SYLLABUS

Academic year 2024 - 2025

1. Details about the program

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 Sport
1.4. Field of study	Biology
1.5. Study cycle[1]	Bachelor
1.6. Specialization	Biology (EN)

2. Details about the course

2.1. Course name	Mathematics applied in biology			Code	FSTI.MFE.BIOEN.L.CO.1.1100.C-3.6
2.2. Course coordinator	Lecturer PhD Miruna-Ștefana SOREA				
2.3. Practical activity coordinator	Lecturer PhD Miruna-Ștefana SOREA				
2.4. Year of study[2]	1	2.5. Semester[3]	1	2.6. Type of assessment[4]	Colloquium
2.7. Type of discipline[5]	Mandatory	2.8. Formative category of the discipline[6]			C

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	1	--	--	--	**2**
3.2. Proportion of the discipline within the curriculum – *total number of hours according to the curriculum*					
3.2.a. Lecture	3.2.b. Seminar	3.2.c. Laboratory	3.2.d. Project	3.2.e Other	Total[7]
14	14	--	--	--	**28**

Allocation of time budget for individual study [8]	**Hours**
Study based on textbook, lecture notes, bibliography and course notes	20
Additional research: library, specialized electronic platforms and field or on-site investigation and documentation	12
Preparing for the seminar / laboratories, home assignments, reports, portfolios and essays	10
Tutoring[9]	2
Examinations[10]	3
3.3. Total number of hours for individual study[11] ***(NOSI$_{sem}$)***	**47**
3.4. Total number of hours in the curriculum (*NOAD$_{sem}$*)	**28**
3.5. Total number of hours per semester[12] **(*NOAD$_{sem}$* + *NOSI$_{sem}$*)**	**75**
3.6. Number of hours / ECTS	**25**
3.7. Number of credits[13]	**3**

4. Prerequisites (if applicable)

4.1. Prerequisite courses for enrollment to this subject (from the curriculum) [14]	Mathematics from school education
4.2. Competencies	To be able to use Microsoft Word and to be able to access the Internet

5. Requirements (wherever applicable)

5.1. Lecture organization [15]	Classroom equipped with blackboard, smartboard, laptop/PC, video projector, appropriate software, internet connection. Depending on the epidemiological situation: webcam, microphone, Google Meet.
5.2. Organization and structure of practical activities (seminar) [16]	Classroom equipped with blackboard, smartboard, laptop/PC, video projector, appropriate software, internet connection. Depending on the epidemiological situation: webcam, microphone, Google Meet.

6. Specific competencies[17]

Number of credits assigned to the discipline[18]		3	Distribution of credits according to competencies[19]
6.1. Professional competencies	CP1	Applying specific mathematical techniques and methods for the purpose of modeling, analyzing, and optimizing complex biological processes.	0.5
	CP2	Ability to perform statistical analysis and forecasting.	0.5
	CP3	Building mathematical models to study the evolution of some biological processes or phenomena and to interpret the obtained results.	0.5
6.2. Transversal competencies	CT1	The application of rigorous and efficient work rules, the manifestation of responsible attitudes towards the scientific and didactic field, for the optimal and creative exploitation of one's own potential in specific situations, in compliance with the principles and norms of professional ethics.	0.5
	CT2	Efficient and effective performance of organized team activities.	0.5
	CT3	Effective use of information sources, communication resources and assisted professional training, both in Romanian and in an international language.	0.5

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

7.1. General objective	At the end of the course and seminar, students will be able to use mathematical knowledge in order to understand, describe, model and optimize natural phenomena and processes.

7.2. Specific objectives	At the end of the course and seminar, students will be able to: • correctly use mathematical notions in practical applications in the field of biology: functions, sequences, limits, derivatives, integrals, elements of linear algebra, differential equations, probabilities, statistics • use mathematical software (Maple and MATLAB) to solve mathematical exercises and problems and to create and simulate mathematical models of biological systems • build and validate epidemiological models and statistical models that describe biological processes • perform calculations and statistical tests with the aim of verifying hypotheses and modeling relationships between certain variables, using specific software tools (R, Python, MS Excel) • graphically represent and visualize the data with the help of specific software tools (R, Python, R, MS Excel)

