COURSE TITLE: **Methods for Monitoring and Diagnostics of Electrical Machines**
Institute/Division: Faculty of Electrical and Computer Engineering/E2
Number of contact hours: 45 (15h lectures, 25h laboratory, 5h project)
Course duration: 1 semester
ETCS credits: 6

1. Objectives of the course

Objective 1: Overview of the monitoring and diagnosis problems in case of electrical machines and devices.
Objective 2: Identifying the most common problems which occure while monitoring and diagnosing electrical machines and devices .
Objective 3: Understanding selected methods of monitoring and diagnosing electrical machines and devices.
Objective 4: Studying tools and devices for monitoring and diagnosing electrical machines and devices.
Objective 5: Overview of the latest trends in the monitoring and diagnosis of electrical machines and devices.

2. Prerequisites in terms of knowledge, skills and other competencies

1. Knowledge of the course in physics, mathematics and informatics.
2. Basic skills in signal processing.
3. Fundamental knowledge of basic electrical engineering, electrical machines and devices.
4. Ability to use software supporting the process of monitoring, collecting and data processing data (Matlab, LabView).

3. Education effects

EK1 Skills: Knowledge of selected issues related to monitoring and diagnosis of electrical machines and devices.
EK2 Skills: Knowledge of methods for monitoring and diagnosing electrical machines and devices.
EK3 Skills: Ability to select the appropriate method to diagnose machines and electrical devices condition.
EK4 Skills: Ability of performing analyzes usefull for the development of diagnostic methods and algorithms for electrical machines and devices .
EK5 Skills: Competence in solving complex tasks related to monitoring and diagnosis of electrical machines and drives, planning the testing process and running diagnostic systems. .

4. Course contents

The content of lectures and laboratory classes:

Lectures:

Basic issues of technical diagnostics of electrical machines and drives.
Basic goals and tasks of technical diagnostics of electrical machines and drives.
Computer methods for diagnosing electrical power systems.
Issues of analysis and synthesis of the condition of electrical machines and drives.
Modeling machines and drives for diagnosis of their condition.
Description of machines and drives using different types of models.
Determination and classification of working conditions of diagnosed electrical machines and drives.
Determination of permissible limit conditions in exploitation.
Creating diagnostic patterns for a comprehensive assessment of the electrical machinmes and drives condition.
Vibroacoustic diagnostics of machines.
Sensors used for monitoring and diagnostics of electrical machines and drives.
Devices and accessories used to acquire measurement data.
Methods of processing diagnostic signals.

Extraction methods of relevant characteristics for diagnostic assessment of objects condition.

Transformations, transformations, and search options: FFT, PCA, continuous wavelet transform used in diagnostic signal processing.

Application of artificial intelligence methods to diagnose the condition of electrical machines and drives.
Structure of diagnostic systems where one can use artificial intelligence methods.
Characteristics of professional diagnostic systems of machines and devices used in power engineering.
Database systems for monitoring and diagnostics of electrical machines and drives.

Laboratory:

Diagnosis of the state of the induction motor cage basing on the current spectrum, momentary power analysis, spatial vector and axial flow.
Diagnosis of the state of rolling bearings in rotating machines.
Vibroacoustic diagnostics of machines.
Programming of data acquisition circuits - LabVIEW, Matlab.
Diagnosis of machines and devices using neural networks, pattern recognition and fuzzy logic.

5. Teaching Tools

Lectures, computer laboratory, multimedia presentations, practical exercises, individual project, consultation.

6. Assessment method: Laboratory exercises and project.

7. List of references:

1. Peter Tavner,Li Ran,Jim Penman and Howard Sedding: Condition Monitoring of Rotating Electrical Machines.London 2008.
2. Hamid A. Toliyat,Subhasis Nandi,Seungdeog Choi,Homayoun Meshgin-Kelk: Electric Machines: Modeling, Condition Monitoring, and Fault Diagnosis. CRC Press Taylor & Francis Group, 2013.

8. Information about academic teachers

The person responsible for the card:

dr inż. Maciej Sułowicz (contact: msulowicz@pk.edu.pl)

Persons engaged in the subject:

dr inż. Janusz Petryna (contact: jpetryna@pk.edu.pl)

dr inż. Maciej Sułowicz (contact: msulowicz@pk.edu.pl)