

STUDY MODULE DESCRIPTION FORM		
Name of the module/subject Statistics for engineers		Code 1010341751010349408
Field of study Mathematics in Technology	Profile of study (general academic, practical) general academic	Year /Semester 3 / 5
Elective path/specialty -	Subject offered in: Polish	Course (compulsory, elective) obligatory
Cycle of study: First-cycle studies (Polish Qualifications Framework level six)	Form of study (full-time, part-time) full-time	
No. of hours Lecture: 30 Classes: - Laboratory: 30 Project/seminars: -		No. of credits 4
Status of the course in the study program (Basic, major, other) major		(university-wide, from another field) university-wide
Education areas and fields of science and art The sciences Mathematical sciences		ECTS distribution (number and %) 4 100% 4 100%
Responsible for subject / lecturer: dr Ewa Bakinowska email: ewa.bakinowska@put.poznan.pl tel. 61 665 2816 Faculty of Electrical Engineering Piotrowo 3A, 60-965 Poznań		
Prerequisites in terms of knowledge, skills and social competencies:		
1	Knowledge	1.Student knows the basic concepts of probability theory (random variable, probability function, density function, distribution function, expected value of a random variable, the variance of the random variable) 2.Student knows the basic probability distributions of discrete random variables and density of continuous random variables. 3.Student knows the concepts of two-dimensional random variable, the correlation coefficient of random variables, dispersion matrix. 4.Student knows the basic concepts of linear algebra. 5.Student knows the basic concepts of mathematical analysis (including in the field of differential and integral calculus) [K_W01 (P6S_WG), K_W03 (P6S_WG)]
2	Skills	1.Student knows how to determine the cumulative distribution function of a random variable 2.Student can determine the expected value, variance and standard deviation of the random variable (discrete and continuous) 3.Student knows how to calculate the correlation coefficient of random variables. 4.Student is able to think logically. 5.Students can use the calculator. 6.Student is able to operate a computer. [K_U01 (P6S_UW)]
3	Social competencies	The student is aware of the purpose of learning. The student is aware of the level of his knowledge in relation to the conducted research. [K_K01 (P6S_KK)]
Assumptions and objectives of the course: The aim of the course is to acquaint students with selected issues of statistical inference and the introduction into the environment program of the statistical calculations and visualize the results of R, as well as acquiring the ability to apply knowledge using statistical program R in the technique.		
Study outcomes and reference to the educational results for a field of study		
Knowledge:		

<p>1. The student knows the basic distributions of test statistics. He knows the basic theorem of mathematical statistics. Distribution of the mean from the sample (Central Limit Theorem) Has basic knowledge of statistical inference: from the theory of estimation, from the theory of statistical hypothesis testing, from the theory of regression analysis. He knows the methods of applying the known statistical methods in technical sciences. The student knows the assumptions and the method of creating a regression model for the studied problem. Has extended knowledge of mathematical modeling [K_W02 (P6S_WG)]</p> <p>2. The student has ordered knowledge of terminology in the field of statistics [K_W03 (P6S_WG)]</p> <p>3. The student knows the basics of software used for statistical calculations and visualization of results (R program). He knows how to use them in solving technical problems. - [K_W06 (P6S_WG)]</p> <p>4. The student has ordered knowledge about data analysis [K_W07 (P6S_WG)]</p>
<p>Skills:</p> <p>1. The student is able to use knowledge in higher mathematics (confidence intervals, testing statistical hypotheses, correlation analysis). Student is able to build and analyze simple statistical models (regression analysis model, analysis of variance model) [K_U02 (P6S_UW)]</p> <p>2. Student is able to formulate a statistical problem (also for technical data), conduct research, interpret the results obtained and draw conclusions [K_U05 (P6S_UW)]</p> <p>3. The student is able to use the basic methods of statistical data analysis [K_U07 (P6S_UW)].</p> <p>4. The student is able to use the knowledge learned to solve problems (also engineering problems) [K_U10 (P6S_UW)].</p> <p>5. The student is able to prepare multimedia presentation using statistical terminology [K_U12 (P6S_UK)].</p>
<p>Social competencies:</p> <p>1. The student is aware of deepening and expanding knowledge to solve new problems (including technical problems) [K_K02 (P6S_KK)]</p> <p>2. The student can think and act in a creative way. Understands the need for systematic work on all tasks. - [K_K03 (P6S_KO)]</p>

<p style="text-align: center;">Assessment methods of study outcomes</p>
<p>Lecture: Valuation of knowledge and skills during written completion of lectures.</p> <p>Laboratory: Assessment of knowledge and skills based on written tests.</p>
<p style="text-align: center;">Course description</p>

1. Population and sample.
Empirical distribution.
Position and dispersion measures
Distributions of sample statistics
The Central Limit Theorem.
Boxplots, Violin plots, Pie Charts, histograms.

