COURSE DESCRIPTION CARD - SYLLABUS

Course name
Reliability and safety of technical objects [S1Lot2-BTL>NiBOT]

Course

Field of study
Aviation

Year/Semester
2/4

Area of study (specialization)
Air Transport Safety

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
30

Laboratory classes
0

Other
0

Tutorials
30

Projects/seminars
0

Number of credit points

4,00

Coordinators

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Lecturers

Prerequisites

Knowledge: knows the construction of basic types of technical objects and knows the general principles of their operation; has basic knowledge of probability and mathematical statistics Skills: can use basic models in the field of probability and mathematical statistics. Social competences: understands that the further from the phase of constructing technical objects their high unreliability is noticed, the more expensive it is; is aware that the costs of repairing technical objects usually account for a small part of the losses caused by their damage; knows how to manage the time available to perform the tasks indicated for the implementation.

Course objective

Learning about elementary and advanced methods, processes, procedures and models relating to problems of reliability and safety of systems and learning the skills to apply them.

Course-related learning outcomes

Knowledge:
has ordered and theoretically founded general knowledge in the field of key technical issues and detailed knowledge in the field of selected reliability issues of technical objects

has ordered, theoretically founded general knowledge in the field of technology and various means of air transport, about the life cycle of means of transport, both hardware and software, and in particular about the key processes taking place in them
has ordered and theoretically founded general knowledge in the field of key technical issues and detailed knowledge of selected issues related to air transport, knows the basic techniques, methods and tools used in the process of solving tasks related to air transport, mainly of an engineering nature

Skills:
the student can use theoretical probability distributions; is able to analyze and interpret statistical data; is able to use the methods and tools of mathematical statistics in engineering practice.
can use the language of mathematics (differential and integral calculus) to describe simple engineering problems
can determine the properties of technical objects in the form of reliability characteristics

Social competences:
understands that in technology, knowledge and skills very quickly become obsolete
is aware of the importance of knowledge in solving engineering problems, knows examples and understands the causes of malfunctioning engineering projects that have led to serious financial and social losses, or to a serious loss of health and even life
correctly identifies and resolves dilemmas related to the profession of aerospace engineer

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Written test from the lecture and practical part of the course.

Programme content

The programme content covers the fundamental reliability issues of technical objects (i.e. reliability models and characteristics of non-renewed and renewed objects) and selected procedures for the risk management of hazards associated with these objects.

Course topics

classes, introduction to the reliability of technical facilities). Technical objects as subjects of reliability assessments. Non-renewable and renovated objects. Object failure. Reliability tests of technical objects. Life models of non-renewable and renewed objects. Reliability of non-renewable objects: probabilistic and statistical reliability characteristics. Selected elements of structural reliability. Classification of reliability structures; simple and complex structures. Fault tree analysis. Reliability control of systems with simple structures. Reliability model of operation of technical objects with non-zero reneawal time. Multi-state models of exploitation of technical objects. Availibility function and coefficient Estimating the time an object stays in exponential states. The concept of ensuring the safety of technical facilities. Methods of hazard risk analysis at the stage of designing technical objects. Exercises in the application of methods, processes, procedures and models related to the reliability and safety of technical objects

Teaching methods

1. Lecture with multimedia presentation.
2. Exercises - solving tasks.

Bibliography

Basic:
1. Inżynieria niezawodności, Por. pod red. J. Migdalskiego, Wyd. ATR Bydgoszcz i Ośr. Badań Jakości Wyr. "ZETOM", Warszawa, 1992.
2. Kadziński A., Niezawodność obiektów technicznych. E-skrypt Politechniki Poznańskiej, Poznań, 2012.
3. Karpiński J., Korczak E., Metody oceny niezawodności dwustanowych systemów technicznych. Wyd. Omnitech Press, Instytut Badań Systemowych, Warszawa, 1990.
4. Augustyn, E., Kadziński, A., Gill, A. Safety systems components in air task domain of Tactical Aircraft Operating System. Transportation Research Procedia, Elsevier B.V. 2019. Vol. 40. P. 1238-43. https://doi.org/10.1016/j.trpro.2019.07.172.

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Politechniki Warszawskiej, Warszawa, 2004.
7. Lewitowicz, J. Podstawy eksploatacji statków powietrznych. Wydawnictwo Instytutu Technicznego Wojsk
Lotniczych, Warszawa. 2007.
8. Szymanek A., Bezpieczeństwo i ryzyko w technice. Wyd. Politechniki Radomskiej, Radom 2006.

Additional:
1. Bobrowski D., Modele i metody matematyczne teorii niezawodności w przykładach i zadaniach, WNT, Warszawa, 1985.
5. Niezawodność i eksploatacja systemów. Pod redakcją Wojciecha Zamojskiego. Wyd. Politechniki Wrocławskiej, Wrocław 1981.
6. Radkowski S., Podstawy bezpiecznej techniki. Oficyna Wyd. Politechniki Warszawskiej, Warszawa 2003.
7. Słowiński B., Podstawy badań i oceny niezawodności obiektów technicznych. Wyd. Uczelniane Wyższej Szkoły Inżynierskiej w Koszalinie, Koszalin 1992.
8. Kadziński, A. Studium wybranych aspektów niezawodności systemów oraz obiektów pojazdów szynowych [Study on selected dependability aspects of systems and rail vehicles objects]. Wydawnictwo Politechniki Poznańskiej, Poznań. 2013.
9. Gill, A. Warstwowe modele systemów bezpieczeństwa do zastosowań w transporcie szynowym [Layered models of safety systems for rail transport applications]. Wydawnictwo Politechniki Poznańskiej, Poznań. 2018.

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
Classes requiring direct contact with the teacher	60	2,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	40	1,50