COURSE DESCRIPTION CARD - SYLLABUS

Course name
Theory of probability [S1MNT1>RP]

Course

Field of study
Mathematics of Modern Technologies

Year/Semester
2/3

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
0

Other
0

Tutorials
30

Projects/seminars
0

Number of credit points

5,00

Coordinators

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Lecturers

Prerequisites

A student knows and understands (at an advanced stage) definitions and theorems learned in the following courses: Mathematical Analysis I, Mathematical Logic, and Mathematical Analysis II. The student is able to use (at an advanced stage) knowledge on: the calculus of sentences, the set theory, and the differential and integral calculus. The student is aware of the level of their knowledge and the need of deepening and expansion of their knowledge.

Course objective

The main aim of this course is to familiarize the student with: the basic concepts of the probability theory, the methods of determining the probability of random events, examples of random variables, the methods of determining the parameters of random variables, and the possibilities of using selected distributions of random variables to describe random phenomena.

Course-related learning outcomes

Knowledge:
• knows and understands (at an advanced stage) the basic definitions and theorems (with proofs) of the probability theory, and examples of discrete and continuous random variables [K_W01(P6S_WG),

K_W03(P6S_WG)];
• has knowledge of the probability theory concerning the possibility of applying selected distributions of random variables to the modeling of relevant random phenomena [K_W 01(P 6S_W G), K_W 03(P 6S_W G)].

Skills:
• student is able to use (at an advanced stage) appropriate theorems to determine the probability of random events; is able to list examples of random variables, determines (at an advanced stage) the parameters of random variables of discrete and continuous type; applies appropriate types of random variable distributions to the analysis of random phenomena [K_U01(P6S_UW)].

Social competences:
• isreadytothefurthereducationduetotheawarenessoflimitationsofhisownknowledge[K_K04(P6S_KR)];
• is aware of the existence of random factors influencing the modeled phenomenon [K_K05(P6S_KR)].

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lectures: knowledge acquired during the lecture is verified on the basis of a written examination; to pass the lecture it is necessary to get at least 50% of the points from the mentioned written examination;
Tutorials: skills acquired during the classes are verified on the basis of two colloquia; to pass the classes it is necessary to get at least 50% of the total number of points from the mentione colloquia; grading system:
• 0%-50% - 2.0;
• 50%-60% - 3.0;
• 60%-70% - 3.5;
• 70%-80% - 4.0;
• 80%-90% - 4.5;
• 90%-100% - 5.0.
Update: 22/05/2024

Programme content

Update: 01.06.2024r.
Lectures & Classes:
• Information about the subject, course program, exam, literature and consultations. Basics of combinatorics: product rule, permutations, variations and combinations.
• Basics of probabilistics: random experience, countably additive event field, probabilistic space, random events and event algebra, relations between events, classical and axiomatic definition of probability, geometric probability, probability properties.
• Conditional probability, probability of the product of events, independent events, total probability theorem, Bayes' theorem, applications of the presented theorems.
• Definition of a random variable and its types, probability distribution of random variable values, independence of random variables, functions characterizing the distribution of a random variable: cumulative distribution function, probability density, probability function, properties of functional characteristics and their applications.
• Conditional random variables, sequences of independent random variables, quantile function and its applications, transformations of a random variable,
• Overview of discrete distributions: Bernoulli, binomial, negative binomial, uniform, geometric, hypergeometric, Poisson.
• Overview of continuous type distributions: uniform, exponential, normal, lognormal, gamma, beta, Rayleigh, Weibull.
• Definition and properties of the distribution convolution.
• Numerical characteristics of a random variable: expected value, median, mode, quartiles, variance, standard deviation, skewness, flattening, ordinary and central moments.
• Standardization of a random variable, Markov, Chebyshev, Gauss inequalities, laws of large numbers, limit theorems.
• Characteristic functions of random variables. Sums of random variables, chi-square distribution, Student's t-distribution, F-Snedecor distribution.
• Concept and description of a random process, random processes with independent increments, point random processes, Poisson process, stationary random processes, Markov processes.

Course topics

Lecture topics
T01: Elements of combinatorics;
T02: Probabilistic space;
T03: Conditional probability, its properties and applications;
T04: Random variables and their types;
T05: Functional and numerical characteristics of random variables;
T06: Conditional random variables;
T07: Overview of discrete type distributions;
T08: Overview of continuous type distributions;
T09: Functions of random variables;
T10: Characteristic function and function generating random moments of a variable;
T11: Two-dimensional random variable and its distributions;
T12: Limit theorems.
T13: Introduction to stochastic processes.

Teaching methods

Lectures: traditional lecture (theory presented in connection with the current knowledge of students);
Tutorials: blackboard tutorials (solving of math problems with the help of a teacher).

Bibliography

Basic:
• J.L. Devore, Probability and Statistics for Engineering and the Sciences.
• A. Plucińska, E. Pluciński, Probabilistyka: statystyka matematyczna, procesy stochastyczne, rachunek prawdopodobieństwa, Warszawa, Wydawnictwo Naukowe PWN SA, 2017;
• W. Krysicki, J. Bartos, W. Dyczka, K. Królikowska, M. Wasilewski, Rachunek prawdopodobieństwa i statystyka matematyczna w zadaniach część 1: Rachunek prawdopodobieństwa, Warszawa, Wydawnictwo Naukowe PWN, 2012;
• M.Krzyśko, Wykłady z teorii prawdopodobieństwa, Warszawa, Wydawnictwa Naukowo-Techniczne, 2000.

Additional:
• K. Andrzejczak, Statystyka elementarna z wykorzystaniem systemu Statgraphics. Wydawnictwo PP.
• W. Kordecki, Rachunek prawdopodobieństwa i statystyka matematyczna: definicje, twierdzenia, wzory, Wrocław, Oficyna Wydawnicza GiS, 2010;
• W. Feller, Wstęp do rachunku prawdopodobieństwa część 1, Warszawa, Państwowe Wydawnictwo Naukowe, 2006;
• H. Jasiulewicz, W. Kordecki, Rachunek prawdopodobieństwa i statystyka matematyczna: przykłady i zadania, Wrocław, Oficyna Wydawnicza GiS, 2003.

Breakdown of average student's workload

	Hours	ECTS
Total workload	125	5,00
Classes requiring direct contact with the teacher	62	2,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	63	2,50