8. Course description and content

8.1. Lecture[20]	**Teaching methods**[21]	**Hours**
Lecture 1 Functions and their applications in biology I	Participatory lecture, debate, data display, problem-solving, demonstration.	1
Lecture 2 Functions and their applications in biology II	Participatory lecture, debate, data display, problem-solving, demonstration.	1
Lecture 3 Limits and their applications in biology	Participatory lecture, debate, data display, problem-solving, demonstration.	1
Lecture 4 Derivatives and their applications in biology I	Participatory lecture, debate, data display, problem-solving, demonstration.	1
Lecture 5 Derivatives and their applications in biology II	Participatory lecture, debate, data display, problem-solving, demonstration.	1
Lecture 6 Integrals and their applications in biology I	Participatory lecture, debate, data display, problem-solving, demonstration.	1
Lecture 7 Integrals and their applications in biology II	Participatory lecture, debate, data display, problem-solving, demonstration.	1
Lecture 8 Differential equations and their applications in biology	Participatory lecture, debate, data display, problem-solving, demonstration.	1
Lecture 9 Notions of linear algebra	Participatory lecture, debate, data display, problem-solving, demonstration.	1
Lecture 10 Functions of several variables in biology. Optimization	Participatory lecture, debate, data display, problem-solving, demonstration.	1
Lecture 11 Systems of differential equations	Participatory lecture, debate, data display, problem-solving, demonstration.	1
Lecture 12 Probabilities	Participatory lecture, debate, data display, problem-solving, demonstration.	1
Lecture 13 Introduction to biostatistics I	Participatory lecture, debate, data display, problem-solving, demonstration.	1
Lecture 14 Introduction to biostatistics II	Participatory lecture, debate, data display, problem-solving, demonstration.	1
	Total number of lecture hours:	**14**

8.2. Seminar	Teaching methods[22]	Hours
Seminar 1 Exercises on the topic: Functions and their applications in biology I	Applications, discussions, debate, modeling, projects. Usage of specialized software. Usage of assisted computer training. Organized teamwork.	1
Seminar 2 Exercises on the topic: Functions and their applications in biology II	Applications, discussions, debate, modeling, projects. Usage of specialized software. Usage of assisted computer training. Organized teamwork.	1
Seminar 3 Exercises on the topic: Limits and their applications in biology	Applications, discussions, debate, modeling, projects. Usage of specialized software. Usage of assisted computer training. Organized teamwork.	1
Seminar 4 Exercises on the topic: Derivatives and their applications in biology I	Applications, discussions, debate, modeling, projects. Usage of specialized software. Usage of assisted computer training. Organized teamwork.	1
Seminar 5 Exercises on the topic: Derivatives and their applications in biology II	Applications, discussions, debate, modeling, projects. Usage of specialized software. Usage of assisted computer training. Organized teamwork.	1
Seminar 6 Exercises on the subject: Integrals and their applications in biology I	Applications, discussions, debate, modeling, projects. Usage of specialized software. Usage of assisted computer training. Organized teamwork.	1
Seminar 7 Exercises on the topic: Integrals and their applications in biology II	Applications, discussions, debate, modeling, projects. Usage of specialized software. Usage of assisted computer training. Organized teamwork.	1
Seminar 8 Exercises on the topic: Differential equations and their applications in biology	Applications, discussions, debate, modeling, projects. Usage of specialized software. Usage of assisted computer training. Organized teamwork.	1
Seminar 9 Exercises on the topic: Notions of linear algebra	Applications, discussions, debate, modeling, projects. Usage of specialized software. Usage of assisted computer training. Organized teamwork.	1
Seminar 10 Exercises on the topic: Functions of several variables in biology. Optimization	Applications, discussions, debate, modeling, projects. Usage of specialized software. Usage of assisted computer training. Organized teamwork.	1
Seminar 11 Exercises on the topic: Systems of differential equations	Applications, discussions, debate, modeling, projects. Usage of specialized software. Usage of assisted computer training. Organized teamwork.	1
Seminar 12 Exercises on the topic: Probabilities	Applications, discussions, debate, modeling, projects. Usage of specialized software. Usage of assisted computer training. Organized teamwork.	1
Seminar 13 Exercises on the topic: Introduction to biostatistics I	Applications, discussions, debate, modeling, projects. Usage of specialized software. Usage of assisted computer training. Organized teamwork.	1
Seminar 14 Exercises on the topic: Introduction to biostatistics II	Applications, discussions, debate, modeling, projects. Usage of specialized software. Usage of assisted computer training. Organized teamwork.	1
	Total number of seminar hours:	**14**

