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 2023		Academic year of realisation of subject		2022/2023		
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 inż. Jacek Rudnicki				
	Teachers		dr inż. Jacek Rudnicki				

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_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		[SW3] Assessment of knowledge contained in written work and projects [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_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

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
	Written exam	50.0%	80.0%
	Colloquium during the semester	50.0%	20.0%

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	Adresy na platformie eNauczanie: Probabilistyka i procesy stochastyczne, PG_00057259, W, C, OCE, sem.01, letni 22/23 - Moodle ID: 28224 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=28224
Example issues/ example questions/ tasks being completed		
Work placement	Not applicable	