

FACULTY OF ELECTRICAL
ENGINEERING**SUBJECT CARD**

Name in Polish: **Diagnostyka procesów przemysłowych**
 Name in English: **Diagnostics of industrial processes**
 Main field of study (if applicable): **Electrical Engineering**
 Specialization (if applicable): **Industrial Electrical Engineering**
 Level and form of studies: **2nd level, part-time**
 Kind of subject: **optional**
 Subject code: **ELR043271**
 Group of courses: **NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU):	22		11		
Number of hours of total student workload (CNPS):	54		27		
Form of crediting:	examination		crediting with grade		
For group of courses mark (X) final course:					
Number of ECTS points:	2		1		
including number of ECTS points for practical (P) classes :			1		
including number of ECTS points for direct teacher-student contact (BK) classes:	1.40		0.70		

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Has a basic knowledge of electrical engineering, knows the working rules of the basic types of electric machines.
2. Has a basic knowledge of electrical drives.
3. Has a basic knowledge of digital signal processing.
4. Able to correctly and effectively use knowledge of the construction and operation of electrical machines and drives.
5. Able to correctly apply the mathematical tools associated with digital signal processing.
6. Able to properly perform basic measurements of electrical and mechanical.

SUBJECT OBJECTIVES

- C1. Familiarizing students with topics of technical diagnostics of industrial plants.
 C2. Familiarizing students with the basic methods of monitoring and diagnostics of industrial processes and electrical drives.
 C3. Acquiring skills to qualitative understand and the interpretation of results of diagnostic
 C4. Acquisition of practical knowledge regarding the construction, operation and completion systems for monitoring and diagnosis of industrial facilities, in particular, complex drive systems.

SUBJECT EDUCATIONAL EFFECTS*relating to knowledge:*

- PEK_W01 Has knowledge of the basic methods for monitoring and diagnosis of industrial plants
 PEK_W02 Has knowledge of the basic methods of testing and fault detection of electrical machines and drives
 PEK_W03 Has matured knowledge of the measurement methods and signal processing used in the diagnosis

relating to skills:

- PEK_U01 Has skills associated with the detection of basic faults in industrial processes including electrical machines and drives.
 PEK_U02 Can choose the method and measuring equipment for monitoring industrial objects.

relating to social competences:

- PEK_K01 Understands the needs for team work on finding and improving the methods of problem solving.

PROGRAMME CONTENT		
Form of classes - lecture		Number of hours:
Lec 1	Introduction to technical diagnostics	2
Lec 2	Diagnostic signals and symptoms (classification, characteristics, techniques of digital estimation, filtering).	2
Lec 3	Indirect measurement of selected electrical and mechanical signals used in monitoring and diagnostics in industry	2
Lec 4	Thermal diagnostics of industrial facilities (temperature measuring, thermal testing, thermovision)	2
Lec 5	Monitoring and diagnosis of rotating machines	2
Lec 6	Monitoring and diagnostics of converters electric drives	2
Lec 7	Detection methods of industrial processes damage	2
Lec 8	Methods of industrial processes faults location	2
Lec 9	Mathematical models in the diagnosis process (observers and Kalman filter)	2
Lec 10	Artificial intelligence methods in the diagnosis process	2
Lec 11	Computer monitoring and diagnostic systems (construction and software). Review of industrial solutions	2
Total hours:		22

Form of classes - laboratory		Number of hours:
Lab 1	Introduction to the lab. Modern methods of recording electrical signals using LabVIEW and data acquisition card	2
Lab 2	Computer system for automatically testing and monitoring induction motor drive	2
Lab 3	Diagnosis of induction motors based on the stator current analysis	2
Lab 4	Diagnosis of induction motors based on the mechanical vibration analysis	2
Lab 5	Application of thermovision for thermal diagnostics of industrial objects	2
Lab 6	Monitoring of the dipped pumps	1
Total hours:		11

TEACHING TOOLS USED
N1. Multimedia lecture with elements of traditional and problematic lectures N2. Consultation N3. Written exam N4. Preparation to the laboratory exercises and testing of student knowledge N5. Implementation reports of the exercises

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT		
Evaluation <i>F - forming (during semester)</i> <i>P - concluding (at semester end)</i>	Educational effect number	Way of evaluating educational effect achievement
F1(W)	PEK_W01 PEK_W02 PEK_W03	Participation in lectures
F2(W)	PEK_W01 PEK_W02 PEK_W03	Written exam
P(W)	$P=0,2 \cdot F1 + 0,8 \cdot F2$	
F1(L)	PEK_U01 PEK_U02	Evaluation of preparations for the exercises
F2(L)	PEK_U01 PEK_U02 PEK_K01	Evaluation of reports of laboratory exercises
F3(L)	PEK_U01 PEK_U02 PEK_K01	Activity in laboratory
P(L)	$P=0,4 \cdot F1 + 0,4 \cdot F2 + 0,2 \cdot F3$	

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

- [1] Kowalski C.T., Diagnostyka układów napędowych z silnikiem indukcyjnym z zastosowaniem metod sztucznej inteligencji, Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2013
- [2] Kowalski C.T., Monitorowanie i diagnostyka uszkodzeń silników indukcyjnych wykorzystaniem sieci neuronowych, Prace Naukowe Instytutu Maszyn, Napędów i Pomiarów Elektrycznych, nr57, Wrocław 2005
- [3]] Korbicz J. i inni (edytorzy), Diagnostyka procesów. Modele, metody sztucznej inteligencji, zastosowania, WNT Warszawa, 2002
- [4] Kościelny M.J., Diagnostyka zautomatyzowanych procesów przemysłowych, Akademicka Oficyna Wyd. EXIT, Warszawa 2001
- [5] Glinka T., Badania diagnostyczne maszyn elektrycznych w przemyśle, Komel, Katowice 2000

SECONDARY LITERATURE:

- [1] Vas P., Parameter estimation, condition monitoring and diagnosis of electrical machines, Clarendon Press, Oxford 1993

SUBJECT SUPERVISOR

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT ELR043271 - Diagnostics of industrial processes AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **Electrical Engineering** AND SPECIALIZATION **Industrial Electrical Engineering**

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)	Subject objectives	Programme content	Teaching tool number
PEK_W01	S2ETP_W11	C.1 C.2	Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7 Lec8 Lec9 Lec10 Lec11	N.1 N.2 N.3
PEK_W02	S2ETP_W11	C.1 C.2	Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7 Lec8 Lec9 Lec10 Lec11	N.1 N.2 N.3
PEK_W03	S2ETP_W11	C.1 C.2	Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7 Lec8 Lec9 Lec10 Lec11	N.1 N.2 N.3
PEK_U01	S2ETP_U09	C.3 C.4	Lab1 Lab2 Lab3 Lab4 Lab5 Lab6	N.4 N.5
PEK_U02	S2ETP_U09	C.3 C.4	Lab1 Lab2 Lab3 Lab4 Lab5 Lab6	N.4 N.5
PEK_K01	K2ETK_K07	C.3 C.4	Lab1 Lab2 Lab3 Lab4 Lab5 Lab6	N.4 N.5