Power Supply of Industrial Enterprises and Energy Saving

SYLLABUS

Code and name of specialty	**141 – Power engineering, electrical engineering and electromechanics**	**Institute / faculty**	**Power engineering, electronics and electromechanics**
Name of the program	**Electric drive, mechatronics and robotics**	**Department**	**Automated electromechanical systems**
Program type	**Educational and professional**	**Language of education**	**English**

Teacher

Full name, ***e-mail*** **Bohdan Vorobiov** ***bohdan.vorobiov@khpi.edu.ua***

Doctor of Philosophy (Ph.D), head of the department of automated electromechanical systems of NTU "KhPI". Work experience - 6 years. Author of more than 30 scientific works. Leading lecturer in the disciplines: "Fundamentals of scientific research", "Modelling of Mechatronic Systems", "Design of power supply systems in mechatronics".

General information about the course

Abstract	The discipline is aimed at providing students with theoretical knowledge about patterns, methods and means of scientific and technical research, solving real problems of identification and modeling of electromechanical objects and systems (EMCs) with the help of personal computers (PCs).
Course objectives	Formation of a future specialist in a clear system of the basics of theoretical knowledge, practical skills and skills of structural and parametric identification of EMC in linear modes of their operation, use of specialized software tools (software) to perform identification based on experimental data and obtain an optimal model of the dynamics of the object or system being studied.
Format	Lectures, practical classes, calculation tasks, consultations. Final control - credit.
Semester	7

Competences: Ability to solve complex specialised tasks and practical problems related to the operation of electrical systems and networks, electrical part of stations and substations and high voltage engineering. Ability to solve complex specialised problems and practical problems related to metrology, electrical measurements, operation of automatic control devices, relay protection and automation. Ability to solve complex specialised tasks and practical problems related to the problems of electricity generation, transmission and distribution. Ability to develop projects of electric power, electrical and electromechanical equipment in compliance with the requirements of legislation, standards and terms of reference. Awareness of the need to improve the efficiency of electric power, electrical and electromechanical equipment. Ability to promptly take effective measures in emergency (emergency) situations in electrical and electromechanical systems. Ability to draw up and calculate diagrams of electrical installations for various purposes, determine the composition of their equipment and optimise their operating modes.

Learning outcomes: To know and understand the principles of operation of electrical systems and networks, power equipment of power plants and substations, protective grounding and lightning protection devices and be able to use them to solve practical problems in professional activities. To know and understand the theoretical foundations of metrology and electrical measurements, the principles of operation of automatic control devices, relay protection and automation, to have the skills to make appropriate measurements and use these devices to solve professional problems. Analyse processes in electric power, electrical and electromechanical equipment, relevant complexes and systems. Be able to assess the energy efficiency and reliability of electric power, electrical and electromechanical systems. Find the necessary information in scientific and technical literature, databases and other sources of information, assess its relevance and reliability. Understand the importance of traditional and renewable energy for the successful economic development of the country. Solve complex specialised problems in the design and maintenance of electromechanical systems, electrical equipment of power plants, substations, systems and networks. Apply suitable empirical and theoretical methods to reduce electricity losses during its production, transportation, distribution and use. Solve professional problems in the design, installation and operation of electric power, electrical, electromechanical complexes and systems.

Topics covered

Topic 1: Calculation of electrical loads.

Topic 2. Selection of the number and power of power transformers.

Topic 3. Compensation of reactive power.

Topic 4. Short circuit in power supply systems.

Topic 5. Selection of devices and current-carrying parts.

Topic 6. Electrical networks of internal and external power supply.

Form and methods of teaching (a description of teaching methods is provided).

The process of learning in this discipline involves lectures, practical classes, a course project, independent work and consultations.

During lectures, the explanatory and illustrative method is used, in which the teacher presents the ready-made information by various means, and students perceive, understand and fix it in their memory. This method involves the use of such media as the word (oral and printed), prepared lecture texts, visual aids and equipment selection guides.

During practical classes, the methods of problem-based presentation and partial search are used, in which the teacher poses a problem and formulates a task, gradually guides and controls its solution, and students organise an active search, provide ways to solve the task. This method involves the use of printed manuals and reference books, lecture materials, and computer calculation software.

The course project is based on the research method, in which the teacher analyses the material taught, poses a problem and assigns tasks, and students substantiate assumptions, search for relevant sources of information, make calculations in the process of solving the problem and gain skills in creating technical drawings.

Independent work is the main means of learning the material in the time free from compulsory activities. The student must study the topics according to the recommended literature specified in the curriculum of the discipline.

Control methods (a description of control methods is provided)

The system of quality control of students' learning includes current control and final control in the form of an exam.

The current control of knowledge is implemented at each lesson in the form of a survey of previous lecture material, module work, and a course project. The results of the current performance are indicated in the rating card with the appropriate number of points and are taken into account as information in the rating system for assessing the exam in this discipline.

The control of the component of the work programme, which is mastered during the student's independent work with additional lecture material, is carried out in practical classes in the form of a discussion.

Semester control is carried out orally on the basis of examination tickets in the amount of educational material determined by the curriculum within the time limits established by the curriculum.

