National Technical University of Ukraine
Igor Sikorsky Kyiv Polytechnic Institute "

Department of theoretical electrical engineering

THEORETICAL FOUNDATIONS OF ELECTRICAL ENGINEERING. PART 1. LINEAR ELECTRIC CIRCUITS OF DIRECT AND ALTERNATING CURRENT

Working program of the academic discipline (Syllabus)

Details of the academic discipline	
Level of higher education	***First (undergraduate)***
Discipline	*14 "Electrical engineering"*
Specialty	*141 "Electric power engineering, electrical engineering and electromechanics"*
Educational program	*"ELECTROMECHANICAL AUTOMATION SYSTEMS, ELECTRIC DRIVES AND ELECTRIC MOBILITY", "ELECTRICAL MACHINES AND APPARATUS"*
Discipline status	*Language obligation (normative)*
Form of education	*daytime*
Year of training, semester	*1st year, spring semester*
Scope of the discipline	*6 ECTS credits / 180 hours* *classroom hours - 90 hours:* *lectures – 36 hours; practices – 36 hours; laboratory work - 18 hours;* *independent work - 90 hours*
Semester control/ control measures	*Examination/ MKR, protection of RGR, protection of laboratory works*
Class schedule	*1 lecture (2 hours) once a week;* *1 practical lesson (2 hours) once a week;* *1 laboratory work (4 hours) once every 2 weeks.*
Language of teaching	*Ukrainian*
Information about the head of the course / teachers	*Lecturer* : *Ph.D. associate professor, Lyudmila Yuriivna Spinul , 0503838643, e - mail : spinul 20@ gmail . com* *Practical* : *Ph.D. associate professor, Lyudmila Yuriivna Spinul , 0503838643, e - mail : spinul 20@ gmail . com* Laboratory: academic degree, academic title, full name, contact information
Placement of the course	*https://classroom.google.com/c/NjM2OTEzNDgzMzM0?cjc=c6j2bso*

Curriculum discipline

1. Description of the educational discipline, its purpose, subject of study and learning outcomes

The program of the study discipline "Theoretical foundations of electrical engineering-1" was compiled in accordance with the educational and professional training program of a bachelor in the field of knowledge 14 "Electrical engineering" in the specialty 141 "Electric power engineering, electrical engineering and electromechanics".

The goal of the educational discipline is the formation and consolidation of students the following competencies: **K01** . Ability to abstract thinking , analysis and synthesis , **K 02** . Ability apply knowledge in practical situations , **K05** . Ability to search , process and analyze information from various sources , **K06.** Ability identify , set and solve problems , **K07** . Ability work in a team , **K08** . Ability work autonomous , **K12**

. Ability solve practical tasks from involvement methods of mathematics, physics and electrical engineering .

The subject of the educational discipline is the laws of the theory of linear electric circuits, typical mathematical methods of analysis of electric circuits of constant and single-phase sinusoidal currents.

Program learning outcomes for the formation and improvement of which the discipline is aimed at: PR05 Know the basics of electromagnetic field theory, methods of calculating electric circuits and be able to use them to solve practical problems in professional activity, **PR07** Carry out process analysis in electric power, electrotechnical and electromechanical equipment, relevant complexes and systems . **PR08** Choose and apply suitable methods for the analysis and synthesis of electromechanical and electric power systems with specified indicators.

2. Pre-requisites and post-requisites of the discipline (place in the structural and logical scheme of training according to the relevant educational program)

To successfully master the discipline, the student must possess the theoretical base of the disciplines "General Mathematics", "General Physics". The discipline "Theoretical foundations of electrical engineering-1" precedes the study of the disciplines "Theoretical foundations of electrical engineering-2", "Electric machines", "Automated electric drive".

3. Content of the academic discipline

SECTION 1. Linear electric circuits of direct current.
Topic 1.1. Basic concepts and laws of an electric circuit.
Topic 1.2. Methods of calculating an electric circuit.
SECTION 2. Linear electrical circuits of single-phase sinusoidal current.
Topic 2.1. The main properties of a sinusoidal current circuit and its calculation.
Topic 2.2. Electric circuits with inductively coupled elements and their calculation.
Topic 2.3. Resonance phenomena and frequency characteristics.
Topic 2. 4 . Fundamentals of the theory of quadrupoles.

