Addition 2

ANNOTATION OF THE COURSE

Name of indicators	Characteristic
Full name of the discipline	Electrical Engineering, Electronics, Microprocessor Technology
Teaching Staff	Ph.D., Assoc. Prof. Honcharov Yevhen Viktorovich
Specialty	131 Applied Mechanics
Educational program	required professional training
Number of hours	120
Credit ECTS	4
Description	The study of the course is based on knowledge of the fundamental principles of physics, electricity, magnetism, higher mathematics (1-5 semesters). The course is special (professional) for engineering education, including for the field of production and technology. It prepares students to master special disciplines and develops skills that help to further solve engineering problems using electrical approaches, electrical and electronic devices in modern conditions, and in modern fields of science, technology and industries in which students specialize. **The purpose of the discipline is** formation of students; competencies and learning outcomes in the field of electrical engineering and electronics, by providing them with a base of theoretical and practical training. **Study results:** *know*: the general principles of selection of control and automation of technological processes in the mechanical engineering industry *be able to*: choose effective means of control and automation of technological processes in the mechanical engineering industry, taking into account the goals and existing constraints. **Teaching methods**: Lecture. The lecture uses different techniques of oral presentation of information: maintaining attention for a long time, activating the thinking of students; techniques that provide logical memorization: beliefs, arguments, proofs, classification, systematization, generalizations, etc. The method of discussion of educational material and discussion is used at lectures and practical classes. Discussion allows significantly deepening and systematizing knowledge, understanding of a particular problem, to check the basis of the conclusions reached by students during the study of specific topics. The discussion method develops in them the ability to defend their views and beliefs. The discussion helps to identify, logically and critically understand the different perspectives, scientific concepts and approaches to the issues under consideration. The organization and support of the discussion is achieved through the use of the following techniques: formulation of questions (basic, additional guidance, etc.), discussion of students; answers and opinions, adjustment of answers and formulation of conclusions. Practical and laboratory classes. The method used in

	preparing and performing laboratory work is: do as I do. In discussing the results obtained from laboratory work, the method of sequential assimilation of the material throughout the discussion is used. Students' independent work is associated with the assimilation of theoretical material in preparation for practical classes and the implementation of mandatory homework. At performance of independent works weekly consultations, step-by-step summing up of results, final control are organized.
Type of discipline	required
Final control	5/6 semester exam

Додаток 3

ЗМІСТ НМКД

№ з/п	Складова НМКНД	Наявність складової НМКНД	
		Електронний файл на сайті кафедри/посилання	Друкований варіант в НМКД
1	2	3	4
1	Титульний аркуш	+	+
2	Анотація навчальної дисципліни	+	+
3	Робоча навчальна програма	+	+
4	Конспект лекцій	+	+ *
5	Методичні вказівки/рекомендації до практичних, лабораторних, семінарських занять	+	+
6	Навчально-методичні матеріали до самостійної роботи студентів. Індивідуальні завдання.	+	+
7	Навчально-методичні матеріали для проведення практики	+	+
8	Методичні вказівки/рекомендації до виконання курсової роботи (проєкту), розрахунково-графічної роботи	+	+
9	Методичні вказівки/рекомендації до виконання бакалаврських випускних та магістерських кваліфікаційних робіт		
10	Комплекс задач поточного та підсумковому контролю	+	+
11	Модульні контрольні роботи (за наявністю) у вигляді переліку теоретичних питань та типових завдань для розв’язку, з яких формуватимуться індивідуальні завдання	+	+
12	Перелік питань до заліку/екзамену з дисципліни	+	+
13	Екзаменаційні білети, якщо екзамен передбачено навчальним планом	+	+
14	Комплексна контрольна робота (ККР), ректорська контрольна (РКР)		
15	Перелік навчально-методичної, наукової фахової літератури, періодичних видань, електронних ресурсів, що можуть бути використані для опанування дисципліни та не були наведені в робочій програмі дисципліни	+	+
16	Перелік засобів інформаційного, візуального та програмного забезпечення дисципліни		
*Паперовий варіант виготовляється у випадку службової необхідності (ліцензування, акредитація тощо).			

