COURSE DESCRIPTION CARD - SYLLABUS

Course name
Exploitation [N1MiBM2>EKS]

Course

Field of study
Mechanical Engineering

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 (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

3,00

Coordinators

Lecturers

Prerequisites

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

Course objective

To learn the basic issues and acquire practical skills regarding: the use and operation of machinery, reliability, prevention and control of wear processes, the impact of machinery dispatchers (maintenance teams) on technical facilities, infrastructure and the environment. Course related learning outcomes Knowledge Definitions, machinery exploitaion terminology. Basic terms of reliability of machinery and devices. Sources of damage in the life cycle of technical objects including the contribution of the human factor. Processes and phenomena that are causes of wear of parts and components of machinery and damage and malfunctions of machinery. Studnet knows the basic technical operations related to the correct exploitation and maintenance of machines (properties and selection of fluids and operating means, balancing of rotors, alignment of shafts, foundation of machines, detection and prevention of adverse phenomena and processes occurring in machines and technical infrastructure). Skills Student can identify sources and obtain information from them regarding the exploitation of machinery. Student can assess the impact of the complexity of machine design on it's reliability. Student can select and use appropriate maintanance matherials. Student can identify the causes of malfunctions and damage as well as wear of machine parts and components. Student can carry out basic operations related to the operation of machines (e.g. mounting of machines, lubrication, balancing of rotors, alignment of shafts, monitoring and controling of operating parameters of machines to guarantee correct functioning and prevent disadvantageous phenomena). Social competences Student understands the need for lifelong learning; He/ She can inspire and organise the learning of others. Student is aware of the importance and understands non-technical aspects and consequences of engineering activities. He/she understands the role of the man in the emergence of failures and states of unfitness of technical systems .He/she is aware of the social role of a graduate of a technical university, in particular he/she understands the need to formulate and communicate to the society, in particular through the mass media, information and opinions on the achievements of technology and other aspects of engineering activity; he/she makes efforts to communicate such information and opinions in a commonly understood way, justifying different points of view

Course-related learning outcomes

Knowledge:
-

Skills:
-

Social competences:
-

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: on the basis of a written colloquium covering all theoretical and practical issues.
Laboratory: on the basis of verification of the current theoretical preparation for the exercises and the report made on the basis of the instructions for the exercises and under the supervision of the instructor of the laboratory classes. The reports are made during the classes.
Assessment criteria for lectures and laboratory:
below 60 % nd. 60-67 % dst. 68-74 % dst plus 75-83 % db. 84-91 db plus 92-100 % bdb.

Programme content

Lectures:
Operational strategies. Basic concepts of reliability, the use and maintenance of machinery. Physical phenomena occurring in the contact zone of solids. Friction processes of metals and non-metals. Friction in extreme conditions. The essence of lubrication and types of lubrication. Tribological and tribo-chemical wear processes - essence and symptoms. Types of corrosion, occurrence and prevention. Properties and characteristics of solid, liquid and gaseous lubricants. Classification, selection and purpose of lubricants. Relationship of lubrication to efficiency. Wear and ageing of consumer products (e.g. laptops, cars, household appliances). Causes of damage and their sources in the successive stages of existence of a technical object. Human involvement in the chain of events leading to states of unfitness of technical objects and disasters. Resistance of materials to wear and tear. Methods of leak detection in pneumatic

systems and installations, detection and prevention of cavitation on hydraulic system components and flow machine components. Basic maintenance activities related to machine operation: foundation, rotor balancing, shaft alignment, lubrication. Methods of monitoring high power rotating machinery and detection and prevention of adverse phenomena: critical velocities, oil whip, rubbing, shaft breakage.
Laboratory classes:
Laboratory conducted in 3-hour blocks, students in teams prepare and perform experiments in the following areas: friction, wear, lubrication in a pin-on-disk, block-on-ring, rolling friction with sliding, oscillatory linear motion. Experimental testing of selected lubricants. Modelling of conditions in the contact zone of cooperating bodies. Study of the influence of surface topography on lubrication phenomena. Single and dual plane balancing of rigid rotors. Shaft alignment by conventional and laser techniques. Leak detection in pneumatic systems - comparison of the effectiveness of different techniques. Cavitation detection on hydraulic components and rotors. Machine foundation - selection of vibration isolation elements. Demonstration of phenomena associated with the operation of machines with rotors mounted in plain bearings (optional exercise).
The elaboration of the results and the research report should be completed during the laboratory classes. During the execution of the exercises, students should make use of knowledge sources.

Course topics

none

Teaching methods

Lecture: multimedia presentation - presentation illustrated with examples and films, problem analysis, discussion and case study.
Laboratory: Completion of a task to carry out an experiment and formulate conclusions. Experiments performed on dedicated laboratory stations.

Bibliography

Basic:
1. Inżynieria Diagnostyki Maszyn. ed. B. Żółtowski i C. Cempel, PTDT ITE PIB Radom, 2004.
2. Handbook of condition monitoring, Edited by B.K.N. Rao, Elsevier Science Ltd. 1996.
3. Diagnostyka Maszyn, Zasady ogólne przykłady zastosowań, ed. C. Cempel i F. Tomaszewski, MCNEMT Radom, 1992.
4. Barczewski R., Laboratory of Systems Diagnostics - instructions for laboratory exercises - electronic edition (Moodle).

Additional:
1. Cempel C., Diagnostyka Wibroakustyczna Maszyn, PWN Warszawa 1989.
2. Morel J., Drgania Maszyn i diagnostyka ich stanu technicznego (tłum.) PTDT, 1992.
3. Dwojak J. Rzepiela M., Diagnostyka drganiowa stanu maszyn i urządzeń, Biuro Gamma, Warszawa 2005.
4. Supplementary materials available on the MOODLE e-learning platform.
5. Selected standards (PN-ISO), measuring & testing procedures, technical magazines: Główny Mechanik, Utrzymanie Ruchu, Maintenance and Reliability.

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	26	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	49	2,00