4. Educational materials and resources

Main information resources:

1. Painter V.S. Theoretical basics of electrical engineering: Textbook: – Lviv: Lviv Polytechnic Publishing House , 2018. – 416 p.
2. Matvienko M. P. Fundamentals of electrical engineering and electronics. Textbook. - K.: Lira-K Publishing House, 2017. - 504 p.
3. Khilov V.S. Theoretical foundations of electrical engineering: Dnipro: National Technical University "Dnipro Polytechnic", 2021. -433 p.
4. Karpov Yu.O. , Katsiv S.Sh. , Kuharchuk V.V. , Vedmitsky Yu.G. Theoretical foundations of electrical engineering. stable modes of linear electric circuits with concentrated and distributed parameters . Textbook . – Kherson: " Oldi -Plus+", 2019. – 326 p.
5. Panachevnyi B.I., Svergun Y.F. General electrical engineering . Textbook . - K.: "Caravela", 2018. - 296 p.
6. "Theoretical foundations of electrical engineering. Collection of problems: study guide" / incl . O.V. Koroshchenko , V.F. Dennyk , O.A. Zhuravel , etc.; according to general ed . O.V. Koroshchenko . -Donetsk, DVNZ " DonNTU ", 2012. -673 p.
7. Gurzhii A.M., Meshchaninov S.K., Nelga A.T., Spivak V.M. Electrical engineering and basics of electronics: Textbook. -Kyiv: "Litera LTD", 2020. - 288 p

8. Nilsson JW & Riedel SA Electric circuits. Tenth edition. Pearson Education Limited. 2020. https://ktuee.files.wordpress.com/2019/11/electric-circuits-by-james-w.-nilsson-susan-riedel-10th-edition.pdf .

9. Theoretical foundations of electrical engineering. Part 1. Study guide [Electronic resource]: study guide for bachelor's degree holders in the educational programs "Electrical systems and networks", "Electrical stations", "Electrical machines and devices", "Control, protection and automation of power systems", "Electromechanical automation systems, electric drive and electric mobility ", "Electrotechnical devices and electrotechnological complexes" "Unconventional and renewable sources of energy" / V. S. Boyko, L. Yu. Spinul , M. P. Buryk , V. Yu. Lobodzinskyi ; KPI named after Igor Sikorsky. – Electronic text data (1 file: 3.35 MB). – Kyiv: KPI named after Igor Sikorskyi, 2022. – 199 p. https://ela.kpi.ua/handle/123456789/47853

10. Distance course "Theoretical electrical engineering" *https://classroom.google.com/c/NjM2OTEzNDgzMzM0?cjc=c6j2bso*

Additional:

1. Educational and methodological manual for the course "Electrical engineering". Section "Calculation of direct current linear circuits" / incl . A. A. Shcherba, V. P. Grudska , L. Yu. Spinul - K.: Polytechnic Polytechnic Institute. - 2004.

2. Educational and methodological manual for the course "Electrical engineering". Section "Calculation of linear circuits of single-phase sinusoidal current" / incl . Shcherba A.A., Grudska V.P., Spinul L.Yu. - K.: IVC "Polytechnic". - 2004.

3. Educational and methodological manual "Mutual induction in alternating current circuits". / incl . Shcherba A.A., Grudska V.P., Chibelis V.I., Spinul L.Yu. - K.: VOC "Polytechnic". - 2006.

4. Calculation of direct current electric circuits. Educational edition. / Composer: I.A. Kurylo, I.N. Namatsalyuk , A.A. Shreba - K.: NTUU "KPI", FEA, 2006. - 51 p.

5. Calculation of electrical circuits of sinusoidal single-phase current. Methodical instructions for performing calculation works. / Composer: I.A. Kurylo, I.N. Namatsalyuk , A.A. Shreba - K.: NTUU "KPI", 2004. - 82 p.