Appendix 1

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

NATIONAL TECHNICAL UNIVERSITY
«KHARKIV POLYTECHNIC INSTITUTE»

Department Applied Electrical Engineering

«**APPROVED**»
Head of the Department Applied Electrical Engineering
(name of the department)

_____ Korytchenko Kostyantyn Volodymirovich
(signature) (full name)
«_____»_____20__

THE EDUCATIONAL SUBJECT WORKING PROGRAM

ELECTRICAL ENGINEERING, ELECTRONICS, MICROPROCESSOR TECHNOLOGY

higher education level first
first (bachelor's) / second (master's)

field of knowledge 13 Mechanical engineering
(code and name)

specialty 131 Applied Mechanics
(code and name)

educational program 131-03 Automated production technologies
(names of education programs/ specialty)

type of subject required professional training
(general training / professional training; required / optional)

form of education full time
(full-time / part-time/ optional)

Kharkiv – 20__

Appendix 2

APPROVAL LIST

The educational subject on working program

ELECTRICAL ENGINEERING, ELECTRONICS, MICROPROCESSOR TECHNOLOGY
(title of the subject)

Developers:

Head of Department Applied Electrical Engineering, Dr. of techn. sciences, Prof.	_____	K.V. Korytchenko
(position, academic degree and academic title)	(signature)	(full name)
Vice-head of Department Applied Electrical Engineering, Dr. of techn. sciences, Prof.	_____	V.F. Bolyukh
(position, academic degree and academic title)	(signature)	(full name)
Assoc. Prof. of Department Applied Electrical Engineering, Ph.D., Assoc. Prof.	_____	Y.V. Honcharov
(position, academic degree and academic title)	(signature)	(full name)

The working program was considered and approved at the department meeting
Applied Electrical Engineering
(the name of the department providing the teaching of the subject)

Report from «____»_____20__ № _____

Head of Department Applied Electrical Engineering _____ K.V. Korytchenko
(name of the department) (signature) (full name)

Appendix 3

LETTER OF AGREEMENT

Code and name of the educational program	Name of the head of the supply group	Signature
131-03 Automated production technologies	Permyakov Alexander Anatolievich	

«_____» _____ 20__ .

Appendix 4

CONFIRMATION LETTER OF THE WORKING EDUCATION PROGRAM

Date of meeting of department -developer of working plan and educational program	Protocol number	Head of the department signature	Heads of the educational program

Appendix 5

OBJECTIVE, COMPETENCE, LEARNING RESULTS AND STRUCTURAL-LOGICAL SCHEME OF EDUCATIONAL SUBJECT

The course “Electrical engineering, electronics and microprocessor technology” is a fundamental basis for engineering education, including for the mechanical engineering industry. It guides students in the flow of modern scientific and technical information, prepares students to master special subjects and forms skills that help in the future to solve engineering problems using electrical engineering, electronic and microprocessor devices in modern conditions and in modern fields of science, technology and industry, in which students specialize.

Purpose: formation of students' competence and learning outcomes in the field of electrical engineering, electronics and electrical equipment by providing them with a base of theoretical and practical training.

Competencies

ПК-2	Ability to apply basic knowledge, at a minimum, of general physics, electrical engineering, electronics and microprocessor technology to the extent necessary to provide engineering training in the chosen profession

Studying results

РН 2	Demonstrate knowledge and understanding of fundamental, natural and engineering subjects, including physics, electrical engineering, electronics, circuit engineering and microprocessor engineering at the level necessary to achieve other outcomes of the educational program and to solve typical tasks and problems of automation

Structural-logical scheme of study of subject

The study of this subject is directly based on:	The results of studying this subject are directly based on:
Higher mathematics	All special subjects
Physics	

Appendix 6

DESCRIPTION OF THE COURSE

(the distribution of teaching time by semester and type of training)

Semester	Total volume		By class (hours)			Individual tasks of students (CP, CW, CGT, R, RE)	Current control	Semester control	
	Total amount (hours) / ECTS credits	Of them							
		Lecture classes (hours)	Independent work (hours)	Lectures	Laboratory classes	Practical classes, seminars		Control works (number of works)	Test	Examination
1	2	3	4	5	6	7	8	9	10	11
5/6	(120)/4	64	56	32	16	16	CGT			**X**

The ratio of hours of class to the total amount is 53 (%):

Appendix 7

STRUCTURE OF THE EDUCATIONAL SUBJECT

№ s/n	Types of training (L, LW, IW)	Number of hours	Semester number (if subject is taught in several semesters). Content module names. Name of topics and questions of each lesson. Tasks for independent work.	Recommended reading (basic, auxiliary)
1	2	3	4	5
			Content module № 1 Electric Circuits	
			Theme 1. DC electric circuits	
1	**L1**	**2**	**Introduction. Basic concepts and laws of electrical engineering. DC electric circuits and their structure. Source of electromotive force (EMF). Energy balance of the electric circuit. Modes of operation of the electric circuit.**	1, 2
2	**P1**	**2**	Calculation of simple direct current circuits with serial, parallel and mixed connection of elements by the method of equivalent transformations (direct and inverse problem).	1-3
3	**LW1**	**2**	Instruction of safety and technical rules. Laboratory stand arrangement. Explore simple DC circuits with series, parallel, and mixed element connections.	4
4	**IW1**	**2**	*Studying the basic laws and concepts of electric circuits. Solving LW1 tasks. Registration of LW1 and preparation for its delivery*	1, 2, 4
			Theme 2. AC Circuits	
5	**L2**	**2**	**General concepts about sinusoidal current circuits. Characteristics and parameters of sinusoidal current. Obtaining and presenting sinusoidal currents, voltages, EMF: analytical, graphical and vector. Current values of currents, voltages, EMF. Elements of the AC circuit.**	1, 2

