Національний технічний університет України
«КИЇВСЬКИЙ ПОЛІТЕХНІЧНИЙ ІНСТИТУТ
імені ІГОРЯ СІКОРСЬКОГО»

Department emblem (if available)

Department of Radio Engineering

Fundamentals of Circuit Theory. Part 1

Curriculum of the academic discipline (Syllabus)

Course details	
Level of higher education	***First (bachelor's)***
Field of knowledge	*17 – Electronics, Automation, and Electronic Communications*
Special	*172 – Electronic communications and radio engineering*
Educational program	*Intelligent technologies of radio-electronic engineering, Information and Communication Radio Engineering, Radio Engineering Computerized Systems, Radio Electronic Warfare Technologies*
Status of discipline	*Regulatory*
Form of study	*Full-time (daytime)*
Year of study, semester	*1st year, spring semester*
Scope of the discipline	*3 credits (36 hours of lectures, 36 hours of practical work, 18 hours of independent study)*
Semester control/control measures	*Final test*
Class schedule	
Language of instruction	*Ukrainian*
Information about the course supervisor/teachers	Lecturer: *Andrii V. Bulashenko, PhD in Technical Sciences a.bulashenko@kpi.ua* Practical classes: *Candidate of Technical Sciences, Andriy V. Bulashenko*
Course location	https://do.ipo.kpi.ua/course/view.php?id=6181

Curriculum

1. Description of the academic discipline, its purpose, subject matter, and learning outcomes

The academic discipline "Fundamentals of Circuit Theory. Part 1" is an integral part of the discipline "Fundamentals of Circuit Theory." It closely combines knowledge in the fields of physics and mathematics. Electrical circuits are used in almost all technical means of information transmission and processing. Knowledge in the field of circuit theory, starting with the basics, should accompany specialists of various levels. The subject of the discipline is the study of direct current circuits, harmonic current circuits, and circuits in resonance modes. Circuit analysis apparatus using controlled sources for modeling circuits with radio-electronic components is widely used. Mathematical modeling is closely related to the understanding of physical processes. Therefore, the aim of the course "Fundamentals of Circuit Theory. Part 1" is to develop students' competencies for researching, using, and developing devices that contain electronic circuits and allow them to perform the following tasks:

- calculations of DC electrical circuits using computing technology;
- calculations of alternating current electrical circuits using computing technology;
- calculations of the main parameters of oscillatory circuits.

General competencies (GC)

GC 1. Ability to think abstractly, analyze, and synthesize. GC 2. Ability to apply knowledge in practical situations.
GC 4. Knowledge and understanding of the subject area and understanding of professional activity.
GC 8. Ability to identify, pose, and solve problems.

Professional competencies (PC)

PC 4. Ability to perform computer modeling of devices, systems, and processes using universal application software packages.

Program learning results (PLR)

PLR 1. Analyze, argue, and make decisions when solving specialized problems and practical problems in telecommunications and radio engineering, which are characterized by complexity and incomplete certainty of conditions;
PLR 2. Apply the results of personal research and analysis of information to solve qualitative and quantitative problems of a similar nature in information and communication networks, telecommunications and radio engineering systems;
PLR 4. Explain the results obtained from measurements in terms of their significance and relate them to the relevant theory;
PLR 7. Competently apply the terminology of the telecommunications and radio engineering industry;
PLR 8. Describe the principles and procedures used in telecommunications systems, information and telecommunications networks, and radio engineering;
PLR 13. Apply fundamental and applied sciences to analyze and develop processes occurring in telecommunications and radio engineering systems;
PLR 18. Find, evaluate, and use information from various sources necessary for solving professional tasks, including reproducing information through electronic search;

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

The educational component "Fundamentals of Circuit Theory" belongs to the general training cycle for specialists in the specialty 172 Electronic Communications and Radio Engineering. The discipline is fundamental in the training of bachelors and is related to many other disciplines. The prerequisite disciplines include: "Fundamentals of Metrology," "General Physics." The discipline "Fundamentals of Circuit Theory" itself provides the basis for studying the discipline "Signals and Processes in Radio Engineering."

