COURSE DESCRIPTION CARD - SYLLABUS

Course name
Monitoring in the electric power system [S2Elenerg1-ISD>MwSE]

Course

Field of study
Electrical Power Engineering

Year/Semester
2/3

Area of study (specialization)
Smart Grids

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
15

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

The student has knowledge of mathematics and numerical methods necessary for the synthesis of models and power systems. Student has knowledge of the theory of signal processing and telecommunications used in the power industry and the construction of information systems. Student has knowledge of the construction and operation of measuring equipment and measuring techniques used in the power industry. Student is able to use computer simulations and telecommunications tools to analyze and evaluate the phenomena occurring in the power system.

Course objective

Presentation of the construction and areas of application of supervision and monitoring systems in the power industry. Review of data processing methods in power engineering expert systems: artificial neural networks, evolutionary algorithms and fuzzy logic. Presentation of selected monitoring and supervision systems with built-in expert functions. Basics of programming the software layer of monitoring systems.

Course-related learning outcomes

Knowledge:
1. student has detailed knowledge of the construction of monitoring systems used in the power system

2. student has an extended knowledge of the processing, acquisition and visualization of measurement data
3. student has detailed knowledge of the integration of sensors and measuring transducers with the scada monitoring system

Skills:
1. the student is able to process, visualize and correctly interpret the measurement data recorded by the monitoring system
2. the student is able to use selected it tools to develop elements of the programming layer of the monitoring system
3. the student is able to use the monitoring system for diagnostics of electric power devices and accessories

Social competences:
1. the student is aware of the role of the systems for monitoring the operating condition of electric power equipment and transmission networks in ensuring the continuity of electricity supply to industry and the population.
2. the student is aware of the scale of threats and the impact of the consequences of failure of electrical power equipment on the natural environment.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Lecture: written test
Laboratories: exercise report; computer application

Programme content

The issues covered will include monitoring of power equipment, monitoring of power stations and monitoring of the power system.

Course topics

Lecture
1. Hardware architecture of individual modules of the monitoring system used in the power industry (communication controllers, signal concentrators, object/field controllers, server of the monitoring system and databases for operating operator stations, operator stations, real-time servers, devices implementing communication such as protocol converters, switches, routers, multiplexers, etc.)
2. Review of monitoring systems and their expert functions intended for monitoring transmission and distribution lines, substations, power plants and key devices of the el-en system (transformers, generators, switchgears) and review of systems for energy quality assessment
3. Methods of processing and visualization of measurement data recorded by the monitoring system
4. Review of software for creating the program layer of supervision and monitoring systems

Laboratories
1. Online monitoring system of a power transformer
2. Power system monitoring system
3. Creating control and supervision applications using the LabVIEW environment

Teaching methods

Lecture: multimedia presentation supplemented with examples given on the blackboard. Theory presented in close connection with practice
Laboratories: laboratory exercises carried out in groups, configuration and operation of monitoring systems, computer exercises related to the programming of supervision and monitoring systems and the analysis of measurement data

Bibliography

Basic

1. Bień A., Systemy pomiarowe stosowane w elektroenergetyce, Wydawnictwa AGH, 2013
2. Helt P., Parol M., Piotrowski P., Metody sztucznej inteligencji: przykłady zastosowań w elektroenergetyce, Oficyna Wydawnicza Politechniki Warszawskiej, 2012
3. Owoc M., Elementy systemów ekspertowych. Część I: Sztuczna inteligencja i systemy ekspertowe, Wydawnictwo Akademii Ekonomicznej im. Oskara Langego we Wrocławiu, 2006
4. Wakulicz-Deja A., Nowak-Brzezińska A., Systemy ekspertowe, Akademicka Oficyna Wydawnicza EXIT, 2018
5. Chruściel M., LabVIEW w praktyce, Wydawnictwo BTC, 2008
6. Świsulski D., Komputerowa technika pomiarowa: oprogramowanie wirtualnych przyrządów pomiarowych w LabVIEW, Wydawnictwo Politechniki Gdańskiej, 2005
Additional
1. Lisowiec A., Nowakowski A., Wlazło P., Teleinformatyczny system e-diagnozowania i testowania w sieciach rozdzielczych SN, Instytut Tele- i Radiotechniczny, Warszawa, 2015
2. Duer S., Wrzesień P., Ekspertowa baza wiedzy wspomagająca diagnozowanie urządzeń farmy wiatrowej, Wydawnictwo Uczelnianie Politechniki Koszalińskiej, 2017
3. Sikorski, W.; Walczak, K.; Gil, W.; Szymczak, C. On-Line Partial Discharge Monitoring System for Power Transformers Based on the Simultaneous Detection of High Frequency, Ultra-High Frequency, and Acoustic Emission Signals. Energies 2020, 13, 3271. https://doi.org/10.3390/en13123271
4. LabVIEW Datalogging and Supervisory Control Module Developer’s Manual, 2001

Breakdown of average student's workload

	Hours	ECTS
Total workload	55	2,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	25	1,00