SYLLABUS

1. Information regarding the programme

1.1 Higher education institution	**Babeş-Bolyai University**
1.2 Faculty	**Faculty of Biology and Geology**
1.3 Department	**Department of Molecular Biology and Biotechnology**
1.4 Field of study	**Biology**
1.5 Study cycle	**Master**
1.6 Study programme / Qualification	**Bioinformatics applied in life sciences**

2. Information regarding the discipline

2.1 Name of the discipline (en) (ro)			**Advanced programming and algorithms in bioinformatics** **Programare avansată pentru bioinformatică**				
2.2 Course coordinator			**Assist. prof. dr. László Zoltán**				
2.3 Seminar coordinator			**Assist. prof. dr. László Zoltán**				
2.4. Year of study	**1**	2.5 Semester	**2**	2.6. Type of evaluation	**E**	2.7 Type of discipline	**Compulsory**
2.8. Code of the discipline		**BME1124**					

3. Total estimated time (hours/semester of didactic activities)

3.1 Hours per week	**4**	Of which: 3.2 course	**2**	3.3 seminar/laboratory	**2**
3.4 Total hours in the curriculum	**56**	Of which: 3.5 course	**28**	3.6 seminar/laboratory	**28**
Time allotment:					hours
Learning using manual, course support, bibliography, course notes					24
Additional documentation (in libraries, on electronic platforms, field documentation)					18
Preparation for seminars/labs, homework, papers, portfolios and essays					16
Tutorship					8
Evaluations					4
Other activities:					

3.7 Total individual study hours	70
3.8 Total hours per semester	126
3.9 Number of ECTS credits	5

4. Prerequisites (if necessary)

4.1. curriculum	• Previous programming experience is not required, but it is an advantage
4.2. competencies	• Average computer skills

5. Conditions (if necessary)

5.1. for the course	• Beamer • Online meeting platform
5.2. for the seminar /lab activities	• Attendance of a minimum of 90% of practical/ seminar classes, • Computers, specific development environment

6. Specific competencies acquired

Professional competencies	• Development of the ability to use concepts to create a variety of programs to perform various bioinformatics tasks. • Descriptions of the algorithms and methods by which these can be implemented in computer code.
Transversal competencies	• Efficient conduct of activities organized in an interdisciplinary group • Using the specific concepts of bioinformatics to interpret the results or solve theoretical and experimental problems

7. Objectives of the discipline (outcome of the acquired competencies)

7.1 General objective of the discipline	• Description of analytical methods and downstream data processing, integration and visualization for bioinformatical analyses.
7.2 Specific objective of the discipline	• Description of main techniques regarding data acquisition and processing strategies • Understanding the principles underlying the bioinformatical processes • Knowledge regarding the main databases for genetic data • Applying bioinformatics tools for analysing genetic data

8. Content

8.1 Course	Teaching methods	Remarks
Intro to the course and Linux	• Interactive exposure • Presentation • Explanation • Practical examples • Case-study discussions	
Intro to Bioconductor		
Handling Genbank and other file types.		
Sequence Alignment algorithms.		
Clustering (Genetic algorithms and k-means)		
Principle Component Analysis		
Text Mining and Perl		
Phylogenetic Trees		
Bibliography 1. The R Project for Statistical Computing [http://www.R-project.org/ 2. Perl.org [http://www.perl.org/] 3. Tisdall, J. D. (2001) Beginning Perl for Bioinformatics. O'Reilly Media 4. Gentleman, R. (2008). R Programming for Bioinformatics. In R Programming for Bioinformatics. https://doi.org/10.1201/9781420063684 5. Ristić, M. M. (2009). R programming for bioinformatics. Journal of Applied Statistics, 36(8). https://doi.org/10.1080/02664760802695884 6. Tisdall, J. D. (2003). Mastering Perl for Bioinformatics. Building, 159.		
8.2 Seminar / laboratory	Teaching methods	Remarks
Introduction to Linux and R in Linux	• Interactive exposure • Explanation • Conversation • Practical demonstration	
Writing program to read Genbank and other files types.		
Single and multiple sequence Alignments.		
Clustering (Genetic algorithms and k-means)		
Principle Component Analysis		
Text Mining		
Phylogenetic Trees and visualisation		
Bibliography		

1. The R Project for Statistical Computing [http://www.R-project.org/
2. Perl.org [http://www.perl.org/]
3. Tisdall, J. D. (2001) Beginning Perl for Bioinformatics. O'Reilly Media
4. Gentleman, R. (2008). R Programming for Bioinformatics. In R Programming for Bioinformatics. https://doi.org/10.1201/9781420063684
5. Ristić, M. M. (2009). R programming for bioinformatics. Journal of Applied Statistics, 36(8). https://doi.org/10.1080/02664760802695884
6. Tisdall, J. D. (2003). Mastering Perl for Bioinformatics. Building, 159.
7. Yu, G. (2020). Using ggtree to Visualize Data on Tree-Like Structures. *Current Protocols in Bioinformatics*, *69*(1). https://doi.org/10.1002/cpbi.96

9. Corroborating the content of the discipline with the expectations of the epistemic community, professional associations and representative employers within the field of the program

- The course promotes the gaining of theoretical knowledge and practical skills required for teamwork in the field of research and development in academic entities, but also in R&D units in private companies;
- The course is listed in the curriculum of similar specializations at Romanian and foreign Universities.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course	Knowledge of concepts and methods from the topics of the course	Written exam (combined test)	50%
10.5 Seminar/lab activities	Evaluation of a short individual project on the topic of metabolomics	Oral colloquium	50%
10.6Minimum performance standards			
Each student should obtain minimum 5 at the written exam and oral colloquium. In order to obtain the minimum grade 5, the student must demonstrate the mastery of the basic concepts described during the course and practicum classes.			

Date	Signature of course coordinator	Signature of seminar coordinator
16.01.2023	**Assist. Prof. dr. László Zoltán**	**Assist. Prof. dr. László Zoltán**

Date of approval	Signature of the head of department
20.01.2023	**Assoc. Prof. Beatrice Kelemen**