3. Course content

Names of sections and topics	Number of hours				
	Total	including			
		Lectures	Practical (seminars)	Laboratory computer practicum)	Self-study

Section 1. Linear direct current electrical circuits					
Topic 1.1. Basic concepts and laws of electrical circuit theory	**11**	**6**	**4**	**-**	**1**
Topic 1.2. Basic methods for calculating electrical circuits	**17**	**8**	**8**	**-**	**1**
Module Test (MT) for section 1	**3**	**-**	**2**	**-**	**1**
Home control work (HCW) for Section 1	**3**				**3**
Total for section	**34**	**14**	**14**	**-**	**6**
Section 2. Linear AC electrical circuits					
Topic 2.1. Periodic alternating current	3	1	1	-	1
Topic 2.2. Analysis of circuits in harmonic mode	23	11	11	-	1
Topic 2.3. Circles with mutual induction	6	2	2		2
MT for Section 2	3	-	2	-	1
HCW for Section 2	3			-	3
Total for section	**38**	**14**	**16**	**-**	**8**
Section 3. Single oscillatory circuits					
Topic 3.1. Series oscillatory circuit.	6.5	4	2	-	0.5
Topic 3.2. Parallel oscillatory circuit.	6.5	4	2	-	0.5
MT for section 3	3		2	-	1
HCW for section 3	2			-	2
Total for Section 3	**18**	**8**	**6**	-	**4**
Total hours	**90**	**36**	**36**	-	**18**

4. Teaching materials and resources

Basic literature

1. Fundamentals of Circuit Theory: Lecture Course [Electronic resource]: textbook for students majoring in 172 Electronic Communications and Radio Engineering / A. V. Bulashenko; Igor Sikorsky Kyiv Polytechnic Institute. – Electronic text data (1 file, 7.4 MB). – Kyiv: Igor Sikorsky Kyiv Polytechnic Institute, 2023. – 420 p.
2. Fundamentals of Circuit Theory: Textbook for students of higher educational institutions. Part 1 / Yu. O. Koval, L. V. Hrynchenko, I. O. Milyutchenko, O. I. Rybin / Edited by V. M. Shokol and V. I. Pravda. – Kharkiv: SMIT Company, 2008. – 432.
3. Fundamentals of Circle Theory: Textbook for Students of Higher Educational Institutions. Part 2 / Yu.O. Koval, L.V. Grinchenko, I.O. Milyutchenko, O.I. Rybin / Edited by V.M. Shokol and V.I. Pravda. – Kharkiv: SMIT Company, 2008. – 560.
4. Fundamentals of Circuit Theory. Collection of Problems [Electronic resource]: textbook for students majoring in 172 Electronic Communications and Radio Engineering / A. V. Bulashenko; Igor Sikorsky Kyiv Polytechnic Institute. – 2nd edition, revised and supplemented. – Electronic text data (1 file, 4.9 MB). – Kyiv: Igor Sikorsky Kyiv Polytechnic Institute, 2024. – 180 p.
5. Fundamentals of circuit theory. Calculation of linear direct current electrical circuits. Practical exercises. [Electronic resource]: textbook for students majoring in 172 Electronic Communications and Radio Engineering / A. V. Bulashenko; Igor Sikorsky Kyiv Polytechnic Institute. – Electronic text data (1 file, 2.66 MB). – Kyiv: Igor Sikorsky Kyiv Polytechnic Institute, 2023. – 85 p.
6. Fundamentals of circuit theory. Calculation of linear AC electrical circuits. Practical exercises. [Electronic resource]: textbook for students majoring in 172 Electronic Communications and Radio Engineering / A. V. Bulashenko; Igor Sikorsky Kyiv Polytechnic Institute. – Electronic text data (1 file, 2.219 MB). – Kyiv: Igor Sikorsky Kyiv Polytechnic Institute, 2023. – 75 p.
7. Fundamentals of circuit theory. Calculation of single circuits. Practical exercises. [Electronic resource]: textbook for students majoring in 172 Electronic Communications and Radio Engineering / A. V. Bulashenko; Igor Sikorsky Kyiv Polytechnic Institute. – Electronic text data (1 file, 1.51 MB). – Kyiv: Igor Sikorsky Kyiv Polytechnic Institute, 2023. – 62 p.
8. Fundamentals of Circuit Theory. Recommendations for Completing Homework Assignments. [Electronic resource]: textbook for students majoring in 172 Electronic Communications and Radio Engineering / A. V. Bulashenko; Igor Sikorsky Kyiv Polytechnic Institute. – 2nd ed., revised and supplemented. – Electronic text data (1 file, 2.12 MB). – Kyiv: Igor Sikorsky Kyiv Polytechnic Institute, 2024. – 46 p.

