# SYLLABUS

*Academic year 2023 - 2024*

## 1. Details about the program

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|---|---|
| 1.1. Higher Education Institution | **„Lucian Blaga" University of Sibiu** |
| 1.2. Faculty | Faculty of Sciences |
| 1.3. Department | Environmental Sciences, Physics, Physical Education and Sports |
| 1.4. Field of study | BIOLOGY |
| 1.5. Study cycle[1] | BACHELOR |
| 1.6. Specialization | BIOLOGY |

## 2. Details about the course

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|---|---|---|---|---|---|
| 2.1. Course name | **Methods of biological data analysis** | | Code | FSTI.MFE.BIOEN.L.SO.3.1020.C-4.7 | |
| 2.2. Course coordinator | Assoc. Prof. Ana Maria Benedek-Sîrbu, PhD | | | | |
| 2.3. Practical activity coordinator | Assoc. Prof. Ana Maria Benedek-Sîrbu, PhD | | | | |
| 2.4. Year of study[2] | 2 | 2.5. Semester[3] | 3 | 2.6. Type of assessment[4] | C |
| 2.7. Type of discipline[5] | O | 2.8. Formative category of the discipline[6] | | | S |

## 3. Estimated total time

| 3.1. Proportion of the discipline within the curriculum – *number of hours / week* | | | | | |
|---|---|---|---|---|---|
| 3.1.a.Lecture | 3.1.b. Seminar | 3.1.c. Laboratory | 3.1.d. Project | 3.1.e Other | Total |
| 1 | - | 2 | - | - | **3** |
| 3.2. Proportion of the discipline within the curriculum – *number of hours / week* | | | | | |
| 3.2.a.Lecture | 3.2.b. Seminar | 3.2.c. Laboratory | 3.2.d. Project | 3.2.e Other | Total[7] |
| 14 | - | 28 | - | - | **42** |

| **Allocation of time budget for individual study**[8] | **No. hours** |
|---|---|
| Study based on textbook, lecture notes, bibliography and course notes | 14 |
| Additional research: library, specialized electronic platforms and field or on-site investigation and documentation | 15 |
| Preparing for the seminar / laboratorires, home assignments, reports, portfolios and essays | 15 |
| Tutoring[9] | 10 |
| Examinations[10] | 4 |
| **3.3. Total number of hours for individual study**[11] ***(NOSI$_{sem}$)*** | **58** |
| **3.4. Total number of hours in the curriculum (*NOAD$_{sem}$*)** | **42** |
| **3.5. Total number of hours per semester**[12] **(*NOAD$_{sem}$* + *NOSI$_{sem}$*)** | **100** |
| **3.6. No of hours / ECTS** | **25** |
| **3.7. Number of credits**[13] | **4** |

**4. Prerequisites** (if applicable)

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| 4.1. Prerequisite courses for enrollment to this subject (from the curriculum) [14] | |
| 4.2. Competencies | |

**5. Requirements** (wherever applicable)

| | |
|---|---|
| 5.1. Lecture organization and structure[15] | Room with videoprojector |
| 5.2. Organization and structure of practical activities (lab/sem/pr/other) [16] | Computer room |

**6. Specific competencies[17]**

| | | | |
|---|---|---|---|
| Number of credits assigned to the discipline[18] | | 4 | Distribution of credits according to competencies[19] |
| **6.1. Professional competencies** | CP1 | Define the basic concepts, theories and methods in the field of experimental design and data analysis in order to facilitate the connections required in the field of biology | 1 |
| | CP2 | Ability to elaborate and interpret statistical models | 0.5 |
| | CP3 | Analyse and communicate scientific information. | 0.5 |
| | CP4 | Ability to use different types of ANOVA, depending on the experimental design, the regression and correlation analysis, to elaborate simple and multiple linear models on different types of biological data sets. | 1 |
| **6.2. Transversal competencies** | CT1 | Implementation of effective and responsible work strategies, punctuality, reliability and personal responsibility, based on principles, norms and values of professional ethics code. | 0.25 |
| | CT2 | Efficient work in multidisciplinary team on different hierarchical levels | 0.25 |
| | CT3 | Documentation in English language for professional and personal development through training and effective adaptation to new scientific discoveries | 0.5 |

**7. Course objectives** (reflected by the framework of specific competencies)

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|---|---|
| 7.1. General objective | Develop the ability to analyse biolgical data sets using R software. |
| 7.2. Specific objectives | • Develop the ability to elaborate and implement sampling designs in hypothetic-deductiv studies.<br>• Definition and correct use of controls and treatments, avoidance of pseudoreplication.<br>• Presentation and use of the basic methods of biological data illustration, statistical analysis and interpretation.<br>• Use of R software to transform, illustrate and analyse biological data |

