SYLLABUS

Academic year 2023 - 2024

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 Science, 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**			Cod	FSTI.MFE.BIOEN.L.CO.1.1100.C-3.6
2.2. Course coordinator	Assoc. Prof. PhD Amelia Bucur				
2.3. Practical activity coordinator	Assoc. Prof. PhD Amelia Bucur				
2.4. Year of study[2]	1	2.5. Semester[3]	1	2.6. Type of assessment[4]	C
2.7. Type of disciplinei[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 – *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]
2	2				**28**

Allocation of time budget for individual study [8]	**No. 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 / laboratorires, 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. No 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 in 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 and structure[15]	Blackboard, laptop,computer, internet, video projector, graphics tablet, Maple, SPSS/PSPP.
5.2. Organization and structure of practical activities (sem) [16]	Blackboard, laptop,computer, internet, video projector, graphics tablet, Maple, SPSS/PSPP.

6. Specific competencies[17]

		Number of credits assigned to the discipline[18]	3
6.1. Professional competencies	CP1	The student must know basic methods of mathematical modeling in the field of Environmental Sciences.	Distribution of credits according to competencies[19]: 1
	CP2	The student has to develop their abilities to correctly apply the acquired knowledge in order to realize a statistical analysis, to make forecasts, and in order to identify and solve optimization problems.	1
6.2. Transversal competencies	CT1	Efficient usage of the tools provided by mathematical statistics, of methods of solving optimization problems, of the analysis and interpretation of indicators of diversity, of some decisional methods of optimal diversification, and of the opportunities for assisted professional training, both in Romanian, as well as in English.	1

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

7.1. General objective	For the student to know mathematical models in the field of Environmental Sciences. For the student to develop the ability to correctly apply the acquire knowledge in order to realize a statistical analysis, to study the laws of population growth, to make forecasts, to identify and solve optimization problems.
7.2. Specific objectives	For the students to understand and apply the tools provided by mathematical statistics, the properties of the functions, the methods of solving optimization problems.

8. Course description

8.1. Lecture[20]	**Teaching methods[21]**	**No. of hours**
Lecture 1. Basic mathematical elements (real numbers, equations, functions).	Participatory lecture, debate, data display, problem-solving, demonstration.	1
Lecture 2. Elements of the probability theory (probability field, random variables, conditioned probabilities).	Participatory lecture, debate, data display, problem-solving, demonstration.	1
Lecture 3. Methods of mathematical statistics with applications in biology: statistical indicators, histograms, correlation, regression.	Participatory lecture, debate, data display, problem-solving, demonstration.	1
Lecture 4. Methods of mathematical statistics with applications in biology: aspects regarding distribution laws, statistical tests.	Participatory lecture, debate, data display,	1

	problem-solving, demonstration.	
Lecture 5. Evaluation of diversity (the problem of evaluating diversity, types of diversity indicators).	Participatory lecture, debate, data display, problem-solving, demonstration.	1
Lecture 6. Transmission of genetic information. Probabilistic model.	Participatory lecture, debate, data display, problem-solving, demonstration.	1
Lecture 7. Using functions of real variable in Biology.	Participatory lecture, debate, data display, problem-solving, demonstration.	1
Lecture 8. Using functions of multiple variables in Biology.	Participatory lecture, debate, data display, problem-solving, demonstration.	1
Lecture 9. Differential equations of first order.	Participatory lecture, debate, data display, problem-solving, demonstration.	1
Lecture 10. Differential equations of higher order.	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. Problems of linear optimization.	Participatory lecture, debate, data display, problem-solving, demonstration.	1
Lecture 13. Problems of multicriterial optimization.	Participatory lecture, debate, data display, problem-solving, demonstration.	1
Lectue 14. Evaluation of the students' knowledge.	Participatory lecture, debate, data display, problem-solving, demonstration.	1
	Total number of lecture hours:	**14**

8.2. a. Seminar	**Teaching methods**	**No. of hours**
Seminar 1. Basic mathematical elements. Exercises and problems (reports and proportions, the simple rule of three, equations, functions). Leslie matrices.	Applications, discussions, debate, modeling, projects. Usage of specialized software. Usage of assisted computer training. Organized teamwork.	1
Seminar 2. Measures and units of measurement in Biology. Indices. Exercises with the probability theory. Test.	Applications, discussions, debate, modeling, projects. Usage of specialized software. Usage of assisted computer training. Organized teamwork.	1
Seminar 3. Methods of statistical mathematics with applications in Biology: statistical indicators, histograms, correlations, regression. Examples.	Applications, discussions, debate, modeling, projects. Usage of specialized software. Usage of assisted computer training. Organized teamwork.	1
Seminar 4. Methods of statistical mathematics with applications in Biology. Applications in software specialized in processing databases.	Applications, discussions, debate, modeling, projects. Usage of specialized software. Usage of assisted computer training. Organized teamwork.	1
Seminar 5. Diversity indicators. Forecast methods. Examples. Evaluation of the students' knowledge.	Applications, discussions, debate, modeling, projects. Usage of specialized software. Usage of assisted computer training. Organized teamwork.	1
Seminar 6. The entropic algorithm of classification. Evaluation of the students' knowledge.	Applications, discussions, debate, modeling, projects. Usage of specialized software. Usage of assisted computer training. Organized teamwork.	1
Seminar 7. Use of functions of real variable in Biology. Examples.	Applications, discussions, debate, modeling, projects. Usage of specialized software. Usage of assisted computer training. Organized teamwork.	1
Seminar 8. Use of functions of multiple variables in Biology. Examples.	Applications, discussions, debate, modeling, projects. Usage of specialized software. Usage of assisted computer training. Organized teamwork.	1
Seminar 9. Use of differential equations in Biology. Examples. The dynamics of biologic populations. The kinetics of biologic populations.	Applications, discussions, debate, modeling, projects. Usage of specialized software. Usage of assisted computer training. Organized teamwork.	1
Seminar 10. Differential equations of higher order. Equations with partial derivatives. Examples.	Applications, discussions, debate, modeling, projects. Usage of specialized software. Usage of assisted computer training. Organized teamwork.	1
Seminar 11. Systems of differential equations. Examples.	Applications, discussions, debate, modeling, projects. Usage of specialized software. Usage of assisted computer training. Organized teamwork.	1

