Zał. nr 5 do ZW 78/2023

Attachment no. 4. to the Program of Studies

FACULTY OF CHEMISTRY

SUBJECT CARD

Name of subject in Polish Genomika obliczeniowa
Name of subject in English Computational genomics
Main field of study (if applicable): Biosciences
Specialization (if applicable): Bioinformatics
Profile: academic
Level and form of studies: 2nd level, full-time
Kind of subject: obligatory
Subject code W03BSS-SM2014W, W03BSS-SM2014L
Group of courses NO

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15		15		
Number of hours of total student workload (CNPS)	25		25		
Form of crediting (Examination / crediting with grade)	Examination		crediting with grade		
For group of courses mark (X) final course					
Number of ECTS points	1		1		
including number of ECTS points for practical classes (P)			1		
including number of ECTS points corresponding to classes that require direct participation of lecturers and other academics (BU)	0,65		0,7		

*delete as not necessary

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Basic bioinformatics, genetics and molecular biology knowledge
2. Basic knowledge of computer science
3. Specialized English

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SUBJECT OBJECTIVES

C1 Teaching elementary topics in genomics.
C2 Introducing main genomics databases.
C3 Familiarizing students with methods of sequencing, assembling and description of genomes.
C4 Familiarizing students with comparative genomics methods and applications.
C5 Introducing main concepts and methods used in transcriptomic research.
C6 Teaching about practical applications of genomics research and genomic information.
C7 Acquainting students with the ethical aspects of genomics research and the use and safety of genomic information.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:
PEU_W01 – knowledge of the basic concepts in genomics;
PEU_W02 – knowledge of the content and organization of genomic databases;
PEU_W03 – knowledge of the genome mapping, sequencing, assembly and description methods;
PEU_W04 – knowledge of the tools used to analyze and compare genomic sequences;
PEU_W05 – knowledge of the methods used in transcriptomic and their applications;
PEU_W06 – knowledge of the possible use of genomic information.

relating to skills:
PEU_U01 – ability to search the genomic databases and retrieve information from such sources;
PEU_U02 – ability to select appropriate methods and tools for the studied problem;
PEU_U03 – ability to conduct basic manipulations, comparisons and analysis on genomic information;
PEU_U04 – ability to perform the quality control and genome assembly using sequencing data;
PEU_U05 – ability to conduct the basic analysis and visualization of transcriptomic data;
PEU_U06 – ability to analyze the obtained results.

relating to social competences:
PEU_K01 – awareness of the ethical aspects of genomics research and challenges associated with data protection.

PROGRAMME CONTENT

Lecture	**Number of hours**

Lec 1	**Introductory lecture**: the plan and content of the course and crediting rules. Introduction of the basic concepts in genomics, historical background of genomic research, applications and perspectives.	2h
Lec 2	**Genomic information organization**: sources of genomic information and principles of data collection and access. Introduction of genomic databases and data structure.	2h
Lec 3	**Assembly of genome sequences**: presentation of the gene assembly process based on homology approach and *de novo*. Introduction to the procedures and methods used for quality control and assembly of genome sequences.	2h
Lec 4	**Structural genomics and description of genomes**: overview of principles and methods of genome mapping including types of genomic maps. Presentation of main rules and methods of genes prediction and genome annotations.	2h
Lec 5	**Functional and comparative genomics**: the types of data gained from transcriptomic experiments, approach to the transcriptomic data analysis, presentation and applications. Overview of the comparative genomics methods together with applications examples.	2h
Lec 6	**Experimental techniques**: presentation of main experimental techniques used for the exploration of genomes including new generation techniques. Discussion of the application possibilities and the future of these field.	2h
Lec 7	**Ethical aspects of genomic research**: the ethical aspects of genomic research, the use of genomic information in science and other fields and challenges of data safety. Law regulations regarding the genomic information.	2h
Lec 8	Written exam	1h
	Total hours	15h

Laboratory		**Number of hours**
Lab 1	**Introductory classes**: the program of laboratory classes, organization and rules of the computer lab. Overview of basic tools and software used during the course. Introduction to the Ensembl genome browser.	2h
Lab 2	**Genomic databases**: introduction to the main genomic databases, data organization and visualization. Overview of related ‘omics’ databases.	2h
Lab 3	**Genomic databases; genome description**: Practical examples reflecting the genome annotation, including analysis of known transcript or variants. The use of genomic databases as a source of information including basic comparative analysis.	2h
Lab 4	**Project I:** Practical individual tasks for the first report.	2h
Lab 5	**Genome information analysis:** Practical examples of large-scale genomic data retrieving, handling, sorting, comparing, etc., using genomic databases and online tools.	2h

Lab 6	**Genome assembly:** Introduction to genome sequencing data (reads) quality control and genome assembly. Practical examples.	2h
Lab 7	**Transcriptomics:** Practical examples of transcriptomic data analysis and methods of visualization of the results.	2h
Lab 8	**Project II:** Practical individual tasks for the second report.	1h
	Total hours	15h

TEACHING TOOLS USED
N1. Lecture N2. Multimedia presentation N3. Practical usage of databases N4. Practical usage of software N5. Tutorials with examples for analyzed problems N5. Solving individual tasks N6. Preparation of reports

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F – forming during semester), P – concluding (at semester end)	Learning outcomes code	Way of evaluating learning outcomes achievement
P (Lecture)	PEU_W01- PEU_W06, PEU_U01, PEU_U02, PEU_K01	Final exam
F1 (Laboratory)	PEU_W01-PEU_W02, PEU_U01-PEU_U03	Report from the Individual Project I
F2 (Laboratory)	PEU_W01- PEU_W05, PEU_U01-PEU_U06	Report from the Individual Project II
P (Laboratory) **=F1+F2**		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] *Fundamentals of Bioinformatics and Computational Biology,* G.B. Singh, Springer-Verlag London, 2015.

[3] *Introduction to Genomics,* Lesk A. Oxford University Press, Oxford, 2017.

[2] *Big Data Analytics in Genomics,* Wong, Ka-Chun, Springer-Verlag London, 2016.

SECONDARY LITERATURE:

[1] *Comparative Gene Finding, Models, Algorithms and Implementation,* M. Axelson-Fisk, Springer-Verlag London, 2015.

[2] *Genomes,* T. A. Brown, 4th Edition, Garland Science: New York, 2017.

SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)

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