COURSE OUTLINE

(1) GENERAL

SCHOOL	SCHOOL OF NATURAL SCIENCES		
ACADEMIC UNIT	DEPARTMENT OF BIOLOGY		
LEVEL OF STUDIES	Undergraduate		
COURSE CODE	**BIO_HE2**	SEMESTER	6/8
COURSE TITLE	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 the whole of the course, give the weekly teaching hours and the total credits*	WEEKLY TEACHING HOURS	CREDITS
Lectures	2	
Teaching/Exercises in the computer room	1	
ECTS		3
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*	**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 [English]
COURSE WEBSITE (URL)	http://www.biology.upatras.gr/index.php?option=com_content&view=article&id=36&Itemid=302

(2) 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 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

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…*
	…….

- 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

<table>
<tr><td>DELIVERY
Face-to-face, Distance learning, etc.</td><td>Face-to-face</td></tr>
<tr><td>USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
Use of ICT in teaching, laboratory education, communication with students</td><td>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.</td></tr>
<tr><td>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</td><td>
<table>
<tr><th>Activity</th><th>Semester workload</th></tr>
<tr><td>Lectures</td><td>26</td></tr>
<tr><td>Lectures/Practice in the computer room</td><td>12</td></tr>
<tr><td>Private study hours and exercise solving for the computer room practice every week</td><td>12</td></tr>
<tr><td>Study and analysis of bibliography
Preparation of an Oral Presentation of a Recent Publication
Private study hours</td><td>25</td></tr>
<tr><td>Course total
[25 hours of work-load per ECTS credit]</td><td>75</td></tr>
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</td></tr>
<tr><td>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</td><td>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</td></tr>
</table>

students.	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