2. Estimation (point and interval)

3. Hypothesis testing
Hypotheses testing of the expected value (mean)
Hypotheses testing of variance
Hypotheses testing of proportion

4. Comparison of two populations
Tests for two expected values (means)
Test for two variances
Tests for the two fractions

5. Correlation
The correlation coefficient of the sample. Testing the correlation coefficient. Test for two correlation coefficients. Spearman rank correlation coefficient. Kendall's rank correlation coefficient.

6. Regression
Testing the significance of the regression coefficient
Analysis of variance in regression
Confidence intervals in regression analysis, Curves confidence

7. Analysis of variance
Experimental factor. Experimental treatment. Experimental Unit.
Completely random design.
A one-way classification model

8. Tests for multiple comparisons (t-test (Fisher method), Tukey - test, Scheffe? -test)

9. Nonparametric tests (independence test, chi-squared test, tests for randomness)

10. Subject complementary: Generalized linear models

11. Introduction to the environment R. Carry out the above statistical analyses using R. The visualization of data using R.

Applied methods of education:

a) lectures:

- lecture with multimedia presentation supplemented by examples given on the blackboard
- Interactive lecture with questions to students
- Presenting a new topic preceded by a reminder of related content known to students from other subjects

b) laboratories:

- Use of tools to enable students to perform tasks at home (program R)
- Presenting a new topic preceded by a reminder of related content known to students from other subjects

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Basic bibliography:

D. Bobrowski, (1986) Probabilistyka w zastosowaniach technicznych, Wydawnictwo Naukowo Techniczne.
D. Bobrowski, K. Maćkowiak-Łybacka, (2006) Wybrane metody wnioskowania statystycznego, Wydawnictwo Politechniki Poznańskiej.
J. Koronacki, J. Mielniczuk (2001) Statystyka dla studentów kierunków technicznych i przyrodniczych. WNT, Warszawa.
W. Kordecki (2010) Rachunek prawdopodobieństwa i statystyka matematyczna, Definicje, twierdzenia, wzory, Oficyna Wydawnicza GiS.
H. Jasiulewicz, W. Kordecki, (2003) Rachunek prawdopodobieństwa i statystyka matematyczna, Przykłady i zadania Oficyna Wydawnicza GiS.
T. Górecki (2011), Podstawy statystyki z przykładami w R, Wydawnictwo BTC.

Additional bibliography:

R. Kala, (2005) Statystyka dla przyrodników, Wydawnictwo Akademii Rolniczej w Poznaniu.
H. Chudzik, H. Kielczewska, I. Mejza, (2006) Statystyka matematyczna w przykładach i zadaniach, Wydawnictwo Akademii Rolniczej w Poznaniu.
R. L. Scheaffer, J. T. McClave (1995) Probability and Statistics for Engineers, Duxbury.
D.A. MacQuarrie, (2005) Matematyka dla przyrodników i inżynierów I i II, WN PWN

Result of average student's workload		
Activity	Time (working hours)	
1. participation in lectures (15 x 2h.)	30	
2. participation in laboratory classes (15 x 2h.)	30	
3. participation in the consultations related to the implementation of the education process, in laboratory (2 x 2h)	4	
4. completion (own work) reports on laboratory exercises: (13 x 1h).	13	
5. preparing for the test and participate in the colloquium (6h. + 4h)	10	
6. familiarization with the indicated literature / teaching materials (11h)	11	
7. preparing to pass the course and participation in completion of lectures: (10h. + 2h)	12	
Student's workload		
Source of workload	hours	ECTS
Total workload	110	4
Contact hours	70	3
Practical activities	43	2