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

Department of Radio Engineering Systems

[RE-189] HUAWEI TELECOMMUNICATION NETWORKS

Curriculum of the academic discipline (Syllabus)

Course details

Level of higher education	First (bachelor's)
Field of knowledge	17 - Electronics, Automation, and Electronic Communications
Specialization	172 - Electronic Communications and Radio Engineering
Educational program	All educational programs
Discipline status	Elective (F-catalog)
Form of higher education	Full-time
Year of training, semester	Available for selection starting from the 3rd year, fall semester
Scope of the discipline	4 credits (Lectures: 18 hours, Practical classes: 0 hours, Laboratory classes: 36 hours, Independent work: 66 hours)
Semester control/control measures	Credit
Class schedule	https://schedule.kpi.ua
Language of instruction	Ukrainian / English
Information about the course director / teachers	Lectures: Myronchuk O. Yu., Lab: Myronchuk O. Yu., Independent work: Myronchuk O. Yu.
Course location	

Curriculum

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

The purpose of the discipline is to acquire knowledge about data transmission networks, understand the basic concepts and principles of data transmission networks, and acquire practical skills in designing and maintaining networks.

After studying the discipline, students will:

- understand concepts related to data transmission networks;

- be able to describe the processes of information transmission;

- be familiar with the types of modern networks and their topologies;

- be able to classify network devices and know their main functions;

- be able to configure equipment, design networks, and maintain them.

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

Required knowledge and skills:

- user-level proficiency with personal computers;

- understanding of the basic principles of computer technology;

- knowledge of number systems used in computing (decimal, binary, hexadecimal);

- basic level of English proficiency not lower than A2.

3. Course content

List of topics

1. Fundamentals of data transmission networks
2. Reference network model
3. Basics of Huawei VRP
4. Network-level protocols and IP addressing
5. Basics of IP routing
6. OSPF Fundamentals
7. Ethernet Switching Basics
8. Principles of VLAN Construction and Configuration
9. STP Principles and Settings
10. Connection between VLANs
11. Eth-Trunk, iStack, CSS
12. ACL principles and settings
13. AAA principles and settings
14. Network address translation
15. Network services and applications
16. WLAN Overview
17. WAN Technologies
18. Network Management, Operation, and Maintenance
19. IPv6 basics
20. SDN and NFV Overview
21. Network programmability and automation
22. Typical architectures and practical aspects of campus network design

4. Training materials and resources

The course is taught under a memorandum of cooperation between Igor Sikorsky KPI and Huawei. The course uses Huawei's HCIA-Datacom course materials, which the instructor distributes to students during the first class and which are available on the Huawei Talent portal. For in-depth study of specific topics, we recommend the following literature:

Organization of Computer Networks [Electronic resource]: textbook: for students majoring in 121 "Software Engineering" and 122 "Computer Science" / Igor Sikorsky KPI; Yu. A. Tarnavsky, I. M. Kuzmenko. – Electronic text data (1 file: 45.7 MB). – Kyiv: Igor Sikorsky Kyiv Polytechnic Institute, 2018. – 259 p.

Educational content

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

Lectures

Lecture 1: Fundamentals of data transmission networks. Reference network model.

Lecture 2: Network layer protocols and IP addressing.

Lecture 3: Network address translation

Lecture 4: Network services and applications

Lecture 5:Overview of WLAN

Lecture 6: WAN technologies

Lecture 7: Network management, operation, and maintenance

Lecture 8: Network programmability and automation

Lecture 9: Typical architectures and practical aspects of campus network design

Lab sessions

Lab 1: Huawei VRP Basics

Lab 2: IP Routing Basics

Lab 3: OSPF Basics

Lab 4: OSPF Basics

Lab 5: Ethernet Switching Basics

Lab 6: Ethernet Switching Basics

Lab 7: Principles of VLAN Construction and Configuration

Lab 8: Communication Between VLANs

Lab 9: Principles and Configuration of STP

Lab 10: Principles and Configuration of STP

Lab 11: Eth-Trunk, iStack, CSS

Lab 12: Eth- Trunk, iStack, CSS

Lab 13: ACL Principles and Configuration

Lab 14: AAA Principles and Configuration

Lab 15: Network Address Translation

Lab 16: WLAN Overview Lab 17: IPv6

Fundamentals Lab 18: SDN and NFV Overview

6. Independent Student Work

Independent work involves consolidating knowledge of the material studied in lectures and lab sessions by working through the main and additional literature provided.

