# COURSE DESCRIPTION CARD - SYLLABUS

Course name
Fundamentals of machinery diagnostics [S1ETI1>DT]

## Course

Field of study
Education in Technology and Informatics

Year/Semester
2/4

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
polish

Form of study
full-time

Requirements
compulsory

## Number of hours

Lecture
15

Laboratory classes
15

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

## Number of credit points

2,00

## Coordinators

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## Lecturers

## Prerequisites

Student knows fundamentals of theory of machines and mechanisms, engineering metrology and measurements as well as methods of results analysis. Student is able to perform basic measurements. 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. [k1_w19]
student knows the typical causes and effects of operational damage and malfunctions of machines and their components. student knows the methods and techniques of machinery condition monitoring. the

student knows how to assess the technical condition of machines. student knows the methods and techniques used to identify defects, damage (including the ndt -methods) and malfunctions in the operating of machines and devices and knows how to eliminate them.

Skills:
after completing the course, student is able to assess the general technical condition of machines (in particular rotating machines). student is able to make the right decisions regarding the operation of machines. k1-u15] [k1_u23]
student is able to measure and analyse vibroacoustic signals as well as interpret the results of the analysis. student is able to identify damages, defects, malfunctions in the operating of machines and devices [k1_u23][k1_u19].
student is able to selectively analyse the content of standards, publications and other source materials in the field of technical diagnostics [k1-u01] [k1_u25].

Social competences:
student after completing the course is aware of the necessity for continuous self-learning [k1_k01].
student understands the importance of technical diagnostics in economic terms and the safety of people and the environment [k1_k06]. student is aware of the importance of engineering activities and responsibility for decisions. student is able to organize teamwork and to actively cooperate while performance of tasks [k1_k02][k1_k06].

## Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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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 (i.a. vibroacoustic , visual testing, magnetic particle, eddy-current, liquid penetrant, radiographic, ultrasonic, thermal). Methods and techniques for detecting and identifying faults, defects 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). Assessment of the technical condition of centrifugal fans based on vibration measurements and standard recommendations (PN-ISO standards). Next laboratory exercises are carried out on stands containing typical machine subassemblies such as: rotors, shafts, bearings, belt transmission, gear transmission, gear pump, electric motor. Leak detection in compressed air systems.
Laboratory stands are equipped with dedicated measuring and analysing systems as well as equipment that allows the detection and identification of machine subassemblies 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, 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. Lewińska-Romicka A., Badania nieniszczące, podstawy defektoskopii, WNT W-wa, 2001
5. Barczewski R., Laboratory of Systems Diagnostics - instructions for laboratory exercises - electronic edition (Moodle).
Additional
1. Cempel C., Diagnostyka Wibroakustyczna Maszyn, PWN Warszawa 1989.
2. Żółtowski B, Podstawy diagnostyki maszyn, WU ATR Bydgoszcz 1996,
3. Morel J., Drgania Maszyn i diagnostyka ich stanu technicznego (tłum.) PTDT, 1992.
4. Dwojak J. Rzepiela M., Diagnostyka drganiowa stanu maszyn i urządzeń, Biuro Gamma, Warszawa 2005.
5. Selected standards (PN-ISO), technical magazines: Główny Mechanik, Utrzymanie Ruchu, Maintenance and Reliability, Diagnostyka.
6. Encyclopaedia of condition monitoring, Coxmoor Publishing Company Oxford UK 2006.
7. Supplementary materials available on the MOODLE e-learning platform.
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## Breakdown of average student's workload

| | Hours | ECTS |
|---|---|---|
| Total workload | 60 | 2,00 |
| Classes requiring direct contact with the teacher | 35 | 1,00 |
| Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation) | 25 | 1,00 |