COURSE LAYOUT

1. GENERAL

SCHOOL	APPLIED BIOLOGY and BIOTECHNOLOGY		
DEPARTMENT	BIOTECHNOLOGY		
STUDY LEVEL	*Undergraduate*		
COURSE CODE	3575	**SEMESTER**	2nd
COURSE TITLE	PHYSICS METHODS IN BIOTECHNOLOGY		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**ECTS**
LECTURES	3	3
LABORATORY EXERCISES	2	1
TOTAL	5	4

COURSE TYPE	General Background, Selected course
PREREQUISITES	Secondary education Physics, University First year Mathematics
LANGUAGE	Greek with English support in terminology
IS THE COURSE OFFERED forERASMUS STUDENTS?	YES (in English)
COURSE WEB PAGE	https://oeclass.aua.gr/eclass/courses/BIOTECH160/

2. LEARNING OUTCOMES

Learning Outcomes

It is a basic introductory course in methods of Physics, as they apply in Biotechnology, comprised of three units.

The course material aims at introducing students to the basic techniques of physics that are essential background when using technological/digital tools for detailed laboratory and research studies. The material focuses on areas of physics that are directly relevant to biotechnology.

Upon successful completion of the course the students

(1) will be able to perceive basic electrical symbols and signals used in electrical circuit analysis, to understand ideal electrical circuit elements, gaining knowledge of basic analysis methods so becoming able to analyze and synthesize electrical circuits, including applications of amplifiers in general and operational amplifiers in particular.

(2) will be able to perceive the meaning of digital images, will become familiar with basic methods and mathematical tools related to image processing-analysis of digital images, will be informed about the different application fields, such as biomedical imaging, and will be able to apply techniques of digital image analysis-processing in an educational laboratory as well as in a research environment.

(3) will be able to perceive basic principles and methods of Molecular Simulation, to assess the applications of Molecular Simulation methods and recommend them for specific projects, utilizing Molecular Simulation tools.

GeneralCompetences

3. COURSE CONTENT

Electrical Circuit Applications: Elements, Sources, Node and Loop Methods, Operational Amplifier, D/A Convertor. **Digital Image Analysis and Processing**: Color Models, Sampling, 2-D Images and Geometrical Transformations, Image Enhancement, Image Segmentation, Image Edge Detection, Extraction of Image Characteristics, Introduction to Classifiers. **Macromolecular Simulation**: Potential Energy Function: Bonded / Non-Bonded Terms. Macromolecular Interactions: Proteins / DNA. Simulation Methods: Molecular Mechanics, Molecular Dynamics, Entropy, Free Energy Calculations, Quantum Mechanics. **Laboratories:** Design-Analysis of Electrical Circuits, Use of Operational Amplifiers, Image Enhancement, Image Segmentation, Use of Filters for Edge Detection, Extraction methods of Bio-image Characteristics.

4. TEACHING and LEARNING METHODS - Evaluation

TEACHING METHOD	In suitably equipped teaching rooms
USE OF INFORMATICS and COMMUNICATION TECHNOLOGIES	Use of powerpoint presentations and simulations in lectures, use of laboratory websites to inform, educate and communicate with students
TEACHING ORGANISATION	

Activity	*Work Load*
Lectures	39
Laboratory exercises	10
Group and/or individual assignments	5
Independent study	36
Final individual assignment	10
Course total (25 hours of student work loadper ECTS)	*100*

STUDENTS EVALUATION	I. Theory: One project per unit (30%, 50%, 20%, respectively) which is evaluated with - written analytical report - oral presentation II. Laboratory: Written assignments on data processing (100%).

5. BIBILIOGRAPHY

1) Electrical Circuits, (only in Greek) (Ηλεκτρικά Κυκλώματα), Εκδόσεις Ν. Παπαμάρκος, 2012.
2) Digital Image Processing and Analysis, (only in Greek) (Ψηφιακή Επεξεργασία και Ανάλυση Εικόνας), Εκδόσεις Ν. Παπαμάρκος, 2015.
3) Digital Image Processing, (in Greek) (Ψηφιακή Επεξεργασία Εικόνας), R.C. Gonzalez & R.E. Woods, Εκδόσεις Τζιόλα, 2018.
4) Physics for Life Sciences, (in Greek) (Φυσική για τις Επιστήμες Ζωής), J. Newman, Εκδόσεις Δίαυλος, 2013.