STUDY MODULE DESCRIPTION FORM

Name of the module/subject	Code
Electromechanical energy convertion I	

Field of study	Profile of study (general academic, practical)	Year /Semester
Mathematics in Technology	**general academic**	**3 / 5**
Elective path/specialty	Subject offered in:	Course (compulsory, elective)
-	**Polish**	**obligatory**

Cycle of study:	Form of study (full-time,part-time)
First-cycle studies (Polish Qualifications Framework level six)	**full-time**

No. of hours	No. of credits
Lecture: **30** Classes: **-** Laboratory: Project/seminars: **-**	**2**

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

Education areas and fields of science and art	ECTS distribution (number and %)
Technical sciences	**2 100%**
Technical sciences	**2 100%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Basic knowledge in the field of electrical and magnetic circuits, principles of mechanics and energy conversion, extended information in the field of insulating and conductive materials, and basic knowledge in the field of soft and hard magnetic materials [K_W01 (P6S_WG), K_W03 (P6S_WG), K_W10 (P6S_WG)]
2	**Skills**	Knowledge of differential and integral calculus at the general level, ability of effective self-education in the field related to the chosen field of study [K_U02 (P6S_UW), K_U09 (P6S_UU)]
3	**Social competencies**	Is aware of the need to expand their competence, readiness to cooperate within the team [K_K01 (P6S_KK), K_K03 (P6S_KR)]

Assumptions and objectives of the course:

Acquainting with the principles of operation and construction of selected converters of mechanical energy into electric and vice versa. Getting to know the methods of determining the integral parameters of electromagnetic systems and gaining the ability to analyze the operating states of electromagnetic actuators. Practical mastering of principles of formulating and solving equations of electromechanical systems. Strengthening the ability to select the components of propulsion systems operating in various work regimes.

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

Knowledge:

1. Student has structured and theoretically founded knowledge in the field of technical sciences, including electrical engineering, electronics and automation [K_W04 (P6S_WG)]

2. Student has the ordered and theoretically founded knowledge related to the design, construction, operation principle and operation of devices, machines, systems, etc .; knows and understands the processes occurring in their life cycle [K_W08 (P6S_WG)]

Skills:

1. Student is able to select appropriate sources of knowledge and obtain the necessary information from them and make a critical analysis and evaluation of solutions for complex and unusual engineering problems [K_U06 (P6S_UW)]
2. Student can use the knowledge and methods and tools to solve typical engineering tasks [K_U10 (P6S_UW)]
3. Student can design, build and test a simple device, object, system, etc. [K_U11 (P6S_UW)]

Social competencies:

1. Student is able to think and act in a creative and entrepreneurial way, taking into account the safety, ergonomics of work and its economic aspects, is aware of the need to initiate action for the public interest and responsibility for the effects of the team and its participants [K_K03 (P6S_KO)]
2. Student is aware of his social role as a graduate of a technical university, he is ready to communicate popular scientific content to the society and to identify and resolve basic problems [K_K05 (P6S_KR)]

Assessment methods of study outcomes

Lecture:

- continuous assessment on each class (rewarding activity and quality of perception).
- written exam, interview with the lecturer after the lecture cycle

Obtaining additional points for activity during classes, and especially for:

- suggesting discussion of additional aspects of the problem,
- remarks related to the improvement of didactic materials

Course description

Non-linear and non-stationary circuits. Sommerfeld's concept: energy and co-generation. Electromagnetic and mechanical systems - analogies. Forces and moments of magnetic origin. The principle of virtual work. Dynamics of electromechanical systems - Hamilton principle and Lagrange equation. Acyclic electromechanical transducers: basic structures, static characteristics, dynamic states. Transducers. Heating up of electrical devices. Types of electric motors work. Motor selection and conversion of rated power when changing the type of work. The engine as part of the automatic adjustment system. The general structure of the driving system of automatic regulation.

Update: 2018

Applied learning methods: Lecture with multimedia presentation (including drawings, photos, animations, films) supplemented with examples given on the board, taking into account different aspects of the presented issues, including: economic, ecological, legal and social , presenting a new topic preceded by a reminder of related content known to students in other subjects.

Basic bibliography:

1. Sidorowicz J. Napęd elektryczny i jego sterowanie, , Oficyna Wydawnicza Politechniki Warszawskiej , Warszawa, 1994
2. Wach P., Dynamics and Control of Electrical Drivers, Springer Verlag, Berlin-Heidelberg, 2011.
3. Meisel J., Zasady elektromechanicznego przetwarzania energii (tłum. z angielskiego), Wydawnictwo Naukowo Techniczne, Warszawa, 1970
4. Furlani E.P., Permanent magnet and Electromechanical Devices, Academic Press, 2001
5. Wprowadzenie do napędów elektrycznych, Skrypt Politechniki Krakowskiej, Kraków, 1998

Additional bibliography:

1. Zawirski K., Sterowanie silnikiem synchronicznym o magnesach trwałych, Wydawnictwo Politechniki Poznańskiej, Poznań, 2005
2. Orłowska-Kowalska T., Bezczujnikowe układy napędowe z silnikami indukcyjnymi, Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław, 2003

Result of average student's workload

Activity	Time (working hours)
1. Participation in lectures (15x2 hours)	30
2. Participation in consultations related to the implementation of the education process	6
3. Getting to know the indicated literature / didactic materials (10 pages of the scientific text = 1 hour), (number of pages)	8
4. Preparation for the exam and participation in the exam: (10 hours + 2 hours)	12

Student's workload

Source of workload	hours	ECTS
Total workload	56	2
Contact hours	36	2
Practical activities	0	0