STUDY MODULE DESCRIPTION FORM

Name of the module/subject	Code
Theory of probability	**1010341641010341000**

Field of study	Profile of study (general academic, practical)	Year /Semester
Mathematics in Technology	**general academic**	**2 / 4**
Elective path/specialty	Subject offered in:	Course (compulsory, elective)
-	**Polish**	**obligatory**

Cycle of study:	Form of study (full-time,part-time)
First-cycle studies (Polish Qualifications Framework level six)	**full-time**

No. of hours	No. of credits
Lecture: **30** Classes: **30** Laboratory: **-** Project/seminars: **-**	**3**

Status of the course in the study program (Basic, major, other)	(university-wide, from another field)
Basic	**university-wide**

Education areas and fields of science and art	ECTS distribution (number and %)
The sciences	**3 100%**
Mathematical sciences	**3 100%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Student has knowledge of terminology used in the subjects: Mathematical Analysis I and Mathematical Analysis II. - [K_W01 (P6S_WG), K_W03 (P6S_WG)]
2	**Skills**	Student is able to use knowledge about: calculus of sentences and quantifiers, set theory, and differential and integral calculus. - [K_U01 (P6S_UW)]
3	**Social competencies**	Student is aware of the level of his knowledge and the need for further education. - [K_K01 (P6S_KK), K_K02 (P6S_KK)]

Assumptions and objectives of the course:

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.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. Student has knowledge of the probability theory concerning the possibility of applying selected distributions of random variables to the modeling of relevant random phenomena. - [K_W01 (P6S_WG)]

2. Student knows the basic concepts and theorems of the probability theory, and examples of discrete and continuous random variables. - [K_W03 (P6S_WG)]

Skills:

1. Student applies appropriate theorems to determine the probability of random events; is able to list examples of random variables; determines 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 competencies:

1. Student understands and appreciates the importance of intellectual honesty in the activities of its own and other people; he is ready to demonstrate reliability, impartiality, professionalism and ethical attitude. - [K_K04 (P6S_KR)]

2. Student is aware of his social role as a graduate of a technical university, he is ready to communicate popular scientific content to the society and to identify and resolve basic problems related to the field of study. - [K_K05 (P6S_KR)]

Assessment methods of study outcomes

Classes:

- Assessment of the ability to apply knowledge to solve maths problems during two colloquia. To pass the classes it is necessary to get at least 50% of the total number of points in two colloquia.

Lectures:

- Assessment of theoretical knowledge based on a written test. To pass the lectures it is necessary to get at least 50% of the points in written test.

Course description

1. Elements of combinatorics (permutation, variation with repetition, variation without repetition, combination).

2. Random events and probability (space of elementary events, classical definition of probability, general definition of probability, probability space, random event, probability properties, geometrical probability, conditional probability, law of total probability, Bayes rule, independence of random events, lower and upper limit of a sequence of random events, Borel-Cantelli lemma).

3. Random variables and their distributions (definition of random variable, properties of random variables, distribution of a random variable, cumulative distribution function of a random variable and its properties, discrete type distributions, density function of a random variable, continuous type distributions, independent random variables and their properties).

4. Multivariate random variable (definition of random vector, joint probability distribution of a random vector, cumulative distribution function of a random vector, random vector of discrete type, marginal distribution, random vector of continuous type, marginal density function, convolution of probability distributions).

5. The expected value and the moments of a random variable (definition and properties of the expected value of a random variable, moments of a random variable, variance of a random variable, the properties of variance, covariance of random variables, properties of covariance, correlation coefficient and its properties).

6. Parameters of a random vector (expected value of a random vector, covariance matrix, multidimensional normal distribution).

7. Characteristic function (definition of characteristic function and its properties).

8. Limit theorems (law of large numbers, central limit theorem).

Applied methods of education:

- lectures - theory presented in connection with the current knowledge of students,

- classes - solving of exercises on the blackboard.

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Basic bibliography:

1. A. Plucińska, E. Pluciński, Probabilistyka: statystyka matematyczna, procesy stochastyczne, rachunek prawdopodobieństwa, Warszawa, Wydawnictwo Naukowe PWN SA, 2017.

2. J. Mikołajski, Z. Sołtysiak, Zbiór zadań z matematyki dla studentów wyższych szkół technicznych część 4: Rachunek prawdopodobieństwa i statystyka matematyczna, Kalisz, Wydawnictwo Uczelniane Państwowej Wyższej Szkoły Zawodowej im. Prezydenta Stanisława Wojciechowskiego, 2014.

3. 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.

Additional bibliography:

1. W. Kordecki, Rachunek prawdopodobieństwa i statystyka matematyczna: definicje, twierdzenia, wzory, Wrocław, Oficyna Wydawnicza GiS, 2010.

2. W. Feller, Wstęp do rachunku prawdopodobieństwa część 1, Warszawa, Państwowe Wydawnictwo Naukowe, 2006.

3. H. Jasiulewicz, W. Kordecki, Rachunek prawdopodobieństwa i statystyka matematyczna: przykłady i zadania, Wrocław, Oficyna Wydawnicza GiS, 2003.

4. M. Kozaryn, M. Michta, K.Ł. Świątek, Stochastic inclusions driven by two-parameter martingales, Dynam. Systems Appl. 25 (2016) 123-152.

Result of average student's workload

Activity	Time (working hours)
1. Participation in lectures	30
2. Participation in classes	30
3. Preparation for each classes	6
4. Preparation for passing the lectures	5
5. Passing the lectures	4
6. Consultations	4

Student's workload		
Source of workload	**hours**	**ECTS**
Total workload	79	3
Contact hours	68	3
Practical activities	0	0