCE		
COURSE CODE	**2**	**SEMESTER**	**3** ο
COURSE TITLE	GENETICS & BIOLOGY OF PERENNIAL PLANTS		

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 and Practicals	5	5
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (4).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	Field of Science
PREREQUISITE COURSES:	
LANGUAGE OF INSTRUCTION and EXAMINATIONS :	Greek - English
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	eclass/courses/BIOTECH161/

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*

Upon successful completion of the course the student will:

• Understand the biological cycle and secondary growth of perennial plants
•Knowledge of how perennial plants adapt in different environments and their survival mechanisms
• Have perceived the water movement through the xylem of perennial woody plants
• Aquire knowledge of the evolution and genetic relationships of perennial plants

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	*Production of new research ideas*
Adapting to new situations	*Project planning and management*
Decision-making	*Respect for differences and multiculturalism*
Working independently	*Respect for the natural environment*
Team work	*Showing social, professional and ethical responsibility and sensitivity to gender issues*
Working in an international environment	*Criticism and self-criticism*
Working in an interdisciplinary environment	*Production of free, creative and inductive thinking*

• Independent work
•Teamwork
• Work in an interdisciplinary environment
• Generating new research ideas

3. SYLLABUS

1) Biological cycle of perennial woody plants
2) Secondary growth -Secondary tissues: cork, cork skin, secondary phloem, secondary xylem, reaction wood
3) Responsiveness, adaptability, survival mechanisms of perennial plants
4) Water Movement through the xylem of perennial plants
5) Biodiversity, evolutionary changes and phylogenetic analysis of perennial plants
6) Study and examination of external features and characteristics of the structure of perennial woody branches
7) Study and observation of bark and secondary xylem
8) Study and observation of transverse and radial sections of perennial woody plant executives
9) Study and observation of various details and growth layers of perennial woody plants

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	In the classroom
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	Lectures: Power point presentations Support of learning process through e-class platform
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*	

Activity	***Semester workload***
Lectures	39
Lab exercises focusing on the secondary growth of perennial plants in small groups	26
Autonomous study	60
Course total (Total contact hours and training)	***125***

STUDENT PERFORMANCE 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*	I. Final written examination (100%) including: - Multiple Choice or short answer and full essay questions

Specifically-defined evaluation criteria are given, and if and where they are accessible to students.	

5. ATTACHED BIBLIOGRAPHY

-Suggested bibliography :
-Relevant scientific journals:

(Βιολογία των φυτών)-Biology of Plants-Raven, Evert, Eichorn-2015 Utopia Publishers
(Φυσιολογία φυτών)- Plant Physiology -.Taiz, Zeiger 2013…….. Utopia Publishers