1	2	3	4	5
6	**LW2**	**2**	Investigation of a sine wave circuit with a series connection of R, L, C loads	4
7	**P2**	**2**	Calculation of electric circuits of direct current by the method of transformation of elements connected by a “delta” into a “wye”.	1-3
8	**IW2**	**4**	*Study of characteristics and parameters of sinusoidal current. Registration of LW2 and preparation for its delivery*	1, 2, 4
9	**L3**	**2**	**The ratio of sinusoidal voltage and current on the ideal elements R, L, C. The concept of resistance and reactance. Sinusoidal voltage-to-current ratio on series ideal elements, with resistance, reactance and impedance. Kirchhoff's laws for sinusoidal current circuits. Energy and power in a sinusoidal current circuit. Power balance.**	1, 2
10	**IW3**	**4**	*The study of the basic relations of sinusoidal voltage and current in a circle with a series connection of the ideal elements. Studying power in a sine wave circuit with perfect R, L, C elements. Considering balance of power in electric circuits.*	1-4
			Theme 3. Three-phase electric circuits	
11	**L4**	**2**	**Three-phase circuits. The principle of receipt and presentation of the three-phase EMF system. Ways to connect three-phase phase sources. Linear and phase voltages and their relation in three-phase circuits. Ways to include load in three-phase circuit, types of three-phase load.**	1, 2
12	**LW3**	**2**	Investigation of three-phase electric circuits with balanced wye-delta connection.	4
13	**IW4**	**4**	*Studying the form of the three-phase EMF system and how to connect the phases of the three-phase source. Studying ways to include load in three-phase circuit, types of three-phase load.*	1, 2, 4

1	2	3	4	5
			Registration of LW3 and preparation for its delivery	
			Content module № 2 **«Electrical equipment»**	
			Theme 4. Magnetic Circles	
14	**L5**	**2**	**Magnetic Circuits of DC. Classification of magnetic circuits. The law of electromagnetic induction. Ampere law. Total current law. Magnetic circuits with variable magnetomotive force. Power losses in a steel core coil.**	1, 2
15	**P3**	**2**	Calculation of a complex electric circuit according to Kirchhoff's laws and the mesh analysis method (loop currents).	1-3
16	**IW5**	4	*Study of magnetic circuits with variable magnetomotive force. Studying the relationship between electrical and magnetic parameters in a steel core with sinusoidal voltage-activated coil.*	1, 2, 5
			Theme 5. Transformers	
17	**L6**	**2**	**Transformers. Purpose, structure and structure of the transformer. Types of transformers. The principle of operation of a single-phase transformer. Equation of voltages and currents. Power loss. Modes of operation. Transformer performance**	1, 2
18	**P4**	**2**	Determining the parameters of schemes for replacing electricity loads in alternating current electric circuits. Calculation of single-phase circuits of sinusoidal current with series connection of elements R, L, C.	1-3
19	**LW4**	**2**	Studies of single-phase transformer	5
20	**IW6**	**4**	*Study of the principle of operation of a single-phase transformer. Study of idle modes, short circuit and load, determination of transformer parameters. Registration of the LW4 and preparation for its delivery.*	1, 2, 5

1	2	3	4	5
			Theme 6. Electromagnetic devices: chokes, electromagnets, electrical apparatus, relays, circuit breakers.	
21	**L7**	**2**	**Electromagnetic devices. Adjusting throttles. Power electromagnets. Switching, starting and adjusting devices. Contactors. Relays are protective. Air circuit breakers.**	1, 2
22	**P5**	**2**	Calculation of sinusoidal current circuits with parallel and mixed connection of electric loads	7, 8, 9
			Theme 7. DC Electric Machines	
23	**L8**	**2**	**DC Electric Machines. Purpose and scope. The device of the DC machine. Principle of operation of the generator and DC motor. EMF, electromagnetic moment, voltage equation. Mechanical characteristics of DC motors with parallel, sequential and mixed excitation.**	1, 2
24	**IW7**	**4**	*Studying of ways of excitation of the DC machine. Study of alternators and DC motors.*	1, 2, 5
25	**LW5**	**2**	Investigation of a DC generator with independent excitation. Asynchronous Motor Research.	5
26	**IW8**	**4**	*Study of the device and principle of operation of the DC machine. Study of EMF and electromagnetic moment, voltage equations and operating modes. Study of mechanical characteristics of DC motors. Registration of LW5 and preparation for its delivery.*	1, 2, 5
			Theme 8. Three-phase induction motors	
27	**L9**	**2**	**Three-phase induction motors. Areas of application. Purpose and structure of a three-phase induction motor. Types of asynchronous motors. The principle of operation of a three-phase induction motor. Asynchronous motor parameters.**	1, 2

