

FACULTY OF ELECTRICAL  
ENGINEERING**SUBJECT CARD**

Name in Polish: **Maszyny elektryczne 1**  
 Name in English: **Electrical machines 1**  
 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: **obligatory**  
 Subject code: **ARR043102**  
 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:	examination				
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. Has a basic knowledge of the theory of DC and AC electrical circuits.
2. Knows and understands the methods used in the linear circuits analysis at steady states.
3. Can appropriately apply the knowledge of the DC and AC linear electrical circuits at steady states for their analysis.

**SUBJECT OBJECTIVES**

- C1. To familiarize the students with the basic knowledge needed to understand the physical phenomena in electrical machines and transformers.
- C2. To familiarize the students with the physical phenomena, construction, parameters, equivalent circuits and phasor diagrams of the transformers.
- C3. To familiarize the students with the physical phenomena, construction, parameters, equivalent circuits and characteristics of the induction and synchronous machines.
- C4. To familiarize the students with the construction and operating properties of the DC commutator motors and generators.

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

- PEK\_W01 Knows the rules of electromechanical energy conversion. Has the knowledge in the field of construction, parameters, equivalent circuits, phasor diagrams and characteristics of the transformers.
- PEK\_W02 Has the knowledge of the electrical machines magnetic fields. Has the knowledge in the field of construction, physical phenomena, equivalent circuits and characteristics of the induction machines.
- PEK\_W03 Has the knowledge in the field of construction, physical phenomena, equivalent circuits and phasor diagrams of the synchronous machines. Knows the construction and operating properties of the DC commutator motors and generators.

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

- PEK\_K01 Has a sense of responsibility for his own work and has the willingness to comply with the principles of teamwork.

PROGRAMME CONTENT		
Form of classes - lecture		Number of hours:
Lec 1	Familiarization with the subject, requirements, form of crediting and literature. The phenomenon occurring in electrical machines	2
Lec 2	Transformer construction, electromagnetic phenomena, EMF. Idle state, loading state, short circuit state.	2
Lec 3	Transformer equivalent circuits, equations, phasor diagrams.	2
Lec 4	Three-phase transformers: construction, winding connections, parallel operation.	2
Lec 5	Magnetic fields and circuits of the electrical machines: constant field, pulsating field, rotating field.	2
Lec 6	Windings of the three-phase electrical machines, rules for drawing winding diagrams, EMF, the elimination of the higher harmonics in the EMF waveforms.	2
Lec 7	Induction machines: construction, principle of operation. Idle state, loading state, short-circuit state. Equivalent circuits, equations, phasor diagrams.	2
Lec 8	Electromagnetic torque of the induction machines, electromechanical characteristics, power losses, power balance.	2
Lec 9	Starting of the slip-ring and squirrel cage induction motors.	2
Lec 10	Speed control of the induction motors.	2
Lec 11	Synchronous machines: construction and principle of operation, electromagnetic torque,	2
Lec 12	Synchronous machines, generator and motor operation, equivalent circuits, equations, phasor diagrams .	2
Lec 13	Synchronous motor starting and synchronization , reactive power compensation.	2
Lec 14	Construction and principle of operation of the DC commutator machines. Electromechanical characteristics of the DC generators	2
Lec 15	DC commutator motors: electromechanical characteristics, starting, speed control. Overview of the basic types of electrical micromachines.	2
Total hours:		<b>30</b>

TEACHING TOOLS USED
N1. Lecture with the use of the audio-visual technology, multimedia presentations.

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 PEK_K01	Examination
P(w)	P=F1	

PRIMARY AND SECONDARY LITERATURE
<b>PRIMARY LITERATURE:</b> [1] Plamitzer A., Maszyny elektryczne, WNT, Warszawa 1989. [2] Latek W: Zarys maszyn elektrycznych. WNT W-wa 1974 r. <b>SECONDARY LITERATURE:</b> [1] Dąbrowski M. Projektowanie maszyn prądu przemiennego, WNT Warszawa 1994 [2] Dąbrowski M. Konstrukcja maszyn elektrycznych, WNT W-wa 1978 [3] Jezierski E.: Transformatory WNT Wa-wa 1983 r. [4] Latek W.: Maszyny elektryczne w pytaniach i odpowiedziach. WNT Wa-wa 1978 r. [5] Bajorek Z.: Maszyny elektryczne. WNT 1976 r.

SUBJECT SUPERVISOR
Jan Zawilak, jan.zawilak@pwr.edu.pl

MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**ARR043102 - Electrical machines 1**  
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_W26	C.1 C.2	Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7 Lec8 Lec9 Lec10 Lec11 Lec12 Lec13 Lec14 Lec15	N.1
PEK_W02	K1AiR_W26	C.3	Lec11 Lec12 Lec13 Lec14 Lec15	N.1
PEK_W03	K1AiR_W26	C.3 C.4	Lec4 Lec5 Lec6 Lec7 Lec8 Lec9 Lec10 Lec11 Lec12 Lec13 Lec14 Lec15	N.1
PEK_K01	K1AiR_K03	C.1 C.2 C.3 C.4	Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7 Lec8 Lec9 Lec10 Lec11 Lec12 Lec14 Lec15	N.1