STUDY MODULE DESCRIPTION FORM

Name of the module/subject	Code
Electrical machines and drives in control engineering	**1010331231010329994**

Field of study	Profile of study (general academic, practical)	Year /Semester
Automatic Control and Robotics	**general academic**	**2 / 3**
Elective path/specialty	Subject offered in:	Course (compulsory, elective)
-	**Polish**	**obligatory**

Cycle of study:	Form of study (full-time,part-time)
First-cycle studies	**full-time**

No. of hours	No. of credits
Lecture: **30** Classes: **-** Laboratory: **-** Project/seminars: **-**	**3**

Status of the course in the study program (Basic, major, other)	(university-wide, from another field)
major	**from field**

Education areas and fields of science and art	ECTS distribution (number and %)
technical sciences	**3 100%**
Technical sciences	**3 100%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Student should have knowledge in chosen branches of physics including the electricity and the magnetism and the knowledge of the theory of electric circuits.
2	**Skills**	Student is able to obtain information from literature, databases and other sources; has abilities of the self-education for improving qualifications and the update of professional competence.
3	**Social competencies**	Student is aware of a need to expand his competence and readiness to undertake the cooperation in the team; has an awareness of the importance and understands other aspects of engineering activity, including its influence on the environment.

Assumptions and objectives of the course:

Getting to know principles of magnetic circuits analysis. Getting knowledge of operation, characteristics and methods of analysis of: transformers, induction motors, synchronous motors, brushed d.c. motors, electronically commutated motors as well as the other electromechanical converters.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. The student has a knowledge tidied up in the structure, the application and control of the automation and robotics systems - [K_W19++]
2. Student knows and understands typical engineering technologies, knows and understands principles of the selection of servo- and measuring-testing devices. - [K_W20++]

Skills:

1. Student is able to use models of simple electromechanical systems, as well as to use them for analysis and design automations and robotics systems. - [K_U05+++]
2. Student is able to select the kind and parameters of servo- and measuring system, control unit for the chosen application and to effect their integration in the form of the ultimate measuring-control system. - [K_U17++]

Social competencies:

1. Student has an awareness of the need for the professional approach towards technical issues, of meticulous acquainting oneself with documentation and environmental conditions, in which devices and their elements can function - [K_K04++]

Assessment methods of study outcomes

Lecture:

?constant progress monitoring during all classes (awarding a bonus to the actively participating students),

?evaluation of student?s knowledge and skills on a written examination in a form of test.

Getting additional points for the activity during classes, particularly for:

?proposing answers to the questions and tasks presented during the lectures,

suggestions on how to improve the teaching materials.

Course description

Magnetic circuits and transformers. Rotating machine principles: distributed windings, rotating magnetic field and rotating electromotive force. Induction motors: construction, principle of operation, equivalent diagram scheme;, basic characteristics, angular velocity control. Single-phase induction motors. Synchronous machines: construction, principle of operation, phasor diagrams. Permanent magnet motors.. Starting up the synchronous motors. Synchronous motor optimal control. Reluctance motors. The stepper motors The brushed direct current motors: construction, principles of operation, the armature reaction, commutation. The torque-speed characteristic and speed control. The brushed a.c. motors. Brushless direct current motors. Tachometers. Special electromechanical converters.

Updating 2017: Electrical machines heating. Operation modes and selection of electric motors.

Methods of education:

- lecture with multimedia presentation supplemented with examples given on the board,
- interactive lecture with questions to students,
- student activity is taken into account during the course of the assessment process.

Basic bibliography:

1. A. M. Plamitzer, Maszyny Elektryczne, wyd. VII, WNT Warszawa, 1982.
2. R. Crowder, Electric Drives and Electromechanical systems, Elsevier, 2006
3. W. Karwacki, Maszyny Elektryczne, Wyd. Pol. Wrocławskiej, Wrocław, 1993.
4. W. Przyborowski, G. Kamiński Maszyny elektryczne, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2014
5. T. Glinka, Maszyny Elektryczne wzbudzane magnesami trwałymi, Wyd. Politechniki Śląskiej, Gliwice 2002.
6. R Sochocki, Mikromaszyny Elektryczne, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 1996
7. R. Miksiewicz, Maszyny Elektryczne, Wyd. Politechniki Śląskiej, Gliwice 2000.
8. M. S. Sarna, Electric Machines, Steady-State Theory and Dynamic Performance, West Publishing Company, wyd. 2, 1994 i wyd. Następne
9. W.H. Yeadon, A.W. Yeadon, Handbook of small electrical motors, McGraw-Hill, 2001

Additional bibliography:

1. W. Latek, Teoria Maszyn Elektrycznych, wyd. II, WNT Warszawa, 1987.
2. Z. Bajorek, Maszyny Elektryczne, WNT Warszawa, 1977.
3. T. Wildi, Electrical Machines, Drives, and Power Systems, Prentice Hall, Pearson International Edition, New Jersey 2002.
4. Przepiórkowski, Silniki Elektryczne w praktyce Elektronika, Wydwnictwo BTC, Warszawa 2007.

Result of average student's workload

Activity	Time (working hours)
1. Participation in the lecture	30
2. Consultation	5
3. Preparation for examination	20
4. Participation in the examination	5

Student’s workload

Source of workload	hours	ECTS
Total workload	60	3
Contact hours	40	2
Practical activities	0	0