COURSE OUTLINE

1. GENERAL

SCHOOL	SCHOOL OF ENGINEERING, UNIVERSITY OF PATRAS		
DEPARTMENT	DEPARTMENT OF COMPUTER ENGINEERING AND INFORMATICS		
LEVEL OF COURSE	UNDERGRADUATE, CORE ELECTIVE		
COURSE CODE	CEID_NE548	**SEMESTER OF STUDIES**	EASTER
COURSE TITLE	INTRODUCTION TO BIOINFORMATICS		

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 thewhole of the course, give the weekly teaching hours and the total credits*	**TEACHING HOURS PER WEEK**	**ECTS CREDITS**
Lectures	2	2
Laboratory Exercises	2	2
Recitation sections	1	1
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).		

COURSE TYPE *general background, special background, specialised general knowledge, skills development*	General knowledge and skills development.
PREREQUISITE COURSES:	There are no prerequisites. Recommended prerequisite knowledge are the courses of data structures (CEID_23Y210), algorithms (CEID_23Y205), and data base development (CEID_24Y344)
TEACHING AND ASSESSMENT LANGUAGE:	Greek. Instruction may be given in English if foreign students attend the course.
THE COURSE IS OFFERED TO ERASMUS STUDENTS	YES
COURSE WEBPAGE (URL)	https://eclass.upatras.gr/courses/CEID1047/

2. LEARNING OUTCOMES

Leraning 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*

Learning outcomes:

At the end of this course the student should be able to:

1. present the main principles and notions of Bioinformatics,
2. understand the connection that exists between the problems in managing biological macromolecules, and techniques for managing strings
3. design and implement algorithms for string processing in order to solve biological problems,
4. understand the basic principles of computer aided drug design,
5. present the main clustering and classification algorithms as they are applied in order to solve biological problems.
6. search efficiently in biological databases and understand the concepts described in these databases
7. understand the concept of phylogenetic trees
8. understand basic genome sequencing techniques and especially Next Generation Sequencing techniques.

At the end of the course the student will have further developed the following skills/competences:

1. ability to exhibit knowledge and understanding of the basic principles and notions of bioinformatics and string processing algorithms
2. ability to apply methodologically this knowledge and understanding in order to solve problems in bioinformatics
3. ability to cooperate with others in order to solve complex problems in the area of bioinformatics

General Abilities

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
situations
Decision-making
Working independently
Team work
Working in an international environment
interdisciplinary environment .....
Production of new research ideas
Project planning and management
Respect for difference and multiculturalism Adapting to new
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 Working in an
Others…

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Decision-making
Working independently Team work
Project planning and management
Production of free, creative and inductive thinking
Production of new research ideas

3. COURSE CONTENT

Introduction to the use of algorithms for effective management and storage of strings and sequences of biological data.

Exact pattern matching algorithms (Boyer-Moore, Knuth-Morris-Pratt, Karb-Rabin) and multiple string sarching.

Introduction to the suffix tree and its applications. Approximate pattern matching and sequence alignment algorithms.

Introduction to sequence databases and their uses.

Sequence Database finding algorithms (FASTA, BLAST, PAM, PROSITE, BLOCKS, BLOSUM).

Introduction to computer-aided drug design.

Structure based drug design, presentation of the structure-activity relationship.

Models for the representation of biological molecules at three-dimensional level, internal coordinate system, computational methods for finding the optimal (Conformational Search), and binding site determination algorithms.

Algorithms for exploring Biological Databases for finding small molecules at three-dimensional level (Geometry-based similarity search).

Biological data categorization techniques in order to predict the behavior of biological molecules, such as categorization algorithms that employ machine learning techniques (Neural Networks, Genetic Algorithms, SVMs, Clustering Algorithms, etc.)

Phylogenetic trees

Genome Sequencing Algorithms

Next Generation Sequencing

4. TEACHING AND LEARNING METHODS - ASSESSMENT

TEACHING METHOD *Face-to-face, Distance learning, etc.*	Face-to-face

USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES *Use of ICT in teaching, laboratory education, communication with students*	We use Information and Communications Technology in communication with students. We use e_class, e_mail.
TEACHING ORGANIZATION *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.*	

Δραστηριότητα	***Φόρτος Εργασίας Εξαμήνου***
Lectures	60
Recitation sections	60
Laboratory exercises	30
Total number of hours for the Course	150

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	
STUDENT ASSESSEMNT *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* *Specifically-defined evaluation criteria are given, and if and where they are accessible to students.*	• delivering and solving a set of exercises in string processing topics (30% of the total grade) • composing and presenting an essay by groups of 1-2 students, concerning the critical presentation and analysis of a set of scientific papers that deals with a specific topic of the course, and an oral examination on the notes of the course (70% of the final grade)

5. RECOMMENDED LITERATURE

1. Bioinformatics Algorithms: An Active Learning Approach by Phillip Compeau, Pavel Pevzner (2018), third edition, Active Learning Publishers
2. Arthur Lesk, Introduction to Bioinformatics, Oxford University Press, Fifth Edition, 2019
3. Jonathan Pevsner, Bioinformatics and Functional Genomics, 3rd Edition, Wiley 2015
4. ΕΙΣΑΓΩΓΗ ΣΤΟΥΣ ΑΛΓΟΡΙΘΜΟΥΣ ΒΙΟΠΛΗΡΟΦΟΡΙΚΗΣ, NEIL C. JONES, PAVEL A. PEVZNER, ΕΚΔΟΣΕΙΣ ΚΛΕΙΔΑΡΙΘΜΟΣ ΕΠΕ, 2010
5. ΒΙΟΠΛΗΡΟΦΟΡΙΚΗ, Σοφία Κοσσιδά, ΕΚΔΟΣΕΙΣ ΝΕΩΝ ΤΕΧΝΟΛΟΓΙΩΝ, 2009
6. Βιοπληροφορική & Λειτουργική Γονιδιωματική, Jonathan Pevsner,ΑΚΑΔΗΜΑΪΚΕΣ ΕΚΔΟΣΕΙΣ Ι. ΜΠΑΣΔΡΑ & ΣΙΑ Ο.Ε., 1η/2019
7. Βιοπληροφορική, A. BAXEVANIS, B.F. OUELLETTE, ΠΑΡΙΣΙΑΝΟΥ ΜΟΝΟΠΡΟΣΩΠΗ ΑΝΩΝΥΜΗ ΕΚΔΟΤΙΚΗ ΕΙΣΑΓΩΓΙΚΗ ΕΜΠΟΡΙΚΗ ΕΤΑΙΡΕΙΑ ΕΠΙΣΤΗΜΟΝΙΚΩΝ ΒΙΒΛΙΩΝ, 2η/2012