Seminar 12. Problems of linear optimization. Examples.	Applications, discussions, debate, modeling, projects. Usage of specialized software. Usage of assisted computer training. Organized teamwork.	1
Seminar 13. Problems of multicriterial optimization.	Applications, discussions, debate, modeling, projects. Usage of specialized software. Usage of assisted computer training. Organized teamwork.	1
Seminar 14. Evaluation of the students' knowledge.	Applications, discussions, debate, modeling, projects. Usage of specialized software. Usage of assisted computer training. Organized teamwork.	1
Total number of hours: seminar/laboratory		14

9. Bibliography

9.1. Recommended references	R.W.Shonkwiler, J.Herod, *Mathematical Biology An Introduction with Maple and Matlab*, Ediţia a II-a, Springer Science+Business Media, Londra, 2009: http://e.guigon.free.fr/rsc/book/ShonkwilerHerod09.pdf
	J.Stewart, T.Day, *Biocalculus: Calculus, Probability and Statistics for the Life Science*, Cengage Learning, Boston, USA, 2015
	M.Aitken, B.Broadhurst, S.Hladky, *Mathematics for Biological Scientists,* Garland Science, Londra, UK, 2010
	P.Legendre, L.Legendre, *Numerical Ecology*,Elsevier Science, Amsterdam, The Netherlands,2003: http://www.ievbras.ru/ecostat/Kiril/R/Biblio/Statistic/Legendre%20P.,%20Legendre%20L.%20Numerical%20ecology.pdf
9.2. Additional references	A.Bucur, *Matematică cu aplicaţii în ecoloie și biologie. Suport de curs și seminar*, Editura Universității Lucian Blaga din Sibiu, Sibiu, 2020
	M.Farman, A.Akgül, M.S.Hashemi, L.Guran, A.Bucur, *Fractal Fractional Order Operators in Computational Techniques for Mathematical Models in Epidemiology, CMES-*Computer Modeling in Engineering & Sciences, 2023 (acceptat pentru publicare) DOI: 10.32604/cmes.2023.028803
	Roland W. Shonkwiler, *Mathematical Biology. An Introduction with Maple and Matlab,* Springer, London, 2009
	John H.McDonalds, *Handbook of Biological Statistics,* Sparky House Publishing Baltimore, Maryland, 2008
	J.D.Murray, *Mathematical Biology*, Springer-Verlag Berlin Heidelberg, 1993

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[22]

The course contains specific notions that are strictly necessary to graduates in the labor market specific to this field.

11. Evaluare

Type of activity	11.1 Assessment criteria	11.2 Assessment methods		11.3 Percentage of the final grade	Notes.[23]
11.4a Coloquium	• Theoretical and practical knowledge (quantity, correctness,accuracy)	Midterm / ongoing assignments[24]:	$W_{1.1}$=10% $M_{1.1}\geq 5$	W_1=70% $M_1\geq 5$	W_1=$WP_{1.1}$+ $W_{1.2}$+ $W_{1.3}$+$WP_{1.4}$
		Home assignments:	$W_{1.2}$=0% $M_{1.2}\geq 5$		
		Other activities[25]:	$W_{1.3}$=0%		

			$M_{1.3}$≥5		
		Final assessment:	$W_{1.4}$=60% $M_{1.4}$≥5		
11.4b Seminar	• Frequency/relevance of contributions or answers	• Proof of contributions, portfolio (scientific papers, syntheses)		W_2=30% M_2≥5	CPE CEF
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=_% 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=_% M_4≥5	
11.5 Minimum performance standard[26]				M_T=5	W_T=100%

$M_T = \mathbf{1} + 0{,}9 \times \sum_{n=1}^{4}(W_n \times M_n) \geq 5$

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

$M_T = \mathbf{1} + 0{,}9 \times [(W_{1.1} \times M_{1.1} + W_{1.2} \times M_{1.2} + W_{1.3} \times M_{1.3} + W_{1.4} \times M_{1.4}) + W_2 \times M_2 + W_3 \times M_3 + W_4 \times M_4]$

Where: **1 =** *starting point (added when calculating the final mark)*

***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.

Data completării: |_1_|_6_| / |_0_|_9_| / |_2_|_0_|_2_|_3_|

Data avizării în Departament: |_1_|_9_| / |_1_|_0_| / |_2_|_0_|_2_|_3_|

	Degree, titlle, first name, surname	**Signature**
Course coordinator	Assoc. Prof. PhD Amelia Bucur	
Study program coordinator	Assoc. Prof. Ana-Maria Benedek-Sîrbu, PhD	
Director of the Departament	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] *Legătura cu alte discipline, utilitatea disciplinei pe piața muncii*
[23] *CPE – condiționează participarea la examen; nCPE – nu condiționează participarea la examen; CEF - condiționează evaluarea finală; N/A – nu se aplică*
[24] *Se va preciza numărul de teste și săptămânile în care vor fi susținute.*
[25] *Cercuri științifice, concursuri profesionale etc.*
[26] *Se particularizează la specificul disciplinei standardul minim de performanță din grila de competențe a programului de studii, dacă este cazul.*