

FACULTY OF ELECTRICAL
ENGINEERING**SUBJECT CARD**

Name in Polish: **Mikromaszyny elektryczne dla automatyki przemysłowej**
 Name in English: **Electrical micromachines for industrial automation**
 Main field of study (if applicable): **Control Engineering and Robotics**
 Specialization (if applicable): **Automation of Machines, Vehicles and Apparatus**
 Level and form of studies: **2nd level, full-time**
 Kind of subject: **obligatory**
 Subject code: **ARR043104**
 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):	60				
Form of crediting:	crediting with grade				
For group of courses mark (X) final course:					
Number of ECTS points:	2				
including number of ECTS points for practical (P) classes :					
including number of ECTS points for direct teacher-student contact (BK) classes:	1.40				

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Has a basic knowledge of the construction of electrical machines and transformers.
2. Knows and understands the principles of operation of electrical machines and transformers.
3. Knows and understands the physical phenomena in electrical machines and transformers.
4. Knows the equivalent circuits and vector diagrams of electrical machines and transformers at different operating conditions.

SUBJECT OBJECTIVES

C1. To familiarize the students with the construction, principle of operation, electromagnetic phenomena and electromechanical characteristics of the electrical micromachines.

SUBJECT EDUCATIONAL EFFECTS

relating to knowledge:

PEK_W01 Has the knowledge of the construction, principles of operation of the electrical micro-machines.

PEK_W02 Has the knowledge of the electromechanical characteristics of the electrical micro-machines.

relating to skills:

relating to social competences:

PEK_K01 Can think and act in a creative way.

PROGRAMME CONTENT		
Form of classes - lecture		Number of hours:
Lec 1	Familiarization with the subject, requirements, form of crediting and literature.	1
Lec 2	Physical phenomena occurring in the circuits of the permanent magnet micro-machines.	2
Lec 3	The principles of solving of the circuits with permanent magnets. Stabilization of the magnetic flux.	2
Lec 4	DC motors: commutator, disc, drag-cup: construction, electromagnetic phenomena, operating properties, control.	2
Lec 5	Universal motors: construction, transients, electromagnetic torque, vector diagram, electromagnetic characteristics, speed regulation.	2
Lec 6	Brushless DC motors (BLDC motors) a) the essence of generation of the electromagnetic torque, b) constructions: cylindrical, disc, coreless, c) supplying systems, transients of the electrical and mechanical quantities, d) electromechanical characteristics, applications in: computer technology, automatic control engineering, audio - video, robots and vehicles drives.	3
Lec 7	Permanent magnet low power synchronous motors (permasyns): magnetic circuit structures, electromagnetic torque, start-up, applications.	2
Lec 8	Reluctance motors: structure of the electromagnetic circuits, power supply, reluctance torque, applications: a) synchronous reluctance motors, b) reluctance motors with changeover windings.	3
Lec 9	Asynchronous motors synchronized by reluctance torque. Single-phase asynchronous motors.	2
Lec 10	Linear and tube induction motors.	1
Lec 11	Phase shifters and induction voltage regulators.	2
Lec 12	Resolvers.	2
Lec 13	Tachogenerators.	2
Lec 14	Permanent magnet motors cooperation with the controlled rectifiers and pulse converters.	2
Lec 15	Crediting.	2
Total hours:		30

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_K01	Crediting with grade
P(w)	P=F1	

PRIMARY AND SECONDARY LITERATURE
PRIMARY LITERATURE: [1] I. Dudzikowski, M. Ciurys, Komutatorowe i bezszczotkowe maszyny elektryczne wzbudzone magnesami trwałymi, Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 2011. [2] Glinka T., Maszyny elektryczne wzbudzone magnesami trwałymi, Wydawnictwo Politechniki Śląskiej, Gliwice 2002 . [3] Sochocki R., Mikromaszyny elektryczne, Wydawnictwo Politechniki Warszawskiej, Warszawa 1996. SECONDARY LITERATURE: [1] J. Przepiórkowski, Silniki elektryczne w praktyce elektronika, Wydawnictwo BTC, 2007.

SUBJECT SUPERVISOR
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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
ARR043104 - Electrical micromachines for industrial automation
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **Control Engineering and Robotics**
AND SPECIALIZATION **Automation of Machines, Vehicles and Apparatus**

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	S2AMPU_W02	C.1	Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7 Lec8 Lec9 Lec10 Lec11 Lec12 Lec13 Lec14	N.1
PEK_W02	S2AMPU_W02	C.1	Lec4 Lec5 Lec6 Lec7 Lec8 Lec9 Lec10 Lec13	N.1
PEK_K01	K2AiR_K06	C.1	Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7 Lec8 Lec9 Lec10 Lec11 Lec12 Lec13 Lec14 Lec15	N.1