6. Theoretical foundations of electrical engineering - 1. Laboratory practice [Electronic resource]: study guide for bachelor's degree holders in the educational programs "Electrotechnical devices and electrotechnological complexes", "Non-traditional and renewable energy sources", "Power plants", "Electromechanical systems of automation and electric drive" , "Electrical machines and devices", "Electrical systems and networks", "Management, protection and automation of power systems" specialty 141 "Electric power, electrical engineering and electromechanics" / M.P. Buryk , L.Yu. Spinul , V.Yu. Lobodzinskyi , Yu. V. Peretyatko , O. O. Illina ; KPI named after Igor Sikorsky. – Electronic text data (1 file: 1.49 MB). – Kyiv: KPI named after Igor Sikorskyi, 2022. – 96 p. https://ela.kpi.ua/handle/123456789/47710 .

7. Linear electric circuits of constant and single-phase sinusoidal current. Calculated graphic work [Electronic resource]: study guide for bachelor's degree holders in the educational programs "Electrical systems and networks", "Electrical stations", "Electrical machines and devices", "Management, protection and automation of power systems", "Electromechanical automation systems, electric drive and electromobility ", "Electrotechnical devices and electrotechnological complexes", "Non-traditional and renewable energy sources" specialty 141 "Electric power, electrical engineering and electromechanics" / M. P. Buryk , L. Yu. Spinul , V. Yu. Lobodzinskyi , O. V Petruchenko , N. V. Belenok ; KPI named after Igor Sikorsky. – Electronic text data (1 file: 4.11 M bytes). – Kyiv: KPI named after Igor Sikorskyi, 2022. – 175 p. https://ela.kpi.ua/handle/123456789/48890

8. Theoretical fundamentals of electrical engineering . Linear network theory [Electronic resource] : tutorial for bachelor's degree programs for specialty "141 Electricity , electrical engineering and electromechanics " / Ju . V. Peretyatko , LY Spinul ; Igor Sikorsky Kyiv Polytechnic Institute . –

Electronic text data (1 file: 759 KB). – Kyiv : Igor Sikorsky Kiev Polytechnic Institute , 2019. - 44 p. – https://ela.kpi.ua/handle/123456789/42066

9. Theoretical fundamentals of electrical engineering . Single phase AC circuits [Electronic resource] : tutorial for students doing Bachelor's degree programs in specialty "141 Electric Power Engineering , Electrical Engineering and Electromechanics " / Yuliia Peretyatko , Liudmyla Spinul , Maksym Shcherba ; Igor Sikorsky Kyiv Polytechnic Institute . – Electronic text data (1 file: 1.62 MB). – Kyiv : Igor Sikorsky Kyiv Polytechnic Institute , 2020. - 62 p. https://ela.kpi.ua/handle/123456789/42070

10. Theoretical fundamentals of electrical engineering . Part 1 [Electronic resource] : tutorial for students doing Bachelor's degree programs in specialty "141 Electric Power Engineering , Electrical Engineering and Electromechanics " / Yuliia Peretyatko , Liudmyla Spinul , Maksym Shcherba ; Igor Sikorsky Kyiv Polytechnic Institute . – Electronic text data (1 file: 2.79 MB). – Kyiv : Igor Sikorsky Kyiv Polytechnic Institute , 2021. – 137 p. https://ela.kpi.ua/handle/123456789/42069