1	2	3	4	5
28	**IW9**	**4**	*Study of the structure of a three-phase induction motor. Study of the principle of operation and parameters of a three-phase induction motor.*	1, 2, 5
29	**L10**	**2**	**Electromagnetic torque and mechanical characteristics of an induction motor. Energy diagram of a three-phase induction motor. Start-up methods and methods of controlling the rotation of three-phase induction motors. Braking modes of three-phase induction motors.**	1, 2
30	**P6**	**2**	Calculation of three-phase electric circuits with balanced load connected with “wye” and “delta”	1-3
			Content module № 3 **«Fundamentals of Electronics»**	
			Theme 9. Physical processes in semiconductors. Classification of semiconductor devices	
31	**L11**	**2**	**Semiconductors and their properties. Physical processes in semiconductors. Electronic and hole conductivity. The electron-hole junction, its properties and characteristics. Classification of semiconductor devices. Semiconductor resistors.**	1
32	**IW10**	**4**	*Study of basic properties of electron-hole junction.*	1, 6
			Theme 10. Semiconductor resistors, diodes, transistors, thyristors	
33	**L12**	**2**	**Semiconductor diodes: Purpose, types, designations, parameters and characteristics. Thyristors: purpose, types, designations, device, circuits and characteristics.**	1
34	**IW11**	**4**	*Study of basic properties of semiconductor resistors, diodes and thyristors. Their purpose, designation, principle of operation, parameters and characteristics.*	1, 6
35	**LW6**	**2**	Research on semiconductor diode, zener diode and dynistor	5

1	2	3	4	5
36	**P7**	**2**	Carrying out content module No 1 “Calculation of electric circuits of direct current”	1-3
37	**L13**	**2**	**Bipolar Transistors: Purpose, Structure, Types, Designations, Circuits and Modes. Principle of operation of bipolar transistor. Amplifying properties, parameters and characteristics.**	1
38	**IW12**	**4**	*The study of the basic properties of bipolar transistors. Their purpose, designation, principle of operation, parameters and characteristics.*	1, 6
			Theme 11. Single phase rectifiers	
39	**L14**	**2**	**Rectifiers. Structural diagram and parameters of rectifiers. Single-phase rectifiers: circuits, principle of operation, parameters and characteristics. Rectifier smoothing filters: diagrams, principle of operation, parameters and characteristics.**	1
40	**LW7**	**2**	Investigation of single-phase semiconductor rectifiers	5
41	**IW13**	**4**	*Study of single-phase rectifiers, their scheme, principle of operation, parameters and characteristics.* *Registration of the LW7 and preparation for its delivery*	1, 6
			Theme 12. Electronic voltage multipliers, inverters, voltage regulators	
42	**L15**	**2**	**Voltage multipliers. Parallel and sequential voltage doublers: circuits and principle of operation. Standalone inverter: circuit, principle of operation. Voltage stabilizers. Parametric and compensation stabilizers: scheme, principle of action, indicators.**	1
43	**IW14**	**3**	*Study of voltage multipliers, standalone inverter and voltage stabilizers. Their scheme, principle of action, parameters and characteristics.*	1, 6
44	**LW8**	**2**	Final lesson on laboratory work	4-6

1	2	3	4	5
			Theme 13. Electronic amplifiers	
45	**L16**	**2**	**General concepts about amplifiers. Classification, block diagram, basic parameters, indicators. Low frequency amplifier on bipolar transistor according to the scheme with the common emitter: purpose of circuit elements, principle of operation, characteristics.** **Elements of digital and microprocessor technology. General information about microprocessors. Numerical systems. Microprocessor structure**	1
46	**P8**	**2**	Carrying out content module No 2 "Calculation of single-phase electrical circuits of sinusoidal current"	1-3
47	**IW15**	**3**	*Studying the low frequency amplifier on a bipolar transistor according to the scheme with a common emitter*	1, 6
Total (hours)		64		

Notes

1. The semester number indicates if the subject is taught in several semesters.

2. In the Total (hours) indicator, the number of hours will differ from the total number of class hours by the number of hours allocated to study themes and issues that are studied by the student (paragraph 3 of Appendix 8).

