Syllabus
selective component

Electrical Engineering and Electromechanics

Discipline name:	**Electrical Engineering and Electromechanics**
Level of higher education:	**first (bachelor's)**
Course page in Moodle:	https://dl2022.khadi-kh.com/course/view.php?id=3749
The volume of the educational component	**4credits and (120 hours)**
Form of final control	**Passed**
Consultations:	**on schedule**
Name of the department:	**Department of Metrology and Life Safety**
Language of instruction:	**English**
Course leader:	**Serikova Irina Alekseevna, Cand. techn. sciences**
Contact phone number:	*(067)108-52-37*
Email:	*Sirina301212@gmail.com*

Summary of the educational component:
The purpose of the discipline is to prepare bachelors in the field of automation and instrumentation to solve professional problems of information and measuring technologies in metrology and information-measuring technology.

Subject of discipline*:* theoretical foundations of electrical engineering, electronics and microprocessor technology.

The main tasks of studying the discipline are:
formation of students' a set of knowledge, skills and ideas about electrical engineering and electromechanics, the basics of building automotive electrical equipment in the creation of modern systems for automatic control of car units, optimization of energy and weight and size indicators of systems and devices of on-board electrical equipment, adaptation of electrical systems to the modes and operating conditions of vehicles.

Prerequisites for the study of the educational component: physics, mathematics, theoretical mechanics.

Competences that the applicant acquires:
***General competencies*:**
. Ability to abstract thinking.
. Ability to apply knowledge in practical situations.
. The ability to conduct research at a certain level.
. Skills in the use of information and communication technologies.

Special (professional) competencies:
. Ability to apply fundamental scientific facts, concepts, theories, principles for solving professional problems and practical problems of industrial engineering.
. Ability to evaluate and ensure the quality of work performed.
. Ability to apply computerized design systems and specialized software to solve engineering problems in the field of mechanical engineering.

Learning outcomes:
Develop parts and assemblies of machines using computer-aided design systems.

Ability and skills to use methods for studying the dynamic characteristics and strength indicators of machines and their mechanisms.

The ability and skills to select the structure of the mechatronic system, the algorithm of its functioning under the specified parameters of machine processes, taking into account advanced scientific achievements in the fields of electronics, mechanics, control systems.

Thematic plan

Topic number	Title of topics (LK, LR, PR, SZ, WED)	Number of hours	
		Eye	Correspondence
1	2	3	4
1	LC Introduction. The subject and purpose of the course, the main sections. The concept of sources and receivers of electrical energy. The simplest electrical circuit.	2	2
	PR (LR, SZ) Study of the work of electrical measuring devices. Ammeter, voltmeter, inatmeter.	2	2
	CP Classification of electrical measuring devices. Mechanisms and systems of devices. Devices of magnetoelectric, electromagnetic, electrodynamic, induction systems. Varieties of electrical measuring devices, accuracy classes, principle of operation, design.	11	14
2	LC DC electrical circuits. Basic laws of electrical circuits. Electric current power. The energy balance equation in DC circuits. Modes of operation of electric circuits. Measurement of electrical quantities. Measurement errors.	2	
	PR (LR, SZ) Study of the operation of DC electrical circuits with a mixed connection of receivers.	2	
	CP Study of the principle and method of overlapping in DC electrical circuits. Calculation of the energy balance in DC circuits.	11	14
3	LC Basic methods for calculating complex linear DC electrical circuits.	2	
	PR (LR, SZ) DC source research	2	
	CP Methods for calculating DC circuits.	11	14
4	LC AC electrical circuits. Advantages of using alternating current electrical energy. Forms of representation of sinusoidal electrical quantities. The main ratios in AC circuits.	2	
	PR (LR, SZ). Study of AC electrical circuits with a serial connection diagram of the	2	

	elements of the circuit. Triangle of resistances. Voltage resonance.		
	CP Calculation of AC electrical circuits with a parallel connection diagram of the elements of the circuit. Current resonance. Construction of triangles of resistances and capacities. Vector diagrams.	11	14
5	LC Three-phase AC systems. Main advantages. Connection according to the "star" scheme with and without a zero wire and a "triangle" scheme. The main ratios between linear and phase currents and voltages. Active, reactive and full power in three-phase AC systems.	2	
	PR (LR, SZ) Investigation of a three-phase electrical circuit connected according to the "star" scheme with and without a zero wire and the "triangle" circuit.	2	
	CP Methods of connecting the phases of sources and receivers. Three-phase circles connected according to the "triangle" scheme. Vector diagrams in three-phase circles	11	14
6	LC Electric Machines. Classification. Transformers. DC machines. Purpose, structure and principle of operation of generators and DC motors	2	
	PR (LR, SZ) Research of DC generators of independent, parallel and mixed excitation.	2	
	CP Classification, the structure of transformers. The principle of operation of a single-phase transformer. Basic ratios. Substitution scheme and vector diagram. Modes of non-working stroke and short circuit, loss power, hp Three-phase transformers, autotransformers, measuring transformers.	11	14
7	LC Synchronous and asynchronous machines. Purpose, structure and principle of operation of a synchronous three-phase generator. Operation of the synchronous generator in idle mode and under load. Stepper motor.	2	
	PR (LR, SZ) Investigation of the operation of a synchronous three-phase alternator. Study of the mechanical characteristics of an asynchronous motor.	2	
	CP Three-phase asynchronous motors. Purpose and principle of operation of three-phase asynchronous motors. Rotational	11	14

