COURSE OUTLINE "MODELING OF PHYSICAL-CHEMICAL PROCESSES IN BIOLOGY"

1. GENERAL

SCHOOL	HEALTH SCIENCES		
DEPARTMENT	MOLECULAR BIOLOGY AND GENETICS		
LEVEL OF STUDIES	ISCED LEVEL 6		
COURSE CODE	**MBG520**	**SEMESTER**	5th
COURSE TITLE	MODELING OF PHYSICAL-CHEMICAL PROCESSES IN BIOLOGY		

TEACHING ACTIVITIES *If the ECTS Credits are distributed in distinct parts of the course e.g. lectures, labs etc. If the ECTS Credits are awarded to the whole course, then please indicate the teaching hours per week and the corresponding ECTS Credits.*	**HOURS/WEEK**	**ECTS CREDITS**
	2	3

COURSE TYPE *Background, General Knowledge, Scientific Area, Skill Development*	SCIENTIFIC AREA SKILL DEVELOPMENT
PREREQUISITES:	NO
TEACHING & EXAMINATION LANGUAGE:	GREEK
COURSE OFFERED TO ERASMUS STUDENTS:	NO
COURSE URL:	https://eclass.duth.gr/courses/ALEX01303/

2. LEARNING OUTCOMES

Learning Outcomes
Please describe the learning outcomes of the course: Knowledge, skills and abilities acquired after the successful completion of the course.

Course objectives

- The teaching method is based beyond the classical lectures in the learning process of problem / topic, where students are asked to implement, in groups, specific applications that they will choose, combining individual study with the ability to search and compile information within collaboration. In small groups.
- The teaching is initially done with lectures on the basic concepts to all students, then students ate divided into groups (with a small number of people). Each group is unsigned with the implementation of a specific problem of modeling in the field of Biology.
- The course aims to familiarize students with the natural laws governing biological systems and how they can be used to model processes through:
  - the development of the appropriate mathematical model.
  - the implementation (or use) of software to solve the model
  - the extraction of information, with simultaneous evaluation and export of proposals for redesign of the whole process.

Examples of modeling physicochemical properties and processes that you modify in the course include:

- Measures of hydrophobicity.

Modeling of Ligand-macromolecular interactions.

- Examples of computer–aided drug design, CADD
- Population models (e.x. Predator-Pray)
- Epidemiology models (e.x. SIR Susceptibles, Infectives, Removed)
- Dynamic models in systems biology and neuroscience

- Basic mathematical tools: Linear Algebra, numerical analysis, stochastic processes, stability analysis.

Learning Outcomes

After the successful completion of the course, the student will be able to:

- Understand the basic questions in the field of modeling of biological processes, and to be able to make and implement corresponding models.
- Understand the process of modeling through the stages of "inventing" the mathematical model, developing or using computational tools to solve the model, drawing conclusions based on the original model and finally the process of reviewing / expanding the model based on comparison with experimental observation.
- Work in groups and individually to search for new concept.

General Skills

Name the desirable general skills upon successful completion of the module

Search, analysis and synthesis of data and information,	*Project design and management*
ICT Use	*Equity and Inclusion*
Adaptation to new situations	*Respect for the natural environment*
Decision making	*Sustainability*
Autonomous work	*Demonstration of social, professional and moral responsibility and*
Teamwork	*sensitivity to gender issues*
Working in an international environment	*Critical thinking*
Working in an interdisciplinary environment	*Promoting free, creative and inductive reasoning*
Production of new research ideas	

Search, analysis and synthesis of data and information, Critical thinking, Promoting free, creative and inductive reasoning, *Teamwork, Decision making, Autonomous work.*

