

Course Syllabus

I. General Information

Course name in English	Programing and data acquisition
Course name in Polish	Programowanie i akwizycja danych
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/ dr Michał Dolecki

Type of class (<i>use only the types mentioned below</i>)	Number of teaching hours	Semester	ECTS Points
Lecture	30	II	6
Tutorial	30	II	

Course pre-requisites	Basic calculus and concept of programming
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II. Course Objectives

C1 – understand how measurements of various biological processes and phenomena are conducted and how data are generated from them
C2 - understand tools and systems for automatized measuring and data collection
C3 – understand the necessity of data standardization and data transformation for valid analysis
C4 – import data from different data generation / collection tools into a data analysis software
C5 – program in data analysis software / tools cleaning, transformation and formatting of raw imported data into a ready-to-analyze data set

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 data generation, data recording and data collection are done in modern data-intensive biological application	K_W05
W_02	understands how features and specialities of the data acquisition process can determine applicable methods for data analysis later	K_W05, K_W08
W_03	can explain each step and methodological tools involved in data acquisition, collection and pre-processing	K_W04
W_04	understands common ways for data standardization and its purpose	K_W04
W_05	knows how to design a data collection process having the scientific question that needs to be answered in focus	K_W04, K_W08

SKILLS		
U_01	demonstrates ability to use (pre-process, analyze, visualize) data created and / or collected by different recording or data collection tools	K_U01, K_U03, K_U14, K_U17
U_02	can decide when and how to apply necessary pre-processing step with respect to scientific hypothesis one wants to check	K_U03, K_U07, K_U14
U_03	can program some basic data pre-processing steps (cleaning, missing data, transformation, standardization) using data scientific software tools	K_U04, K_U07, K_U14
SOCIAL COMPETENCIES		
K_01	understands the importance of data privacy in the collection and subsequent phases of data analysis	K_K01, K_K03, K_K04

IV. Course Content

<p>Lectures</p> <p>1. Course introduction; Introduction to prominent data collection systems in the domain of biotechnology; 2 Specialties of collecting data for genomics algorithms; 3 Specialties of data for development of diagnostic instruments; 3. Recording and storing data using a microcontroller platform; 4. Data storage technologies; 5. Data pre-processing: cleaning data; 6. Data pre-processing: data standardization; 7. Data pre-processing: missing data; 8. Combining data from several sources; 9. Combining data from several sources; 10. Combining data from several sources; 11. Creating a ready-to-analyze dataset ; 12. Documenting the data cleaning and preparation steps; 13. Documenting the data cleaning and preparation steps; 14. Documenting the data cleaning and preparation steps; 15. Data - Pipeline - automatizing and scheduling</p> <p>Tutorials (in Computer labs)</p> <p>Accompany the weekly lectures by introducing practical application of the concepts introduced in the lectures.</p>
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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	Problem lecture	exam	Evaluated test
W_05	Conventional lecture	exam	Evaluated test
SKILLS			
U_01	Tutorial	Test, Project-based learning	Evaluated test, Project rating card
U_02	Tutorial	Test, Project-based learning	Evaluated test, Project rating card
U_03	Tutorial	Test, Project-based learning	Evaluated test, Project rating card
U_04	Tutorial	Test, Project-based learning	Evaluated test, Project rating card
SOCIAL COMPETENCIES			
K_01	Discussion	Test	Evaluated test

VI Grading criteria, weighting factors

Midterm Exam - 25 %

Final Exam- 35 %

Final project / Presentation - 40%

Degree	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 95-100 %
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 85-94 %
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 75-84%
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 65-74%
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 55-64%
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)	69 (60 + 9 individual consultation)
Number of hours of individual student work	81

VIII Literature

Basic literature
Data Wrangling with R, Bradley Boehmke, 2016, Springer – Verlag New York
Introduction to Data Technologies, Paul Murrel, 2017, Chapman and Hall/CRC
Additional literature