Supplementary literature

1. Fundamentals of Theory and Computer Modeling of Electronic Circuits: Textbook [Electronic resource]: textbook for students majoring in 172 Telecommunications and Radio Engineering / V. D. Stashuk, A. V. Bulashenko; Igor Sikorsky Kyiv Polytechnic Institute. – Electronic text data (1 file, 6.58 MB). – Kyiv: Igor Sikorsky Kyiv Polytechnic Institute, 2019. – 400 p.
2. Fundamentals of Electronic Circuit Theory: Textbook (second edition: revised and expanded) / Yu. Ya. Bobalo, B. A. Mandziy, P. G. Stakhiv, L. D. Pysarenko, Yu. I. Yakimenko; Edited by Prof. Yu. I. Yakimenko. – Kyiv: Publishing House of the National Technical University of Ukraine "Kyiv Polytechnic Institute," 2011. – 332 p.
3. Baidak Yu.V. Fundamentals of Circuit Theory. Textbook – Kyiv: Vyshcha Shkola: Slovo, 2009. – 271 p.
4. Theoretical Foundations of Electrical Engineering: Textbook: in 3 volumes / edited by I.M. Chyzenko, V.S. Boiko. – Kyiv: IVC "Polytechnika Publishing House," 2004. – Vol. 1: Steady State of Linear Electrical Circuits with Concentrated Parameters. – 272 p.
5. Gumen M.B. Fundamentals of electrical circuit theory. In 3 volumes. Vol. 1. Analysis of linear electrical circuits. Time domain: Textbook. / M.B. Gumen, A.M. Gurzhiy, V.M. Spivak; Edited by M.B. Gumen. – Kyiv: Vyshcha Shkola, 2003. – 399 p.

Educational content

5. Methodology for mastering the academic discipline (educational component)

Lectures

To successfully master the lecture material, it is necessary to attend lectures and use literary sources [1], [2], [3].

4. Lectures

Class number	Lecture content	Number of hours
1	Basic concepts and laws of electrical circuit theory. Basic definitions: electrical circuit, current, voltage, power, energy, diagram, graph, node, branch, loop. Passive circuit elements and their properties: resistance, inductance, and capacitance. Active circuit elements: current source and voltage source. Classification of electrical circuits. Basic laws of electrical circuits: Ohm's law, Kirchhoff's laws Kirchhoff's laws, and the power balance law.	2
2	Controlled sources and the use of the basic laws theory of electrical circuits. Independent sources: voltage source and current source. Controlled sources. Use of the basic laws of circuit theory to calculate electrical circuits with controlled and uncontrolled sources. The method of proportional quantities and its use for solving problems. Current and voltage dividers and their use for solving problems.	2