Policy and control

7. Academic discipline (educational component) policy

Class attendance rules

Lectures: attending classes according to the schedule; studying the material independently, remotely, using the materials provided or on the Huawei Talent portal, is also permitted.

Laboratory work: attending classes according to the schedule. During laboratory work, there may be situations when a student does not have time to complete the work during the class. In this case, it must be completed independently at home using the simulator program or on laboratory equipment during additional time allocated by the teacher.

8. Types of control and rating system for assessing learning outcomes

Current assessment: completion of laboratory work, computational and graphical work, writing a modular test.

Calendar assessment: conducted twice per semester as monitoring of the current status of syllabus requirements.

Semester assessment: test.

The student's rating score for the semester is determined by the results of completing up to 10 laboratory assignments and a modular test. Two laboratory classes are allocated for completing laboratory assignments 1-8. One laboratory class is allocated for completing laboratory assignments 9-10. The maximum score for a laboratory assignment is 4. Thus, during the semester, a student can receive 40 points for completing laboratory work. The maximum score for a modular test is 60. The modular test is conducted in the form of a test at the end of the semester. Successful completion of laboratory work is considered to be obtaining at least 60% of the maximum score for which the work is assessed. For applicants who have fulfilled all the conditions for admission to the exam and have a rating of less than 60 points, as well as for those applicants who wish to improve their rating, the teacher conducts a semester test in the form of a credit test during the last scheduled class of the semester. The condition for admission to the test is the completion of all assignments that were performed during the semester. The test is conducted in the form of a test with an additional task on the practical application of the knowledge gained. In this case, the previous rating is canceled and the result of the test determines the final test score.

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
Conditions for admission not met	Not admitted

9. Additional information about the discipline (educational component)

Students studying the discipline register on the Huawei Talent portal at Igor Sikorsky KPI ICT Academy. The portal offers the opportunity to view and listen to material in English. After studying the discipline, the most successful students have the opportunity to receive a voucher free of charge and take an online exam at Huawei to obtain an HCIA-Datacom certificate.

Description of material, technical, and information support for the discipline

Huawei software and equipment

Work program of the academic discipline (syllabus):
Compiled by O. Yu. Myronchuk;
Approved by the RTS Department (Minutes No. 06/2024 dated 06/27/2024)
Approved by the methodological commission of the faculty/research institute (protocol No. 06/2024 dated 28.06.2024)

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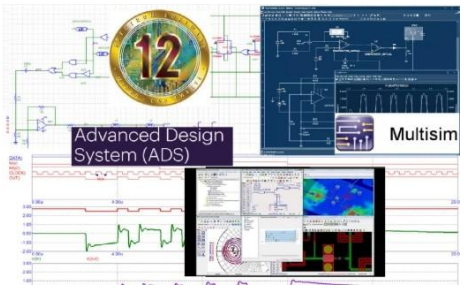
Department of Radio Engineering Systems

[RE-50] TECHNOLOGIES OF AUTOMATED DESIGN OF RADIOELECTRONIC DEVICES



Curriculum of the academic discipline (Syllabus)

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Control/control measures	Credit
Class schedule	https://schedule.kpi.ua
Language of instruction	Ukrainian
Information about the course leader/teachers	Lecturer: Golovin V. A., Lab: Golovin V. A.,
Course location	https://do.ipo.kpi.ua/course/view.php?id=5171

Curriculum

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

Technologies for the automatic design of radio-electronic devices use modern mathematical and specialized software environments.

