FUNDAMENTALS OF MECHATRONICS

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

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GENERAL DESCRIPTION OF THE COURSE

Abstract	The discipline is aimed at getting acquainted with the conceptual foundations, structures and principles of creating technical objects that combine elements of precision mechanics, electronics, electromechanics, and information technologies.
Course objective	Develop students' integrity of understanding of the basic categories and principles of mechatronics and provide practical skills in the analysis and synthesis of mechatronic objects.
Types of classes and control	Lectures, laboratory works, practical studies, calculated task, independent work and consultation. Final control – Exam
Semester	07

Competencies: Apply application software, microcontrollers and microprocessor technology to solve practical problems in professional activities. To solve professional problems in the design, installation and operation of electric power, electrotechnical, electromechanical complexes and systems. To know and understand the processes of using and consuming electricity by means of an electric drive in compliance with the specified parameters of technological processes and the quality of electricity. Be able to carry out calculations for the analysis of transient and steady modes of operation of electric drives and mechatronic modules and systems. Know and understand the principles of drawing up and calculating schemes of electrical installations for various purposes, determine the composition of their equipment and optimize their operating modes.

Covered topics:

Topic 1. General information about mechatronics.
Topic 2. Mechatronic systems in various areas of production activity.
Topic 3. Methods for constructing mechatronic systems.
Topic 4. Mechatronic movement modules.
Topic 5. Electric motors of mechatronic modules.
Topic 6. Motion converters.
Topic 7. Kinematic precision of mechatronic modules.
Topic 8. Information devices of mechatronic systems.
Topic 9. Microprocessor control systems.
Topic 10. Intelligent mechatronic modules.
Topic 11. Online platforms for designing and modeling mechatronic systems.

Teaching methods. This course has lectures, laboratory works, 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.

During laboratory works uses the active method, with students integrating theoretical and methodological knowledge, practical knowledge and skills in a single process. This method helps students to learn more information by applying MATLAB and Simulink software when carrying out tasks. Laboratory works are building so that can be use into models and blocks of coursework and diploma.

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, checking the level of the student's readiness to perform laboratory work and its defense, 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 all the laboratory work has been completed and the calculation tasks have been defended.

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

The distribution of student performance evaluation points is calculated individually for each discipline, taking into account the features and structure of the course. The current amount of points that a student can accumulate for a semester can reach both the maximum point and a lower point with the allocation of points for an exam or credit.

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

Current testing	Practical studies	Laboratory works	Calculated task	Exam	Sum
20	10	20	30	20	100

* It is not necessary to allocate points for points. Set-off can be obtained by accumulating points.
** It is necessary to allocate points for the exam (the number of points is individual for each discipline at the discretion of the lecturer)

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	– Inability to give reasoned answers

			its practical application; – the ability to solve simple practical problems.	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. Грабченко А.І., Клепіков В.Б., Доброскок В.Л., Крижний Г.К., Аніщенко М.В., Кутовий Ю.М., Пшеничников Д.О., Гаращенко Я.М. Вступ до мехатроніки. Навчальний посібник. – Харків: НТУ «ХПІ», 2014. – 274 с.
2. Ловейкін В.С., Ромасевич Ю.О., Човнюк Ю.В. Мехатроніка. Навчальний посібник. – Київ, 2012. – 357 с.
3. Артюх О. М., Дударенко О. В., Кузьмін В. В. Основи мехатроніки.

Навчальний посібник. – Запоріжжя, НУ «Запорізька політехніка», 2021. – 372 с.
4. Лавріненко Ю.М., Марченко О.С., Савченко П.І., Синявський О.Ю., Войтюк Д.Г. Лисенко В.П. Електропривод: підручник (за ред. Лавріненка Ю.М.). – К.: вид-во Лір-К., 2009. – 504 с.
5. Губарев О.П. Мехатроніка: циклічно-модульний підхід до вирішення практичних задач автоматизації / О.П. Губарев, О.С. Ганпанцурова. – К.: НТТУ «КПІ». – 2016. – 160 с.
6. Попович М.Г., Лозинський О.Ю., Клепіков В.Б. Електромеханічні системи автоматизації та електропривод. – К.: Либідь, 2005. – 678 с.
7. Аніщенко М.В. Комп'ютерне моделювання електроприводів побутової техніки. Навчальний посібник. – Харків: «Підручник НТУ «ХПІ», 2015. – 88 с.
8. Трофименко О.Г., Прокоп Ю.В., Швайко І. Г., Буката Л.М. С++. Теорія та практика. Навчальний посібник. – Одеса, 2011. – 587 с.
9. Robert H. Bishop. Mechatronics. An Introduction. Boca Raton: CRC Press, 2006. 285 p.
10. Robert H. Bishop. Mechatronic System Control, Logic, and Data Acquisition. Boca Raton: CRC Press, 2008. 755 p.
11. Robert H. Bishop. Mechatronic Systems, Sensors, And Actuators. Boca Raton: CRC Press, 2007. 656 p.
12. David G. Alciatore. Introduction to mechatronics and measurement systems. New York: McGraw-Hill Education, 2018. 609 p.
13. Erika Ottaviano. Mechatronics for cultural heritage and civil engineering. Cham: Springer International Publishing, 2018. 372 p.
14. Тренажер QNET Мехатронні датчики. Лабораторний практикум QNET-MECHKIT – керівництво для викладача. 2015. – 120 с.

Structural and logical scheme of studying course

Previous courses:	**The following disciplines:**
Fundamentals of metrology and electrical measurements	Industrial works
Fundamentals of computer systems theory in mechatronics	Systems of automated design in mechatronics
Power elements of systems of mechatronics and robotics	Electrical equipment of the car and electric vehicle
Theory of automatic control	

Developers:

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