COURSE DESCRIPTION CARD - SYLLABUS

Course name
Vibroacoustics of machines

Course

Field of study
Mechanical Engineering
Area of study (specialization)

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

Year/Semester
4/7
Profile of study
practical
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

Basics of mathematics (incl. statistics), mechanics, electrical engineering, computer science (IT). Basics of machine design. Fundamentals of theory of machines and mechanisms. Ability for self-learning and knowledge acquiring, basing on library (including e-resources) and Internet resources (e.g. Moodle).

Course objective

Students receive knowledge about the sources of vibroacoustic phenomena as well as methods of measuring and analysing vibrations and noise. The course makes students aware of the negative impact of vibrations and noise emitted by machines and devices on engineering structures, the natural environment and the work environment. The course improves the students' ability to measure and evaluate vibrations and noise in accordance with the methodology specified in standards and regulations. Introduction to methods of minimizing noise and vibration

Course-related learning outcomes

Knowledge

After completing the course, the student knows the specificity of the sources of noise and vibrations in machines and devices as well as in production processes.
The student knows the methodology of measurement and analysis of vibrations and noise. He knows the measurement quantities and measures parameterizing noise and vibrations.
The student knows the basic standards and regulations concerning the assessment of vibroacoustic impacts on the work and living environment and on technical infrastructure. The student knows the organizational and technical methods of minimizing vibrations and noise.

Skills

After completing the course, the student is able to identify the sources of vibrations and noise in machines, devices and production processes and determine their specificity. The student knows how to perform measurements and analyses of vibrations and noise.

The student is able to interpret the results of vibration and noise measurements and relate them to the limit values given in standards and regulations. The student is able to assess the impact of vibrations and noise on the work environment, living environment or technical infrastructure. The student is able to propose technical and organizational solutions aimed at minimizing the impact of vibrations and noise on the anthropotechnical environment. The student is able to make a report on the research and tests carried out.

Social competences

The student understands the importance of protection of the work and life environment and technical infrastructure against vibrations and noise in terms of health, economy and safety. The student is aware of the importance of engineering activities and the responsibility associated with issuing opinions and decisions. Student is aware of the role of engineering staff in shaping the environment of human life and work. 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 during carried out experiments. Evaluation of mastery of course content, skills and acquired competencies based on the quality of prepared reports. 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:
The area of vibroacoustics. The specificity of vibroacoustic phenomena in terms of frequency and amplitude. Sources of vibrations and noise in machines and devices. Introduction to the measurement and analysis of noise - basic concepts, quantities and measures parameterizing noise. Devices and equipment used for noise measurements. Noise in the work environment (sounds in the audible range, infrasound, ultrasounds). Measurement methodology and assessment of the impact of noise on human. Noise reduction methods. Introduction to the measurement and analysis of mechanical vibrations. Quantities and measures parametrizing vibrations. Devices and equipment used for vibration measurement and analysis. Methodology of measurement and evaluation of mechanical vibrations in the work environment. Methodology for assessing the impact of machine and device vibrations on the environment and technical infrastructure. Assessment of the influence of environmental vibrations on machines and devices. Methods of vibration reduction (vibration eliminators and vibro-isolators).

Laboratory classes:

Assessment of noise risk at workplaces. Determination of the acoustic power level of machines and devices. Noise spectral analysis - octave and 1/3-octave analysis. Testing the effectiveness of noise suppressors. Testing the vibro-insulating properties of materials, mechanical structures and vibro-isolators. Elimination of machines vibrations - dynamic eliminator. Identification of vibration parameters of mechanical systems on the basis of free vibration analysis (facultative exercises).

Teaching methods

Lectures - multimedia presentations. The content of lectures is available in electronic form before the start of classes, which enables comfortable and active participation in lectures. Lectures are supported on the Moodle e-learning platform. There are: presentations, multimedia, off-line webinars, source materials (magazines, selected publications, technical notes), sets of tasks and a set of examination issues.

Laboratories: experiments are performed at laboratory stands on the basis of instructions.

Bibliography

Basic

1. Engel Z., Piechowicz J., Stryczniewicz L.; Podstawy wibroakustyki przemysłowej, AGH, Kraków 2003, ISBN 83-916516-9-X.
2. Engel Z., Ochrona środowiska przed drganiami i hałasem, PWN, 2001.

Additional

1. Cempel C., Wibroakustyka stosowana, PWN Warszawa 1989.
2. Ciesielski R., Kwiecień A, Stypuła K., Propagacja drgań w warstwach przypowierzchniowych podłoża gruntowego , Wydawnictwo Politechniki Krakowskiej 1999.
3. Barczewski R., Vibroacoustic measurements and tests - set of tasks - electronic version (Moodle).
4. Supplementary materials available on the MOODLE e-learning platform.
5. Selected standards (PN-ISO), regulations, publications, technical notes, data sheets .

Breakdown of average student's workload

	Hours	ECTS
Total workload	60	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]	25	1,0

[1] delete or add other activities as appropriate