3	Equivalent transformations of electrical circuits. Equivalent transformations of series and parallel connected elements. Equivalent transformations of electrical power sources.	2
4	Methods for calculating electrical circuits. The loop current method and the node voltage method. Taking controlled sources into account.	2
5	Principle of superposition. Principle of superposition for current sources and voltage sources. Concept of circuit functions. Main types and calculation formulas.	2
6	Equivalent generator method. Theorem on equivalent voltage source and theorem on equivalent current source. Condition for maximum power transfer to the load.	2
7	Principle of reciprocity. Principle of reciprocity for voltage sources and principle of reciprocity for current sources. Compensation theorem.	2
8	The concept of periodic alternating current. Average and effective values of alternating current. The concept of harmonic current: instantaneous value of harmonic current, amplitude, period, frequency, phase shift. Average and effective values. Representation of harmonic oscillations by rotating vectors. The concept of a vector diagram. Complex representation of harmonic oscillations. Method of complex amplitudes. Representation of harmonic oscillations by Euler's formula. The concept of a complex conjugate. Representation of a harmonic oscillation as a vector with amplitude and phase. Complex numbers and operations on them.	2
9	Passive elements in harmonic current circuits: resistance, inductance, capacitance. Relationship between the phases of currents and voltages across these elements. Power and energy in passive elements. Reactive and complex resistance of inductance, reactive and complex conductance of inductance. Reactive and complex resistance of capacitance, reactive and complex conductance of capacitance.	2
10	Series and parallel connection of elements in harmonic current circuits. Representation of currents and voltages in such circuits using vector diagrams at zero initial phase. Voltage triangle and resistance triangle. Current triangle and conductance triangle.	2
11	Ohm's and Kirchhoff's laws in complex form. The concepts of complex circuit resistance (impedance) and complex circuit conductance (admittance). Representation of currents and voltages in such circuits using vector diagrams with a non-zero initial phase.	2
12	Passive two-terminal networks in harmonic current circuits. Active and reactive components of current and voltage. Use of the method of loop currents and node voltages to calculate circuits under harmonic action.	2
13	Power in harmonic current circuits. Harmonic form of power. Active, reactive, and total power. Power factor. Power triangle. Complex power. Determination of power on passive and active circuit elements. Branch quality factor and power balance. Condition for maximum power transfer to the load.	2
14	Circuits with inductively coupled elements. The phenomenon of self-induction and mutual induction. Coupling coefficient and leakage inductance. Polarity of coils with magnetic couplings. Series connection of coils with inductive couplings. Decoupling of inductively coupled circuits.	2
15	Serial oscillatory circuit. The concept of circuit selectivity. The concept of resonance. Voltage resonance. Circuit characteristics: resonance frequency, characteristic impedance, quality factor, and passband. Input impedance of the circuit.	2
16	Frequency characteristics of a series circuit: dependence of input impedance, current, and voltage on frequency. Types of circuit detuning: absolute, relative, generalized. Normalized resonance curve. Relationship between quality factor and passband. Effect of generator resistance and load on circuit characteristics. Duty cycle. Concept of added resistance.	2
17	Parallel oscillatory circuit. Resonance of currents. Determination of the resonant frequency. Types of parallel circuits. Quality factor of the circuit and passband. Frequency characteristics of the first type of circuit.	2
18	Second and third type parallel circuits. Resonance frequency and input impedance of the circuit. Vector diagram and determination of the turn-on coefficient.	2

5. Practical classes

The main objectives of the practical training cycle are to learn practical methods for solving basic problems in the analysis of radio-electronic devices using specific examples, to reinforce theoretical knowledge and apply it to research work, and to learn how to use computing technology competently. During the practical classes, problems are solved according to the problem collection [4]. Examples of solved problems can be found in manuals [5], [6], [7].

Class number	Lesson topic and problems to be solved
1	Basic concepts and laws of circuit theory
	Classroom: 1.2(a), 1.5(a), 1.7(a), 1.9, 1.10(a), 1.11(a,b),
	Homework (HW-01): 1.2(b), 1.3, 1.5(b), 1.7(b), 1.10(b), 1.11(c,d)
2	Kirchhoff's laws and equivalent source transformations
	Classroom: 1.11(k), 1.16(a), 1.15(a), 1.17(a,b)
	Homework (HW-02): 1.15(b), 1.16(b), 1.17(c,d,e), 1.13, 1.18.

