COURSE DESCRIPTION CARD - SYLLABUS

Course name
Exploitationof mechatronic devices [N1Mech2>EUM]

Course

Field of study
Mechatronics

Year/Semester
4/7

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
part-time

Requirements
compulsory

Number of hours

Lecture
8

Laboratory classes
16

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

3,00

Coordinators

Lecturers

Prerequisites

The student has basic knowledge of physics, mathematics, mechanics, strength of materials, materials science, metrology, machine diagnostics. He can: think logically, draw conclusions from observations of physical phenomena, use sources of knowledge, work in a team. He has the need to acquire new knowledge and competences

Course objective

Learning basic issues and acquiring practical skills related to: use and maintenance of machines, reliability, prevention and control of wear processes, the impact of machine operators (maintenance teams) on facilities and technical infrastructure and the environment.

Course-related learning outcomes

Knowledge:
The student knows the definitions and terminology in the field of machine operation, basic concepts related to the reliability of machines and devices, sources of damage in the life cycle of technical objects including the participation of the human factor, processes and phenomena related to wear. Knows the basic technical principles related to the correct operation and maintenance of machines.

Skills:

Is able to indicate sources and obtain information from them concerning the operation of machines. Is able to assess the impact of the complexity of the machine design on its reliability. Is able to select and use appropriate operating materials. Is able to identify the causes of wear of machine parts and assemblies and improper functioning and damage. Is able to perform basic activities related to the operation of machines. Is able to work in a team to solve a given problem.

Social competences:
Understands the need for lifelong learning; is able to inspire and organize the learning process of others. Is aware of the importance and understanding of non-technical aspects and effects of engineering activities. Understands the role of humans in the occurrence of damage and failures of technical systems. Is aware of the social role of a technical university graduate, and in particular understands the need to formulate and convey to society, in particular through the mass media, information and opinions on technical achievements and other aspects of engineering activities; makes efforts to convey such information and opinions in a generally understandable manner, with justification of different points of view.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

The learning outcomes presented above are verified as follows:
Lecture: based on a written colloquium covering all theoretical and practical issues.
Laboratory: based on verification of current theoretical preparation for performing the exercises and a report prepared based on the instructions for the exercises and under the supervision of the laboratory instructor. Reports are prepared during classes.
Assessment criteria for lectures and laboratory:
below 60% ndst. 60-67% dst. 68-74% dst. plus 75-83% db. 84-91 db plus 92-100% vdb.

Programme content

Operation of machines and devices, engineering tribology, maintenance of machine traffic, reliability of technical systems, lubrication theory, wear processes, product life cycle.

Course topics

Operational strategies. Basic concepts of reliability, use and maintenance of machines. Physical phenomena occurring in the contact zone of solid bodies. Friction processes of metals and non-metals. Friction in extreme conditions. The essence of the lubrication phenomenon and types of lubrication. Tribological and tribo-chemical wear processes - essence and symptoms. Types of corrosion, occurrence and methods of prevention. Properties and characteristics of solid, liquid and gaseous lubricants. Classification, selection and purpose of lubricants. The relationship between lubrication and efficiency. Wear and aging of consumer products. Causes of damage and their sources in subsequent stages of the existence of a technical object. Human participation in the chain of events leading to states of unsuitability of technical objects and catastrophes. Wear resistance of materials. Tribology in MEMS and NEMS systems. Methods of detecting leaks in pneumatic systems and installations, detecting and preventing cavitation on elements of hydraulic installations and subassemblies of fluid-flow machines. Basic maintenance activities related to machine operation: foundation, rotor balancing, shaft alignment, lubrication. Methods of monitoring high-power rotating machines and detection and prevention of unfavorable phenomena: critical speeds, oil whip vortex, abrasion, shaft cracking. Laboratory
During laboratory classes conducted in 3-hour blocks, students in teams prepare and perform selected experiments in the scope of: experimental studies of the processes: friction, wear, lubrication in the pin-on-disk, block-on-ring, rolling friction with slip, oscillatory linear motion. Experimental studies of selected lubricants. Modeling of conditions prevailing in the contact zone of cooperating bodies. Studies of erosion, adhesion, cavitation, stick-slip phenomena. Studies of the effect of surface topography on the phenomenon of lubrication. Single- and two-plane balancing of rigid rotors. Shaft alignment using conventional methods and laser techniques. Detection of leaks in pneumatic systems - comparison of the effectiveness of different techniques. Detection of cavitation on hydraulic system elements and rotors. Machine foundations - selection of vibration isolating elements. Demonstration of phenomena related to the operation of machines with rotors mounted in slide bearings. Active use of knowledge sources - analysis of experimental data.

Teaching methods

Lecture: multimedia presentation - presentation illustrated with examples and films, problem analysis, discussion and case analysis. Laboratory: Discussion, multimedia presentations, .

Bibliography

Basic:
1. G.Stachowiak, A.W.Batchelor: Engineering Triblology, Butterworth-Heineman, 2013.
2. I. Hutchings, P.Shipway: Friction and wear of engineering materials, Butterworth-Heineman,2017.
3. G.Stachowiak, A.W.Batchelor: Experiental methods in Tribology, Elsevier, 2004.
4. M. Hebda, A Wachal: Trybologia, WNT, 1999.
5. H. Czichos, Tribology, Elsevier, 1978.3.
6. St. Nosal: Tribologia, Wyd. Politechniki Poznańskiej, Poznań 2012.
7. St. Legutko: Eksploatacja maszyn, Wyd. Politechniki Poznańskiej, Poznań 2007.
8. R. Łączkowski: Wyważane elementów wirujących. WNT Warszawa 1979.

Additional:
1. W. Neville, P.Sachs: Practical Plant Failure Analysis, CRC Press, Boca Raton 2007.
2. H. Bloch, F. Geitner: Practical Machinery Management for Process Plants Vol.1,2,3, Gulf Professional Publishing, Houston 19993. H. Bloch, F. Geitner: Practical Machinery Management for Process Plants Vol.1,2,3, Gulf Professional Publishing, Houston 1999.
3. A. Podniadło: Paliwa, oleje i smary w ekologicznej eksploatacji, WNT,2002.
4. K.N. Rao, Handbook of condition monitoring, Elsevier 1996.
5. R. Lindley, P.E. Higgins: Maintenance engineering Handbook, Mc Graw Hill Book Company
6. J. Dwojak, M. Rzepiela: Zastosowanie lasera do ustawiania maszyn, Gamma, W-wa 2001
7. Wybrane normy PN-ISO, procedury badawczo-pomiarowe oraz artykuły z czasopism:
Główny Mechanik, Utrzymanie Ruchu, Maintenance and Reliability
8. Materiały uzupełniające zawarte na platformie e-learningowej eKusy .

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	24	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	51	2,00