The main purpose of computer-aided design (CAD) systems is to increase the efficiency of engineering activities: reducing the labor intensity and time required for design,

ensuring high quality of design solutions and documentation, minimizing full-scale modeling and testing of prototypes, and reducing production preparation costs.

CAD is a package of application-oriented programs. The study of CAD deserves attention because, in manufacturing, the results of implementing the latest CAD-based technologies in the design of the most complex products have long proven their advantages over traditional methods.

Today, no important development in electronics, radio engineering, and other fields can do without the use of computer-aided design systems. The term "CAD" itself has become synonymous with characteristics such as high precision and high design speed.

Studying modern CAD systems and acquiring skills in working with them contributes to improving the quality of engineering training, significantly reduces the time required for young specialists to adapt to the workplace after graduating from university, and significantly increases their attractiveness to employers.

Objective: The objective of the course is to familiarize students with the theoretical material on the design of radio-electronic devices, to develop skills and form practical abilities in solving design problems in modern CAD packages necessary for design, engineering, and research professional activities.

Abilities:

- use computer-aided design systems for the design of radio-electronic devices;
- build models of electronic components and devices;
- select optimal operating modes for circuits.

Knowledge:

- basic methods, algorithms for modeling, analysis, and optimization;
- the capabilities of modern CAD systems in the design of radio-electronic devices.

Skills:

- build models of circuit elements;
- build models of electronic devices;
- perform all types of circuit analysis in CAD;
- perform parametric optimization of circuits.

Experience:

- designing analog circuits of various frequency ranges;
- designing digital logic circuits;
- designing mixed analog and digital circuits;
- calculations in various modern CAD systems.

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

Prerequisites

The effectiveness of studying the discipline depends on the level of knowledge and skills acquired during the training, such as circuit theory, numerical methods for solving equations, modeling, level of PC proficiency, foreign language (preferably English).

Post-requisites

knowledge and skills acquired by higher education applicants OR bachelor's degree when studying this course

used in the process of teaching at the bachelor's, master's, engineering, and scientific levels

3. Contents of the academic discipline

No.	Title of topics and list of main questions (list of teaching aids, references to literature, and assignments for independent study)
1	Typical structural diagram of the design process. Classification of radio equipment complexity levels and automated design levels. Top-down and bottom-up hierarchy of design processes. Concepts of simulation and formulaic design. General information about CAD. Definition of CAD. The role of CAD in scientific and technical progress. CAD as a human-machine system. Classification of CAD. Types of CAD support. Classification of technical support for CAD. Main types of computers and their characteristics. Hardware support for CAD. Automated workstations and intelligent workstations CAD networks.
2	CAD software. Basic software requirements. System software General-purpose operating systems CAD device software Linguistic support for CAD and requirements for it. Classification of CAD languages. Languages for describing models, design tasks, and processing calculation results. Information support for CAD. Classification of information support for CAD. Basic concepts of information support. Methods of organizing data storage. Database management systems. System and application databases. Integrated databases for CAD. Use of Internet information resources for CAD information support. Methodological and organizational support for CAD. Composition and purpose of methodological and organizational support. Concept of the CAD life cycle. Methodology for developing and supporting CAD. Mathematical support for CAD. Classification of basic CAD algorithms. Basic requirements for algorithms. Mathematical apparatus for different levels of design.
3	Mathematical models of CAD components and objects. Definition of a mathematical model, requirements for models. Levels of representation of mathematical models ,hierarchy of models for different levels of design
4	Mathematical models of direct current circuits. Basic methods for calculating static modes. Comparative characteristics, limits of use, selection of method coefficients that affect convergence and solution accuracy. Mathematical models of circuits in the frequency domain. Calculations of frequency characteristics. Methods for solving systems of linear equations. Sparse systems
5	Mathematical models of circuits for calculating transient processes, explicit and implicit methods, step selection problems, stability of methods, influence of time constants.
6	Mathematical models of circuits for calculating steady-state processes. Basic solution methods. Comparison of methods, selection of coefficients. Methods of statistical analysis of circuits. Monte Carlo method, worst case
7	Optimization in CAD. Classification of methods and tasks for optimizing radio-electronic devices. Features of forming and solving optimization tasks, criteria . Basic methods for solving optimization problems
8	Design engineering. Formulation of design engineering tasks. Algorithms for layout, placement, and routing. Criteria for the effectiveness of for solving design tasks