**8. Course description**

| **8.1. Lecture**[20] | | **Teaching methods**[21] | **No. of hours** |
|---|---|---|---|
| Lecture 1 | The strategy of elaboration and implementation of biological studies | Interactive lecture, explanation, conversation, problematisation | 2 |
| Lecture 2 | Introduction in experimental design | Interactive lecture, explanation, conversation, problematisation | 2 |
| Lecture 3 | Hypothesis testing | Interactive lecture, explanation, conversation, problematisation | 2 |
| Lecture 4 | Different types of experimental designs | Interactive lecture, explanation, conversation, problematisation | 2 |
| Lecture 5 | Linear corellation and simple regression | Interactive lecture, explanation, conversation, problematisation | 2 |
| Lecture 6 | Multiple linear regression. Choosing the best model. | Interactive lecture, explanation, conversation, problematisation | 2 |
| Lecture 7 | Illustrating, interpretating and reporting results | Interactive lecture, explanation, conversation, problematisation | 2 |
| | | **Total number of lecture hours:** | **14** |

| 8.2. **Practical activities** (8.2.a. Seminar[22]/ 8.2.b. Laboratory[23]/ 8.2.c. Project[24] / 8.2.d. Other practical activities[25]) | **Teaching methods** | **No. of hours** |
|---|---|---|
| Lab. 1. Introduction to R | Explanation, conversation, problematisation, dialogue, brainstorming, case studies, use of computer, problem solving | 4 |
| Lab. 2. Preliminary data analysis and illustration | Explanation, conversation, problematisation, dialogue, brainstorming, case studies, use of computer, problem solving | 4 |
| Lab. 3. Introduction to statistical analysis | Explanation, conversation, problematisation, dialogue, brainstorming, case studies, use of computer, problem solving | 2 |
| Lab. 4. t tests. Verifying t-test assumptions | Explanation, conversation, problematisation, dialogue, brainstorming, case studies, use of computer, problem solving | 2 |
| Lab. 5. Z tests for proportions, chi-square tests for independence and goodness of fit | Explanation, conversation, problematisation, dialogue, brainstorming, case studies, use of computer, problem solving | 2 |
| Lab. 6. ANOVA for different types of experimental designs | Explanation, conversation, problematisation, dialogue, brainstorming, case studies, use of computer, problem solving | 4 |
| Lab. 7. Linear correlation | Explanation, conversation, problematisation, dialogue, brainstorming, case studies, use of computer, problem solving | 2 |
| Lab. 8. Simple linear regression | Explanation, conversation, problematisation, dialogue, brainstorming, case studies, use of computer, problem solving | 2 |
| Lab. 9. Multiple linear regression. Choosing the best model | Explanation, conversation, problematisation, dialogue, brainstorming, case studies, use of computer, problem solving | 2 |

| | | |
|---|---|---|
| Lab. 10. Non-parametric tests | Explanation, conversation, problematisation, dialogue, brainstorming, case studies, use of computer, problem solving | 2 |
| Lab. 11. Recap | Explanation, conversation, problematisation, dialogue, brainstorming, case studies, use of computer, problem solving | 2 |
| | **Total number of hours: laboratory** | **28** |

## 9. Bibliography

| | |
|---|---|
| 9.1. Recommended references | 1. Krebs, Ch., 1989 - Ecological Methodology. Harper Collins Publishers.<br>2. Venables, W.N., Smith, D.M., the R Core Team, 2018 - An Introduction to R. CRAN.R – project.org |
| 9.2. Additional references | 1. Faraway, J.J., 2002 – Practical Regression and ANOVA in R. CRAN.R – project.org |

## 10. Correlating the course description with the expectations and requirements of representatives of the epistemic community, professional associations and significant employers and stakeholders related to the study program and the specific area[26]

The course content enables students to obtain skills of understanding and reproduction of the terms, concepts and principles of experimental design and analysis of biological data, gives them the ability to communicate using the specific scientific language and to elaborate adequate experimental designs for different research questions, and to elaborate statistical models on different types of biological datasets. It stimulates the participation in collective work / research and professional development of original ideas.

## 11. Evaluation

| Type of activity | 11.1 Assessment criteria | 11.2 Assessment methods | | 11.3 Percentage of the final grade | Notes.[27] |
|---|---|---|---|---|---|
| 11.4a Exam / Coloquium | • Theoretical and practical knowledge (quantity, correctness,accuracy) | Midterm / ongoing assignments[28]: | % | 50% | |
| | | Home assignments: | % | | |
| | | Other activities[29]: | % | | |
| | | Final assessment: | 100% | | |
| 11.4c Laboratory | • Knowledge of equipment, methods of using specific instruments and tools; assessment of tools or achievements, processing and interpretation of results | • Practical exam | | 50% | |
| 11.5 Minimum performance standard[30]<br>- students are expected to know the main methods of data analysis and their usage and assumptions and be able to apply and interpret a simple linear regression | | | | | |

