STUDY MODULE DESCRIPTION FORM

Name of the module/subject	Code
Reliability theory	

Field of study	Profile of study (general academic, practical)	Year /Semester
Mathematics in Technology	**general academic**	**4 /7**
Elective path/specialty	Subject offered in:	Course (compulsory, elective)
-	**Polish**	**elective**

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:	Laboratory: **30**	Project/seminars: **-**		**4**

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

Education areas and fields of science and art	ECTS distribution (number and %)
The sciences	**4 100%**
Mathematical sciences	**4 100%**

Responsible for subject / lecturer:

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Responsible for subject / lecturer:

Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Student understands the role and significance of construction of mathematical reasoning. He/she knows the relationship between set theory, mathematical logic, differential and integral calculus and other branches of mathematics with calculus of probability and statistics. Knows at least one software package, used for symbolic computation, and one packet for statistical processing of data. [K_W01 (P6S_WG), K_W02 (P6S_WG)]
2	**Skills**	He / she has the ability to express mathematical content in speech and in writing, in the texts of both a theoretical and practical. Can apply basic probability distributions on technical issues. Can apply appropriate methods for parameter estimation and statistical hypotheses verification. Can use computer in determining statistics for technical data. [K_U01 (P6S_UW), K_U02 (P6S_UW)
3	**Social competencies**	Student knows own limitation of their knowledge and understands the need for further education. Can accurately formulate questions that deepen their understanding of the topic or find missing elements of reasoning. [K_K01 (P6S_KK), K_K02 (P6S_KK)]

Assumptions and objectives of the course:

The aim of this course is to give the opportunity to learn and discuss contemporary problems of reliability theory, including selected problems of probability theory as well as the properties of statistics and statistical methods used for the experimental data inference. Mastering probabilistic and statistical methods used in reliability studies. Presented material should give the opportunity to solve selected engineering problems.

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

Knowledge:

1. Student will gain knowledge in the application of advanced probabilistic and statistical methods in the study of the durability of technical objects – [K_W01 (P6S_WG), K_W02 (P6S_WG)]

2. Student will gain knowledge in database preparation and computer-assisted reliability tests – [K_W06 (P6S_WG), K_W07 (P6S_WG)]

Skills:

As a result of the course the student will be able to:

1. construct models and solve technical problems using time distributions of simple and complex technical objects - [K_U01 (P6S_UW), K_U02 (P6S_UW), K_U05 (P6S_UW), K_U07 (P6S_UW)]

2. apply methods of reliability theory with computer aided support for the study of phenomena and random processes - [K_U05 (P6S_UW), K_U14 (P6S_UO)]

Social competencies:

As a result of the course the student will score competencies of:

1. precisely formulate questions to deepen his / her own understanding of advanced probabilistic and statistical methods - [K_K01 (P6S_KK), K_K02 (P6S_KK)]
2. teamwork in solving complex research projects - [K_K05 (P6S_KR)]

Assessment methods of study outcomes

Lectures

- Continuous assessment activity for solving problems formulated for self-solving.
- Rating theoretical knowledge and practical skills shown on the written test.

Laboratories

- Current rating - granting bonuses for new skills of practical use of introduced principles and methods.
- Assessment of the knowledge and skills of its application on the basis of a report and presentation problematic tasks completed individually and in groups with computer-aided.
- The final term paper evaluating the effectiveness of the use of the gained knowledge.

Course description

Basic characteristics of the reliability of simple and complex technical objects. Lifetimes distribution review. Laplace and Laplace-Stieltjes transformation and their applications. Empirical characteristics of the reliability. Models of non-renewable and renewable complex technical objects. Lifetime classes and their properties. Statistical Inference in Reliability Theory. Nonparametric kernel estimation reliability characteristics. Reliability of the binary systems. Poisson process. Markov processes. Renewal process. Damage models. Preventive renovation of objects. Computer support for reliability testing. Simulation models of reliability and safety.

Applied methods of education:

- lectures - presenting the theory connected with a current students' knowledge, presenting a new topic preceded by a reminder of related content known to students from other subjects

- practical course (exercises) - solving examples on the blackboard, discussions

- laboratory course - group programming, simulations

Update: 10.2018

Basic bibliography:

1. Bobrowski Dobiesław, Modele i metody matematyczne teorii niezawodności, Wydawnictwo Naukowo-Techniczne, Warszawa 1985.
2. .Grabski Franciszek, Jaźwiński Jerzy, Funkcje o losowych argumentach w zagadnieniach niezawodności, bezpieczeństwa i logistyki, WKŁ, Warszawa 2008.
3. Lawless Jerald F., Statistical Models and Methods for Lifetime Data, John Wiley & Sons, Inc., 2003.
4. Gertsbakh Ilya, Reliability theory with applications to preventive maintenance, Springer, 2000.

Additional bibliography:

1. Aven Terje, Jensen Uwe, Stochastic models in reliability, Springer, 1999.
2. Barlow Richard E., Engineering Reliability, ASA and SIAM, 1998.
3. Jokiel-Rokita Alicja, Magiera Ryszard, Selected stochastic models in reliability, Wrocław 2011, Politechnika Wrocławska, Projekt współfinansowany ze środków UE w ramach Europejskiego Funduszu Społecznego.

Result of average student's workload

Activity	Time (working hours)
1. Lectures attendance (15 x 2 h)	30
2. Practical course (laboratory) attendance (15 x 2 h)	30
3. consulting	2
4. preparing to presentation tasks	15
5. preparing to the laboratory course	8
6. familiarization with the indicated literature / teaching materials (10 pages of scientific text = 1 hr.)	10
7. Practicing to exam (13 h + 2 h)	15

Student's workload

Source of workload	hours	ECTS
Total workload	110	4
Contact hours	65	2
Practical activities	50	2