The student is considered admitted to the semester exam in the discipline provided that he/she has completed all practical classes provided for in the discipline's curriculum and defended the course project.

Distribution of points received by students

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

Table 1 - Distribution of points for assessing student performance for an exam

Ongoing testing and independent work			Total
Content module 1 – 15	Content module 2 – 15	Content module 3 – 15	
T1	T2 – T3	T4 – T6	45

Course project	Etc.	Exam	Total
40	5	10	100

Criteria and system for assessing students' knowledge and skills

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

Successful assessment of learning outcomes is a prerequisite for awarding credits to a student. Therefore, statements about the learning outcomes of programme components should always be accompanied by clear and appropriate assessment criteria for awarding credits. This makes it possible to state whether the learner has acquired the necessary knowledge, understanding and competences.

Assessment criteria are descriptions of what the learner is expected to do to demonstrate that the learning outcome has been achieved.

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

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

2. Increasing the objectivity of student knowledge assessment is achieved through 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 into the ECTS scale (A, B, C, D, E, F, FX, F).

Table 2 - Scale of assessment of knowledge and skills: national and ECTS

Rating score, points	**Score ESTS and its definition**	**National score**	**Evaluation criteria**	
			positive	**negative**
1	**2**	**3**	**4**	**5**
90-100	A	Excellent	- In-depth knowledge of the module's educational material contained in the main and additional literary sources; - ability to analyse the phenomena studied in their interconnection and development; - ability to make theoretical calculations; - answers to questions are clear, concise, logically consistent; - ability to solve complex practical problems.	The answers to the questions may include minor inaccuracies
82-89	B	Good	- A deep level of knowledge in the scope of mandatory material that - provided by the module; - ability to give reasoned answers to questions and make theoretical calculations; - ability to solve complex practical problems.	The answers to the questions contain certain inaccuracies;

75-81	C	Good	- Strong knowledge of the material, - Strong knowledge of the material being studied and its practical application; - Ability to give reasoned answers to questions and make theoretical calculations; - Ability to solve practical problems.	- Inability to use theoretical knowledge to solve complex practical problems.
64-74	D	Satisfactory	- Knowledge of the main fundamental provisions of the material, and their practical application; - Ability to solve simple practical problems.	- Inability to give reasoned answers to questions; - Inability to analyse the material presented and perform calculations; - inability to solve complex practical problems.
60-63	E	Satisfactory	- Knowledge of the main fundamental provisions of the module material, - ability to solve the simplest practical problems.	- Ignorance of certain (non-fundamental) issues from the module material; - inability to express opinions consistently and reasonably; - inability to apply theoretical provisions in solving practical problems
35-59	FX (further study required)	Unsatisfactory	Additional study of the module material can be completed within the timeframe provided by the curriculum.	Ignorance of the basic fundamental provisions of the module's educational material; - Significant errors in answering questions; - Inability to solve simple practical problems.

1-34	F (re-study required)	Unsatisfactory	-	- Complete lack of knowledge of a significant part of the module's educational material; - significant errors in answering questions; -Ignorance of the basic fundamental provisions; -Inability to navigate in solving simple practical problems

Main literature: (list of literature that provides this discipline)

1. Milykh V. I. Electric supply of industrial enterprises: a textbook for students of electromechanical specialties / V. I. Milikh, T.P. Pavlenko. - Kharkiv: FOP Panov A.M., 2016. - 272 p.

2. Milikh V. I. Electric supply of industrial enterprises: a textbook for students of electromechanical specialties / V. I. Milikh, T. P. Pavlenko. - Kyiv: Caravela, 2018. - 272 p.

3. Kozlov, V.D. Electric part of stations and substations: textbook / V.D. Kozlov, V.P. Zakharchenko, O.M. Tachynina; in general ed. V. D. Kozlova.– Kyiv: NAU, 2018. – 312 p.

4. Malinovsky A.A. Basics of electricity supply: education. manual / A. A. Malinovskyi, B. K. Khokhulin. - Lviv: Publishing House of the National University "Lviv Polytechnic", 2005. - 324p.

5. Shesterenko V. E. Systems of electric consumption and electric supply of industrial enterprises: textbook / V. E. Shesterenko. – Vinnytsia: Nova Kniga, 2004. – 656 p.

6. Neklepaev B. M. Electrical part of power plants and substations. Reference materials for course and diploma design. For university students / B. M. Neklepaev, I. P. Kryuchkov. - M.: Energoatomizdat, 1989. - 608 p.

7. Koliushko D.G. Designing power supply systems of industrial enterprises: educational method. manual / D. G. Koliushko, L. V. Asmolova – Kharkiv: KhPI National Technical University, 2021. – 96 p.

Structural and logical scheme of studying the discipline

Table 3: List of disciplines

The study of this discipline is directly based on:	The results of studying this discipline are directly relied upon:

Fundamentals of metrology and electrical measurements	Automated electric drive for general industrial installations part 1 and part 2
Electric machines	
Fundamentals of the electric power industry	
Theoretical foundations of of electrical engineering. part 1 and part 2	

Lecturer: Ph.D, HoD. Bohdan VOROBIOV. _____

(position, name) (signature)