COURSE LAYOUT

1. GENERAL

SCHOOL	APPLIED BIOLOGY & BIOTECHNOLOGY		
DEPARTMENT	BIOTECHNOLOGY		
STUDY LEVEL	*Undergraduate*		
COURSE CODE	**218**	**SEMESTER**	6th (Spring)
COURSE TITLE	BIOPHYSICS		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**ECTS**
LECTURES	3	3,4
PRACTICAL EXERCISES	2	1,6
TOTAL		5

COURSE TYPE	Scientific Specialization
PREREQUISITES	Physics, Biochemistry
LANGUAGE	Greek
IS THE COURSE OFFERED for ERASMUS STUDENTS?	No
COURSE WEB PAGE	https://oeclass.aua.gr/eclass/courses/BIOTECH131/

2. LEARNING OUTCOMES

Learning Outcomes

The course is a basic introductory course in Biophysics techniques used in the analysis of the structure of biomolecules (proteins, DNA, RNA) such as X-ray crystallography, scattering techniques, multidimensional NMR, molecular dynamics as well as other quantitative techniques such as calorimetry, circular dichroism and fluorescence spectroscopy. Finally, the course aims to help students understand the applications of these techniques in the design of drugs and other bioactive molecules.

Upon successful completion of this course the student will be able to
1) understand and be able to describe basic concepts of Biophysics such as the unit cell, structure factor etc., various phenomena such as Rayleigh scattering, spin-spin coupling etc. and various systems such as FRET biosensors.
2) know the basic principles of experimental methodologies for structure analysis of biomolecules (in particular X-ray crystallography, scattering techniques such as SAXS, SANS and DLS, 2-dimensional NMR spectroscopy, molecular dynamics)
3) know the basic principles of other biophysical experimental methodologies for analysis of biomolecules & interactions (calorimetry, DSC, ITC, van't Hoff method, fluorescence spectroscopy and cyclic dichroism spectroscopy).
4) have a general understanding of how the above techniques are applied in Biotechnology and biological sciences.
5) analyze experimental biophysics data using software such as digital image processing.
6) adequately present the results and conclusions of a relevant study.

General Competences
1. Acquiring knowledge of terminology and correct description skills. 2.Development of analytical & critical skills. 3.Development of problem solving skills. 4.Searching, analyzing and synthesizing data and information, including the use of appropriate technologies. 5.Connecting knowledge with reality and applications. 6.Developing skills for decision-making, effective teamwork and adapting to new situations. 7.Demonstrate social, professional and ethical responsibility. 8.Respect for the working and natural environment. 9.Promote free, creative and deductive thinking.

3. COURSE CONTENT

Theory: Review of the structure of biological macromolecules. Thermodynamics and calorimetry. Molecular Mechanics. Crystals. Crystallization. Theory of x-ray diffraction. Reciprocal space. Crystallographic symmetry. Structure factors and Intensities. Data Collection. Electron Density Function. Approaches to the Phase Problem. Structure refinement. Radiation scattering from solutions of macromolecules. Absorption & CD spectroscopy. Fluorescence spectroscopy. NMR Spectroscopy. Applications in drug design and Nanotechnology

Laboratory: Determination of thermodynamic parameters for salt dissolution by the Van't Hoff method, crystallization of lysozyme, diffraction experiments with lysozyme crystals, analysis of electron density map for lysozyme-ligand complex, fluorescence microscopy image processing, analysis of fluorescence spectroscopy data and construction of molecular model.

4. TEACHING and LEARNING METHODS - Evaluation

TEACHING METHOD	In suitably-equipped teaching rooms
USE OF INFORMATICS and COMMUNICATION TECHNOLOGIES	Use of powerpoint slides, e-crystallography simulations, videos, etc. in lectures, use of e-class website system for information, interactive training (quiz), availability of educational material, delivery & grading of exercises, assessment with tests before laboratory exercises and communication with students .
TEACHING ORGANISATION	

Activity	*Work Load*
Lectures	39
Laboratory exercises	10
Group and/or individual assignments	30
Independent study	41
12 optional weekly quiz	3
Final Exam	2
Course total (25 hours of student work load per ECTS)	*125 (5 ECTS)*

STUDENTS EVALUATION	I. Theory: Written final examination (50%) comprising: multiple choice questions, problem solving and short answer questions. Optional quiz exercises ((when taken into account they contribute by 12,5% and the final written exam contributes by 37,5%). II. Laboratory: Tests before each laboratory session (7,5%), written assignments on the laboratory exercises (25%), final personal assignment (17,5%).

5. BIBILIOGRAPHY

1. Principles in Physical Biochemistry (van Holde, Johnson, Ho) 2nd Edition
2. Themata Moriakis Biofysikis (Hamodrakas) Symmetria publications

For the laboratory:
"Biophysics Laboratory Exercises", AUA, Karpusas M.