COURSE OUTLINE

1. GENERAL

SCHOOL	NATURAL SIENCES		
ACADEMIC UNIT	BIOLOGY		
LEVEL OF STUDIES	UNDERGRADUATE		
COURSE CODE	**ΒΙΟ_ΒΠΛ**	**SEMESTER**	**6-8**
COURSE TITLE	**BIOINFORMATICS**		

INDEPENDENT TEACHING ACTIVITIES	**WEEKLY TEACHING HOURS**	**CREDITS**
Lectures	2	
Teaching/Exercises in the computer room	1	
Total		3

COURSE TYPE	Specialised general knowledge
PREREQUISITE COURSES	None. However, it is recommended that the students have acquired good knowledge in the fields of Genetics, Molecular Biology, Cell Biology, Biochemistry, Developmental Biology, Physiology, Biostatistics and basic knowledge in the use of computers.
LANGUAGE OF INSTRUCTION and EXAMINATIONS	Greek
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes
COURSE WEBSITE (URL)	http://www.biology.upatras.gr

2. LEARNING OUTCOMES

Learning outcomes

The course is an introduction to the scientific fields of Bioinformatics and Systems Biology, demonstrating the role and the need of informatics and mathematical modeling in approaching and solving problems in life sciences. The students are presented with the experimental and computational tools, which characterize the modern biological research, including the biological databases and specialized software. The students are exposed to the perspective and practice of the high-throughput analysis of biological data from various levels of cellular function: genomics, transcriptomics, proteomics, metabolomics, metabolic flux analysis and their integrated analysis. Effort is placed in exposing the students to the approaches of modern biological research and furthering their perception regarding the need for holistic analyses of the biological systems as networks of biomolecular networks that could support a comprehensive understanding of the biological phenomena and the genotype/phenotype relationship.

General Competences

- Search for, analysis and synthesis of data and information, with the use of the necessary technology
- Working independently
- Working in an interdisciplinary environment
- Production of new research ideas
- Production of free, creative and inductive thinking

3. SYLLABUS

Lectures

- Introduction to the science of Bioinformatics and how this was succeeded by Systems Biology/ Discussion regarding the necessity of this new approach and science in the post-genomic revolution era/ Which research areas are covered by this scientific field, how mathematical modeling is involved and the use of informatics tools
- Timetable of Genomic Revolution

- Definition and Description of omic technologies
- Main Differences between "conventional/targeted" biology and Systems Biology
- Cellular function as a network of biomolecular networks
- Analytical technologies for next generation sequencing
- Analytical technologies for transcriptomic analysis (microarrays and RNA-Seq)
- Analytical technologies for proteomic and metabolomic analyses
- Definition of Experimental Space/ Profile Matrix – Omic data normalization and filtering methods
- Multivariate Statistical Analysis of Omic Data
- Introduction to Pathway & Network Analysis of omic data
- Introduction to integrated analyses of omic profiles in Systems Biology / New Directions

COMPUTER ROOM

- Databases PubMed/Medline, GenBank, UniProt
- Metabolic Databases (KEGG, Expasy, MetaCyc)
- Comparison between metabolic networks of model organisms
- Databases of protein protein interactions
- Comparison of Protein Protein Interaction Databases for various examples
- Introduction to the multivariate statistical analysis software of omic data TM4/MeV
- Using the software to analyze omic profiles
- Watching and discussing video on integrated analyses of omic data in systems biology (multi-omics)
- Watching and discussing video for biomolecular network analyses

4. TEACHING and LEARNING METHODS - EVALUATION

DELIVERY	Face-to-face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY	Yes; Use of ICT in teaching and communication with students through the e-class platform. In addition, the computer room is used for demonstration of biological databases and specialized bioinformatics software.	
TEACHING METHODS	***Activity***	***Semester workload***
	Lectures	26
	Lectures/Practice in the computer room	12
	Private study hours and exercise solving for the computer room practice every week	12
	Study and analysis of bibliography Preparation of an Oral Presentation of a Recent Publication Private study hours	25
	Course total	**75**
STUDENT PERFORMANCE EVALUATION	The students are evaluated from: • Their answers in exercises for the computer room practice • Oral presentation in front of the class of a recent publication in the fields of Bioinformatics/Systems Biology • Written exam at the end of the semester including:	

	✓ Multiple-choice questions ✓ Questions requiring a short answer and justification ✓ Problem solving

5. ATTACHED BIBLIOGRAPHY

Suggested bibliography:

- Malcolm Campbell & Laurie J. Heyer: Discovering Genomics, Proteomics & Bioinformatics Cold Spring Harbor Laboratory Press
- V. Helms. Principles of computational Biology: From Protein Complexes to Cellular Networks Wiley – VCH (κύρια για τον ορισμό των πρωτεϊνικών & μεταβολικών δικτύων)
- M. Klapa – Bioinformatics (Notes / Review Publications) [https://eclass.upatras.gr/courses/BIO378/]

Related academic journals:

Molecular Systems Biology
BMC Systems Biology
Bioinformatics
BMC Bioinformatics
Frontiers in Physiology – Systems Biology