

STUDY MODULE DESCRIPTION FORM		
Name of the module/subject Electrical machines in control engineering and robotics		Code 1010334241010321692
Field of study Automatic Control and Robotics	Profile of study (general academic, practical) (brak)	Year /Semester 2 / 4
Elective path/specialty -	Subject offered in: Polish	Course (compulsory, elective) obligatory
Cycle of study: First-cycle studies	Form of study (full-time, part-time) part-time	
No. of hours Lecture: 30 Classes: - Laboratory: 18 Project/seminars: -		No. of credits 5
Status of the course in the study program (Basic, major, other) (brak)		(university-wide, from another field) (brak)
Education areas and fields of science and art technical sciences Technical sciences		ECTS distribution (number and %) 5 100% 5 100%
Responsible for subject / lecturer: Prof. dr hab. inż. Lech Nowak email: lech.nowak@put.poznan.pl tel. 61 665 2380 Wydział Elektryczny ul. Piotrowo 3A, 60-965 Poznań		Responsible for subject / lecturer: Dr inż. Kazimierz Radziuk email: kazimierz.radziuk@put.poznan.pl tel. 61 665 2636 Wydział Elektryczny ul. Piotrowo 3A, 60-965 Poznań
Prerequisites in terms of knowledge, skills and social competencies:		
1	Knowledge	Student should have a 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: Cel przedmiotu: 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. Getting acquainted with methods of the measurements of the electrical machinery parameters and characteristics (transformers, induction motors, synchronous, brushed direct current motors,, electronically commutated motors and special 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++]		
3. Student is able to build, to start and to test the simple electromechanical system - [K_U20++]		
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		
<p>Lecture:</p> <p>? constant progress monitoring during all classes (awarding a bonus to the actively participating students),</p> <p>? evaluation of student's knowledge and skills on a written examination in a form of test.</p> <p>Laboratory:</p> <p>? the evaluation of student's knowledge and skills based on his performance during the lab exercise,</p> <p>? the evaluation of student's active participation and progress during all classes, and his ability to work as a part of the team.</p> <p>? the evaluation of student's report from the performed exercise.</p> <p>Getting additional points for the activity during classes, particularly for:</p> <p>? proposing answers to the questions and tasks presented during the lectures and lab classes,</p> <p>? suggestions on how to improve the teaching materials.</p>		
Course description		
<p>Magnetic circuits. Transformers: construction, operation modes, equivalent circuit. 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, universal motors. Brushless direct current motors. Tachometers. Special electromechanical converters.</p>		
Basic bibliography:		
<ol style="list-style-type: none"> 1. A. M. Plamitzer, <i>Maszyny Elektryczne</i>, wyd. VII, WNT Warszawa, 1982. 2. W. Karwacki, <i>Maszyny Elektryczne</i>, Wyd. Pol. Wrocławskiej, Wrocław, 1993. 3. M. S. Sarna, <i>Electric Machines, Steady-State Theory and Dynamic Performance</i>, West Publishing Company, wyd. 2, 1994 i wyd. Następne 4. Z. Bajorek, <i>Maszyny Elektryczne</i>, WNT Warszawa, 1977. 5. T. Glinka, <i>Maszyny Elektryczne wzbudzone magnesami trwałymi</i>, Wyd. Politechniki Śląskiej, Gliwice 2002. 6. R. Sochocki, <i>Mikromaszyny Elektryczne</i>, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 1996 7. R. Miksiewicz, <i>Maszyny Elektryczne</i>, Wyd. Politechniki Śląskiej, Gliwice 2000. 		
Additional bibliography:		
<ol style="list-style-type: none"> 1. W. Latek, <i>Teoria Maszyn Elektrycznych</i>, wyd. II, WNT Warszawa, 1987. 2. Praca zbiorowa, <i>Poradnik Inżyniera Elektryka</i>, Tom 2, WNT Warszawa 2007. 3. T. Wildi, <i>Electrical Machines, Drives, and Power Systems</i>, Prentice Hall, Pearson International Edition, New Jersey 2002. 4. Przepiórkowski, <i>Silniki Elektryczne w praktyce Elektronika</i>, Wydawnictwo BTC, Warszawa 2007. 		
Result of average student's workload		
Activity	Time (working hours)	
1. Participation in the lecture	1	
2. Consultation	1	
3. Preparation for examination	1	
4. Participation in the examination	1	
Student's workload		
Source of workload	hours	ECTS
Total workload	175	5
Contact hours	60	2
Practical activities	48	2