	magnetic flux. The main ratios in asynchronous motors. Engine drivers.		
8	LC Control and protection equipment. Manual switching devices. Switches and switches. Packet switches and switches. Electromagnetic and thermal relays.	2	2
	PR (LR, SZ) Microprocessor control systems for technological equipment. Fuses. Protection devices (RCDs). Magnetic controllers. Principle of operation	2	2
	WED. Contactors. Protection devices (RCDs). Inverters. Frequency converters. AC voltage and current stabilizers. Frequency voltage regulators.	11	14
Total for semester 1			
	LUX	16	4
	PR (LR, NW)	16	4
	WED	88	112
In just semester *N*			
TOTAL by discipline		120	

Teaching Methods:

• lectures, laboratory and practical classes, explanations, etc.;
• typical calculation works;
• standardized tests;
• tasks for in-depth creative training;
• tests;
• presentations of completed tasks and research;
• student presentations and speeches at scientific events;
• final comprehensive tests.

Grading system and requirements

1 Current success

1.1 The current performance of applicants for the performance of educational types of work in training sessions and for the performance of tasks of independent work is assessed using a four-point scale of grades, followed by recalculation in a 100-point scale. During the assessment of current performance, all types of work provided for by the curriculum are taken into account.

1.2 Lectures are evaluated by determining the quality of the specified tasks.

1.3 Practical classes are assessed by the quality of the control or individual task, the performance and design of practical work.

1.4 Evaluation of the current performance of applicants for higher education is carried out at each practical lesson (laboratory or seminar) on a four-point scale ("5", "4", "C", "2") and recorded in the journal of accounting for academic performance.

– "excellent": the applicant perfectly mastered the theoretical material, demonstrates deep knowledge of the relevant topic or academic discipline, the main provisions;

– "good": the applicant has well mastered the theoretical material, owns the main aspects from primary sources and recommended literature, reasonably teaches it; has practical skills, expresses his reasoning about certain problems, but assumes certain

inaccuracies and errors in the logic of presenting theoretical content or in the analysis of practical;

– "satisfactory": the applicant has mainly mastered the theoretical knowledge of an educational topic or discipline, is oriented in primary sources and recommended literature, but unconvincingly answers, confuses concepts, uncertainly answers additional questions, does not have stable knowledge; answering questions of a practical nature, reveals inaccuracies in knowledge, does not know how to evaluate facts and phenomena, connect them with a future profession;

– "unsatisfactory": the applicant has not mastered the educational material of the topic (discipline), does not know scientific facts, definitions, is almost not oriented in primary sources and recommended literature, there is no scientific thinking, practical skills are not formed.

2 **Final assessment**

The applicant for higher education receives an exam (credit) at the last lesson in the discipline based on the results of the current assessment. The average score for current activities is converted into points on a 100-point scale.

Applicants for higher education who have an average current grade in a discipline lower than "3" (60 points) in the last lesson can increase their current score by passing tests in the discipline.

Assessment of knowledge of applicants by testing is carried out on a scale:

– " Excellent": the theoretical content of the course has been mastered entirely, without gaps, the necessary practical skills in working with the mastered material have been formed, all the training tasks provided for by the training program have been completed, the quality of their implementation is estimated by the number of points close to the maximum. (at least 90% of correct answers);

– " Very good": the theoretical content of the course is mastered entirely, without gaps, the necessary practical skills in working with the mastered material are mainly formed, all the training tasks provided by the training program have been completed, the quality of most of them is estimated by the number of points close to the maximum. (from 82% to 89% of correct answers);

– " Good": the theoretical content of the course is mastered entirely, without gaps, some practical skills of working with the mastered material are not sufficiently formed, all the training tasks provided by the training program have been completed, the quality of none of them is assessed by the minimum number of points, some types of tasks are performed with errors (from 74% to 81% of correct answers);

– " Satisfactory": the theoretical content of the course is partially mastered, but the gaps are not significant, the necessary practical skills in working with the mastered material are mainly formed, most of the training tasks provided by the training program have been completed, some of the tasks completed may contain errors (from 67% to 73% of correct answers);

– " Satisfactory enough": the theoretical content of the course is partially mastered, but the gaps are not significant, the necessary practical skills in working with the mastered material are mainly formed, most of the training tasks provided by the training program have been completed, some of the tasks completed may contain errors (from 60% to 66% of correct answers);

– " Unsatisfactory": the theoretical content of the course is partially mastered, the necessary practical skills of work are not formed, most of the provided training programs have not been completed, or the quality of their implementation is estimated by the number of points close to the minimum; with additional independent work on the course material, it is possible to improve the quality of educational tasks (with the possibility of re-compilation)(less than 60% of correct answers);

- *"Unacceptable"* - the theoretical content of the course has not been mastered, necessary

Practical skills of work are not formed, all completed training tasks contain gross errors, additional independent work on the course material will not lead to any significant improvement in the quality of educational tasks. (with a mandatory re-course).

