THEORY OF ELECTRIC DRIVE

SYLLABUS

Specialty code and title	**141 Electric Power Engineering, Electrical Engineering and Electromechanics**	**Institute title / Faculty title**	**Power Engineering, Electronics and Electromechanics**
Program title	**Electric Drive, Mechatronics and Robotics**	**Department**	**Automated Electromechanical Systems**
Program type	**Educational and professional**	**Language of instruction**	**English**

LECTURER

Pshenychnykov Dmytro Oleksiyovych *pshenichdm@gmail.com*

PhD, Assistant Professor. Experience – 30 years. An author is over 60 scientific works. A leading lecturer is from courses: «Theoretical basic of electric drive» «Енергоресурсозбереження засобами електропривода», «Автоматизований електропривод загальнопромислових установок»,

GENERAL DESCRIPTION OF THE COURSE

Abstract	Electro-mechanical transmission of electric energy, the principle of construction of the electric machines and the theoretic questions of the operation in stationary and transient regimes are considered, the properties of the machines operation regimes and maintaining and application are analyzed. Elements of electric drives, mechanics, equation of motion. Characteristics of actuating mechanisms. The systems of electric drives speed regulation and control with the power electronic converters, regulation characteristics. Transient processes and power engineering questions. Control methods of electric drives.
Course objective	To be able to calculate parameters and characteristics of different electric machines and analyze their operation regimes. To master the systems of electric drive, influence of the parameters on the characteristics, methods of speed regulation, methods of the transient processes calculation, calculations of drives energy parameters and motor selection. To be able to calculate the impact of the transient processes
Types of classes and control	Lectures, practical studies, calculated task, independent work and consultation. Final control – Exam
Semester	6

Competencies: Ability to abstract thinking, analysis and synthesis. Ability to solve complex specialized tasks and practical problems related to metrology, electrical measurements, operation of automatic control devices, relay protection and automation. Ability to carry out calculations for the analysis of transient and steady-state response of electric drives and mechatronic modules and systems.

Program results of training: To know and understand the theoretical foundations of metrology and electrical measurements, the principles of automatic control devices, relay protection and automation, to have the skills to carry out corresponding measurements and use these devices to solve professional problems. Analyze processes in electric power, electrical and electromechanical equipment, corresponding complexes and systems. Select and apply methods for the analysis and synthesis of electromechanical and electric power systems with specified parameters. Solve complex specialized problems in the design and technical services of electromechanical systems, electrical equipment of power plants, substations, systems and networks. Know how to perform calculations to analyze transient and steady-state responses of electric drives, mechatronic units and systems.

Covered topics:

Topic 1.Mechanics of electric drive.
Topic 2. Electromechanical characteristics of electric motors
Topic 3. Selection of electric motor
Topic 4. Electric drive transients
Topic 5. Electric drive control

Teaching methods. This course has lectures, practical studies, calculated task, independent work and consultation.

During the lecture uses the explanatory method, at which the teacher report an information student different ways. The student receives information, understand and remember it. This method provides for the use such media as the word (verbally and print), different special books, computer and other materials.

Practical studies develop students' ability to apply theoretical knowledge to solve practical problems. Practical work is carried out after the study of the topics, so it is of a generalizing type.

The student performs an individual calculated task, which aimed at improving consolidate knowledge of the course. In individual calculated task the research method is used. The teacher analyzes the material that has been studied, setting a problem and giving tasks. The student argues the assumptions, finds information and makes calculations in the process of solving the problems and gains skills in simulation electromechanical systems and analyzing the behavior of their transients.

Independent work is the main means of learning the material at a free time. The student must study the topics of the recommended literature specified in the work program of the discipline.

Control methods. The system of quality control of students' education includes conducting of current control and final control in the form of exam.

Current knowledge control is realized at each lesson in the form of testing of the lecture material, carrying out topical control work, performing individual calculation task. Current performance scores are indicated on the rating card by the appropriate number of points and taken into account as information on the rating system of the exam grade in the course.

The student's independent work with the additional lecture material is carried out by rechecking the notes.

Semester control is conducted orally.

A student is considered to be admitted to the final exam in the course, provided that the calculation tasks have been defended.

