COURSE DESCRIPTION CARD - SYLLABUS

Course name
Fundamentals of machinery diagnostics

Course

Field of study
Mechanical Engineering
Area of study (specialization)

Level of study
First-cycle studies
Form of study
full-time

Year/Semester
3/5
Profile of study
general academic
Course offered in
Polish
Requirements
compulsory

Number of hours

Lecture
15
Laboratory classes
15
Other (e.g. online)

Tutorials
Projects/seminars

Number of credit points

3

Lecturers

Responsible for the course/lecturer:
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Responsible for the course/lecturer:

Prerequisites

Fundamentals of theory of machines and mechanisms, fundamentals of machine dynamics, engineering metrology and measurements, knowledge of the principles of technical drawing and the ability to read technical documentation. Ability for self-learning and knowledge acquiring, basing on library (including e-resources) and Internet resources (e.g. Moodle).

Course objective

Students receive basic knowledge in the field of technical diagnostics (in particular vibroacoustic diagnostics). Students improve their skills in assessing the technical condition of machines and subassemblies, as well as in the detection and identification of damage.

Course-related learning outcomes

Knowledge

After completing the course, the student has knowledge of the goals and methods of technical diagnostics at the stage of construction, production and operation of technical objects. Student knows the typical causes and effects of operational damage and malfunctions of machines and their components, and knows how to eliminate them. Student knows the methods and techniques of machinery condition monitoring. The student knows how to assess and classify the technical condition of machines. Student knows the methods and techniques used to identify defects, damage and malfunctions in the functioning of machines and devices, and knows how to eliminate them.

Skills

After completing the course, the student is able to assess the general technical condition of machines (in particular rotating machines) based on the methodology described in the standards. The student is able to make the right decisions regarding the operation of machines (e.g. continued operation without restrictions, maintenance, repair, decommissioning the machine). The student is able to measure and analyse vibroacoustic signals as well as interpret the results of the analysis. The student is able to identify damages, defects, malfunctions in the operating of machines and devices. The student is able to define recommendations for the maintenance or repair of machines and their subassemblies. The student is able to selectively analyse the content of standards, publications and other source materials in the field of technical diagnostics.

Social competences

The student understands the importance of technical diagnostics in economic terms and the safety of people and the environment. The student is aware of the importance of engineering activities and responsibility for decisions related to the operation of machines and devices. The student is aware of the role of engineering staff in technical development. The student knows how to think and act creatively and proactively. He is able to organize teamwork and to cooperate while performance of tasks.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Laboratory classes:

Short entry tests before each laboratory exercise. Assessment of knowledge and skills, as well as activity during carried out experiments. Evaluation of mastery of course content, skills and acquired competencies based on the quality of individually prepared reports. The substantive and computational correctness, report completeness and the ability to specifying conclusions, remarks and observations are verified. Necessary condition to pass the laboratory: passing a set of laboratory exercises and getting the required number of points from entry tests and reports.

Lecture

Written or remote tests (via MOODLE platform): 10-20 issues covering the entire lecture material and issues indicated for own studies (self-studying).
Grading scale both laboratory and lecture (exam): below 60% unsatisfactory; 60-67% satisfactory, 68-75% satisfactory plus; 76-83% good; 84- 91% good plus; 92 -100% very good.

Programme content

Lectures:
Basic terminology. Symptom life curve of a technical object. The place of diagnostics in the subsequent stages of the life of technical systems (design diagnostics, post-production and operational diagnostics, diagnostics of technological processes). Methods of testing and assessing the technical condition of machines, their subassemblies and elements. Measures and characteristics of vibroacoustic signals used as diagnostic symptoms. Methods and techniques for detecting and identifying faults, defects and malfunctions of rotating machines, engines, flow machines and other types of machines and their subassemblies (i.a. shafts and rotors, rolling bearings, belt and gear transmissions).

Laboratory classes:

Laboratory exercises carried out on real objects and on laboratory stands (small-size models of aggregates, machines). The first classes take place in a centrifugal fan station. Technical expertise of the rotating machine is performed. Assessment of the technical condition is carried out on the basis of vibration measurements and standard recommendations (PN-ISO standards). Next laboratory exercises are carried out on stands containing typical machine components and subassemblies such as: rotors, shafts, bearings, belt transmission, gear transmission, gear pump, electric motor. Laboratory stands are equipped with dedicated measuring and analysing systems as well as software that allows the detection and identification of machine damages and faults.

The current list of exercises is available on the Moodle platform.

Teaching methods

Lecture: multimedia presentation. The content of lectures is available in electronic form before the beginning of the class, which allows comfortable and active participation in lectures.

Laboratories: the experiments are carried out on specialized didactic stands equipped with dedicated measuring and analysing systems.
Lectures and laboratories are fully supported on the Moodle e-learning platform. There are available: lectures, multimedia, off-line webinars, source literature (magazines, selected publications, technical notes), instructions for laboratory exercises, report templates, sample reports. It is also possible to perform exercises remotely based on prepared photo and video tutorials and individual data sets. Tests, competitions and quizzes, sets of exam questions, criteria on the basis of which reports are assessed are also available there.

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	70	3,0
Classes requiring direct contact with the teacher	35	2,0
Student's own work (literature studies, self-education based on e-learning resources, preparation for laboratory classes, reports, preparation for tests/exam) [1]	35	1,0

[1] delete or add other activities as appropriate