

FACULTY OF ELECTRICAL
ENGINEERING**SUBJECT CARD**

Name in Polish: **Elektromechaniczne systemy napędowe**
 Name in English: **Electromechanical drive systems**
 Main field of study (if applicable): **Electrical Engineering**
 Specialization (if applicable): **Electrical Power Engineering**
 Level and form of studies: **2nd level, part-time**
 Kind of subject: **obligatory**
 Subject code: **ELR043262**
 Group of courses: **NO**

| | Lecture | Classes | Laboratory | Project | Seminar |
|--|-------------|---------|----------------------|---------|---------|
| Number of hours of organized classes in University (ZZU): | 22 | | 11 | | |
| Number of hours of total student workload (CNPS): | 108 | | 27 | | |
| Form of crediting: | examination | | crediting with grade | | |
| For group of courses mark (X) final course: | | | | | |
| Number of ECTS points: | 4 | | 1 | | |
| including number of ECTS points for practical (P) classes : | | | 1 | | |
| including number of ECTS points for direct teacher-student contact (BK) classes: | 2.80 | | 0.70 | | |

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Student has the general knowledge of fundamental laws of mechanical and electrical engineering. Student has a basic knowledge of the analysis of electrical circuits and the construction and operation of electrical machines.
2. Student has a basic knowledge of the theory of electric drives and the operation of power electronics and control systems.
3. Student has the ability to critically analyze the operation of selected mechanical, electrical and electric drive systems.
4. Student can work in a group and present the results of his work .

SUBJECT OBJECTIVES

- C1. Presentation of principles of electromechanical energy conversion and methods of analysis and modeling of electromechanical drive systems.
- C2. Understanding of the electromechanical and electromagnetic phenomena in electromechanical drive systems.
- C3. Obtaining of the skills for analysis and synthesis of control systems of electromechanical drive systems.

SUBJECT EDUCATIONAL EFFECTS*relating to knowledge:*

PEK_W01 The student has the knowledge for formulation of mathematical models of electromechanical drive systems and using it for the analysis and simulation

PEK_W02 The student is able to describe the properties of electromechanical drive systems and knows the methods of shaping of these properties

relating to skills:

PEK_U01 The student has the ability to interpret basic electromagnetic parameters and determine its influence on the characteristics of electromechanical drive systems.

PEK_U02 The student has the ability to determine the properties of electromechanical drive systems on the base of analysis or simulation and experimental results

relating to social competences:

PEK_K01 The student understands the need of active attitude for development of self-knowledge and skills

| PROGRAMME CONTENT | | |
|---------------------------|--|------------------|
| Form of classes - lecture | | Number of hours: |
| Lec 1 | Basic concepts of electromechanics and classification of electromechanical drive systems | 2 |
| Lec 2 | Modeling and analysis of electromechanical drive systems with a resilient connection and multibody systems | 2 |
| Lec 3 | Modeling of electromechanical drive systems with DC motors | 2 |
| Lec 4 | Modeling of electromechanical drive systems with three-phase induction motors. | 2 |
| Lec 5 | Modeling of electromechanical drive systems with multi-phase induction motors | 2 |
| Lec 6 | Modeling of electromechanical systems with induction generators | 2 |
| Lec 7 | Modeling and analysis of electromechanical drive systems with synchronous motors | 2 |
| Lec 8 | Modeling and analysis of electromechanical drive systems with BLDCM motors | 2 |
| Lec 9 | Modeling and analysis of electromechanical drive systems with PMSM motors | 2 |
| Lec 10 | Principles and methods of modeling electromechanical drive systems using bond graphs | 2 |
| Lec 11 | Fundamentals of design and components selection of electromechanical drive systems | 2 |
| Total hours: | | 22 |

| Form of classes - laboratory | | Number of hours: |
|------------------------------|--|------------------|
| Lab 1 | Presentation of the Laboratory Rules. Presentation of the laboratory devices and establishing the rules for realization of laboratory exercises. | 2 |
| Lab 2 | Investigation of electromechanical drive system with DC motor | 2 |
| Lab 3 | Investigation of multimotor electromechanical drive system | 2 |
| Lab 4 | Investigation of selected states of electromechanical energy conversion in electromechanical drive system | 2 |
| Lab 5 | Investigation of electromechanical system with autonomous induction generator | 2 |
| Lab 6 | Final written test | 1 |
| Total hours: | | 11 |

| TEACHING TOOLS USED |
|---|
| N1. Subject lecture |
| N2. Lecture with multimedia presentation |
| N3. Laboratory tests conducted in the traditional manner in student exercise groups |

| 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 | Exam |
| P(W) | P=F1 | |
| F1(L) | PEK_U01 PEK_U02 PEK_K01 | Positive note from laboratory test reports |
| F2(L) | PEK_U01 PEK_U02 PEK_K01 | Positive note from written test |
| P(L) | P=0,3*F1 + 0,7*F2 | |

| PRIMARY AND SECONDARY LITERATURE |
|---|
| PRIMARY LITERATURE: |
| [1] Jagiełło A.S.: Systemy elektromechaniczne dla elektryków, Politechnika Krakowska, Kraków, 2008 |
| [2] Meisel J.: Zasady elektromechanicznego przetwarzania energii, WNT, Warszawa, 1970. |
| [3] Puchała A.: Dynamika maszyn i układów elektromechanicznych, PWN, Warszawa, 1977. |
| SECONDARY LITERATURE: |
| [1] Czemplik A.: Modele dynamiki układów fizycznych dla inżynierów. Zasady i przykłady konstrukcji modeli dynamicznych obiektów automatyki. WNT, Warszawa, 2008 |
| [2] Paszek W.: Stany nieustalone maszyn elektrycznych prądu przemiennego. WNT, Warszawa, 1986 |

SUBJECT SUPERVISOR

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**MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
ELR043262 - Electromechanical drive systems
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY **Electrical Engineering**
AND SPECIALIZATION **Electrical Power Engineering****

| 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 | K2ETK_W04 | C.1 C.2 C.3 | Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7 Lec8 Lec9 Lec10 Lec11 | N.1 N.2 |
| PEK_W02 | K2ETK_W04 | C.1 C.2 C.3 | Lec1 Lec2 Lec3 Lec4 Lec5 Lec6 Lec7 Lec8 Lec9 Lec10 Lec11 | N.1 N.2 |
| PEK_U01 | K2ETK_U03 | C.1 C.2 C.3 | Lab1 Lab2 Lab3 Lab4 Lab5 Lab6 | N.3 |
| PEK_U02 | K2ETK_U03 | C.1 C.2 C.3 | Lab1 Lab2 Lab3 Lab4 Lab5 Lab6 | N.3 |
| PEK_K01 | K2ETK_K01 | C.1 C.2 C.3 | Lab1 Lab2 Lab3 Lab4 Lab5 Lab6 | N.3 |