Distribution of marks which a student gets and scale of assessment of knowledge and skills (national and ECTS)

Table 1. Distribution of points for evaluating a student's current performance

Current testing	Practical studies	Calculated task	Exam	Sum
35	20	20	25	100

Criteria and system for grading students' knowledge and skills

According to the ECTS system, the grading system should be understood as a complex of methods (written, oral and practical tests, exams, projects, etc.) used to assess the achievement of the expected learning outcomes by students.

Successful grading of learning results is a condition for awarding credits to a student. Therefore, statements about the results of studying program components should always be accompanied by clear and appropriate grading criteria for awarding credits. This makes it possible to state whether the student has acquired the necessary knowledge, understanding, and competencies.

Grading criteria are descriptions of what a learner is expected to do to demonstrate the achievement of a learning outcome.

The main conceptual concepts of the system of assessment of students' knowledge and skills are:

1. To improve the quality of training and competitiveness of specialists by stimulating independent and systematic work of students during the academic semester, by establishing constant feedback from teachers to each student and timely adjustment of their learning activities.

2. Objectivity of students' knowledge assessment is enhanced by control during the semester using a 100-point scale (Table 2). Grades are necessarily converted to the national scale (with the state semester grade of «excellent», «good», «satisfactory» or «unsatisfactory») and to the ECTS scale (A, B, C, D, E, FX, F).

Table 2: Knowledge and skills rating scale: national and ECTS

The amount of points for all types of educational activities	ECTS rating	National scale rating	Rating criteria	
			positive	negative
1	2	3	4	5
90-100	A	Excellent	- Deep knowledge of the teaching material in the basic and supplementary literature; - ability to analyze the studied processes in their interconnection and development; - ability to carry out theoretical calculations; - answers to questions are concise, logical and consistent; - the ability to solve complex practical problems.	Answers to questions may contain minor inaccuracies
82-89	B	Good	- Deep knowledge in the scope of mandatory material; – ability to give reasoned answers; – the ability to solve complex practical problems.	Answers to the questions contain certain inaccuracies
75-81	C	Good	– Strong knowledge of the material being studied and its practical application; – ability to give reasoned answers and carry out theoretical calculations; – ability to solve practical problems.	Inability to solve complex practical problems
64-74	D	Satisfactory	– Knowledge of the fundamental points of the studied material and its practical application; – the ability to solve simple practical problems.	– Inability to give reasoned answers to questions; – inability to analyze the material presented and carry out calculations – inability to solve practical problems
60-63	E	Satisfactory	– Knowledge of the fundamental points of the studied material; – the ability to solve the simplest practical problems.	– Ignorance of certain questions from the material; – inability to consistently express an opinion; – inability to

				solve practical problems
35-59	FX	Unsatisfactory with the possibility of reassembly	– Additional study of the material can be completed in the terms provided by the curriculum.	– Ignorance of the basic fundamental points of the educational material; – points errors in answering questions; – inability to solve simple practical problems
1-34	F	Unsatisfactory with the compulsory re-study of the discipline	-	– Complete lack of knowledge of a significant part of the material; – significant errors in answering questions; – ignorance of the main fundamental points; – inability to navigate when solving simple practical problems

Basic literature:

1 S.K. Pillai. *Basics of Electrical Drives*. New Academic Science Limited, 2015.
2 N. Mohan, *Electric Machines and Drives: A First Course,* Wiley, 2012.
3 A. Veltman, D.W.J. Pulle, and R.W. DeDoncker, *Advanced Electrical Drives: Analysis, Modeling, Control,* Springer, 2011.
4 J.L. Kirtley, *Electric Power Principles: Sources, Conversion, Distribution, and Use,* Wiley, 2010.
5 A. Veltman, D.W.J. Pulle, and R.W. DeDoncker, *Fundamentals of Electrical Drives,* Springer, 2007.
6 I. Boldea and S.A Nasar, *Electric Drives*, CRC Press, 2nd ed. 2006.

Structural and logical scheme of studying course

Previous courses:	**The following disciplines:**
Higher Mathematics	Simulation of Electromechanical Systems
Physics	Automated Electric Drive of Industrial Mechanisms
Theoretical Basics of Electrical	Industrial Robots

Engineering	
Theory of automatic control	Dynamics of Electromechanical Systems
Electric mashines	

Developers:

Associate professor at the Department of AEMS,
Ph.D., Dmytro PSHENYCHNYKOV _____

(present post, a degree and academic rank, name and surnames) (signature)