Course Syllabus

Course from study programme for the cycle: 2022/2023

I. General Information

Course name	Foundations of probabilistic methods
Programme	Informatics
Level of studies (BA, BSc, MA, MSc, long-cycle MA)	BSc
Form of studies (full-time, part-time)	full-time
Discipline	Informatics
Language of instruction	Polish

Course coordinator	Dr Kamil Powroźnik

Type of class *(use only the types mentioned below)*	Number of teaching hours	Semester	ECTS Points
lecture	30	III	5
tutorial			
classes			
laboratory classes	30	III	
workshops			
seminar			
introductory seminar			
foreign language classes			
practical placement			
field work			
diploma laboratory			
translation classes			
study visit			

Course pre-requisites	Mathematical analysis (numerical sequences and series, differential and integral calculus of functions of one and several variables)

II. Course Objectives

C1 - Studying mathematical methods used for the description of random phenomena
C2 - Learning methods for calculating probabilities of random events, determining distributions of random variables and finding numerical parameters of probability distributions
C3 - Learning about different modes of convergence of random variables
C4 - Calculating the characteristic functions (Fourier transforms)

C5 - Learning the basic limit theorems of probability theory

III. Course learning outcomes with reference to programme learning outcomes

Symbol	Description of course learning outcome	Reference to programme learning outcome
KNOWLEDGE		
W_01	Students give various definitions of probability and build mathematical models describing random phenomena and random experiments	K_W09
W_02	Students list the most important discrete and continuous probability distributions	K_W09
W_03	Students quote the basic theorems of probability theory	K_W09
SKILLS		
U_01	Students use in practice various probability definitions, the law of total probability and the Bayes formula, examine the independence of random variables, calculate parameters of distributions for discrete and continuous random variables, calculate covariances and correlation coefficients, find equations of regression lines	K_U22
U_02	Students recognize probability distributions based on characteristic functions	K_U22
U_03	Students apply probabilistic methods for solving problems from various fields	K_U22
SOCIAL COMPETENCIES		
K_01	Students formulate opinions on selected practical issues using tools of probability theory	K_K01

IV. Course Content

1. Elements of combinatorics.
2. Random experiment, sample space, elementary events, random events.
3. Classical and geometrical definitions of probability. Examples of applications.
4. Axioms of probability. Properties of probability. Construction of a probability measure.
5. Independence of a random events. Conditional and total probability. Bayes formula. Bernoulli scheme.
6. Random variable and its distribution. Discrete and continuous variables. Probability and density functions. Cumulative distribution function of a random variable.
7. Basic distributions of discrete and continuous type. Standard normal distribution and its applications.
8. Main characteristics od random variables and theirs properties (expectation, variance, moments and central moments).
9. Characteristic function and its properties. The inversion formula. Levy-Cramer's theorem. A relation between a characteristic function and moments.
10. Multivariate random variables. Marginal and conditiona distributions. Independence of a random variables.
11. Covariance and correlation coefficient, properties of a correlation coefficient. Lines of regression..
12. Various kinds of convergence of random variables. Relationships between various modes of convergence.

13. Limit theorems (such as Laws of large numbers, Poisson limit theorem, Central Limit Theorem).

V. Didactic methods used and forms of assessment of learning outcomes

Symbol	Didactic methods *(choose from the list)*	Forms of assessment *(choose from the list)*	Documentation type *(choose from the list)*
KNOWLEDGE			
W_01	Conventional lecture, guided practice elements of e-learning	Written exam, written test	Evaluated exam, evaluated test
W_02	Conventional lecture, guided practice, elements of e-learning	Written exam, written test	Evaluated exam, evaluated test
W_03	Conventional lecture, guided practice, elements of e-learning	Written exam, written test	Evaluated exam, evaluated test
SKILLS			
U_01	Practical classes, guided practice, elements of e-learning	Written exam, written test	Evaluated exam, evaluated test
U_02	Practical classes, guided practice, elements of e-learning	Written exam, written test	Evaluated exam, evaluated test
U_03	Practical classes, guided practice, elements of e-learning	Written exam, written test	Evaluated exam, evaluated test
SOCIAL COMPETENCIES			
K_01	Discussion, practical classes	Written exam, written test	Evaluated exam, evaluated test

VI. Grading criteria, weighting factors.....

Lecture:

Written exam divided on two parts:

- practical - verifying the ability to apply in practice the knowledge gained during lectures and classes,
- theoretical - checking the theoretical knowledge acquired during the lecture.

Evaluation criteria :

[0-50%) points - unsatisfactory (2)

[50% -60%] - satisfactory (3)

[60% -70%) - satisfactory plus (3.5)

[70% -80%) - good (4)

[80% -90%) - good plus (4.5)

[90% -100%] - very good (5)

Classes:

Two written tests. To get a credit student should obtain form both tests minimum 50% of points.

Evaluation criteria :
[0-50%) points - unsatisfactory (2)
[50% -60%] - satisfactory (3)
[60% -70%) - satisfactory plus (3.5)
[70% -80%) - good (4)
[80% -90%) - good plus (4.5)
[90% -100%] - very good (5)

The detailed description of assessment is given during the first lecture/classes.

VII. Student workload

Form of activity	Number of hours
Number of contact hours (with the teacher)	90
Number of hours of individual student work	60

VIII. Literature

Basic literature
1. A. Borowkow, ''Rachunek prawdopodobieństwa'', PWN 1977. 2. J. Jakubowski, R. Sztencel, ''Wstęp do teorii prawdopodobieństwa'', Script 2002. 3. P. Billingsley, ''Prawdopodobieństwo i miara'', PWN 1967. 4. W. Feller, ''Wstęp do rachunku prawdopodobieństwa'', t. I–II, PWN 1969. 5. M. Fisz, ''Rachunek prawdopodobieństwa i statystyka matematyczna'', PWN 1967. 6. Notatki z wykładu.
Additional literature
1. W. Krysicki i in., ''Rachunek prawdopodobieństwa i statystyka matematyczna w zadaniach'', t. I-II, PWN 1997. 2. T. Gerstenkorn, T. Śródka, ''Kombinatoryka i rachunek prawdopodobieństwa'', PWN 1978.