KARTA PRZEDMIOTU

I. Dane podstawowe

Nazwa przedmiotu	Foundations of probabilistic methods
Nazwa przedmiotu w języku angielskim	Foundations of probabilistic methods
Kierunek studiów	Informatics
Poziom studiów (I, II, jednolite magisterskie)	I
Forma studiów (stacjonarne, niestacjonarne)	stationary
Dyscyplina	Informatics
Język wykładowy	English

Koordynator przedmiotu/osoba odpowiedzialna	dr hab. August Zapała

Forma zajęć *(katalog zamknięty ze słownika)*	Liczba godzin	semestr	Punkty ECTS
wykład	30	3	6
konwersatorium			
ćwiczenia	30	3	
laboratorium			
warsztaty			
seminarium			
proseminarium			
lektorat			
praktyki			
zajęcia terenowe			
pracownia dyplomowa			
translatorium			
wizyta studyjna			

Wymagania wstępne	Mathematical analysis (elements of set theory, sequences and series of numbers, differential and integral calculus of functions of one and several variables)

II. Cele kształcenia dla przedmiotu

Studying mathematical methods used for the description of random phenomena.
Learning methods for calculating probabilities of random events, determining distributions of random variables and finding numerical parameters of probability distributions
Learning about different modes of convergence of random variables
Calculating the characteristic functions (Fourier transforms)
Learning the basic limit theorems of probability theory

III. Efekty uczenia się dla przedmiotu wraz z odniesieniem do efektów kierunkowych

Symbol	Opis efektu przedmiotowego	Odniesienie do efektu kierunkowego
WIEDZA		
W_01	Students give various definitions of probability and build mathematical models describing random phenomena and random experiments	K_W02
W_02	Students list the most important discrete and continuous probability distributions	K_W02
W_03	Students quote the basic theorems of probability theory	K_W02
UMIEJĘTNOŚCI		
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
KOMPETENCJE SPOŁECZNE		
K_01	Students formulate opinions on selected practical issues using tools of probability theory	K_K01

IV. Opis przedmiotu/ treści programowe

The sample space, elementary events and random events. Fields and σ-fields of events. Classical and geometrical definitions of probability, examples of applications. Axioms of probability.
Independence of events, fields and σ-fields of events. Conditional probability, the law of total probability and Bayes formula. Discrete probability spaces. Distribution function. Construction of a probability from distribution function on R. Multivariate distribution function and its connection with probability on a finite dimensional Euclidean space. Random variable, the law and distribution function of the random variable. Discrete and continuous distributions, probability density. Random vectors and multidimensional distributions. Marginal distributions of discrete and continuous random vectors. Independent random variables, criteria of independence for discrete and continuous random variables. Expectation and its properties. Variance, standard deviation, and their properties. Moments and central moments. Covariance and correlation coefficient, properties of the correlation coefficient. Lines of regression.
Various modes of convergence of random variables (in distribution, in probability, almost surely and in mean). Markov's and Chebyshev's inequalities. Relationships between various modes of convergence.
Complex random variables, independence and expectations of complex random variables. Characteristic functions and their properties. Lévy's theorem (the inversion formula). Inversion formulas for discrete distributions. Inversion formulas for probability densities. The Lévy-Cramér theorem.
The Lindeberg-Feller central limit theorem for a sequence of random variables, Lyapunov and Lindeberg-Lévy theorems (without proof).
Weak law of large numbers – Khintchine's, Chebyshev's and Markov's theorems, classical criterion

for convergence to a constant (without proof). Kolmogorov's inequality, Kolmogorov's criterion and the strong law of large numbers (without proof).

V. Metody realizacji i weryfikacji efektów uczenia się

Symbol efektu	Metody dydaktyczne *(lista wyboru)*	Metody weryfikacji *(lista wyboru)*	Sposoby dokumentacji *(lista wyboru)*
WIEDZA			
W_01	Conventional lecture	Test / Written test Exam / Written test	Evaluated written paper
W_02	Conventional lecture	Test / Written test Exam / Written test	Evaluated written paper
W_03	Conventional lecture	Test / Written test Exam / Written test	Evaluated written paper
UMIEJĘTNOŚCI			
U_01	Laboratory classes	Test / Written test	Evaluated written paper
U_02	Laboratory classes	Test / Written test	Evaluated written paper
U_03	Laboratory classes	Test / Written test	Evaluated written paper
KOMPETENCJE SPOŁECZNE			
K_01	PBL (Problem-Based Learning)	Test / Written test	Evaluated written paper

VI. Kryteria oceny, wagi…

Assesment of classes - 2 written tests (4 problems at each test, each task 0-25 points, total max 4x25 points = 100 points), resit test

To get a credit student should pass at least one of 2 tests, obtaining minimum 50% points, or pass a written examination. The final examination consists of two parts: written (50%) - verifying the ability to apply in practice the knowledge gained during lectures and classes, and oral (50%) - checking the theoretical knowledge acquired during the lecture.

VII. Obciążenie pracą studenta

Forma aktywności studenta	Liczba godzin
Liczba godzin kontaktowych z nauczycielem	90
Liczba godzin indywidualnej pracy studenta	60

VIII. Literatura

Literatura podstawowa
G. Grimmett, D. Welsh, Probability. An Introduction, Clarendon Press, Oxford 1986 P. Billingsley, Probability and Measure, 3-rd ed. Wiley 1994 M. Loève, Probability Theory, Van Nostrand 1960 A. Borowkow, Rachunek prawdopodobieństwa, PWN 1977 J. Jakubowski, R. Sztencel, Wstęp do teorii prawdopodobieństwa, Script 2002 W. Feller, Wstęp do rachunku prawdopodobieństwa, t. I–II, PWN 1969
Literatura uzupełniająca
W. Krysicki i in. – Rachunek prawdopodobieństwa i statystyka matematyczna w zadaniach, t. I-II, PWN 1997