COURSE DESCRIPTION CARD - SYLLABUS

Course name

Basics of machine exploitation

Course

Field of study

Aerospace Engineering

Area of study (specialization)

Safety and Management of Aviation

Air Transport

Level of study

Form of study

Year/Semester

2/3

Profile of study

general academic

Course offered in

polish

Requirements

elective

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
60	15	
Tutorials	Projects/seminars	
45		

Number of credit points

7

Lecturers

Responsible for the course/lecturer:

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ul. Piotrowo 3, 60-965 Poznań

Wydział Inżynierii Lądowej i Transportu

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Responsible for the course/lecturer:

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Prerequisites

Knowledge: The student has basic knowledge about economic phenomena, including the market mechanism and the specifics of making economic decisions by market entities. The student has basic

knowledge in the field of mechanics, physics, chemistry, technical drawing, strength of machine construction materials, fluid mechanics, basics of automation and electrical engineering.

Skills: The student is able to integrate obtained information, analyze phenomena occurring in the environment, draw conclusions, formulate and justify opinions. The student knows how to explain the essence of processes and phenomena occurring in internal combustion engines, shows technical thinking, reading and understanding of construction drawings, associating cause-and-effect relationships in mechanics, physics, chemistry. The student is able to solve simple problems in the field of fluid mechanics and the basics of machine construction

Social competences The student is able to work independently, search for information in the literature, knows the principles of discussion and work in a group, taking different roles in it. The student is able to determine the priorities important in solving the tasks set before him. The student demonstrates independence in solving problems, gaining and improving acquired knowledge and skills. The student shows interest and motivation to learn about contemporary technical solution

Course objective

The aim of the course is to learn the theoretical problems related to the technical diagnostics of means of transport as well as methods and ways of solving issues of assessment of their technical condition and forecasting. Acquiring the skills to formulate and solve simple problems of operation (use and operation) of means of transport. Understanding the elementary methods, procedures, models and characteristics in the field of reliability of technical objects and acquiring the ability to apply them.e.

Course-related learning outcomes

Knowledge

1. Knows the concepts of operation, use, service, fitness and failure, damage, durability, reliability, limit state - [T1A_W06]

2. Knows the typical course of changes in technical condition and criteria for its assessment - [T1A_W06]

3. Knows the issues of functional defects and operating errors - [T1A_W06]

4. Has basic knowledge of operational and corrective maintenance, periodic inspections and status checks - [T1A_W06]

5. Knows basic technical service strategies, service schedules, service levels - [T1A_W06]

6. Has knowledge in mathematics, including algebra, analysis, theory of differential equations, probability studies, analytical geometry necessary to: describe the operation of discrete mechanical systems, understand computer graphics methods, describe the operation of electrical and mechatronic systems - [K1A_W01]

7. Has basic knowledge in the field of technical diagnostics of means of transport as well as methods and methods of solving issues of technical condition assessment and forecasting, knows: conditions for diagnosing technical objects, the essence of technical diagnostics applied to air transport means, tasks and objectives of technical diagnostics - [K1A_W20]

8. Has expanded knowledge necessary to understand profile subjects and specialist knowledge about construction, methods of construction, manufacture, operation, air traffic management, security systems, impact on the economy, society and the environment in the field of aviation and space for selected specialties. - [K1A_W23]

9. Has basic knowledge of technical diagnostics of means of transport as well as methods and methods of solving issues of technical condition assessment and forecasting, - [K1A_W25]

10. Has basic knowledge about the conditions of diagnosing technical objects, the essence of technical diagnostics applied to means of transport, tasks and objectives of technical diagnostics. - [K1A_W25]

Skills

1. Can create a statistical description of changes in state during use - [T1A_U04]

2. Is able to analyze data assuming Weibull distribution - [T1A_U04]

3. Is able to carry out an analysis to identify the types, causes and effects of failure - [T1A_U04]

4. Is able to analyze objects and technical solutions, is able to search in the catalogs and on the manufacturers' websites ready components of machines and devices, including means of transport and storage, assess their suitability for use in own technical and organizational projects - [K1A_U09]

5. Is able to organize and substantively direct the design and operation of an uncomplicated on-board device, machine or technical flying object from the group covered by the selected specialty - [K1A_U15]

6. Is able to develop a manual and repair instructions for a simple machine or its components from the group of machines covered by the selected specialty - [K1A_U18]

7. Is able to obtain information from literature, the Internet, databases and other sources, - [K1A_U01]

8. Has the ability to self-study with the use of modern teaching tools - [K1A_U06]

Social competences

1. The student is aware of the importance of rational operation of means of transport in technical, safety, economic and ecological aspects - [T1A_K02]

2. Is aware of the importance and understands the non-technical aspects and effects of engineering activities, including its impact on the environment, and the associated responsibility for the decisions taken - [K1A_K02]

3. Can interact and work in a group, assuming different roles in it - [K1A_K03]

4. Understands the need and knows the possibilities of continuous training, knows the need to acquire new knowledge for the purpose of professional development - [K1A_K01]

5. Can define tasks and priorities for their implementation for themselves and the team of employees - [K1A _K05]

6. Is able to identify and resolve dilemmas related to the exercise of the profession, among others problems on the level of technology - environment - [K1A _K06]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Control works that are used to analyze the skills acquired by studies in the field of operational data analysis.