3	Contour current method (CCM), nodal voltage method (NVM), superposition principle, and reciprocity principle
	Lectures: 1.20, 1.23, 1.27(a), 1.28(a), 1.30, 1.31
	Homework (HW-03): 1.21, 1.24, 1.27(b,c), 1.28(b), 1.29, 1.32.
4	Calculation of circuits with controlled sources
	Classroom: 1.33, 1.36(a), 1.38(a), 1.40(a), 1.41(a), 1.42(b), 1.43(a).
	Homework (HW-04): 1.34(c), 1.35(b), 1.38(b), 1.40(b), 1.41(d), 1.42(d), 1.43(c).
5	Equivalent generator method for simple circuits
	Classroom: 1.46(a,b), 1.47(a), 1.49(a), 1.51(a,b), 1.52(a), 1.53(a).
	Homework (HW-05): 1.47(b), 1.49(c), 1.50(b), 1.51(c), 1.52(b), 1.53(c,d).
6	Equivalent generator method for complex circuits Classroom exercises: 1.56(a), 1.57(b), 1.58(a), 1.59(b), 1.60(a,b).
	Homework (HW-06): 1.56(b), 1.57(c), 1.58(b), 1.59(c), 1.60(c, d).
7	Module Test (MT-1). Direct current
8	Basic laws in simple harmonic current circuits
	Classroom: 2.3(a), 2.6, 2.12(a), 2.13(a), 2.16(a,b), 2.17(a), 2.10(a).
	Homework (HW-07): 2.3(b), 2.5(c), 2.12(b), 2.13(b), 2.15(a,b), 2.16(b,d), 2.17(b), 2.10(b);
9	Basic laws in complex harmonic current circuits
	Classroom: 2.18(b), 2.20(a), 2.21(a), 2.24, 2.25(a), 2.27(a), 2.29(a), 2.30(a), 2.28(a).
	Homework (HW-08): 2.20(b), 2.21(b), 2.23(a,b), 2.25(b), 2.27(b), 2.29(b), 2.30(b), 2.28(b).
10	Power, branch integrity, and equivalent circuits in harmonic current circuits
	Classroom assignments: 2.33(a), 2.35(a), 2.36(a), 2.37(a), 2.38(a), 2.39(a), 2.41
	Homework (HW-09): 2.33(b), 2.35(b), 2.36(b), 2.37(b), 2.38(b), 2.39(b), 2.40(b,c)
11	Calculation of harmonic current circuits using the equivalent generator method
	Classroom: 2.42(a,b), 2.43(a), 2.44(a), 2.45(a,c), 2.46(b), 2.47(a)
	Homework (HW-10): 2.43(b), 2.44(b), 2.45(b,d), 2.46(b), 2.47(b), 2.48(a)
12	Calculation of complex harmonic current circuits
	Classroom: 2.50(a), 2.51(a), 2.52(a), 2.53(a), 2.54(a) 2.56(a), 2.57(a).
	Homework (HW-11): 2.50(b), 2.51(b), 2.52(b), 2.53(b), 2.54(b), 2.56(b), 2.57(b).
13	Calculation of circuits with magnetic links
	Classroom assignments: 2.62(a), 2.63, 2.64(a), 2.65, 2.67(a), 2.69(a)
	Homework (HW-12): 2.62(b), 2.64(b, c), 2.67(b), 2.66, 2.69(b)
14	MT-2. Alternating current
15	Calculation of series circuits
	Classroom: 3.2(a), 3.4(a), 3.5, 3.12(a), 3.13(a), 3.16(a), 3.17(a).
	Homework (HW-13): 3.3, 3.6, 3.9(b), 3.12(b), 3.13(b), 3.16(b), 3.17(b).
16	Calculation of parallel circuits
	Classroom: 3.22(a,b), 3.23(a), 3.24(c), 3.25(a), 3.26(a), 3.29(a).
	Homework (HW-14): 3.22(c), 3.24(b), 3.25(b), 3.26(b), 3.28(a), 3.29(c, d).
17	Calculation of contours with magnetic connections
	Classroom assignments: 3.31(a), 3.32(a), 3.34(a,b), 3.36(a), 3.35, 3.43.
	Homework (HW-15): 3.32(b), 3.33(b) 3.34(b, d), 3.36(b), 3.37.
18	MT-3. Oscillatory circuits

6. Independent work of higher education students

No	Title of the topic for independent study	Number of hours of independent study
1,2	Section 1. Linear electric circuits of direct current. Section 2. Linear electric circuits of alternating current. Section 3. Single oscillatory circuit	6
	Calculate work (CW)	8
	Total for sections 1, 2, 3	14
4	Section 4. Circuit functions, four-pole circuits, and the operator method	10
	Determination of circuit functions using the resistance and conductance matrix	2
	Equivalent circuits of four-terminal networks.	2
	Calculation of transient processes in circuits using the operator method	2
	Preparation for laboratory work on Section 4	2
	Preparation for MT	2
5	Section 5. Linear electrical circuits with distributed parameters	6

	Long lines in harmonic mode.	2
	Preparation for laboratory work on Section 5	2
	Preparation for MT	2
	Preparation for the exam	3
	Total hours	60

The questions for independent study are listed in the table.