4. Teaching materials and resources

Electronic versions of basic textbooks, methodological guidelines for laboratory work, examples of problem solutions, a n d reference systems are available to students on the department server.

Basic literature

1. ADS-16 Design System. Textbook Electronic version. Department website

2018. 156 p.
2. J.Vlach, K.Sighal Computer Methods for Circuit Analysis and Designhttps://vdoc.pub/download/computer-methods-for-circuit-analysis-and-design-uufbn145hg40

Copy available on the department website.

1. Micro-Cap 12 Electronic Circuit Analysis Program Reference Manual. https://www.spectrum-soft.com/download/rm12.pdf
2. NI MultisimTM User Manual https://www.physics.wisc.edu/courses/home/spring2021/623/MultiSim_docs/NI-Multisim_manual.pdf
3. Advanced Design System Quick Start. http://edadownload.software.keysight.com/eedl/ads/2011/pdf/adstour.pdf
4. PDF Files for ADS Documentation. https://edadocs.software.keysight.com/display/ads201101/PDF+Files+for+ADS+Documentation

Literature . Supplementary

1. Petrenko A.I. Fundamentals of Automated Design, Kiev, Tekhnika, 1982

Educational content

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

Calendar and thematic plan (scheme) of the academic discipline

- Lectures - 9.
- Laboratory work - 9.
- Calculation work.

No Week	Type and number of classes	Lesson topic or independent work assignment	No. hours
1	Lecture	Typical structural diagram of the design process	2
2	Lecture 2	Types of CAD support	2
3	Lecture 3	Mathematical models of components Methods of automated design at different levels representation	2
1	Laboratory work 2	CAD: MicroCap Calculating transistor characteristics. Studying circuits when two circuit parameters are changed at direct current. Circuit component models. Searching for models on manufacturers' websites via the the Internet.	2
4	Lecture 4	Mathematical models of direct current circuits. Basic methods for calculating static modes. Comparative characteristics, limits of use, selection of method coefficients that affect convergence and solution accuracy. Mathematical models of circuits in the frequency domain. Calculations of frequency characteristics. Methods for solving systems of linear equations. Sparse systems	2
2	Laboratory work 2	CAD: MicroCap Calculations of frequency characteristics and transient processes	2

5	Lecture 5	Mathematical models of circuits for calculating transient processes, explicit and implicit methods, step selection problems, stability of methods, influence of time constants.	2
3	Laboratory work 3	CAD: MicroCap, ADS-16 Calculations of generators using transient processes, harmonic analysis method	4
6	Lecture 6	Calculation of steady-state processes Mathematical models of circuits for calculating steady-state processes. Basic methods of solution. Comparison of methods, selection of coefficients	2
4	Laboratory work 4	CAD: MicroCap Calculations of digital circuits	2
5	Laboratory work 5	CAD: MicroCap Calculations of mixed analog and digital circuits	2
7	Lecture 8	CAD: MicroCap Tolerances. Methods of statistical analysis of circuits. The Monte Carlo method, worst case	2
6	Laboratory work 6	Construction of hierarchical diagrams. Subdiagrams. Using blocks	2
7	Laboratory work 7	CAD: MicroCap, Multiple analysis methods. Monte Carlo method	2
8		Classification of methods and tasks for optimizing radio-electronic devices. Features of forming and solving optimization tasks, optimality criteria. Basic methods for solving optimization tasks optimization	2
8	Laboratory work 8	CAD: MicroCap Optimization of DC circuit parameters in the frequency and time domains.	2
9	Lecture 9	Design engineering. Formulation of design engineering tasks. Algorithms for layout, placement, and routing. Criteria for the effectiveness of design problem solutions	2
9	Laboratory work 9	CAD: Multisim, Development of printed circuit boards. Automated circuit board tracing	2
Total for the content module - 60 hours. (Lectures - 18 hours, laboratory work 18 hours, independent work - 24 hours			

