

SYLLABUS

1. Information regarding the programme

1.1 Higher education institution	Babeş - Bolyai University
1.2 Faculty	Faculty of Mathematics and Computer Science
1.3 Department	Department of Mathematics
1.4 Field of study	Mathematics
1.5 Study cycle	Bachelor
1.6 Study programme / Qualification	Mathematics and Computer Science

2. Information regarding the discipline

2.1 Name of the discipline	Probability Theory						
2.2 Course coordinator	Prof. PhD. Agratini Octavian						
2.3 Seminar coordinator	Prof. PhD. Agratini Octavian						
2.4. Year of study	2	2.5 Semester	4	2.6. Type of evaluation	E	2.7 Type of discipline	Compulsory/ Fundamental

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

3.1 Hours per week	4	Of which: 3.2 course	2	3.3 seminar	2	
3.4 Total hours in the curriculum	56	Of which: 3.5 course	28	3.6 seminar	28	
Time allotment:						hours
Learning using manual, course support, bibliography, course notes						14
Additional documentation (in libraries, on electronic platforms, field documentation)						7
Preparation for seminars/labs, homework, papers, portfolios and essays						10
Tutorship						6
Evaluations						7
Other activities:						-
3.7 Total individual study hours						44
3.8 Total hours per semester						100
3.9 Number of ECTS credits						4

4. Prerequisites (if necessary)

4.1. curriculum	<ul style="list-style-type: none"> • Mathematical Analysis 1, Mathematical Analysis 2, Algebra
4.2. competencies	<ul style="list-style-type: none"> • Limit and Integral Calculus, Set Theory

5. Conditions (if necessary)

5.1. for the course	<ul style="list-style-type: none"> • Lecture room with blackboard and video projector OR graphics tablet (for online purposes)
5.2. for the seminar/lab activities	<ul style="list-style-type: none"> • Seminar room with blackboard OR graphics tablet (for online)

6. Specific competencies acquired

Specific competencies	<ul style="list-style-type: none"> • C1.1. Identification of notions, description of theories and use of specific language • C2.3. Application of appropriate theoretical models of analysis for solving given problems
Transversal competencies	<ul style="list-style-type: none"> • CT2. Efficient development of group work activities

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

7.1 General objective of the discipline	<ul style="list-style-type: none"> • Acquire basic knowledge of Probability Theory, with focus on theoretical aspects as well as applications
7.2 Specific objective of the discipline	<ul style="list-style-type: none"> • Application of classical probabilistic models to solve real life problems • Become familiar with classical probability distributions • Know the role of sequences of random variables in the study of social phenomena

8. Content

8.1 Course	Teaching methods	Remarks
1. Experiments and events. Sigma fields	<ul style="list-style-type: none"> • Interactive exposure • Explanation • Conversation • Didactical demonstration 	
2. Probability function. Conditional probability. Independence of events	<ul style="list-style-type: none"> • Interactive exposure • Explanation • Conversation • Didactical demonstration 	
3. Classic probabilistic models (Samplings with / without replacement, Poisson, Pascal, Geometric)	<ul style="list-style-type: none"> • Interactive exposure • Explanation • Conversation • Didactical demonstration 	
4. Sigma - fields and infinite probability spaces. Properties	<ul style="list-style-type: none"> • Interactive exposure • Explanation • Conversation • Didactical demonstration 	
5. Random variables: definition, properties. Discrete random variables	<ul style="list-style-type: none"> • Interactive exposure • Explanation • Conversation 	

6. Cumulative distribution function: definition, properties	<ul style="list-style-type: none"> • Interactive exposure • Explanation • Conversation • Didactical demonstration 	
7. Probability density function: definition, properties. Continuous random variables	<ul style="list-style-type: none"> • Interactive exposure • Explanation • Conversation • Didactical demonstration 	
8. Random vectors, joint distribution function, joint density function. Marginal distributions and marginal densities. Properties	<ul style="list-style-type: none"> • Interactive exposure • Explanation • Conversation • Didactical demonstration 	
9. Operations with continuous random variables: addition, multiplication, division	<ul style="list-style-type: none"> • Interactive exposure • Explanation • Conversation • Didactical demonstration 	
10. Numerical characteristics of random variables: expectation, variance, moments, covariance, correlation coefficient	<ul style="list-style-type: none"> • Interactive exposure • Explanation • Conversation • Didactical demonstration 	
11. Characteristic function. Properties	<ul style="list-style-type: none"> • Interactive exposure • Explanation • Conversation • Didactical demonstration 	
12. Sequences of random variables. Types of convergence	<ul style="list-style-type: none"> • Interactive exposure • Explanation • Conversation • Didactical demonstration 	
13. Laws of large numbers. Weak law of large numbers. Strong law of large numbers	<ul style="list-style-type: none"> • Interactive exposure • Explanation • Conversation • Didactical demonstration 	
14. Lindeberg condition and Central Limit Theorem Moivre - Laplace theorem.	<ul style="list-style-type: none"> • Interactive exposure • Explanation • Conversation • Didactical demonstration 	

Bibliography

1. AGRATINI, O., *Capitole speciale de matematici*, Lito., Univ. Babeş-Bolyai, Cluj-Napoca, 1996.

2. LISEI, H., *Probability Theory*, Casa Cărții de Știință, Cluj-Napoca, 2004..
 3. SHELDON, R., *A First Course in Probability*, 8th edition, Pearson Prentice Hall, 2010.

8.2 Seminar	Teaching methods	Remarks
1. Euler's Gamma and Beta functions. Properties. Combinatorics	Explanation, conversation, examples.	
2. Probability calculus on a finite field	Explanation, conversation, examples.	
3. Conditional probability. Independent events. Bayes formula	Explanation, conversation, examples.	
4. Classical probabilistic models	Explanation, conversation, examples.	
5. Geometric probability. Exercises	Explanation, conversation, examples.	
6. Discrete random variables. Operations and exercises	Explanation, conversation, examples.	
7. Continuous random variables. Operations and exercises	Explanation, conversation, examples.	
8. Random vectors. Exercises	Explanation, conversation, examples.	
9. Numerical characteristics of random variables	Explanation, conversation, examples.	
10. Classical inequalities for numerical characteristics of random variables	Explanation, conversation, examples.	
11. Characteristic function. Exercises	Explanation, conversation, examples.	
12. Sequences of random variables. Exercises	Explanation, conversation, examples.	
13. Convergence of sequences of random variables	Explanation, conversation, examples.	
14. Limit theorems. Applications	Explanation, conversation, examples.	

Bibliography

1. LISEI, H., MICULA, S., SOOS, A., *Probability Theory through Problems and Applications*, Presa Universitară Clujeană, 2006.

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 content of the course is important because it covers basic concepts and topics in this field.
- The course exists in the studying program of all major universities in Romania and abroad.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Share in the grade (%)
10.4 Course	Know the basic principles in Probability Theory	Written exam.	75 %
10.5 Seminar	Be able to apply course concepts on solving problems in this field	Continuous observation during the semester, seminar participation.	25 %
10.6 Minimum performance standards			
<ul style="list-style-type: none"> • At least grade 5 (from a scale of 1 to 10) at the written exam 			

Date

Signature of course and seminar coordinator

21 April 2021

Prof. PhD. Agratini Octavian

Date of approval

Signature of the head of department

28 April 2021

Prof. PhD. Agratini Octavian