3. The line No 5 indicates the number in accordance with Appendix 14.

Appendix 8

INDEPENDENT WORK

Order No	Name of types of independent work	Number of hours
1	Development of lecture material	42
2	Preparation for practical (laboratory) classes	4
3	Independent study of topics and questions that are not taught at lectures	8
4	Performing an individual task:	2
5	Other types of independent work	
	Together	56

Appendix 9

INDIVIDUAL TASKS

Calculation task

(kind of individual task)

Order No	The name of the individual task and (or) its sections	Terms of implementation (in which week)
1	Issuance of the task	1
2	Calculation of DC electric circuits	4
3	Calculation of single-phase sinusoidal electric circuits	8
4	Task defense	15-16

Appendix 10

TEACHING METHODS

(a description of teaching methods is provided)

Methods of organization and implementation of training:

1. *Lecture.* The lecture uses different techniques of oral presentation of information: maintaining attention for a long time, activating the thinking of students; techniques that provide logical memorization: beliefs, arguments, proofs, classification, systematization, generalizations, etc.
2. *The method of discussion of educational material and discussion* is used at lectures and practical classes. Discussion allows you to significantly deepen and systematize knowledge, understanding of a particular problem, to check the basis of the conclusions reached by students during the study of specific topics. The discussion method develops in them the ability to defend their views and beliefs. The discussion helps to identify, logically and critically understand the different perspectives, scientific concepts and approaches to the issues under consideration. The organization and support of the discussion is achieved through the use of the following techniques: formulation of questions (basic, additional guidance, etc.), discussion of students' answers and opinions, adjustment of answers and formulation of conclusions.
3. *Visual and practical teaching methods.* Illustrative teaching methods include illustration and display. Illustration - showing students posters, cards, graphics, sketches on the board. Demonstration of lecture materials by multimedia.
4. *Practical and laboratory classes.* The method used in preparing and performing laboratory work is: do as I do. In discussing the results obtained from laboratory work, the method of sequential assimilation of the material throughout the discussion is used.

Appendix 11

CONTROL METHODS

(a description of the control methods is provided)

1. Current control: surveys, seminars and practical classes, tests, individual tasks, control work.
2. Semester control: conducted in the form of an examination with assessment in accordance with the curriculum in the amount of study material defined by the curriculum and within the terms set by the curriculum.

Appendix 12

DISTRIBUTION OF STUDENTS RECEIVED AND KNOWLEDGE AND SKILLS SCALE (NATIONAL AND ECTS)

Table 1. Score distribution to evaluate student achievement

Current testing and independent work									Sum
Content module 1					Content module 2				
T1	T2				T3	T4	T5		100
20	20				20	20	20		

* Scoring is not required. Passing test can be obtained by accumulating points.

Criteria and system for assessing students' knowledge and skills.

According to the guidelines of ECTS, an assessment system should be understood as a set of methods (written, oral and practical tests, examinations, projects, etc.) used in assessing the achievement of the expected learning outcomes by the students.

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

Assessment criteria are descriptions of what a person who is learning is expected to do in order to demonstrate the achievement of a learning outcome.

The main conceptual statements of the student's knowledge and skills assessment system are:

1. Improving the quality of training and competitiveness of specialists by stimulating independent and systematic work of students during an academic semester, establishment of constant feedback from teachers to each student and timely correction of his/her learning activities.

2. Improving the objectivity of students' knowledge assessment takes place through monitoring during a semester with the use of a 100-point scale (Table 2). Grades are necessarily translated into the national scale (with the state semester grades "excellent", "good", "satisfactory" or "unsatisfactory") and the ECTS scale (A, B, C, D, E, FX, F).

Table 3 - Knowledge and skills assessment scale: national and ECTS rating

Rating Assessment, points	**ECTS assessment and its definition**	**National assessment**	**Evaluation criteria**	
			positive	**negative**
1	**2**	**3**	**4**	**5**
90-100	A	Excellent	- **Deep knowledge** of the educational material of the module contained in the **main and additional literature sources**; - **ability to analyze** the phenomena being studied in their relationship and development; - **ability to** perform **theoretical calculations;** - **answers** to questions **are clear, concise, logically consistent;** - **ability to solve complex practical problems.**	Answers to questions may contain **minor inaccuracies**
82-89	B	Good	- **Deep level of knowledge** in the amount of **required material** provided by the module; - ability to give **reasonable answers** to questions and perform **theoretical calculations**; - ability to solve **complex practical problems**.	Answers to the questions contain **certain inaccuracies**;
75-81	C	Good	- **Strong knowledge** of the studied material and its **practical application**; - ability to give **reasonable answers** to questions and perform theoretical calculations; - ability to solve **practical problems**.	- Inability to use theoretical knowledge to solve **complex practical problems.**
64-74	D	Satisfactory	- **Knowledge of the basic fundamental provisions** of the studying material, and their **practical application**; - the ability to solve simple **practical problems**.	Inability to give **well-reasoned answers** to the questions; - inability to **analyse** the material presented and **perform calculations**; - Inability to solve **complex practical problems**.

