COURSE DESCRIPTION CARD - SYLLABUS

Course name

Measurement systems in power engineering

Course

Field of study

Power Engineering

Year/Semester

4 / 8

Area of study (specialization)

Sustainable Development of Power Engineering

Profile of study

general academic

Level of study

First-cycle studies

Course offered in

polish

Form of study

part-time

Requirements

elective

Number of hours

Lecture

20

Laboratory classes

10

Other (e.g. online)

Tutorials

Projects/seminars

Number of credit points

3

Lecturers

Responsible for the course/lecturer:

Grzegorz Wiczyński D.Sc. Eng.

email: grzegorz.wiczynski@put.poznan.pl

tel. 61 6652639

Faculty of Automatic, Robotics and Electrical Engineering

Piotrowo 3 Street, 60-965 Poznań

Responsible for the course/lecturer:

Prerequisites

Basic knowledge of mathematics, physics, electrical engineering. Ability to perform measurements of basic electrical quantities. Ability to properly interpret the results of measurements and calculations. Awarness of the need to expand their competences and is ready to cooperate as part of a team.

Course objective

Knowledge of the modern techniques of acquisition, processing and evaluation of measurement data in the power grids. Understanding the basic issues of assessment of power quality.

Course-related learning outcomes

Knowledge

1. Knowledge and understanding of the principles of correct operation of energy machinery and equipment

2. Knowledge in the field of power equipment diagnostics, Knowledge and understanding of the measurement methods of basic quantities characterizing electrical devices and systems; knowledge of the calculation methods and IT tools necessary to analyze the results of experiments.

3. Knowledge of the basic principles of organizing and conducting research in the field of power energy problems and presenting the results of his work.

Skills

1. Ability to plan and carry out experiments, including measurements, as well as construct an algorithm and use properly selected programming environments.

2. Ability to use properly selected methods and devices enabling measurement of basic quantities characterizing energy elements and systems.

3. Ability to present the results obtained in numerical and graphic form, make inferences and interpretations.

Social competences

Awareness of the importance of professional behavior, compliance with professional ethics and the requirement of it from others.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lectures

Evaluation of the knowledge with a written exam related to the content of lectures (test, computational and problem questions). Passing threshold of test equals 50%.

The grade from laboratory and project classes as well as attendance and activities during the lectures are taken into account.

Laboratory

Assessment of knowledge and skills necessary to carry out the laboratory exercise. Assessmeny of the activity and quality of perception during the laboratory exercise. Evaluation of the reports of the exercises performed. Final test in written (passing threshold 50%).

Project

Assessment of skills acquired during project classes on the basis of an implemented project and completed simple electronic measurement system.

Programme content

Lectures

Planning and implementation of the measurement task. Elements of error theory and uncertainty of measurement results. Measuring transducer: processing characteristics, static and dynamic properties, linearity, power supply. Compatibility of the measuring transducer with the meter - signal transmission, mutual interaction. Measurement of electrical signals using an analog and digital oscilloscope. Analog and digital measurements of electrical quantities. Measurements of non-electrical quantities. Introduction to the structure and organization of measuring systems. Preparation of documentation from the obtained measurement results. Thermovision - basics, diagnostics of electrical and power systems. Assessment of power quality in power grids.

Laboratory

Basic quantities describing the state of power grids. Voltage, current and power measurement. Metrological and operational properties and testing of modern measurement equipment. Thermovision temperature measurements. Flickermeter - basics, construction and application. Examples of electricity quality analyzers. Assessment of electricity quality based on measurement results recorded in power networks. Measurement unaccuracy of quantities describing the state of power grids.

Teaching methods

Lectures

Lectures are performed using multimedia presentations illustrated with simulation examples and necessary mathematical calculations on the blackboard. Theoretical questions are presented in the exact reference to the practice.

Laboratory

Laboratory exercises are carried out in laboratory teams. During the classes, the measuring system is connected, the selected measurements are carried out, the results of the measurements and the reports are prepared.

Project

Multimedia presentations with examples given on the blackboard and implementation of the selected project of the measurement system.

Bibliography

Basic

1. D. Zmarzły, Badania jakości energii w wybranej farmie wiatrowej, Wyd. PO, Opole, 2014.

2. Z. Hanzelka, Jakość dostawy energii elektrycznej. Zaburzenia wartości skutecznej napięcia, Wyd. AGH, Kraków, 2013.

3. T. Sikorski, Monitoring i ocena jakości energii w sieciach elektroenergetycznych z udziałem generacji rozproszonej, Wyd. PWr, Wrocław, 2013.