***The course description includes components adapted to SEN (Special Educational Needs) persons, according to their type and degree, at all curricular elements and dimensions (competencies, objectives, course description, teaching methods, alternative assessment), in view of providing and ensuring equitable and fair opportunities to academic education for all students, with special attention to special educational needs.***

Date of submission: 25 / 09 / 2023

Date of approval in the Department: 19 / 10 / 2023

| | **Degree, titlle, first name, surname** | **Signature** |
|---|---|---|
| **Course coordinator** | Assoc. Prof. Ana-Maria Benedek-Sîrbu, PhD | |
| **Study program coordinator** | Assoc. Prof. Ana-Maria Benedek-Sîrbu, PhD | |
| **Director Department** | Lecturer PhD. Voichița GHEOCA | |

[1] *Licență / Master*
[2] *1-4 pentru licență, 1-2 pentru master*
[3] *1-8 pentru licență, 1-3 pentru master*
[4] *Examen, colocviu sau VP A/R – din planul de învățământ*
[5] *Regim disciplină: O=Disciplină obligatorie; A=Disciplină opțională; U=Facultativă*
[6] *Categoria formativă: S=Specialitate; F=Fundamentală; C=Complementară; I=Asistată integral; P=Asistată parțial; N=Neasistată*
[7] *Este egal cu 14 săptămâni x numărul de ore de la punctul 3.1 (similar pentru 3.2.a.b.c.d.e.)*
[8] *Liniile de mai jos se referă la studiul individual; totalul se completează la punctul 3.37.*
[9] *Între 7 și 14 ore*
[10] *Între 2 și 6 ore*
[11] *Suma valorilor de pe liniile anterioare, care se referă la studiul individual.*
[12] *Suma (3.5.) dintre numărul de ore de activitate didactică directă (NOAD) și numărul de ore de studiu individual (NOSI) trebuie să fie egală cu numărul de credite alocat disciplinei (punctul 3.7) x nr. ore pe credit (3.6.)*
[13] *Numărul de credit se calculează după formula următoare și se rotunjește la valori vecine întregi (fie prin micșorare fie prin majorare*

$$Nr.credite = \frac{NOCpSpD \times C_C + NOApSpD \times C_A}{TOCpSdP \times C_C + TOApSdP \times C_A} \times 30\ credite$$

Unde:

- NOCpSpD = Număr ore curs/săptămână/disciplina pentru care se calculează creditele
- NOApSpD = Număr ore aplicații (sem./lab./pro.)/săptămână/disciplina pentru care se calculează creditele
- TOCpSdP = Număr total ore curs/săptămână din plan
- TOApSdP = Număr total ore aplicații (sem./lab./pro.)/săptămână din plan
- $C_C$/$C_A$ = Coeficienți curs/aplicații calculate conform tabelului

| **Coeficienți** | **Curs** | **Aplicații (S/L/P)** |
|---|---|---|
| Licență | 2 | 1 |
| Master | 2,5 | 1,5 |
| Licență lb. străină | 2,5 | 1,25 |

[14] *Se menționează disciplinele obligatoriu a fi promovate anterior sau echivalente*
[15] *Tablă, videoproiector, flipchart, materiale didactice specifice, platforme on-line etc.*
[16] *Tehnică de calcul, pachete software, standuri experimentale, platforme on-line etc.*
[17] *Competențele din Grilele aferente descrierii programului de studii, adaptate la specificul disciplinei*
[18] *Din planul de învățământ*
[19] *Creditele alocate disciplinei se distribuie pe competențe profesionale și transversale în funcție de specificul disciplinei*
[20] *Titluri de capitole și paragrafe*
[21] *Expunere, prelegere, prezentare la tablă a problematicii studiate, utilizare videoproiector, discuții cu studenții (pentru fiecare capitol, dacă este cazul)*
[22] *Discuții, dezbateri, prezentare și/sau analiză de lucrări, rezolvare de exerciții și probleme etc.*
[23] *Demonstrație practică, exercițiu, experiment etc.*
[24] *Studiu de caz, demonstrație, exercițiu, analiza erorilor etc*.
[25] *Alte tipuri de activități practice specifice*
[26] *Legătura cu alte discipline, utilitatea disciplinei pe piața muncii*
[27] *CPE – condiționează participarea la examen; nCPE – nu condiționează participarea la examen; CEF - condiționează evaluarea finală; N/A – nu se aplică*
[28] *Se va preciza numărul de teste și săptămânile în care vor fi susținute.*
[29] *Cercuri științifice, concursuri profesionale etc.*
[30] *Se particularizează la specificul disciplinei standardul minim de performanță din grila de competențe a programului de studii, dacă este cazul.*