Educational content

5. Methods of mastering an educational discipline (educational component)

Lecture classes

No s/p	*The name of the topic of the lecture and a list of main questions (list of didactic tools, links to information sources)*
Chapter 1 ***LINEAR ELECTRIC CIRCUITS OF DIRECT CURRENT.***	
1.	Electric circuit, its elements. Volt-ampere characteristic (VAH) of elements. Linear and non-linear elements. Energy sources: voltage source, current source. Schemes of substitution and I-V characteristics of energy sources. Equivalence conditions of substitution schemes. **The structure of an electric circuit and basic laws.** Topological elements of an electric circuit. Circle graph.
2	**Basic laws of an electric circuit.** Ohm's law: for a section of a conductor, for a line with EMF, for a closed circuit. Kirchhoff's first and second laws. Definition voltage on the circle section . **Methods of calculating complex electric circuits.** Method of Kirchhoff equations. Power balance in an electric circuit.
3	**Methods of calculating complex electric circuits.** Method of contour currents. Own and intercontour supports. Method of nodal potentials, method of nodal voltage. Own and internodal conductances.
4	**Equivalent transformations in electric circuits .** Transformation of passive sections of an electric circuit: serial and parallel connection; star and triangle transformation of resistances. Transformation of circuit parts with energy sources: serial connection with EMF sources, parallel connection with current and EMF sources.
5	**Methods of calculating complex electric circuits.** The principle and method of superimposing the action of energy sources. **Active and passive bipoles.** Definition of bipolar. Theorem about an active dipole. The active two-pole method and its use for calculating branch current. Energy transfer from an active bipolar to a passive one. Maximum power transfer condition.
6	**Some properties of an electric circuit.**

	Property of reciprocity and its use. Input and mutual conductances of branches, their calculations. Compensation theorem.
Chapter 2 **LINEAR ELECTRICAL CIRCUITS OF A SINGLE-PHASE SINE CURRENT.**	
7	**The main properties of sinusoidal current. Time and vector diagrams** . Instantaneous values of current, voltage, oscillation phase, initial phase, phase shift angle. Time charts. Actual value of current, voltage. Representation of sinusoidal currents, voltages by rotating vectors and complex functions. Vector diagrams.
8	**Peculiarities of physical processes in an alternating current circuit.** The relationship between voltages and currents on the elements of an alternating current circuit. Calculation diagram of an alternating current circuit. Kirchhoff's laws for an alternating current circuit.
9	**Voltages and powers of elements *R* , *L* , *C* with a sinusoidal current. Active and reactive resistances.** Element *R* with sinusoidal current: instantaneous functions of current, voltage, power. Active power, active resistance. Element *L* with sinusoidal current: instantaneous functions of current, voltage, power. Reactive resistance of the inductance. Element *C* with sinusoidal current: instantaneous functions of current, voltage, power. Reactance of the capacity.
10	**Series and parallel connection of elements *R , L , C* with a sinusoidal current.** Voltage equation for series connection. Active and reactive voltage, active and reactive resistance. Vector diagram of serial connection. Voltage and current triangles. Equations for parallel connection currents. Active and reactive currents, active and reactive conductivity. Complex conductivity. Vector diagram of parallel connection currents. Triangles of currents and conductances . Calculation of a complex circle symbolic (complex) method .
1 1	**Powers of a sinusoidal current circuit.** Active, reactive and full power circle. Correlation between capacities and scheme parameters. Comprehensive power. Power balance.
1 2	**Equations for inductively coupled elements.** Flows and flow coupling of self-induction and mutual induction. Terminals of the same name (clamps). Harmonized and non-harmonized currents. The equation for voltages. Calculation of an electric circuit with inductively coupled elements. Series connection of inductively coupled coils.
1 3	**Equations for inductively coupled elements.** Parallel connection of inductively coupled coils. The method of loop currents for calculating a circuit with inductively coupled circuits coils
1 4	**Energy transfer between inductively coupled circuit elements.** Equations for complex powers of 2 inductively coupled elements. Active and reactive powers of mutual induction. The condition of energy transfer from one coil to another. Transmission direction. Magnetic separation.
1 5	**Resonance in a series oscillating circuit.** Conditions for the occurrence of resonance. Vector diagram of the resonant state. Tuning and frequency characteristics of a series circuit. Energy processes during resonance. **Resonance in a parallel oscillating circuit with losses.**