60-63	E	Satisfactory	- Knowledge of **the basic fundamental provisions** of the module material, - ability to solve the simplest **practical problems.**	Ignorance of **individual (non-principled) questions** from the module material - inability to make a **coherent and well-reasoned** opinion; - inability to apply theoretical statements in solving **practical problems**
35-59	FX (re-study required)	Fail	**Additional study** of the module material can be performed **in the time provided by the educational curriculum.**	Ignorance of the **basic fundamentals** of the module - **significant errors** in answering questions; - inability to solve **simple practical problems**.
1-34	F (re-study required)	Fail	-	- Complete **lack of knowledge** of a considerable part of the module's study material; - **significant mistakes** in answering the questions; -ignorance of the main fundamentals; - inability to orient while solving **simple practical tasks**

Appendix 13

EDUCATIONAL AND METHODICAL SUPPORT EDUCATIONAL SUBJECT

(provides a list of components of educational support of the subject and links to the site where they are located)

1) Curriculum
2) Work program
3) Lecture notes
4) Methodical instructions for laboratory work
5) Question cards

Appendix 14

BIBLIOGRAPHY RECOMMENDED

Basic literature

№ п/п	Назва	Вихідні данні	Упорядники (автори)
1	2	3	4
1.	Lectures on electrical engineering. Tutorial for students.	Kharkiv, NTU “KhPI”, 2023. – 272 p.	Volodymyr Boliukh, Kostyantyn Korytchenko, Vladyslav Markov, Igor Polyakov, Yevgen Honcharov, Natalia Kriukova
2.	Розрахунок електричних кіл та електротехнічних пристроїв: Навчальний посібник	Харків: Планета-Прінт, 2019. – 288 с.	Болюх В.Ф., Коритченко К.В., Марков В.С., Поляков І.В.
3.	Calculation of electric circuits: meth. instructions for the calculation and graphic work on electrical engineering	Kharkiv, NTU “KhPI”, 2022. – 56 p.	V.F. Boliukh, Ye.V. Honcharov, K.V. Korytchenko, N.V. Kriukova, V.S. Markov, I.V. Polyakov
4.	Electric circuits: meth. instructions for laboratory works on electrical engineering. In three parts. P. I	Kharkiv, NTU “KhPI”, 2022. – 46 p.	V.F. Boliukh, Ye.V. Honcharov, K.V. Korytchenko, N.V. Kriukova, V.S. Markov, I.V. Polyakov
5.	Electric and magnetic devices: meth. instructions for laboratory works on electrical engineering. In three parts. P. II	Kharkiv, NTU “KhPI”, 2023. – 38 p.	V.F. Boliukh, Ye.V. Honcharov, V.S. Markov, K.V. Korytchenko, I.V. Polyakov, N.V. Kriukova
6.	Електроніка та мікропроцесорна техніка: лабораторний практикум з електротехніки Ч.ІІІ	Харків: НТУ «ХПІ», 2018. – 76 с.	Болюх В.Ф., Марков В.С., Поляков І.В., Гончаров Є.В., Крюкова Н.В.
7.	Збірник тестів з електротехніки: Навчальний посібник	Харків: НТУ «ХПІ», 2012. – 170 с.	Болюх В.Ф., Кожемякін С.М., Марков В.С., Поляков І.В.

Secondary literature

8 DOE fundamentals handbook electrical science Volume 1 of 4. Washington, D.C.: U.S. Department of Energy, 1992.

9 Eric H. Glendinning, Norman Glendinning Oxford English for Electrical and Mechanical Engineering, Oxford Press, 1995.

10 Navy Electricity and Electronics Training Series. Edition Prepared by ETCS(SW) Donnie Jones, 1998.

11 Tony R. Kuphaldt Fundamentals of Electrical Engineering and Electronics, SDL, 2011.

12 A First Course in Electrical and Computer Engineering By Louis Scharf. CONNEXIONS, Rice University, Houston, Texas, 2009, 313 p.

13 John Bird Electrical Circuit Theory and Technology. Oxford Revised: Newnes, 2003, 984 p.

Appendix 15

INFORMATION RESOURCES ON THE INTERNET

(a list of information resources)

Scientific and Technical Library NTU «KPI» http://library.kpi.kharkov.ua/en.

Methodological support of the Department of Applied Electrical Engineering web site:

1) Assignments for full-time students: http://web.kpi.kharkov.ua/ze/en/assignments-for-full-time-students/

2) Educational literature: http://web.kpi.kharkov.ua/ze/en/literature/

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

NATIONAL TECHNICAL UNIVERSITY
«KHARKIV POLYTECHNIC INSTITUTE»

The department Applied Electrical Engineering

«**APPROVED**»
Head of Department

Korytchenko K.V._____

«_____»_____20__

Syllabus of the course

ELECTRICAL ENGINEERING, ELECTRONICS, MICROPROCESSOR TECHNOLOGY

higher education level first (bachelor's degree)

type of subject required professional training

form of education (full time)

Kharkiv – 20__

The amount of discipline: 4 credits ECTS 120 hours.

Lectures: 32 hours.

Laboratory classes: 16 hours.

