

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, full-time**  
 Kind of subject: **obligatory**  
 Subject code: **ELR043103**  
 Group of courses: **NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU):	15		30		
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 EDUCATIONAL EFFECTS***relating to knowledge:*

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

*relating to skills:*

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

*relating to social competences:*

- PEK\_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: equivalent circuit, electromagnetic torque, reluctance torque.	2
Lec 5	Salient-pole synchronous machines: rated parameters and characteristics, motor and generator work, reactive power compensation	2
Lec 6	DC machines: constructions, principles of work, magnetic poles, magnetic core formation, windings.	3
Lec 7	DC machines: electromagnetic torque, characteristics, parameters.	2
Lec 8	DC machines: starting, speed regulation and braking	2
Total hours:		15

Form of classes - laboratory		Number of hours:
Lab 1	Introduction, safety instructions.	2
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	Determination of induction motor characteristics by direct load.	3
Lab 6	Single-phase induction motor.	3
Lab 7	Induction regulator and phase shifter.	3
Lab 8	AC three-phase generator- characteristics.	3
Lab 9	AC three-phase generator directly connected to mains.	3
Lab 10	Determination of salient-pole synchronous machine parameters.	3
Lab 11	Grading	1
Total hours:		30

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

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	writing and oral exam
P(w)	P=F1	
F1(L)	PEK_U01 PEK_U02 PEK_U03 PEK_K01	Laboratory preparation
F2(L)	PEK_U01 PEK_U02 PEK_U03 PEK_K01	Laboratory activity
F3(L)	PEK_U01 PEK_U02 PEK_U03 PEK_K01	Reports
P(L)	$P=0,3 \cdot F1 + 0,3 \cdot F2 + 0,4 \cdot F3$	

## PRIMARY AND SECONDARY LITERATURE

### PRIMARY LITERATURE:

- [1] Plamitzer A., Maszyny elektryczne, WNT, Warszawa 1989
- [2] Latek W.: Zarys maszyn elektrycznych. WNT W-wa 1974 r.
- [3] Antal L., Janta T., Zieliński P.: Maszyny elektryczne. Ćwiczenia laboratoryjne. Of. Wyd. PWr, Wrocław 2001.

### SECONDARY LITERATURE:

- [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

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## MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT ELR043103 - Electrical Machines 2 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_W30	C.1	Lec1 Lec2 Lec3 Lec4	N.1
PEK_W02	K1ETK_W30	C.2	Lec4 Lec5	N.1
PEK_W03	K1ETK_W30	C.1 C.3	Lec6 Lec7 Lec8	N.1
PEK_U01	K1ETK_U27	C.1 C.4	Lab8 Lab9 Lab10	N.2
PEK_U02	K1ETK_U27	C.3 C.4	Lab1 Lab2 Lab3 Lab4 Lab5 Lab6 Lab7 Lab8 Lab9 Lab10	N.2
PEK_U03	K1ETK_U27	C.4	Lab2 Lab3 Lab4 Lab5 Lab6 Lab7 Lab8 Lab9 Lab10	N.2
PEK_K01	K1ETK_K05	C.4	Lab1 Lab2 Lab3 Lab4 Lab5 Lab6 Lab7 Lab8 Lab9 Lab10 Lab11	N.1 N.2