No	Title of the topic for independent study	Number of hours for independent study
1	Chapter 1. Linear direct current electrical circuits.	6
	Home control work (HCW) according to Section 1	4
	Preparation for MT-1	2
2	Section 2. Linear AC electrical circuits.	8
	HCW according to Section 2	6
	Preparation for MT-2	2
3	Section 3. Single oscillatory circuit	4
	HCW according to Section 3	2
	Preparation for MT-3	2

Individual assignments

One home control work (HCW) consisting of three sections is to be completed. The main goal is to reinforce the theoretical course through practical independent work involving specific calculations.
The HCW consists of the following parts:

- calculation of linear direct current circuits;
- calculation of linear alternating current circuits;
- calculation of oscillatory circuit parameters.

Assignments for the final project are given individually to each student from source [8].

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Policy and control

7. Policy of the academic discipline (educational component)

Studying the discipline "Fundamentals of Circuit Theory. Part 1" requires a detailed consideration of the complex processes that occur in radio-electronic circuits. Successful mastery of the material is only possible with daily work by the student, consisting of: taking lecture notes; studying the content of their own and electronic notes on the eve of the next lecture; detailed familiarization with the content of methodological guidelines in the workshop on the relevant topic; careful completion of homework assignments and drawing conclusions from them that do not contradict theoretical provisions; solving problems from the DKR during preparation for control measures.

Attendance

Attendance at lectures and practical classes — in accordance with the Regulations on the Organization of the Educational Process at Igor Sikorsky KPI. At least once every two weeks, the teacher conducts consultations on various issues of the credit module. During consultations, the teacher can provide assistance in studying the material of classes that were missed by students for various reasons and must be mastered independently.
In any case, students are encouraged to attend all types of classes, as they cover theoretical material and develop the skills necessary to complete homework assignments and take tests at home.

Announcement of test results

The defense of the completed section of the DCR takes the form of an interview with the teacher. During the defense, the student must be able to explain the results obtained and answer the main theoretical questions on the topics of the sections. The results of the defense are announced to the student in their presence or remotely and are accompanied by specific comments and remarks regarding errors (remote communication via Zoom, Telegram with video and audio).
The results for the completed homework assignment are posted after its completion and defense, no later than the next class.

Missed tests

The result for a student who did not attend the assessment is zero. If a student misses an assessment for a valid reason, they are given the opportunity to complete it (write a module assessment) in the presence of the teacher. If the absence was without a valid reason, the issue of making up the test is decided with the teacher in consultation with the department management. A missed test is not counted regardless of the reasons for the absence; in this case, the student receives a "did not show up" mark, and if they are eligible to take the test, they must take it during an additional session.

Academic integrity

The policy and principles of academic integrity are defined in Section 3 of the Code of Honor of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute." For more details, see: https://kpi.ua/code.

Standards of ethical conduct
The standards of ethical conduct for students and employees are defined in Section 2 of the Code of Honor of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute." For more information, visit: https://kpi.ua/code.
Procedure for appealing the results of control measures
Students have the opportunity to raise any issue related to the procedure for conducting and/or evaluating tests and expect that it will be considered in accordance with predetermined procedures.
Students have the right to appeal the results of assessment measures, but must provide a reasoned explanation of which criteria they disagree with according to the assessment sheet and/or comments.