4. B. Więcek, G. De Mey, Termowizja w podczerwieni: podstawy i zastosowania, Wyd. PAK, 2011.

5. A. Cysewska-Sobusiak, Podstawy metrologii i inżynierii pomiarowej, Wyd. PP, Poznań, 2010.

6. G. Wiczyński, Badanie wahań napięcia w sieciach elektrycznych, Wyd. PP, Poznań, 2010.

7. T.Tarasiuk, Ocena jakości energii elektrycznej w okrętowych systemach elektroenergetycznych z wykorzystaniem procesorów sygnałowych, Wyd. AM, Gdynia, 2009.

8. S. Bolkowski, Elektrotechnika, WSiP, Warszawa, 2009.

9. U. Tietze, Ch. Schenk, Układy półprzewodnikowe, WNT, Warszawa, 2009.

10. J. Rydzewski, Pomiary oscyloskopowe, WNT, Warszawa, 2007

11. Z. Kowalski, Jakość energii elektrycznej , Wyd. PŁ, Łódź, 2007.

12. P. Sydenham (red.), tłum. ang. red. J. Dudziewicz, Podręcznik metrologii, t.1: Podstawy teoretyczne, t. 2: Podstawy praktyczne, WKiŁ, Warszawa, 1988-1990.

13. Z. Kowalski, Wahania napięcia w układach elektroenergetycznych, WNT, Warszawa, 1985.

14. E. Romer, Miernictwo przemysłowe, PWN, Warszawa, 1978.

15. G. Rudowski, Termowizja i jej zastosowanie, WNT, Warszawa, 1978.

16. Normy dotyczące kompatybilności elektromagnetycznej: PN-EN 50160, PN-EN 61000-4-30, PN-EN 61000-4-15, PN-EN 61000-4-7.

17. Rozporządzenie Ministra Gospodarki z 4 maja 2007 r. w sprawie szczegółowych warunków funkcjonowania systemu elektroenergetycznego. (Dz.U. Nr 93, poz. 623, z dnia 29 maja 2007 r.).

Additional

18. A. Chwaleba, M. Poniński, A. Siedlecki, Metrologia elektryczna, WNT, Warszawa, 2014.

19. S. Tumański, Technika pomiarowa, WNT, Warszawa, 2013.

20. P. Horowitz, W. Hill Sztuka elektroniki. Cz. 1 i 2, WKiŁ. Warszawa, 2013.

21. W. Gawędzki, Pomiary elektryczne wielkości nieelektrycznych, Wyd. AGH, Kraków, 2010.

22. W. Nawrocki, Sensory i systemy pomiarowe, Wyd. PP, Poznań, 2006.

23. M. Rząsa, B. Kiczma, Elektryczne i elektroniczne czujniki temperatury, WKiŁ, Warszawa, 2005.

24. A. Bień, Metrologia jakości energii elektrycznej w obszarze niskoczęstotliwościowych zaburzeń napięcia sieci, Wyd. AGH, Kraków, 2003.

25. J. Szabatin, Podstawy teorii sygnałów, WKiŁ, Warszawa 2003.

26. D.A. Weston, Electromagnetic compatibility: principles and applications, Marcel Dekker, 2001.

27. T.W. Więckowski, Badania kompatybilności elektromagnetycznej urządzeń elektrycznych i elektronicznych, Wyd. PWr, Wrocław, 2001.

28. R. Schaumann, Van Valkenburg, E. Mac, Design of analog filters, Oxford University Press, 2001.

29. J. Godlewski, Generacja i detekcja promieniowania optycznego, PWN, Warszawa, 1997.

30. Laboratorium z metrologii elektrycznej i elektronicznej, praca zbiorowa pod red. D. Turzenieckiej, Wyd. PP, Poznań, 1996.

31. L. Hasse, Zakłócenia w aparaturze elektronicznej, Radioelektronik, Warszawa,1995.

32. L. Michalski, K. Eckersdorf, Pomiary temperatury, WNT, Warszawa, 1986.

Breakdown of average student's workload

	Hours	ECTS
Total workload	77	3,0
Classes requiring direct contact with the teacher	33	1,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	44	2,0

[1] delete or add other activities as appropriate