Course Syllabus

I. General Information

Course name in English	Bioinformatics
Course name in Polish	Bioinformatyka
Programme	Bioanalytical technologies
Level of studies (BA, BSc, MA, MSc, long-cycle MA)	MSc
Form of studies (full-time, part-time)	Full-time
Discipline	Biological sciences
Language of instruction	English

Course coordinator/person responsible	Asst. Prof. Emin Tahirovic, PhD

Type of class *(use only the types mentioned below)*	Number of teaching hours	Semester	ECTS Points
lecture	30	III	6
tutorial	30	III	

Course pre-requisites	Biostatistics, Basic probability, Programming and Data Acquisition

II. Course Objectives

C1 – Learn the state-of-the-art of biology questions (for computer scientists) and computer science (for medical students)
C2 - Integrate the algorithmic, data mining and cloud knowledge in a bioinformatics application
C3 - Recognize opportunities for technological innovation in the biology field

III. Course learning outcomes with reference to programme learning outcomes

Symbol	Description of course learning outcome	Reference to programme learning outcome
KNOWLEDGE		
W_01	understands how structures and processes in genomics and bio-molecular research offer themselves for computer - algorithmic solutions	K_W04, KW_05,
W_02	understands the purpose and the structure of online biological databases and repositories	KW_05
W_03	understands how and when different computational algorithms can be applied to solve specific biological questions and to check hypothesis about biological phenomena	K_W04
W_04	understand the multidisciplinary context of bioinformatics successfully integrating the algorithmic, data mining and cloud knowledge in a bioinformatics application	K_W02
W_05	understands the choices involved for efficiently solving biology problems using IT infrastructure	KW_08

SKILLS		
U_01	able to use the online biology and genomic databases	K_U02, K_U03, K_U16
U_02	able to write code to efficiently solve biology problems	K_U04
U_03	able to plan and execute basic pre-processing steps and analysis of bio-molecular / genomics data and draw conclusions from results	K_U16, K_U18
SOCIAL COMPETENCIES		
K_01	ability to work in an interdisciplinary team	K_K04
K_02	interdisciplinary approach to problems	K_K02

IV. Course Content

Lectures

1. Introduction: Biology for Computer Scientists and Computer Science for Biologists; **Genome sequencing**: 2. How do we assemble genomes?; 3. Graph algorithms. The String Reconstruction Problem 4. How do we sequence antibiotics? Brute force algorithms; **Comparing Genes, Proteins and Genomes:** 5. How do we compare biological sequences?; 6 Dynamic programming. Introduction to sequence alignment; **Genomic Data Science and Clustering:** 7 Genomic Data Science and Clustering. How did Yeast become a Wine Maker? Clustering Algorithms; 8. Clustering Algorithms II; 9. What Genetic Characteristics do Human Populations Share? Principal component analysis; 10. Principal Component Analysis II; 11. Why biologists have still not have developed an HIV vaccine? Hidden Markov Models; 12. Hidden Markov Models II; 13. Innovation and Bioinformatics: Startups in Bioinformatics; 14. Project presentations I; 15. Project presentations II.

Tutorials

1. Accompany the weekly lectures by introducing practical application of the concepts introduced in the lectures.

V. Didactic methods used and forms of assessment of learning outcomes

Symbol	Didactic methods *(choose from the list)*	Forms of assessment *(choose from the list)*	Documentation type *(choose from the list)*
KNOWLEDGE			
W_01	Conventional lecture	exam	Evaluated test
W_02	Conventional lecture	exam	Evaluated test
W_03	Conventional lecture	exam	Evaluated test
W_04	Conventional lecture	exam	Evaluated test
W_05	Conventional lecture	exam	Evaluated test
SKILLS			
U_01	Tutorial	Test	Evaluated test
U_02	Tutorial	Test	Evaluated test
U_03	Project-based learning	Preparation / implementation of the project	Project rating card
SOCIAL COMPETENCIES			
K_01	Work in Pairs (Think-Pair-Share)	Presentation	Project rating card / Presentation rating card
K_02	PBL (Problem-Based Learning)	Test of practical skills	Evaluated test / written test

VI. Grading criteria, weighting factors

Assignments (x3) - 25 %
Project presentation - 25 %
Midterm Exam - 15%
Final Exam - 35 %

Dergee	Degree criteria	
Very good (5)	the student realizes the assumed learning outcomes to a very good degree	Student demonstrates knowledge of the content of education at the level of 91-100 %
More than good (4,5)	the student realizes the assumed learning outcomes to a more than good degree	Student demonstrates knowledge of the content of education at the level of 86-90 %
good (4)	the student realizes the assumed learning outcomes to a good degree	Student demonstrates knowledge of the content of education at the level of 71-85%
Good enough (3,5)	the student realizes the assumed learning outcomes to a good enough degree	Student demonstrates knowledge of the content of education at the level of 66-70%
sufficient (3)	the student realizes the assumed learning outcomes to a sufficient degree	Student demonstrates knowledge of the content of education at the level of 55-65%
unsufficient (2)	the student realizes the assumed learning outcomes to an unsufficient degree	Student demonstrates knowledge of the content of education at the level of 55%

VII. Student workload

Form of activity	Number of hours
Number of contact hours (with the teacher)	70 (60 + 10 individual consultation)
Number of hours of individual student work	80

VIII. Literature

Basic literature
Bioinformatics Algorithms: An Active-Learning Approach (3rd edition), Philip Compeau and Pavel Pevzner, Active Learning Publishers; 3rd edition (2018)
Additional literature
Bioinformatics and Functional Genomics, Jonathan Pevzner, 2006. Wiley-Blackwell. Introduction to Bioinformatics, Arthur Lesk, 2014. Oxford University Press Bioinformatics, Oxford Journal. BMC Bioinformatics. American Journal of Bioinformatics, Science Publications.