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)			**R programming for data analysis and visualisation** **Programare in R pentru analiza si vizualizarea datelor**				
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	**1**	2.6. Type of evaluation	**E**	2.7 Type of discipline	**Compulsory**
2.8. Code of the discipline		**BME1112**					

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)					20
Preparation for seminars/labs, homework, papers, portfolios and essays					16
Tutorship					6
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	• NA
4.2. competencies	• Average computer skills

5. Conditions (if necessary)

5.1. for the course	• Multimedia projector • Online meeting platform if necessary
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	• The ability to use statistical concepts in data analyses • Data analyses and visualisation of biologic datasets • Create customised functions for analyses of bioinformatic datasets
Transversal competencies	• Using specific methods to analyse data, interpret results or solve theoretical and experimental assignments in daily work problems.

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

7.1 General objective of the discipline	• To enable students to perform exploratory data analysis with statistics and plots.
7.2 Specific objective of the discipline	• Students will be able to understand basic concepts of using R, its data structures and indexing, to use them in their work. They will be able to apply basic functions, to create basic loops to solve different types of problems, to create customized functions, create various plots, to perform basic exploratory data analysis with summary statistics and plots.

8. Content

8.1 Course	Teaching methods	Remarks
General introduction into the R ecosystem	• Interactive exposure • Presentation • Explanation • Practical examples	
R programming basics		
Understanding and manipulating data structures		
Making custom functions in R		
Value of visualisation and design		
Data exploration: descriptive statistics		
Basic data visualization using R		
Data visualization using ggplot2		

Bibliography

1. Roger D. Peng (2020): R Programming for Data Science, http://leanpub.com/rprogramming
2. Hadley Wickham (2016): ggplot2: Elegant Graphics for Data Analysis, https://ggplot2-book.org/index.html
3. Alex Douglas, Deon Roos, Francesca Mancini, Ana Couto & David Lusseau (2021): An Introduction to R, https://intro2r.com/
4. Michael J. Crawley (2014): The R Book, 2nd Edition, https://onlinelibrary.wiley.com/doi/book/10.1002/9781118448908

References (1, 2, 3) are freely available available in electronic format. References (4) is an optional resource made available upon request.

8.2 Seminar / laboratory	Teaching methods	Remarks
Installation of R, setting working directory, databases, help platforms etc.	• Practical demonstration • Case-study discussions	
Use of R as a calculator, functions and matrix operations, missing data and logical operators		
Data management with repeats, sorting, ordering, and lists, vector indexing, factors, strings, display and formatting		

Basics of custom functions, the use of a variety of conditional statements, introduce the use of loops		
Preparation of simple graphs in R using basic functions: scatterplot, boxplot, barplot, stripchart, donut charts, dendrograms.		
Preparation of graphs using ggplot2: scatterplot, boxplot, barplot, stripchart, donut charts, dendrograms.		
Presentations for storytelling assignment		

Bibliography

1. Roger D. Peng (2020): R Programming for Data Science, http://leanpub.com/rprogramming
2. Hadley Wickham (2016): ggplot2: Elegant Graphics for Data Analysis, https://ggplot2-book.org/index.html
3. Alex Douglas, Deon Roos, Francesca Mancini, Ana Couto & David Lusseau (2021): An Introduction to R, https://intro2r.com/
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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 (%)
10.1 Course	Knowledge of concepts and methods from the topics of the course	Written exam	50%
10.2 Seminar/lab activities	Evaluation of a short individual project	Storytelling assignment	50%
10.3.Minimum 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**