COURSE OUTLINE

1. GENERAL

SCHOOL	APPLIED BIOLOGY AND BIOTECHNOLOGY		
DEPARTMENT	BIOTECHNOLOGY		
STUDY LEVEL	*Undergraduate-Elective*		
COURSE CODE	3575	**SEMESTER**	2nd
COURSE TITLE	PHYSICS METHODS IN 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**	**ECTS**
Theory	3	3
Laboratory exercises	2	1
TOTAL	5	4

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	General Knowledge
PREREQUISITES	Secondary education Physics, University First year Mathematics
LANGUAGE	Greek
IS THE COURSE OFFERED forERASMUS STUDENTS?	No
COURSE WEB PAGE	https://oeclass.aua.gr/eclass/courses/BIOTECH160/

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

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

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 differences 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*
The students develop skills related to: • Searching, analyzing, synthesizing data and information by using essential technologies • Adaptation to novel and diverse challenges • Decision making • Independent and teamwork • Exercising criticism and self-criticism • Work in a multidisciplinary environment • Promotion of free, creative and inductive thinking

3. COURSE CONTENT

I. Theory

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 and Image Noise Reduction, 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, Analysis of the Results and Applications of Molecular Dynamics.

II. 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 *Face-to-face, Distance learning, etc*	In suitably equipped teaching rooms.
USE OF INFORMATICS and COMMUNICATION TECHNOLOGIES *Use of ICT in teaching, laboratory education, communication with students*	Use of PowerPoint presentations and simulations in lectures, use of laboratory websites to inform, educate and communicate with students, and use of specialized software for Image processing and Macromolecular Simulation.
TEACHING ORGANISATION *Lectures, Seminars, Laboratory Exercises, Field Exercise, Literature Study & Analysis, Tutorial, Internship, Clinical Exercise, Interactive Teaching, Educational Visits, Study Preparation*	

Activity	*Work Load*
Lectures	39 hr
Laboratory exercises	10 hr

(Project), Written assignments, Independent study *The student's study hours for each learning activity are listed, so that the total workload at the semester level corresponds to ECTS standards.*	Group and/or individual assignments	15 hr
	Independent study	26 hr
	Final individual assignment	10 hr
	Course total (25 hours of student work load per ECTS)	***100 hr (4 ECTS)***
STUDENT EVALUATION *Evaluation Methods, Formative or Inferential, Multiple Choice Test, Short Answer Questions, Essay Development Questions, Problem Solving, Written Assignment, Report / Report, Oral Examination, Public Presentation, Laboratory Work, Other / Others* *Expressly specified assessment criteria are stated and whether and where they are accessible to students.*	I. Theory : One project per content unit (15%, 20%, 15%, respectively) which is evaluated with a written analytical report. II. Laboratory: Laboratory reports of data analysis and presentation of results (50%).	

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.