Practical classes: 16 hours.

Form of control: exam.

Teaching term for «Bachelor» level: 5/6 semester.

Language teaching: English.

The purpose of formation of stable knowledge of students in the field of electrical engineering, electronics and electrical equipment, by providing them with a base of theoretical and practical training.

Competencies

ПК-2	Ability to apply basic knowledge, at a minimum, of general physics, electrical engineering, electronics and microprocessor technology to the extent necessary to provide engineering training in the chosen profession

Learning achievements

РН 2	Demonstrate knowledge and understanding of fundamental, natural and engineering subjects, including physics, electrical engineering, electronics, circuit engineering and microprocessor engineering at the level necessary to achieve other outcomes of the educational program and to solve typical tasks and problems of automation

Topics considered

Theme 1. DC electric circuits.

Theme 2. AC electric circuits.

Theme 3. Three-phase electric circuits.

Theme 4. Magnetic circuits.

Theme 5. Transformers.

Theme 6. Electromagnetic devices: inductors, electromagnets, electric apparatus, relays, circuit breakers.

Theme 7. DC electric machines.

Theme 8. Three-phase asynchronous motors.

Theme 9. Physical processes in semiconductors. Classification semiconductor devices.

Theme 10. Semiconductor resistors, diodes, transistors, thyristors.

Theme 11. Single phase rectifiers.

Theme 12. Electronic voltage multipliers, inverters, voltage stabilizers.

Theme 13. Electronic amplifiers.

Form and methods of teaching

Methods of organization and implementation of training:

1. *Lecture.* The lecture uses different techniques of oral presentation of information: maintaining attention for a long time, activating the thinking of students; techniques that provide logical memorization: beliefs, arguments, proofs, classification, systematization, generalizations, etc.
2. *The method of discussion of educational material and discussion* is applied at lectures and practical classes. Discussion allows you to significantly deepen and systematize knowledge, understanding of a particular problem, to check the basis of the conclusions reached by students during the study of specific topics. The discussion method develops in them the ability to defend their views and beliefs. The discussion helps to identify, logically and critically understand the different perspectives, scientific concepts and approaches to the issues under consideration. The organization and support of the discussion is achieved through the use of the following techniques: formulation of questions (basic, additional guidance, etc.), discussion of students' answers and opinions, adjustment of answers and formulation of conclusions.

3. *Visual and practical teaching methods*. Illustrative teaching methods include illustration and display. *Illustration* – showing students posters, cards, graphics, drawings on the board. Demonstration of lecture materials by multimedia.
4. *Practical and laboratory classes.* The method used in preparing and performing laboratory work is: do as I do. In discussing the results obtained from laboratory work, the method of sequential assimilation of the material throughout the discussion is used.

Control methods

1. Current control: surveys, speeches at seminars and practical classes, tests, making individual tasks, control work.
2. Semester control: conducted in the form of a test with assessment in accordance with the curriculum in the amount of study material defined by the curriculum and within the terms set by the curriculum plan.

Distribution of points that students receive

The distribution of student evaluation scores is calculated individually for each discipline, taking into account the features and structure of the course. The current amount of points a student can earn per semester can be as high as possible and lower with the points awarded for the exam or test.

Table 1. – Score distribution to evaluate student achievement

Current testing and independent work									Sum
Content module 1					Content module 2				
T1	T2				T3	T4	T5		100
20	20				20	20	20		

* Scoring is not required. Passing test can be obtained by accumulating points.

Criteria and system for assessing students' knowledge and skills.

According to the guidelines of ECTS, an assessment system should be understood as a set of methods (written, oral and practical tests, examinations, projects, etc.) used in assessing the achievement of the expected learning outcomes by the students.

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

Assessment criteria are descriptions of what a person who is learning is expected to do in order to demonstrate the achievement of a learning outcome.

The main conceptual statements of the student's knowledge and skills assessment system are:

1. Improving the quality of training and competitiveness of specialists by stimulating independent and systematic work of students during an academic semester, establishment of constant feedback from teachers to each student and timely correction of his/her learning activities.

2. Improving the objectivity of students' knowledge assessment takes place through monitoring during a semester with the use of a 100-point scale (Table 2). Grades are necessarily translated into the national scale (with the state semester grades "excellent", "good", "satisfactory" or "unsatisfactory") and the ECTS scale (A, B, C, D, E, FX, F).

