

FACULTY OF ELECTRICAL  
ENGINEERING**SUBJECT CARD**

Name in Polish: **Maszyny elektryczne 2**  
 Name in English: **Electrical Machines 2**  
 Main field of study (if applicable): **Electrical Engineering**  
 Specialization (if applicable):  
 Level and form of studies: **1st level, part-time**  
 Kind of subject: **obligatory**  
 Subject code: **ELR053163**  
 Group of courses: **NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU):	10		20		
Number of hours of total student workload (CNPS):	60		60		
Form of crediting:	examination		crediting with grade		
For group of courses mark (X) final course:					
Number of ECTS points:	2		2		
including number of ECTS points for practical (P) classes :			2		
including number of ECTS points for direct teacher-student contact (BK) classes:	1.40		1.40		

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

1. Students knows principles during electrical energy transformation (power loss, heating and cooling)
2. Students has knowledge about construction, parameters, properties and characteristics of transformers, induction motors, DC machines.
3. Student knows principles of electrical energy transformation and phenomena in synchronous machines.
4. Student is able to recognize of electrical machines: transformers, AC machines (induction machines and synchronous machines).
5. Student is able to explain principles of transformers and AC machines.
6. Student is able to explain characteristics and properties of transformers and AC machines
7. Student is able to obtain information about electrical machines.
8. Student is aware of their own responsibility for their work and a willingness to comply with the principles of technical university graduate.

**SUBJECT OBJECTIVES**

- C1. Basic knowledge about physical phenomena in synchronous machines, their parameters, properties and characteristics.  
 C2. Basic knowledge about physical phenomena in DC machines, their parameters and properties.  
 C3. Basic knowledge about characteristics of DC machines.  
 C4. Measurement ability to measure characteristics of transformers and AC machines.

**SUBJECT LEARNING OUTCOMES***relating to knowledge:*

- PEU\_W01 Students knows principles during electrical energy transformation and phenomena in synchronous machines, their parameters, properties and characteristics.  
 PEU\_W02 Student has knowledge about construction and phenomena in DC machines.  
 PEU\_W03 Student has knowledge about parameters, properties and characteristics of DC machines.

*relating to skills:*

- PEU\_U01 Student is able to explain phenomena, parameters and properties of synchronous machines.  
 PEU\_U02 Student is able to measure and analyze characteristics and parameters of transformers and AC machines.  
 PEU\_U03 Student is able to work with electrical circuits safely, register electrical quantities and make reports

*relating to social competences:*

- PEU\_K01 Student is aware of their own responsibility for their work and a willingness to comply with the principles of teamwork.

PROGRAMME CONTENT		
Form of classes - lecture		Number of hours:
Lec 1	Introduction. Literature.	1
Lec 2	Magnetic pole in synchronous machines: generation, interaction, magnetic core formation, excitation windings.	1
Lec 3	Cylindrical synchronous machines: equivalent circuit, electromagnetic torque, rated parameters and characteristics, motor and generation work.	2
Lec 4	Salient-pole synchronous machines: electromagnetic torque, reluctance torque, rated parameters and characteristics, motor and generator work.	2
Lec 5	DC machines: constructions, principles of work, magnetic poles, magnetic core formation, windings, electromagnetic torque, characteristics, parameters.	2
Lec 6	DC machines: starting, speed regulation and braking	2
Total hours:		<b>10</b>

Form of classes - laboratory		Number of hours:
Lab 1	Introduction, safety instructions.	1
Lab 2	Three-phase transformer investigation.	3
Lab 3	Parallel work of transformers.	3
Lab 4	Determination of induction motor characteristics by power losses.	3
Lab 5	Single-phase induction motor.	3
Lab 6	AC three-phase generator- characteristics.	3
Lab 7	Determination of salient-pole synchronous machine parameters.	3
Lab 8	Grading	1
Total hours:		<b>20</b>

TEACHING TOOLS USED
N1. Lecture with multimedia presentation.
N2. Laboratory with measurement test stands.

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT		
Evaluation <i>F – forming (during semester) P – concluding (at semester end)</i>	Educational effect number	Way of evaluating educational effect achievement
F1(W)	PEU_W01 PEU_W02 PEU_W03 PEU_K01	writing and oral exam
P(W)	P=F1	
F1(L)	PEU_U01 PEU_U02 PEU_U03 PEU_K01	Laboratory preparation
F2(L)	PEU_U01 PEU_U02 PEU_U03 PEU_K01	Laboratory preparation
F3(L)	PEU_U01 PEU_U02 PEU_U03 PEU_K01	Reports
P(L)	$P=0,3 \cdot F1 + 0,3 \cdot F2 + 0,4 \cdot F3$	

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. [6] Zawilak J., Uzwojenia przełączalne maszyn elektrycznych prądu przemiennego, Wyd. PWr. Wrocław 1986

<b>SUBJECT SUPERVISOR</b>
Tomasz Zawilak, tomasz.zawilak@pwr.edu.pl