8. Types of assessment and the learning outcomes assessment rating system (LRS)

Control measures and distribution of points in the semester Rsem

Type of assessment	Explanation	Maximum points	Deadline
MT	**Total score for all MT**	**30**	
	MT-1. Direct current.	10	Practice No. 7
	MT-2. Alternating current.	10	Practice No. 14
	MT-3. Oscillatory circuits.	10	Practice No. 18
HCW	**3 parts, 10 points each**	**30**	
	HCW, Part 1. Calculation of linear DC circuits	10	Practice No. 7
	HCW, Part 2. Calculation of linear circuits of harmonic current	10	Practice No. 14
	HCW, Part 3. Calculation of oscillatory circuits	10	Practical work No. 18
General colloquium for the semester (in person)		**40**	Lecture No. 18
Total score for the semester		**100**	
Credit	**3 questions on the exam: theory and 2 problems**	**30 points DCR 70 (30+20+20)**	according to the schedule
Total score for the discipline		**10**	after the test

MT – modular test, involves solving practical problems according to the topics of the discipline;
HCW – home control work, involves performing calculation tasks according to the task option and defending it in the form of an interview.
Homework assignments (HCW) are submitted to the instructor for review before writing the HCW on the relevant topic. The solution of one problem in the HCW is graded on a scale from 0 (no solution or completely incorrect) to 1 point for each problem separately.
Homework (HW) is not graded, but is done regularly by students before each practical class in order to thoroughly learn the course material. HW is submitted before the start of the practical class for which the homework was assigned (one week is given to complete each homework assignment), and during the class, the teacher explains the problems that were not solved.
The condition for admission to the exam is
1. Earning at least **20 points** during the semester.
2. Completion of coursework with a positive result (at least 6 points for each).
3. Possession of a workbook with solutions and a notebook with lecture notes.

Table of correspondence between rating points and grades on the university scale:

Number of points	*Grade*
100-95	Excellent
94	Very good
84	Good
74-65	Satisfactory
64-60	Sufficient
Less than 60	Unsatisfactory
Admission requirements not met	Not admitted

9. Additional information on the discipline (educational component)

Questions for preparation for the test.

1. Basic concepts of circuit theory: circuit, current, voltage, power, energy, graph, branch, node.
2. Classification of electrical circuits.
3. Passive and active elements of electrical circuits.
4. Basic laws of electrical circuits
5. Equivalent transformations of passive elements of electrical circuits.
6. Equivalent transformations of electrical circuit sources.
7. Contour current method: algorithm of the method and its proof, consideration of controlled sources.
8. Node voltage method: algorithm of the method and its proof, consideration of controlled sources.
9. The principle of superposition, the principle of reciprocity, and the compensation theorem.
10. Equivalent generator theorem. Condition for maximum power transfer to the load.
11. Harmonic current: basic concepts. Calculation of average and effective values.
12. Representation of harmonic oscillations by rotating vectors. The concept of a vector diagram.
13. Method of complex amplitudes. Basic operations on complex numbers. Complex function and operations with it.
14. Passive elements in harmonic current circuits. Reactive resistances of inductance and capacitance.
15. Series and parallel connection of elements in harmonic current circuits. Complex resistance and conductance. Construction of vector diagrams for such circuits.
16. Ohm's and Kirchhoff's laws in complex form.
17. Harmonic and complex forms of power. Power balance. Branch quality factor.
18. Transmission of maximum power to the load in harmonic current circuits.
19. Construction of vector diagrams.
20. Circuits with inductively coupled elements. Features of their calculation.
21. Transformer in harmonic current circuits: double-circuit transformer circuit and ideal transformer.
22. Basic parameters of a series circuit. Vector diagram at resonance frequency.
23. Frequency characteristics of a series circuit: $Z(\omega)$, $I(\omega)$, $U(\omega)$. Types of circuit detuning. Circuit passband.
24. The effect of the generator on the characteristics of the circuit and ways to reduce it. Inserted resistance.
25. Basic parameters of a parallel circuit. Vector diagram at resonance frequency.
26. Frequency characteristics of a parallel circuit. Input resistance, its real and imaginary components. Types of parallel circuits.
27. Frequency characteristics of series circuits of the first, second, and third types. Vector diagram.
28. Exact value of the resonant frequency of series and parallel circuits.

Working program of the academic discipline (syllabus):

Compiled by senior lecturer, candidate of technical sciences, Andriy Vasylovych Bulashenko

Approved by the Department of Radio Engineering (Minutes No. 6/2024 dated 06/23/2024)

Approved by the Methodological Commission of the RTF Faculty (Minutes No. 6/2024 dated 28.06.2024)