3. COURSE CONTENT

1) Introduction to modeling.
2) Numerical modeling tools.
3) Computational modeling tools.
4) Connection of microcosm to macrocosm through modeling.
5) Physical and chemical properties in computer–aided drug design, CADD.
6) Modeling Population growth.
7) Modeling Predator-Pray systems.
8) Binding of Drug.
9) Infectious models (ex. SIR: Susceptibles, S, Infectives I, Removed, R).
10) Dynamical modeling in systems biology
11) Dynamic stability
12) Examples of modeling I
13) Examples of modeling II

4. LEARNING & TEACHING METHODS - EVALUATION

TEACHING METHOD *Face to face, Distance learning, etc.*	Face to face
USE OF INFORMATION & COMMUNICATIONS TECHNOLOGY (ICT) *Use of ICT in Teaching, in Laboratory Education, in Communication with students*	Use of multimedia, interactive computational experiments

TEACHING ORGANIZATION

The ways and methods of teaching are described in detail.

Lectures, Seminars, Laboratory Exercise, Field Exercise, Bibliographic research & analysis, Tutoring, Internship (Placement), Clinical Exercise, Art Workshop, Interactive learning, Study visits, Study / creation, project, creation, project. Etc.

Activity	***Workload/semester***
Lectures	26
Study at Home	64
Course Total	**90**

The supervised and unsupervised workload per activity is indicated here, so that total workload per semester complies to ECTS standards.	
STUDENT EVALUATION *Description of the evaluation process* *Assessment Language, Assessment Methods, Formative or Concluding, Multiple Choice Test, Short Answer Questions, Essay Development Questions, Problem Solving, Written Assignment, Essay / Report, Oral Exam, Presentation in audience, Laboratory Report, Clinical examination of a patient, Artistic interpretation, Other/Others* *Please indicate all relevant information about the course assessment and how students are informed*	Oral examination (on a weekly basis) and Public Presentation of the final work (100%). The final grade is based on the student's participation in the weekly meetings, as well as on the evaluation of the achievement of the desired goals and the performance of the team through the presentation of their final work.

5. SUGGESTED BIBLIOGRAPHY

1) Title: ΜΑΘΗΜΑΤΙΚΗ ΜΟΝΤΕΛΟΠΟΙΗΣΗ
Εύδοξο: 59303654
Ed: 1/2016
Authors: ΣΤΑΥΡΟΣ ΚΟΜΗΝΕΑΣ
ISBN: 978-960-603-425-1
Ed.: Ελληνικά Ακαδημαϊκά Ηλεκτρονικά Συγγράμματα και

2) Title :ΒΑΣΙΚΕΣ ΑΡΧΕΣ ΣΧΕΔΙΑΣΜΟΥ ΚΑΙ ΑΝΑΠΤΥΞΗΣ ΦΑΡΜΑΚΩΝ
Εύδοξο: 59303610
Edu: 1/2016
Authors: ΒΑΣΙΛΕΙΟΣ ΔΗΜΟΠΟΥΛΟΣ
ISBN: 978-960-603-190-8
Edu: Ελληνικά Ακαδημαϊκά Ηλεκτρονικά Συγγράμματα και

3) Title: Εισαγωγή στον Προγραμματισμό με αρωγό τη γλώσσα Python
Εύδοξο: 320152
Edu: 1/2016
Authors: ΓΕΩΡΓΙΟΣ ΜΑΝΗΣ
ISBN: 978-960-603-415-2
Edu: Ελληνικά Ακαδημαϊκά Ηλεκτρονικά Συγγράμματα και

4) Title: Μαθηματικά μοντέλα στη Βιολογία 2η έκδοση
Εύδοξο: 59395586
Ed. 2 , 2016
Authors: Σγαρδέλης Στέφανος
ISBN: 978-960-12-2294-3
Pub: UNIVERSITY STUDIO PRESS - ΑΝΩΝΥΜΟΣ ΕΤΑΙΡΙΑ ΓΡΑΦΙΚΩΝ ΤΕΧΝΩΝ ΚΑΙ ΕΚΔΟΣΕΩΝ