

FACULTY OF ELECTRICAL
ENGINEERING**SUBJECT CARD**

Name in Polish: **Jakość energii elektrycznej**
 Name in English: **Power Quality**
 Main field of study (if applicable): **Electrical Engineering**
 Specialization (if applicable):
 Level and form of studies: **1st level, full-time**
 Kind of subject: **optional**
 Subject code: **ELR043305**
 Group of courses: **NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU):	30				
Number of hours of total student workload (CNPS):	90				
Form of crediting:	crediting with grade				
For group of courses mark (X) final course:					
Number of ECTS points:	3				
including number of ECTS points for practical (P) classes :					
including number of ECTS points for direct teacher-student contact (BK) classes:	2.10				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Have basic knowledge in the field of linear circuits with sinusoidal waveforms. He knows the rules for creating circuit models and their mathematical description.
2. He has knowledge in the analysis of transients in linear electric circuits. He has knowledge of the macroscopic electromagnetic field approach.
3. He has a basic knowledge of metrology and measurement units, knows basic metrological characteristics of measuring instruments,
He or she is able to do basic measurements of electrical devices using analog and digital oscilloscope. Can set on the basis of measurements of nonlinear characteristics of the elements. Able to present the results in the form of numerical tables and graphics to make their interpretations and draw conclusions
- 4.

SUBJECT OBJECTIVES

- C1. Understanding the concepts of electromagnetic compatibility
 C2. Understanding the principles of interaction between the elements of the power system
 C3. Knowledge of voltage quality parameters, evaluation of the impact of power quality on loads and the impact on the quality of the loads
 C4. Knowing regulations and standardization of components which improve power quality
 C5. Acquisition and consolidation of social skills including emotional intelligence skills involving the cooperation of a group of students with a view to effective problem solving. Responsibility, honesty and fairness in the procedure observance force in academia and society

SUBJECT EDUCATIONAL EFFECTS*relating to knowledge:*

- PEK_W01 He or she knows the key concepts in the field of electromagnetic compatibility. He or she has extensive knowledge in the field of power quality
 PEK_W02 He knows the power requirements of the law and regulations relating to electromagnetic compatibility standards - in particular the power quality.
 PEK_W03 He or she has knowledge of the location and control the interference sources and their affect on the device. and knows the methods of overvoltage protection. He knows methods to improve the power quality and ways to reduce disturbances

*relating to skills:**relating to social competences:*

- PEK_K01 He or she is aware of their own responsibility for their work. Properly identifies and resolves the dilemmas of working in the profession.

PROGRAMME CONTENT

Form of classes - lecture		Number of hours:
Lec 1	Electromagnetic Compatibility. Power quality parameters	2
Lec 2	Definitions of parameters determining the power quality - the conditions of measurement, presentation the impact of the distortion on electric loads	2
Lec 3	Power quality standards	2
Lec 4	Power theory in nonsinusoidal waveforms of current and voltage	2
Lec 5	Sources and external parameters of electromagnetic interference. Lightning as a source of interference, Elements lightning protection, the basic parameters of the varistor, varistor assembly rules	2
Lec 6	Voltage variation. Long and short term flicker	2
Lec 7	Methods of reducing the voltage distortion - examples	2
Lec 8	Measurement methods of harmonics and interharmonics	2
Lec 9	Shielding. The effectiveness of shielding against electromagnetic interference and electrical. Shielding low-frequency magnetic fields, the materials for the construction	2
Lec 10	Harmonic filters. Examples of calculating analysis of the effectiveness of filters.	2
Lec 11	Electric energy losses due to voltage distortion	2
Lec 12	Methods of immunity test of electric loads	2
Lec 13	Measurement of disturbances emission	2
Lec 14	Electromagnetic Compatibility in radio frequency range. Electrostatic discharge (ESD) Fast transients (BURST) and high - energy surges (SURGE)	2
Lec 15	Final test	2
Total hours:		30

TEACHING TOOLS USED

N1. Traditional Lecture with audio-visual techniques

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT

Evaluation <i>F - forming (during semester) P - concluding (at semester end)</i>	Educational effect number	Way of evaluating educational effect achievement
F1(w)	PEK_W01 PEK_W02 PEK_W03 PEK_K01	test
P(w)	P=F1	

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

- [1] Kowalski Z., Jakość energii elektrycznej, Wydawnictwo Politechniki Łódzkiej, Łódź 2007
- [2] Baggini A., Handbook of Power Quality, John Wiley&Sons, Ltd, 2008
- [3] PN-EN 50160:2010, Voltage Characteristics in Public Distribution Systems
- [4] Rozporządzenie Ministra Gospodarki w sprawie szczegółowych warunków funkcjonowania systemu elektroenergetycznego. Dz. U. Nr 93 z dn. 04.05.2007r
- [5] Henry W. Ott, Electromagnetic Compatibility Engineering, John Wiley & Sons, Inc., Hoboken, New Jersey 2009
- [6] Hanzelka Zb., Jakość dostaw energii elektrycznej. Zaburzenia wartości skutecznej napięcia . Wyd. AGH , Kraków 2013

SECONDARY LITERATURE:

- [1] IEEE Std 1159-2009: IEEE Recommended Practice for Monitoring Electric Power Quality
- [2] Dugan R.C., Mc Gramaghan M.F., Beaty H. W., Santoso S: Electrical Power System Quality, Wyd 2. MC Graw-Hill 2002
- [3] Machczyński W., Wprowadzenie do kompatybilności elektromagnetycznej. Wydawnictwo Politechniki Poznańskiej 2010

SUBJECT SUPERVISOR

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
ELR043305 - Power Quality
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **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	K1ETK_ETP_W02	C.1 C.2 C.3 C.4	Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7 Lec8 Lec9 Lec10 Lec11 Lec12 Lec13 Lec14	N.1
PEK_W02	K1ETK_ETP_W02	C.1 C.2 C.3 C.4	Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7 Lec8 Lec9 Lec10 Lec11 Lec12 Lec13 Lec14	N.1
PEK_W03	K1ETK_ETP_W02	C.1 C.2 C.3 C.4	Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7 Lec8 Lec9 Lec10 Lec11 Lec12 Lec13 Lec14	N.1
PEK_K01	K1ETK_K05	C.5	Lec15	N.1