	Conditions for the occurrence of resonance. Possibilities of achieving resonance when changing the frequency. Correlation between currents and circuit parameters at resonance. Vector diagram of the resonant state.
16	Frequency characteristics of reactive bipolar devices. Properties and rules for constructing frequency characteristics. **Classification of quadripoles. Basic forms of equations** . Classification of 4-poles. The equation of a passive 4-pole in the forms [Y], [Z], [A], [B]. Definition of Y and Z parameters. The relationship between the coefficients of Eqs. Symmetry condition of the 4-pole.
1 7	**Equivalent schemes for replacing a passive 4-pole. Definition of A-parameters** . T- and P-schemes of replacing a passive 4-pole. Correlation between A-parameters and resistances of elements of substitution schemes. Determination of A-parameters from idle and short-circuit modes of a 4-pole.
18	**Quadrupole equations expressed in terms of secondary parameters. Connection diagrams of quadripoles.** Determination of A-parameters of a 4-pole through secondary parameters. Parallel, serial and cascade connection of 4-poles, circuit diagram.

Practical classes

No. z/p	*Summary of the practical lesson*
Chapter 1 ***LINEAR ELECTRIC CIRCUITS OF DIRECT CURRENT.***	
1.	**Simple electric circuits. Transformation in an electric circuit. Ohm's law , Kirchhoff's laws.** Series, parallel and mixed connection of resistors. Voltage and current sources. Using Ohm's law for a branched circuit with one EMF source.
2.	**The method of Kirchhoff's laws. Power balance of the electric circuit.** The sequence of calculating an electric circuit using Kirchhoff's laws. Compilation of the power balance of the electric circuit.
3	**Method of contour currents. Power balance of the electric circuit.** The sequence of calculation of an electric circuit by the method of loop currents. Determination of loop resistances and loop emfs. Determination of branch currents through loop currents. Compilation of the power balance of the electric circuit.
4	**Method of nodal potentials. Power balance of the electric circuit.** The sequence of calculation of an electric circuit by the method of nodal potentials. Selection of reference (base node). Determination of nodal conductances and nodal currents. Determination of branch currents.
5	**Superposition method. Power balance of the electric circuit.** The sequence of calculating an electric circuit by the method of superimposing the action of energy sources. Determination of input and mutual conductivities . Compilation of the power balance of the electric circuit.
6	**Method of active bipolar (equivalent generator).** The sequence of calculation of an electric circuit by the active bipolar method. Determination of equivalent parameters of a bipolar device. Transmission of maximum power from an active bipolar to a passive one.
7	**MKR (part 1):** calculation of a complex electric circuit of direct current.
Chapter 2 ***LINEAR ELECTRICAL CIRCUITS OF SINGLE-PHASE SINUSOIDAL CURRENT.***	
8	**Calculation of the circuit of a sinusoidal current in series and parallel connecting elements.** Using Ohm's law and Kirchhoff's first law in complex form. Instantaneous values of currents and voltages, vector diagrams.
9	**Calculation of the sinusoidal current circuit of the mixed connection.** Series-parallel connection of elements and its calculation by the symbolic method. Determination of complex equivalent resistances of a mixed connection, calculation of complex currents and line voltages. Vector diagrams of currents and voltages. Compilation of the circuit power balance.
10	**Calculation of the sinusoidal current circuit.** Calculation of a complex circuit of a sinusoidal current by the symbolic method.
11	**Calculation of a branched circuit with inductive connections.** Calculation of a sinusoidal current circuit with inductive couplings in series and parallel connecting elements.
12	**Calculation of a branched circuit with inductive connections.**

	Using the method of loop currents to calculate a branched circuit with mutual induction. Intrinsic and inter-circuit complex resistances in the presence of inductively connected branches in the circuits. Mutual induction power, power balance.
1 3	**Voltage resonance. Resonance of currents** Resonance phenomena in a series circuit. Determination of resonance condition parameters.
14	**Voltage resonance. Resonance of currents** Resonance phenomena in a series circuit. Determination of resonance condition parameters.
15	**MKR (part 2):** calculation of the circuit of a sinusoidal current by the symbolic method.
16	**Frequency characteristics** Construction of frequency characteristics of a sinusoidal current circuit. Determination of resonance frequencies by frequency characteristic
17	**Four-pole** Calculation of the parameters of the T- and P-scheme of replacing the passive quadrupole. Determination of A-parameters through the supports of elements of substitution schemes. Determination of A-parameters from the idle and short-circuit modes of the four-pole.
18	**Four-pole** Determination of A-parameters of a 4-pole through secondary parameters.