Colloquium and individual conversation, which is the essence of checking the understanding of the essence of issues related to the use of transport means of transport in program content.

Programme content

1) Technical operation. Technical condition in relations: parameter value, tolerance limits, load, load capacity, standard quality property (standard). Condition of fitness and unfitness, damage. Period of use until damage and between damage. Limit state, durability

2) Changes in technical condition during use Typical status changes. Technical criteria of technical condition

3) Statistical description of state changes during use. Numeric characteristics of the random variable. Functional characteristics of the random variable

4) Assessment of the potential of the machine and process Determining tolerance limits. Random load and load changes. Safety factor and safety margin

5) Analysis of operational data about the course to failure and between failures Data analysis assuming Weibull distribution (graphic and analytical method). Evaluation of the average period between damage and readiness

6) Analysis of the types, causes and effects of failure. Functional failures. Operating errors

7) Operation Operational and corrective operation. Periodic inspections and condition checks. Technical support system: service strategies, service schedules, service levels

8. Technical facilities as subjects of reliability assessments. Objects not renewed and renewed. Object damage.

9. Reliability tests of technical objects. Life models of non-renewable and renovated buildings.

10. Reliability of non-renewable facilities - pro-stability reliability characteristics. Reliability of non-renewable objects - statistical reliability characteristics.

11.Selected elements of structural reliability. Classification of reliability structures - simple and complex structures. Simple structures: serial, parallel, serial - parallel, parallel - serial.

12. General formula for reliability. Complex structures: bridge, threshold structures.

13. Tree of failure.

14 Controlling the reliability of systems with certain reliability structures. A reliable model for the operation of technical facilities with a non-zero renewal time.

15. Bistate model of exploitation of technical objects. ProcesyMarkowa.

16. Standby and not ready function. Readiness and non-readiness ratio. Time spent in exponential states.

17. Multi-state Markov models of technical facilities operation.

18. Repository of reliability characteristics of non-renewable and renewed technical facilities.

19. Exercises in applying methods, processes, procedures and models related to the reliability of technical objects.

20. The concept of the term diagnostics, diagnostics as a measuring method, conditions for diagnosing technical objects.

21. The essence of technical diagnostics, tasks and goals of technical diagnostics. The concept of entropy in diagnostics, entropy properties, relative entropy.

22. Phases of the object's existence, diagnostics in individual phases of the object's existence.

23. Diagnostics in the vehicle operation system, diagnostics in the use and maintenance subsystem. Diagnostic system.

24. Analysis of the diagnosis object, diagnostic models (determined and undetermined), a set of features of the state of the object, a set of output parameters (working and associated).

25. Object structure and diagnostic signal, concept of structure, structure parameters describing the condition of the object. Conditions that the output parameter must meet to be considered as a diagnostic parameter.

26.Diagnostic parameters and their division. Symptoms of technical condition.

27. The concept of limit value and permitted symptoms, methods for estimating limit values. 28. Classification of technical conditions of an object, two, three and four-state classification. Classification of diagnostic condition parameters, general and detailed parameters.

29. Diagnosis methods, information synthesis method, information analysis method. Vehicle diagnosis methods, instrumental and non-instrumental methods. The scope of technical diagnostics, diagnosing the current state, supervising the state of the object, genesis of existing (past) states, forecasting future states.

Teaching methods

Informative lecture (conventional) (information transfer in a systematic way) - may have

course (propedeutic) or monographic (specialist)

Exercise method (subject exercises, exercises) - in the form of auditorium exercises

(applying the acquired knowledge in practice - it can take on a different nature: solving cognitive tasks or training psychomotor skills; transforming conscious activity into a habit through repetition).

Laboratory (experiment) method (students conduct experiments independently)

Bibliography

Basic

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1. Bobrowski D., Modele i metody matematyczne teorii niezawodności w przykładach i zadaniach, WNT, Warszawa, 1985.

2. Jaźwiński J., Ważyńska-Fiok K., Niezawodność systemów technicznych. Wyd. Naukowe PWN, Warszawa 1990.

3. Niezawodność i eksploatacja systemów. Pod redakcją Wojciecha Zamojskiego. Wyd. Politechniki Wrocławskiej, Wrocław 1981

4. Niziński S., Diagnostyka samochodów osobowych i ciężarowych. Dom Wydawniczy Bellona, Warszawa 1999

5. Radkowski S., Podstawy bezpiecznej techniki. Oficyna Wyd. Politechniki Warszawskiej, Warszawa 2003.

6. Słowiński B., Podstawy badań i oceny niezawodności obiektów technicznych. Wyd. Uczelniane Wyższej Szkoły Inżynierskiej w Koszalinie, Koszalin 1992.

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8. Żółtowski B., Cempel C., Inżynieria diagnostyki maszyn. Instytut Technologii Eksploatacji, Radom 2004.

Breakdown of average student's workload

	Hours	ECTS
Total workload	175	7,0
Classes requiring direct contact with the teacher	125	5,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	50	2,0

[1] delete or add other activities as appropriate