Table 3 - Knowledge and skills assessment scale: national and ECTS rating

Rating Assessment, points	**ECTS assessment and its definition**	**National assessment**	**Evaluation criteria**	
			positive	**negative**
1	**2**	**3**	**4**	**5**
90-100	A	Excellent	- **Deep knowledge** of the educational material of the module contained in the **main and additional literature sources**; - **ability to analyze** the phenomena being studied in their relationship and development; - **ability to** perform **theoretical calculations;** - **answers** to questions **are clear, concise, logically consistent;** - **ability to solve complex practical problems.**	Answers to questions may contain **minor inaccuracies**
82-89	B	Good	- **Deep level of knowledge** in the amount of **required material** provided by the module; - ability to give **reasonable answers** to questions and perform **theoretical calculations**; - ability to solve **complex practical problems**.	Answers to the questions contain **certain inaccuracies**;

75-81	C	Good	- **Strong knowledge** of the studied material and its **practical application**; - ability to give **reasonable answers** to questions and perform theoretical calculations; - ability to solve **practical problems**.	- Inability to use theoretical knowledge to solve **complex practical problems.**
64-74	D	Satisfactory	- **Knowledge of the basic fundamental provisions** of the studying material, and their **practical application**; - the ability to solve simple **practical problems**.	Inability to give **well-reasoned answers** to the questions; - inability to **analyse** the material presented and **perform calculations**; - Inability to solve **complex practical problems**.
60-63	E	Satisfactory	- Knowledge of **the basic fundamental provisions** of the module material, - ability to solve the simplest **practical problems.**	Ignorance of **individual (non-principled) questions** from the module material - inability to make a **coherent and well-reasoned** opinion; - inability to apply theoretical statements in solving **practical problems**
35-59	FX (re-study required)	Fail	**Additional study** of the module material can be performed **in the time provided by the educational curriculum.**	Ignorance of the **basic fundamentals** of the module - **significant errors** in answering questions; - inability to solve **simple practical problems**.
1-34	F (re-study required)	Fail	-	- Complete **lack of knowledge** of a considerable part of the module's study material; - **significant mistakes** in answering the questions; -ignorance of the main fundamentals; - inability to orient while solving **simple practical tasks**

EDUCATIONAL AND METHODICAL SUPPORT
EDUCATIONAL SUBJECT

(provides a list of components of educational support of the subject and links to the site where they are located)

1) Curriculum
2) Work program
3) Lecture notes
4) Methodical instructions for laboratory work
5) Question cards

Basic Literature: (A list of literature that provides this subject)

. п/п	Назва	Вихідні данні	Упорядники (автори)
1	2	3	4
1.	Lectures on electrical engineering. Tutorial for students.	Kharkiv, NTU "KhPI", 2023. – 272 p.	Volodymyr Boliukh, Kostyantyn Korytchenko, Vladyslav Markov, Igor Polyakov, Yevgen Honcharov, Natalia Kriukova
2.	Розрахунок електричних кіл та електротехнічних пристроїв: Навчальний посібник	Харків: Планета-Прінт, 2019. – 288 с.	Болюх В.Ф., Коритченко К.В., Марков В.С., Поляков І.В.
3.	Calculation of electric circuits: meth. instructions for the calculation and graphic work on electrical engineering	Kharkiv, NTU "KhPI", 2022. – 56 p.	V.F. Boliukh, Ye.V. Honcharov, K.V. Korytchenko, N.V. Kriukova, V.S. Markov, I.V. Polyakov
4.	Electric circuits: meth. instructions for laboratory works on electrical engineering. In three parts. P. I	Kharkiv, NTU "KhPI", 2022. – 46 p.	V.F. Boliukh, Ye.V. Honcharov, K.V. Korytchenko, N.V. Kriukova, V.S. Markov, I.V. Polyakov
5.	Electric and magnetic devices: meth. instructions for laboratory works on electrical engineering. In three parts. P. II	Kharkiv, NTU "KhPI", 2023. – 38 p.	V.F. Boliukh, Ye.V. Honcharov, V.S. Markov, K.V. Korytchenko, I.V. Polyakov, N.V. Kriukova

6.	Електроніка та мікропроцесорна техніка: лабораторний практикум з електротехніки Ч.ІІІ	Харків: НТУ «ХПІ», 2018. – 76 с.	Болюх В.Ф., Марков В.С., Поляков І.В., Гончаров Є.В., Крюкова Н.В.
7.	Збірник тестів з електротехніки: Навчальний посібник	Харків: НТУ «ХПІ», 2012. – 170 с.	Болюх В.Ф., Кожемякін С.М., Марков В.С., Поляков І.В.

Secondary literature

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9 Eric H. Glendinning, Norman Glendinning Oxford English for Electrical and Mechanical Engineering, Oxford Press, 1995.

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13 John Bird Electrical Circuit Theory and Technology. Oxford Revised: Newnes, 2003, 984 p.

Structural-logical scheme of study of discipline

Table 4 – List of subjects

The study of this subject is directly based on:	The results of studying this subject are directly based on:
Higher mathematics	All special subjects
Physics	

Lead Lecturer:
Assoc. Prof. of Department
Applied Electrical Engineering,
Ph.D., Assoc. Prof. Honcharov Yevhen Viktorovych _____
(position, title, full name) (signature)