

## DESCRIPTION OF THE COURSES

- Course code: ARR 3216
- Course title: **MONITORING AND DIAGNOSIS SYSTEMS IN THE INDUSTRY**
- Language of the lecturer: English

| <i>Course form</i>                     | <i>Lecture</i>     | <i>Classes</i> | <i>Laboratory</i> | <i>Project</i> | <i>Seminar</i> |
|--|--------------------|----------------|-------------------|----------------|----------------|
| <i>Number of hours/week*</i>           | 2                  |                | 1                 |                |                |
| <i>Number of hours/semester*</i>       | 30                 |                | 15                |                |                |
| <i>Form of the course completion</i>   | <i>examination</i> |                | <i>credit</i>     |                |                |
| <i>ECTS credits</i>                    | 3                  |                | 1                 |                |                |
| <b><i>Total Student's Workload</i></b> | <b>90</b>          |                | <b>30</b>         |                |                |

- Level of the course (basic/advanced): advanced
- Prerequisites:
- Name, first name and degree of the lecturer: Czesław T. Kowalski, dr hab. inż.
- Names, first names and degrees of the team's members: dr inż. Krzysztof Dyrz, dr inż. Marcin Pawlak
- Year:.....3..... Semester:.....6.....
- Type of the course (obligatory/optional): obligatory
- Aims of the course (effects of the course):
- Form of the teaching (traditional/e-learning):
- Course description: Introduction to technical diagnostics. Sources of diagnostic information, logistic and economical aspects of technical diagnostics. Monitoring and diagnostics – basic definitions. Diagnostic signals and symptoms (classification, features, techniques of digital estimation, filtration). Indirect measurements of chosen electrical and mechanical values used in monitoring and diagnostics in the industry. Thermal and vibration diagnostics. Diagnostics of electrical machines. Fault detection and localization methods of industrial processes. Application of neural network and fuzzy logic in diagnostics. Computer monitoring and diagnostics systems (structure and software). Overview of professional solutions. SCADA monitoring systems for industrial applications. Overview of solutions.
- Lecture:

| <i>Particular lectures contents</i>  | <i>Number of hours</i> |
|--|------------------------|
| 1. Introduction to technical diagnostics. Sources of diagnostic information, logistic and economical aspects of technical diagnostics. Monitoring and diagnostics – basic definitions. | 2                      |
| 2. Diagnostic signals and symptoms (classification, features, techniques of digital estimation, filtration)  | 2                      |
| 3. Indirect measurements of chosen electrical and mechanical values used in monitoring and diagnostics in the industry.  | 2                      |
| 4. Thermal diagnostics.  | 2                      |
| 5. Vibro-acoustic diagnostics.   | 2                      |
| 6. Diagnostics of electrical machines.   | 2                      |
| 7. Fault detection methods of industrial processes.  | 2                      |

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| 8. Fault localization of industrial processes.   | 2 |
| 9. Mathematical models in process diagnosis.   | 2 |
| 10. Artificial neural networks in diagnosis systems.   | 2 |
| 11. Application of fuzzy logic in diagnostics.   | 2 |
| 12. Expert systems in technical diagnostics.   | 2 |
| 13. Computer monitoring and diagnostics systems (structure and software).<br>Overview of professional solutions. | 3 |
| 14. SCADA monitoring systems for industrial applications. Overview of solutions.                                 | 2 |

- Classes – the contents:

- Seminars – the contents:

- Laboratory – the contents:

1. Monitoring system for transient processes of induction motor.
2. Automatic monitoring and diagnostic system for converter-fed induction motor drive.
3. Thermal diagnostics and testing of high voltage induction motors in the industrial conditions (video film).
4. Industrial diagnostics of induction motors based on stator current analysis.
5. Industrial diagnostics of induction motors based on mechanical vibrations analysis.
6. Industrial diagnostics of induction motors based on axial flux analysis.
7. Application of LabVIEW environment for monitoring and diagnostic systems

- Project – the contents:

- Basic literature:

1. Cempel C., Tomaszewski F. (edytorzy), *Diagnostyka maszyn. Zasady ogólne, przykłady zastosowań*, MCNEMT Radom 1992
2. Glinka T., *Badania diagnostyczne maszyn elektrycznych w przemyśle*, Komel, Katowice 2000
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. Kowalski Cz. T., *Monitorowanie i diagnostyka uszkodzeń silników indukcyjnych z wykorzystaniem sieci neuronowych*, Oficyna Wydawnicza Politechniki Wrocławskiej, 2005r.

- Additional literature:

1. Basztura C., *Komputerowe systemy diagnostyki akustycznej*, PWN 1996
2. Vas P., *Parameter estimation, condition monitoring and diagnosis of electrical machines*, Clarendon Press, Oxford 1993

- Conditions of the course acceptance/creditation: lecture – examination, laboratory - credit

\* - depending on a system of studies