Laboratory work

No s/p	*Summary of laboratory work*
Chapter 1 **LINEAR ELECTRIC CIRCUITS OF DIRECT CURRENT.**	
1	Simulation of a real voltage source. Video: https://toe.fea.kpi.ua/laboratory_tasks_08.html
2	Experimental verification of Kirchhoff's and Ohm's laws . Study of the distribution of potentials in an electric circuit. Video: https://toe.fea.kpi.ua/laboratory_tasks_08.html
3	Experimental verification of the method of superimposing the action of energy sources in a linear electric circuit. Video: https://toe.fea.kpi.ua/laboratory_tasks_08.html
4	Research of equivalent transformations of combinations of resistances according to the "star" and "delta" schemes. Video: https://toe.fea.kpi.ua/laboratory_tasks_08.html
5	Study of active bipolar DC. Video: https://toe.fea.kpi.ua/laboratory_tasks_08.html
Chapter 2 **LINEAR ELECTRICAL CIRCUITS OF A SINGLE-PHASE SINE CURRENT.**	
6	Research of serial and parallel connections of consumers of the electric circuit of sinusoidal current. *Video : http :// toe . fea . kpi ua / laboratory _ tasks _09. html*
7	Research of the mixed connection of consumers of the electrical circuit of sinusoidal current. *Video : http :// toe . fea . kpi ua / laboratory _ tasks _09. html*
8	Study of an electric circuit with mutual inductance. *Video : http :// toe . fea . kpi ua / laboratory _ tasks _09. html*
9	Study of electrical resonance in a series oscillating circuit (voltage resonance). *Video : http :// toe . fea . kpi ua / laboratory _ tasks _09. html*

6. Student's independent work

No. z/p	Type of independent work	
1	Calculations based on primary data obtained in laboratory classes	20
2	Preparation for practical classes	15
3	Performing calculation and graphic work	1 5
	Preparation for MKR	10
4	Preparation for the exam	30

Policy and control

7. Policy of academic discipline (educational component)

The system of requirements that the teacher sets before the student:

- rules for attending classes: in accordance with Order 1-273 dated 14.09.2020, it is prohibited to evaluate the presence or absence of the winner at the classroom class, including the awarding of incentive or penalty points. According to the RSO of this discipline, points are awarded for the corresponding types of educational activity.
- rules of behavior in classes: the student has the opportunity to receive points for the appropriate types of educational activity in lectures, practical and laboratory classes, provided for by RSO disciplines. The use of means of communication to search for information on the teacher's Google Drive, on the Internet, in a distance course on the Sikorsky platform is carried out at the instruction of the teacher;
- laboratory work protection rules: laboratory work is protected individually.
- rules for the protection of individual tasks: the protection of calculation and graphic work in the discipline is carried out individually;
- rules for assigning incentive points: incentives are not included in the main scale of RSO, and their sum does not exceed 10% of the starting scale. Incentive points are awarded for participation in university and All-Ukrainian Olympiads in the discipline "Theoretical Basics of Electrical Engineering", participation in faculty and institute scientific conferences.
- policy of deadlines and rescheduling: untimely completion of RGR and untimely protection of laboratory works foresee a reduction of the maximum score for a certain type of activity to 75%. The minimum score does not change. If the student did not pass or did not appear at the MKR, his/her result is evaluated at 0 points. In this case, it is possible to write the MKR, but the maximum score for it will be 75% of the maximum. The rescheduling of the protection of laboratory works, RGR and MKR is not provided for;
- policy on academic integrity: the Code of Honor of the National Technical University of Ukraine "Kyiv Polytechnic Institute" https://kpi.ua/files/honorcode.pdf establishes general moral principles, rules of ethical behavior of individuals and provides a policy of academic integrity for persons working and studying at the university, which they should be guided by in their activities, including when studying and preparing control measures in the discipline "Theoretical foundations of electrical engineering-1". Laboratory works, RGR and MKR, which do not meet the requirements of the current Regulation on the system of prevention of academic plagiarism in KPI named after Igor Sikorskyi, are rated at 0 points. In this case, the laboratory work or RGR can be redone with a change of option. The maximum score will be reduced by 30%.
- when using digital means of communication with the teacher (mobile communication, e-mail, correspondence on forums and social networks, etc.), it is necessary to observe generally accepted ethical norms, in particular, to be polite and limit communication to the working hours of the teacher.

