GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Calculus of probability and stochastic processess, PG_00057259		
Field of study	Ocean Engineering		
Date of commencement of studies	February 2022	Academic year of realisation of subject	2021/2022
Education level	second-cycle studies	Subject group	Obligatory subject group in the field of study Subject group related to scientific research in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	1	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Ship and Land Based Power Plants -> Faculty of Ocean Engineering and Ship Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr Marek Zellma	
	Teachers	dr Marek Zellma	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	15.0	0.0	0.0	0.0	30

E-learning hours included: 0.0

Learning activity and number of study hours

Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
Number of study hours	30	5.0	40.0	75

Subject objectives

The knowledge on the basics of probability theory, mathematical statistics and stochastic processes, and acquire
by them the practical skills to apply this knowledge.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W01] has a deepened and widened knowledge on certain fields of maths, used to formulate, solve and verify complex problems in ocean-technology		[SW1] Assessment of factual knowledge
[K7_U02] can plan and conduct research experiments on selected problems in ocean technology using various research methods		[SU3] Assessment of ability to use knowledge gained from the subject
[K7_W02] has a widened knowledge in the range of modelling technological processes, including knowledge necessary to describe and assess the functioning of selected elements of ocean technology objects and systems		[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects

Subject contents	Lectures: 1. Basic concepts of probability theory and stochastic processes: a phenomenon, event, random event, the probability of a random event, random variable and its distribution, moments of random variable, standardized random variable, multi-dimensional random variable, the conditional distribution of random variable, stochastic dependence (correlation) and the statistical, mathematical statistics, statistics as a function, statistical display, stochastic process (random function). 2. The probability of a random event, unconditional and conditional, and its practical significance: the axiomatic, Laplace, statistical, Miles and graphical definitions. 3. Types of discrete and continuous random variables and their most important distributions in engineering practice: normal (de Moivre - Gaussian), the normal cut at zero, log-normal, gamma, Erlang, Weibull-Gniedenko, exponential, binomial, hypergeometric, Poisson. 4. The study of random variables: possibilities of collecting statistical data, graphical representation of statistical data, creating numerical information (measures of central values, dispersion and asymmetry). 5. The types of surveys used in technology: the complete and partial research. 6. Development of survey results: organizing statistical data, methods of presentation of statistical data. 7. Statistical Inference: estimators and their properties, point and interval estimation, statistical hypothesis verification. 8. Statistical decision theory in the elementary context and its application in technology: decision model, the expected value as a decision criterion, analysis of dendrite of the decision taking probabilistic data into account. 9. The concept of a stochastic process taking into account the probability space: the definition of the process and the division of stochastic processes, the distribution of the stochastic process and its parameters. 10. The main types of stochastic processes used in engineering practice: Poisson process, the normal process, Markov chain, Markov process, semi-Markov process. Classes: 1. Determination of the confidence interval for the unknown value of the average (arithmetic mean) for a set of values of the characteristic X for any device based on statistics obtained under the assumption that this statistic's distribution is asymptotically normal. 2. Determination of confidence interval for the unknown standard deviation for a set of values of the characteristic X for any device based on statistics obtained under the assumption that this statistics distribution is asymptotically normal. 3. Determination of the mean value and standard deviation from the course of empirical distribution in the function grid. 4. Estimation of the measurement errors of the DC (bias) and variable (random error), assuming that the random error and the real value of the tested characteristics of the devices are independent random variables. 5. The use of Fischer"s f-test to compare variances of two random samples. 6. The use of Bartlett's g-test to check homogeneity of variance of two random samples. 7. Application of Fischer"s t-test to compare mean values of the two random samples. 8. Comparing empirical distributions without calculating the mean value and standard deviation. 9. Determination of the correlation (stochastic dependence) of two measurable features (random variables) of any device by designating regression and correlation coefficient. 10. Verification of statistical hypotheses using the Kolmogorov test and Pearson"s chi-square test. 11. Influence of the width of the histogram interval on its shape and the result of the adoption of a statistical hypothesis on the nature of the empirical distribution of random variable. 12. Dependence of probability as a function of time from the adopted probabilistic distribution of random variable describing the right to occurrence (emergence) of the random event.
Prerequisites and co-requisites	

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Colloquium during the semester	50.0%	20.0%
Written exam	50.0%	80.0%

Recommended reading

Basic literature

1. Bartoszewski J.: Wykłady ze statystyki matematycznej. PWN, Warszawa 1989.
2. Bobrowski D.: Probabilistyka w zastosowaniach technicznych. WNT, Warszawa 1986.
3. De' Grot M., H.: Optymalne decyzje statystyczne. PWN, Warszawa 1981.
4. Feller W.: Wstęp do rachunku prawdopodobieństwa. T I i II. PWN, Warszawa 1980, 1981.
5. Firkowicz S., Karpiński J.: Zasady profilaktyki obiektów technicznych. PWN, 1981.
6. Fisz M.: Rachunek prawdopodobieństwa i statystyka matematyczna. PWN, Warszawa 1969.
7. Gajek L., Kałuszka M.: Wnioskowanie statystyczne. WNT, Warszawa 2000.
8. Gercbach I. B., Kordonski Ch. B.: Modele niezawodnościowe obiektów technicznych. WNT, Warszawa 1968.
9. Grabski F., Jadźwiński J.: Funkcje o losowych argumentach w zagadnieniach niezawodności, bezpieczeństwa i logistyki. WKŁ, Warszawa 2009.
10. Krzysztofiak M., Urbanek D.: Metody statystyczne. PWN, Warszawa 1979.
11. Papoulis A.: Prawdopodobieństwo, zmienne losowe i procesy stochastyczne. WNT, Warszawa 1972.

	Supplementary literature	1. Pawłowski Z.: Statystyka matematyczna. PWN, Warszaw 1980. 2. Plucińska A., Pluciński E.: Probabilistyka. Rachunek prawdopodobieństwa, statystka matematyczna, procesy stochastyczne. WNT, Warszawa 2000. 3. Volk W.: Statystyka stosowana dla inżynierów. WN-T, Warszawa 1965. 4. Poradnik niezawodności. Praca zbiorowa pod redakcją J. Migdalskiego. Wydawnictwa Przemysłu Maszynowego „WEMA”, Warszawa 1982.
	eResources addresses	
Example issues/ example questions/ tasks being completed		
Work placement	Not applicable	