

FACULTY OF ELECTRICAL  
ENGINEERING**SUBJECT CARD**

Name in Polish: **Inteligentne systemy pomiarowe**  
 Name in English: **Smart Metering**  
 Main field of study (if applicable): **Control Engineering and Robotics**  
 Specialization (if applicable):  
 Level and form of studies: **1st level, full-time**  
 Kind of subject: **optional**  
 Subject code: **ARR042504**  
 Group of courses: **NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU):	30		15		
Number of hours of total student workload (CNPS):	30		30		
Form of crediting:	crediting with grade		crediting with grade		
For group of courses mark (X) final course:					
Number of ECTS points:	1		1		
including number of ECTS points for practical (P) classes :			1		
including number of ECTS points for direct teacher-student contact (BK) classes:	0.70		0.70		

**PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES**

1. The student has mastered a basic knowledge on electrical engineering (active and reactive power, active and reactive energy, power compensation, power factor, voltage, current).
2. The student can properly and effectively apply the principles and laws of physics in the qualitative and quantitative analysis of physical aspects of engineering

**SUBJECT OBJECTIVES**

- C1. To acquaint students with the knowledge of smart metering.  
 C2. To acquaint students with the knowledge of automation and computerization of the power sector.  
 C3. The acquisition by the student practical knowledge in the field of cyber security smart grids.

**SUBJECT EDUCATIONAL EFFECTS***relating to knowledge:*

- PEK\_W01 The student has knowledge on the direction of computerization of the electricity sector and new technologies in this field.  
 PEK\_W02 He has knowledge of the measurement data management.  
 PEK\_W03 He knows the different concepts, solutions and the promoted visions of smart grids.

*relating to skills:*

- PEK\_U01 Student is able to properly configure the smart energy meter.  
 PEK\_U02 Student is able to correctly interpret the volatility of energy generation by renewable energy sources.

*relating to social competences:*

- PEK\_K01 He understands and knows the need for continuous training opportunities and improves their professional competence.

## PROGRAMME CONTENT

Form of classes - lecture		Number of hours:
Lec 1	Introduction to subject, performance requirements and methods of assessment, description of the structure of the power sector in Poland, the presentation of legislative changes, the definition of basic concepts.	2
Lec 2	Power system: definition, basic concepts and physical phenomena, loss of energy, power quality, ancillary services,	2
Lec 3	Demand Side Management.	2
Lec 4	Distributed generation, renewable energy sources, energy storages, micro-grids, net metering, integration of distributed generation into electricity distribution networks.	2
Lec 5	An introduction to smart power grids: definition, characteristics, structure, vision; prosumer.	2
Lec 6	Smart metering: advanced metering infrastructure, head-end system and meter data management system	2
Lec 7	Smart metering: communication technologies and Home Area Network	2
Lec 8	Data Management	2
Lec 9	Advanced Distribution Operation	2
Lec 10	Advanced Transmission Operation	2
Lec 11	Advanced Asset Management	2
Lec 12	Smart substation	2
Lec 13	Smart Grid Cyber Security	2
Lec 14	Owner of measurement data, privacy	2
Lec 15	Supergrids, colloquium	2
Total hours:		<b>30</b>

Form of classes - laboratory		Number of hours:
Lab 1	Introduction	1
Lab 2	Study of the impact of impact of solar energy on electricity grids	2
Lab 3	Estimating the cost-effectiveness of installing solar cells	2
Lab 4	Determining the impact of mass usage of solar cells on the maximum load in national power grid	2
Lab 5	The choice of tariff and energy supplier to the nature of the load	2
Lab 6	Analysis of the cooperation of system reading with energy meters	2
Lab 7	Configuration and testing of the meter smart.	2
Lab 8	Summary,	2
Total hours:		<b>15</b>

## TEACHING TOOLS USED

- N1. Informative lecture  
 N2. Multimedia presentations  
 N3. A laboratory sessions conducted in the traditional manner (student groups + exercises)

## EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT

Evaluation <i>F - forming (during semester)</i> <i>P - concluding (at semester end)</i>	Educational effect number	Way of evaluating educational effect achievement
F1(W)	PEK_W01 PEK_W02 PEK_W03	Written and / or oral test
P(W)	P=F1	
F1(L)	PEK_U01 PEK_U02	Activity in lab sessions
F2(L)	PEK_U01 PEK_U02 PEK_K01	Evaluation of laboratory exercises reports
P(L)	P = 0,4F1 + 0,6F2	

## PRIMARY AND SECONDARY LITERATURE

### PRIMARY LITERATURE:

[1] Billewicz K. – Smart Metering. Inteligentny system pomiarowy, Warszawa, Wydawnictwo Naukowe PWN 2011

### SECONDARY LITERATURE:

## SUBJECT SUPERVISOR

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### MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT ARR042504 - Smart Metering AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **Control Engineering and Robotics**

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	K1AIR_ASE_W05	C.1 C.2 C.3	Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7 Lec9 Lec10 Lec11 Lec12 Lec13 Lec14 Lec15	N.1 N.2
PEK_W02	K1AIR_ASE_W05	C.1 C.2 C.3	Lec6 Lec8 Lec11	N.1 N.2
PEK_W03	K1AIR_ASE_W05	C.1 C.2	Lec4 Lec5 Lec6 Lec7 Lec9 Lec10 Lec11 Lec12 Lec13 Lec14 Lec15	N.1 N.2
PEK_U01	K1AIR_ASE_U05	C.1 C.2	Lab6 Lab7	N.3
PEK_U02	K1AIR_ASE_U05	C.2	Lab2 Lab3 Lab4 Lab5	N.3
PEK_K01	K1AIR_K01	C.1 C.2 C.3	Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7 Lec8 Lec9 Lec10 Lec11 Lec12 Lec13 Lec14 Lec15 Lab1 Lab2 Lab3 Lab4 Lab5 Lab6 Lab7 Lab8	N.1 N.2 N.3