Table – Compliance of final ratings in points with scores on a national scale and ECTS scale

Score in	Score on a national scale (exam, credit)	ECTS score	
		Score	Criteria
90-100	**Perfectly**	**A**	***"Excellent"*** - the theoretical content of the course is mastered **entirely**, without gaps, the necessary practical skills of working with the mastered material are formed, **all** the training tasks provided for by the training program **have been completed**, the quality of their implementation is estimated by the number of points close to **the maximum**.
82 – 89	**Well**	**B**	***"Very good"*** - the theoretical content of the course is mastered **entirely**, without gaps, the necessary practical skills in working with the mastered material are **mainly** formed, **all** the training tasks provided by the training program **have been completed**, the quality of **most** of them is estimated by the number of points close to **the maximum**.
75 – 81		**With**	***«Good"***- the theoretical content of the course has been mastered **entirely**, without gaps, some practical skills of working with the mastered material are **not sufficiently** formed, **all** the training tasks provided by the training program **have been completed**, the quality of **none** of them **is assessed by the minimum** number of points, some types of tasks are performed with **errors**
67 – 74	**Satisfactory**	**D**	***"Satisfactory" - the*** theoretical content of the course is partially mastered, but the **gaps are not significant**, the necessary practical skills in working with the mastered material are **mainly** formed, **most** of the training tasks provided by the training program **have been completed**, **some** of the tasks performed may contain **errors**.
60 – 66		**And**	***"Enough"*** - the theoretical content of the course is partially mastered, some practical skills of work **are not formed**, **many** of the training tasks provided by the training program **have not been completed**, or the quality of some of them is estimated by the number of points close to the **minimum**.
35 – 59	**Disappointing**	**FX**	***"Unsatisfactory" - the*** theoretical content of the course is partially mastered, the necessary practical skills of work **are not formed**, **most** of the provided training programs **have not been completed**, or the quality of their implementation is estimated by the number of points close to the **minimum**; with **additional independent** work on the course material, **it is possible to improve the quality** performing learning tasks (**with the possibility of re-compilation**)

1 – 34		**F**	***"Unacceptable" - the*** theoretical content of the course has not been **mastered**, the necessary practical skills of work **are not formed**, **all completed** training tasks contain gross **errors**, **additional independent** work on the course material will **not lead** to any significant improvement in the **quality** of educational tasks.(**with a mandatory re-course)**

Course Policy:

– the course involves teamwork, the environment in the audience is friendly, creative, open to constructive criticism;

– mastering the discipline involves the obligatory attendance of lectures and practical classes, as well as independent work;

– independent work involves the study of individual topics of the discipline, which are made in accordance with the program for independent study, or were considered briefly;

– all tasks envisaged by the program must be completed within the prescribed period;

– while studying the course, applicants for higher education must comply with the rules of academic integrity set forth in the following documents: "Rules of academic integrity of participants in the educational process of KhNADU" (https://www.khadi.kharkov.ua/fileadmin/P_Standart/pologeniya/stvnz_67_01_dobroch_1.pdf), "Moral and ethical code of participants in the educational process of KhNADU (https://www.khadi.kharkov.ua/fileadmin/P_Standart/pologeniya/stvnz_67_01_MEK_1.pdf).

– write-offs during tests and tests are prohibited (including using mobile devices). Mobile devices are only allowed to be used during online testing.

Recommended literature:

1. Bazhinov O.V. Electrical systems of motor vehicles: laboratory workshop / O.V. Bazhinov, O.M. Bykov, G.S. Serikov. – Kharkiv: KhNADU, 2012.- 260 p.

2. Y. V. Batygin, S. A. Shinderuk, G.S. Serikov Resonance stronger of electrical power. Basic considerations. Bulletin of the National Technical University "KhPI". Series: Problems of improvement of electrical machines and apparatus. Theory and practice.:zb.sci. pr./ Nats. techn. un-t "Kharkiv. Polytechn. Etc.-t". – Kharkiv: NTU "KhPI". №32(1308)/ 2018. C. 59-63.

3. Y. V. Batygin, S. A. Shinderuk, G.S. Serikov, Eremina E.F. Resonance resonator of electrical power. Experimental research. Lutsk: LNTU. Zb.scientific works: Perspective technologies and devices. No13 (December), 2018. P.18 – 24.

4. Serikov G.S., Serikova I.O., Smirnov O.P., Borisenko G.O. Information control and diagnostic systems of modern vehicles / Automobile and Electronics. Modern technologies. Electronic scientific professional edition (printed version) No 17/2020, p. 17/2020. 62-68.

Additional Sources:

1. Distance course in the discipline [electronic resource]. Access mode: https://dl2022.khadi-kh.com/course/view.php?id=3749

Developer
syllabus of the discipline IrinaSERIKOVA

Head of the Department Oleg BOGATOV