8. Types of control and rating system for evaluating learning outcomes (RSO)

Current control : MKR, RGR, independent work, laboratory work.
Calendar control : is carried out twice a semester as a monitoring of the current state of meeting the requirements of the syllabus .
Conditions for successful completion of the calendar control **:** at least 50% of points for the implementation of the curriculum of the discipline on the control date, which involves the performance and defense of laboratory work, RGR, MKR.
Semester control : exam
Conditions for admission to semester control : performance and protection of all laboratory work and RGR.
WARNING! *Students who, at the time of the pre-exam consultation, have not passed the laboratory and RGR tests, are not allowed to take the main test and are preparing for a retake.*

Table of correspondence of rating points to grades on the university scale:

Number of points	*Rating*
95-100	*Perfectly*
85-94	*Very good*
75-84	*Good*
65-74	*Satisfactorily*
60-64	*Enough*
Less than 60	*Unsatisfactorily*
Less than 30	*Not allowed*

The student's overall rating after the end of the semester consists of points obtained for:

- Completion of 4 independent works in practical classes;
- performance and protection of 9 laboratory works;
- performance of individual work (RGR) in two parts;
- implementation of the ICR in two parts.

No. z/p	Control measure	Max. point	How many	In total
1.	MKR (part 1, part 2)	5	2	10
2.	RGR, part 1	5	1	5
3.	RGR, part 2	6	1	6
4.	Independent work	3	4	12
5.	Laboratory work	3	9	27
6.	Exam	40	1	40
	TOGETHER			100

Independent work in practical classes

Weight score – 3.

The maximum number of points for all practical classes is 3 points * 4 = 12 points.

The minimum number of points in practical classes is 3 points * 4 * 60% = 7.2 points.

Evaluation criteria:

- choosing the optimal method of calculation, correctly performing calculations with a full explanation, checking the results of the solution, constructing the diagrams indicated in the condition - $(1-0{,}9)\cdot 3 \approx 3.0$ - 2.7 points;

- solving the problem correctly or with minor errors with explanations of individual stages of the solution, lack of verification of the results of the solution, lack of diagrams specified in the condition - $(0{,}89-0{,}75)\cdot 3\approx$ 2.69 - 2.25 points;
- solving the problem with significant errors without explanation of the solution, lack of checking the results of the solution and the diagrams indicated in the condition - $(0{,}74-0{,}6)\cdot 3\approx$ 2.24 - 1.8 points;
- solving the problem with fundamental errors - $(<0{,}6)\cdot 3=0$ points.

Performance and protection of laboratory work

Weighted score – 3 (1.5 points – the results are presented in the form of a protocol, 1.5 points – the defense of the work).

The maximum number of points for all laboratory work is 3 points * 9 = 27 points .

The minimum number of points for all laboratory works (provided they are fully completed and protected) is

3 points *9 *60% = 16.2 points .

Evaluation criteria:

Results issued in the form of a protocol:

- excellent preparation for laboratory work (availability of the protocol, knowledge of the purpose of the work, knowledge of the main theoretical provisions that are being tested), active participation in the implementation of research, correct and tidy processing of the results of experiments - (0.9..1) * 1.5 points;
- good preparation for laboratory work, active teaching in conducting research, minor errors in processing the results of experiments - (0.89..0.75) * 1.5 points;
- satisfactory preparation for laboratory work, passive participation in research, significant errors in processing the results of experiments - (0.74..0.6) * 1.5 points;

Job protection:

- complete answers to control questions on the topic of the work - (0.9..1) * 1.5 points;
- incomplete answers to control questions - (0.89..0.75) * 1.5 points;
- partial answers to control questions or lack of answers to individual questions, provided that the general purpose of the work and the main stages of the research are understood - (0.74..0.6) * 1.5 points;
- incorrect answers to most control questions on the topic of the work - 0 points.

