

**DOCTORAL SCHOOL OF WROCLAW UNIVERSITY OF SCIENCE AND
TECHNOLOGY**

SUPERVISOR/TEAM/ DECLARING/CONDUCTING COURSE:

dr hab. inż. Marek Sokolski, prof. uczelni

DEPARTMENT: Mechanical Department

SCIENTIFIC DISCIPLINE: Mechanical Engineering

COURSE CARD

Course name in Polish: Podstawy diagnostyki maszyn

Course name in English: Basis of Condition Monitoring of Machinery

Course language Polish / ~~English~~*

University-wide general course type*:

The course is intended for all PhD students: YES / NO

~~1) BASIC COURSE~~

~~2) SPECIALIST COURSE~~

~~3) SEMINAR~~

~~4) HUMANISTIC COURSE~~

~~5) LANGUAGE~~

Subject code: MEQ100060W

* delete as applicable

	Lecture	Foreign language course	Seminar	Mixed forms
Number of hours of organized classes in university (ZZU)	30	-		
Grading	Exam	Exam	Oral presentation	Exam, inspection, evaluation classes
Number of ECTS points	0			

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knowledge of basics of mechanical engineering and technical mechanics.
2. Knowledge of basics of engineering statistics.
3. Knowledge of principles of measuring basic mechanical quantities in the working process of machines.

COURSE OBJECTIVES

- C1. Acquiring knowledge about the causes of degradation and damage to components and assemblies of machines.
- C2 Acquiring knowledge about the methods of assessing the technical condition of machines on the basis of diagnostic tests.
- C3. Acquiring skills in the use of acoustic and vibration techniques for condition monitoring of machinery.

PROGRAM CONTENTS

DOCTORAL SCHOOL OF WROCLAW UNIVERSITY OF SCIENCE AND TECHNOLOGY

Form of classes – lecture (Lec)		Number of hours
Lec1	Basic concepts and tasks of machine condition monitoring and fault diagnostics.	2
Lec2	Physical aspects of condition monitoring of machinery and fault diagnostics. Degradation processes. Causes and types of failure, classification and measures of damage.	2
Lec3	Technical conditions of machinery and diagnostic information carriers. Diagnostic signals and failure oriented symptoms.	2
Lec4	Basic equations of technical diagnostics. Methods of condition monitoring of machinery.	2
Lec5	Vibroacoustical condition monitoring of machinery – case studies.	3
Lec6	Condition monitoring of human engineering systems.	1
Lec7	Prediction of machinery reliability on the basis of diagnostic tests - case studies.	2
Total hours:		15

Form of classes – foreign language course (Lng)		Number of hours
Lng1		
Lng2		
Lng3		
..		
Total hours:		

Form of classes – seminar (Sem)		Number of hours
Sem1	Criteria for classifying boundary conditions of ability of machines according to standards and literature.	1
Sem2	Phenomena and characteristics of accompanying (residual) processes in machinery.	2
Sem3	Methods of analysis of diagnostic signals – numerical and functional discriminants.	2
Sem4	Condition monitoring of conveyors with use of acoustic and vibration techniques.	2
Sem5	Condition monitoring of hydraulic assemblies of machinery with use of acoustic and vibration techniques.	2
Total hours:		9

Form of classes – mixed forms (mix)		Number of hours
Mix1	Diagnosis of acoustic hazards in the working process of an impact acting machinery (on the example of a hydraulic hammer) - laboratory.	2
Mix2	Condition monitoring of rolling bearing with use of acoustic and vibration techniques - laboratory.	2
Mix3	Condition monitoring of gearboxes with use of acoustic and vibration techniques - laboratory.	2
Total hours		6

TEACHING TOOLS USED	
N1. Multimedia presentation.	
N2. Student work: preparing presentations for seminars.	

DOCTORAL SCHOOL OF WROCLAW UNIVERSITY OF SCIENCE AND TECHNOLOGY

N3. Student work: carrying out diagnostic experiments and preparing reports.

