COURSE DESCRIPTION CARD - SYLLABUS

Course name
Electrical machines and drives in control engineering [S1AiR1E>MiNEwA1]

Course

Field of study
Automatic Control and Robotics

Year/Semester
2/3

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
english

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
0

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

3,00

Coordinators

dr hab. inż. Rafał Wojciechowski prof. PP
rafal.wojciechowski@put.poznan.pl

Lecturers

Prerequisites

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. 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. 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.

Course objective

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.

Course-related learning outcomes

Knowledge:
Has advanced structured knowledge in the construction, application and control of automation and robotics

executive systems [K1_W18 (P6S_WG)].
Knows and understands typical engineering technologies, principles and techniques of construction of simple automation and robotics systems; knows and understands the principles of selection of executive systems, computational units and measurement and control elements and devices [K1_W20 (P6S_WG)].
Skills:
Can determine and use models of simple electromechanical systems and selected industrial processes, and use them for analysis and design of automation and robotics systems [K1_U11 (P6S_UW)].
Is able to build, commission and test a simple electronic and electromechanical system [K1_U15 (P6S_UW)].
Is able to design simple control systems for industrial processes; is able to consciously use standard functional blocks of automation systems and form dynamic properties of measuring circuits [K1_U29 (P6S_UW)].
Social competences:
Is ready to critically assess his/her knowledge; understands the need for and knows the possibilities of continuous training - improving professional, personal and social competence, is able to inspire and organize the learning process of others [K1_K1 (P6S_KK)].
The graduate is aware of the need for a professional approach to technical issues, meticulous familiarization with the documentation and environmental conditions in which the equipment and its components can operate. The graduate is ready to observe the rules of professional ethics and to demand it from others, to respect the diversity of opinions and cultures [K1_K5 (P6S_KR)].

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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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.

Programme content

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 DC motors. Brushless direct current motors. Tachometers. Special electromechanical converters.

Teaching methods

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.

Bibliography

Basic
1. R. Crowder, Electric Drives and Electromechanical systems, Elsevier, 2006
2. Robert M. Del Vecchio, Bertrand Poulin, Pierre T. Feghali, Dilipkumar M. Shah, Rajendra Ahuja Transformer Design Principles: With Applications to Core-Form Power Transformers, 2nd Edition, CRC Press, 2010.
3. M. S. Sarna, Electric Machines, Steady-State Theory and Dynamic Performance, West Publishing Company, 1996 .
4. W.H. Yeadon, A.W. Yeadon, Handbook of small electrical motors, McGraw-Hill, 2001

5. Electric Machinery Fundamentals by Stephen J. Chapman, 4th Edition, McGraw-Hill, 2005
6. Electric Motor Drives – Modeling, Analysis and Control by R. Krishnan Pren. Hall Inc., NJ, 2001
Additional
1. T. Wildi, Electrical Machines, Drives, and Power Systems, Prentice Hall, Sixth edition, Pearson new international edition, 2014.
2. Research papers.

Breakdown of average student's workload

	Hours	ECTS
Total workload	80	3,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	50	2,00