Individual semester assignment (SAM)

According to the working curriculum, each student performs calculation and graphic work. RGR consists of two parts : "Calculation of a complex electric circuit of direct current", "Calculation of a single-phase electric circuit of sinusoidal current".

The maximum number of points for the first part of the RGR is 5 points, the minimum is 3 points.

The maximum number of points for the second part of the RGR is 6 points, the minimum is 3.6 points.

The final grade for the RGR consists of the points received for the preparation of the work and its defense.

Evaluation criteria:

Completed work results:

- correct execution of calculations with a full explanation, checking the results of the solution, correct construction of the diagrams (graphs) specified in the condition – (0,9..1) * (2,5;3) points;
- correct execution of calculations with a partial explanation, verification of the obtained results, insignificant errors in calculations and construction of diagrams (graphs) - (0.89..0.75) * (2.5;3) points;
- correct execution of calculations with an incomplete explanation, errors in solving and constructing diagrams (graphs), lack of verification of the obtained results - (0.74..0.6) * (2.5;3) points;
- performance of work with fundamental errors or absence of a significant part of it, absence of diagrams (graphs) specified in the condition - 0 points.

Job protection:

- complete answers to the questions regarding the stages of work execution - (0,9..1) *(2,5;3) points;
- incomplete answers to questions about the stages of work performance - (0.89..0.75) * (2.5;3) points;
- lack of answers to individual questions regarding the stages of work performance, provided that the general purpose and main stages of performance are understood - (0.74..0.6) * (2.5;3) points;
- lack of answers to most questions regarding the stages of work performance, lack of understanding of its general purpose - 0 points.

Modular control work

The modular control work consists of two parts: "Calculation of a complex electric circuit of direct current", "Calculation of a single-phase electric circuit of sinusoidal current".

The task of each test consists of one task.

The weighted score of each part of the MKR is 5 points.

The maximum score for MKR is 2 *5=10 points.

Evaluation criteria

- choosing the optimal method of calculation, correct execution of calculations with a full explanation, checking the results of the solution, building the diagrams indicated in the condition - (0.9..1)* 5 points;

- correct composition of the system of equations and its solution , verification of the obtained results, in the absence of the diagrams specified in the condition - (0.89..0.75)* 5 points;

- correct composition of the system of equations and its solution, lack of verification of the obtained results and the diagrams indicated in the condition - (0.74..0.6)*5 points;

- solving the problem with fundamental errors - 0 points .

The form of semester control is an exam

The examination work consists of two tasks.

Each task is valued at 20 points.

Evaluation criteria of the exam

The maximum rating of the exam is 40 points.

Evaluation of one zvdvchi :

- choosing the optimal method of calculation, correct execution of calculations with a full explanation, checking the results of the solution, building the diagrams specified in the condition - (0,9..1)* 20 points ;
- correct composition of the system of equations and its solution , checking the obtained results, in the absence of the diagrams specified in the condition - (0.89..0, 75)* 20 points;
- correct composition of the system of equations and its solution, lack of verification of the obtained results and the diagrams indicated in the condition - (0.74..0, 6)* 20 points;
- - solving the problem with fundamental errors - 0 points .

9. Additional information on the discipline (educational component)

List of questions submitted for semester control (as Appendix 1 to the syllabus)

Working program of the academic discipline (syllabus):

Folded Associate Professor of the Department of Theoretical Electrical Engineering, Ph.D., Assoc. Spinul L.Yu.

Approved by the Department of Theoretical Electrical Engineering of the FEA (protocol No. 1 5 dated 06.19.2024)

Agreed by the Methodical Commission of the faculty [1](protocol No. 10 of June 20, 2024)