ACHIEVED SUBJECT LEARNING OUTCOMES		
Type of learning outcome	Code of learning outcome	Assessment of learning outcome
Knowledge	P8S_WG	Knowledge at an advanced level in the theoretical basis for assessing the technical condition of machines based on the analysis of diagnostic signals and symptoms.
Knowledge	P8S_WG	Knowledge at an advanced level in relation to diagnostic tests of machines and their typical components using vibroacoustic methods
Skills	P8S_UW	Ability to formulate goals, research hypotheses and diagnostic program for basic mechanical components of machines.
Skills	P8S_UW	Ability to creatively interpret the results of diagnostic tests of machines and their basic assemblies using vibroacoustic methods.
...		
Social competence		
Social competence		
...		

PRIMARY AND SECONDARY LITERATURE
<p><u>PRIMARY LITERATURE:</u></p> <p>[1] Cempel C.: Diagnostyka wibroakustyczna maszyn. PWN, Warszawa 1989.</p> <p>[2] Cempel C., Tomaszewski F. (red.): Diagnostyka maszyn. Zasady ogólne. Przykłady zastosowań. Wyd. Międzyresortowe Centrum Naukowe Eksploatacji Majątku Trwałego, Radom 1992.</p> <p>[3] Żółtowski B.: Podstawy diagnostyki maszyn. Wyd. Akademii Techniczno Rolniczej w Bydgoszczy, Bydgoszcz 1996</p> <p>[4] Żółtowski B., Cempel C. (red.): Inżynieria diagnostyki maszyn. Wyd. Polskie Towarzystwo Diagnostyki Technicznej, Warszawa, Bydgoszcz, Radom 2004</p> <p><u>SECONDARY LITERATURE:</u></p> <p>[1] Bartelmus W.: Diagnostyka maszyn górniczych. Górnictwo odkrywkowe. Wyd. Śląsk, Katowice 1998.</p> <p>[2] Niziński S.: Eksploatacja obiektów technicznych. Wyd. Instytut Technologii Eksploatacji, Warszawa Sulejówek Olsztyn Radom 2002.</p> <p>[3] Żółtowski B., Ćwik Z.: Leksykon diagnostyki technicznej. Wyd. Uczelniane Akademii Techniczno Rolniczej, Bydgoszcz 1996.</p> <p>[4] Sokolski M., Sokolski P.M.: The concept of a comparative assessment of the reliability of industrial gearboxes on the basis of diagnostic tests - a case study. W: Risk, reliability and safety : innovating theory and practice [Dokument elektroniczny] : proceedings of the 26th European Safety and Reliability Conference, ESREL 2016, Glasgow, Scotland, 25-29 September 2016 / eds. Lesley Walls, Matthew Revie, Tim Bedford. Boca Raton [i in.] : CRC Press/Balkema, cop. 2017. s. 2467-2471.</p> <p>[5] Sokolski P.M., Sokolski M.: Condition monitoring of an industrial bucket elevator for bulk materials. W: Proceedings IRF2018: 6th International Conference Integrity-Reliability-Failure Lisbon/Portugal 22-26 July 2018 [Dokument elektroniczny] / eds. J. F. Silva Gomes and S. A.</p>

**DOCTORAL SCHOOL OF WROCLAW UNIVERSITY OF SCIENCE AND
TECHNOLOGY**

- Meguid. Porto : INEGI/FEUP, 2018. s. 209-216.
- [6] Przystupa F., Sokolski M., Sokolski P.M.: Condition monitoring and diagnostics as important factors for increasing the reliability of machinery components - case study. W: Risk, reliability and safety : innovating theory and practice [Dokument elektroniczny] : proceedings of the 26th European Safety and Reliability Conference, ESREL 2016, Glasgow, Scotland, 25-29 September 2016 / eds. Lesley Walls, Matthew Revie, Tim Bedford. Boca Raton [i in.] : CRC Press/Balkema, cop. 2017. s. 2478-2481.

SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)

dr hab. inż. Marek Sokolski, prof. uczelni
marek.sokolski@pwr.edu.pl