9. Bibliography

9.1. Recommended references	James Stewart, Troy Day, *Biocalculus: Calculus, Probability and Statistics for the Life Science*, Cengage Learning, Boston, USA, 2015
	Ronald W. Shonkwiler, James Herod, *Mathematical Biology. An Introduction with Maple and Matlab*, Ediţia a II-a, Springer Science+Business Media, Londra, 2009
9.2. Additional references	Amelia Bucur, *Matematică cu aplicații în ecologie și biologie. Suport de curs și seminar*, Editura Universității Lucian Blaga din Sibiu, Sibiu, 2020
	Shahbaba Babak, *Biostatistics with R. An Introduction to Statistics Through Biological Data*, Springer, 2012.

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[23]

The subject matter is continuously revised to align with the curricula of other universities in Romania and internationally, and to emphasize its interdisciplinary connections with other subjects/disciplines. To tailor the program to job market demands, input was sought from colleagues at other universities, pre-university mathematics and computer science teachers, and business sector representatives.

11. Evaluation

Type of activity	11.1 Assessment criteria	11.2 Assessment methods		11.3 Percentage of the final grade	Remarks[24]
11.4a Exam/ Colloquium	• Theoretical and practical knowledge (quantity, correctness, accuracy)	Midterm / ongoing assignments[25]:	$W_{1.1}$=30% $M_{1.1}$≥5 (1 written test)	W_1=80% M_1≥5	W_1= $W_{1.1}$+ $W_{1.2}$+ $W_{1.3}$+ $W_{1.4}$
		Home assignments:	$W_{1.2}$=0% $M_{1.2}$≥5		
		Other activities[26]:	$W_{1.3}$=0% $M_{1.3}$≥5		
		Final assessment:	$W_{1.4}$=50% $M_{1.4}$≥5 (written colloquium)		
11.4b Seminar	• Frequency/relevance of contributions or answers	Proof of contributions, portfolio (scientific papers, syntheses)		W_2=20% M_2≥5	
11.4c Laboratory	• • Knowledge of equipment, methods of using specific instruments and tools; assessment of tools or achievements, processing and interpretation of results	• Written questionnaire • Oral examination • Laboratory notebook, experimental work, scientific papers, etc. • Practical demonstrations		W_3=0% M_3≥5	
11.4d Project	• Quality of achieved project, accuracy of project documentation, rationale and evidence of selected solutions	• Self-assessment, project submission and/or defense • Critical assessment of a project		W_4=0% M_4≥5	
11.5 Minimum performance standard[27]				M_T=5	W_T=100%

$$M_T = \sum_{n=1}^{4} (W_n \times M_n) \geq 5$$

$$W_T = W_1 + W_2 + W_3 + W_4 = 100\%$$

$$M_T = (W_{1.1} \times M_{1.1} + W_{1.2} \times M_{1.2} + W_{1.3} \times M_{1.3} + W_{1.4} \times M_{1.4}) + W_2 \times M_2 + W_3 \times M_3 + W_4 \times M_4$$

Where:

W *= weight (W_T = total weight);*

M *= mark (M_T = final mark);*

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: |_0_|_4_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

Date of approval in the Department: |_1_|_7_| / |_0_|_9_| / |_2_|_0_|_2_|_4_|

	Degree, title, first name, surname	**Signature**
Course coordinator	Lecturer PhD Miruna-Ștefana SOREA	
Study program coordinator	Assoc. Prof. PhD Ana-Maria BENEDEK-SÎRBU	
Director of the Department	Lecturer PhD Ioan TĂUȘAN	

[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*
[23] *Legătura cu alte discipline, utilitatea disciplinei pe piața muncii*
[24] *CPE – condiționează participarea la examen; nCPE – nu condiționează participarea la examen; CEF - condiționează evaluarea finală; N/A – nu se aplică*
[25] *Se va preciza numărul de teste și săptămânile în care vor fi susținute.*
[26] *Cercuri științifice, concursuri profesionale etc.*
[27] *Se particularizează la specificul disciplinei standardul minim de performanță din grila de competențe a programului de studii, dacă este cazul.*