SCHOOL	School of Sciences			
ACADEMIC UNIT	Department of Computer Science			
LEVEL OF STUDIES	Undergraduate			
COURSE CODE	**602SKEE**	**SEMESTER**	**6**	
COURSE TITLE	Bioinformatics Algorithms			
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**	**CREDITS**
		Lectures	2	
		Exercises	1	
Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).				5
COURSE TYPE *general background, special background, specialised general knowledge, skills development*	General background			
PREREQUISITE COURSES:				
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek, English (for erasmus students)			
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes			
COURSE WEBSITE (URL)				

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*

The course aims to provide a comprehensive foundation on the Bioinformatics technology for the Computer Engineering student.
The student learns recent advances at the field of Computational Molecular Biology and Bioinformatics. Also, the student is introduced to some important directions for the clinical applications of these new technologies.

The computer engineering student becomes familiarized with computing techniques for Bioinformatics problems. He (she) learns algorithms for DNA, RNA, protein sequence comparison, DNA coding regions prediction, promoter detection, gene expression analysis, protein folding, protein secondary structure prediction.

General Competences

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	*Project planning and management*
Adapting to new situations	*Respect for difference and multiculturalism*
Decision-making	*Respect for the natural environment*
Working independently	*Showing social, professional and ethical responsibility and sensitivity to gender issues*
Team work	*Criticism and self-criticism*
Working in an international environment	*Production of free, creative and inductive thinking*
Working in an interdisciplinary environment	*……*
Production of new research ideas	*Others…*
	…….

The relatively new field of Bioinformatics applies informatics, computer science techniques and computer engineering technology in order to confront difficult problems of Molecular Biology and Genetics.
Initially, the course will introduce basic concepts as what is Bioinformatics and the nature of the problems that they are dealt, Bioinformatics in Greece and the world, Bioinformatics in academic institutions and industry.
Next, the course will present the basics of Molecular Biology and of computing techniques for bioinformatics problems.
Computational techniques for DNA, RNA, protein sequence comparison are also an important domain of recent developments. These techniques concern with machine learning algorithms for DNA coding regions prediction, promoter detection, gene expression analysis, protein folding, protein secondary structure prediction.
Important bioinformatics databases that house a huge amount of biological data, as the NCBI, EBI, KECG, and PDB will be presented and discussed.
Also, the very important in applications subject of sequence alignment and of database searching will be elaborated. The widely used BLAST algorithm will be presented and tools that use BLAST for offering Web based database facilities will be explored.

SYLLABUS

Introduction to Bioinformatics algorithmic techniques and computer software tools.

Study of Biological Databases, their organization, and the data retrieval process. Example databases as NCBI, EBI, KEGG and PDB will be used for web based data retrieval and for studying their programmatic interface.

Another subject of study is the important one of sequence alignment and biological database searching. Dynamic programming based approaches will be introduced. The proper definition of distance metrics between biological sequences will also be elaborated. Next, approximation based heuristic suboptimal searching algorithms, as the BLAST one will be studied.

Also, the next generation sequencing technologies and the DNA microarrays will be another important subject of study. The important novel domains of rational drug discovery and personalized medicine based on the individual genome analysis will also be discussed.

TEACHING and LEARNING METHODS - EVALUATION

DELIVERY *Face-to-face, Distance learning, etc.*	In classroom
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY *Use of ICT in teaching, laboratory education, communication with students*	
TEACHING METHODS *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.* *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 PERFORMANCE EVALUATION *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.*	Written examination (100%)

Activity	***Semester workload***
Lectures	50
Exercises	50
Projects	25
Course total	125

ATTACHED BIBLIOGRAPHY

- Suggested bibliography:
- Related academic journals:

1. Introduction to Bioinformatics, Neil C. Jones and Pavel A. Pevzner, Addison Wesley, 2003

2. Bioinformatics: An active learning approach, Pavel A. Pevzner, Addison Wesley, 2015, Vol. 1 and 2