6. Independent work by students

No. Week	Type and number of classes	Lesson topic or independent work assignment	No. hours
Over the course of 18 weeks	Independent work 1	Preparation for laboratory work	8
4	Independent work 2	Completion of the first part of the calculation work	4
5	Independent work 3	Completion of the first part of the calculation work Defense of work	6
7	Independent work 3	Preparation for modular test	2
9	Independent work 4	Preparation for the test	4
Total independent work - 24 hours.			

Policy and control

7. Academic discipline policy (educational component)

- independent completion of educational tasks, current and final assessment of learning outcomes;
- defending completed assignments on a PC in MicroCap, Multisim, ADS-16 CAD systems;
- high-quality and early completion of educational tasks is encouraged with additional points;
- references to sources of information when using ideas, developments, statements, information;
- compliance with copyright and related rights legislation
- provision of reliable information about the results of one's own (scientific, creative) activities, research methods used, and sources of information.

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

for admission to the final control (test):

1) Students who have attended all classroom sessions required by the curriculum for the discipline and have earned at least 60 points while working on the educational material of the content modules are admitted to the final assessment.
2) For higher education students who have missed classes for valid reasons, adjustments are made to their individual study plans and they are allowed to make up for their academic debt by a certain deadline.

Assessment criteria for each type of work

The assessment of knowledge is based on the completeness and correctness of the tasks

performed. The form of control over the work on the course material is the performance of

laboratory work,
the maximum score that a higher education applicant can receive for each piece of work is 5 points.

The maximum score for completing a modular test is 15 points. The maximum score is awarded for a test completed without errors, in full, demonstrating a sufficiently high level of knowledge and skills in using automated systems for analyzing and calculating circuit parameters

The applicant receives a score of 10 for complete completion of the work with minor errors and poor-quality graphs.

A grade of 5 is given for complete work with minor errors, poor formatting of graphs, and work completed more than 20% over the deadline.

The maximum grade for each individual assignment that a higher education applicant can receive is 20 points. The applicant receives the maximum grade for an individual assignment completed without errors, in full, demonstrating a sufficiently high level of mastery of the educational material, as well as developed practical skills. The work must be formatted in accordance with the specified requirements and submitted for review within the established deadline.

The applicant receives a score of 10 points for an individual assignment completed in full, which has minor flaws, such as failure to meet some of the requirements for the graphic part of the work or minor errors. The work must be submitted for review within the established deadline.

The applicant receives a score of 5 points for an individual assignment completed in full, without errors or with minor errors, but submitted after the deadline.

The assessment uses a rating system and linear normalization of criteria indicators.

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

Number of points	Grade
100-95	Excellent
94-85	Very good
84-75	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)

List of questions for semester assessment

1. Numerical methods for calculating zeros and poles of circuit functions
2. Solving linear equations.
3. Solving nonlinear equations.
4. Explicit and implicit methods for solving differential equations.
5. Formulation of numerical quality criteria.
6. Methods of parametric optimization of circuits.

Description of material, technical, and informational support for the discipline

Laboratory 202-17. 16-20 PCs. Software: Multisim, MicroCap, Altium, ADS-16, Proteus.

RTPS Department Server. Library of electronic copies of books on CAD theory and practice.

Work program for the academic discipline (syllabus):
Compiled by V. A. Golovin;
Approved by the RTPS Department (Minutes No. 06/2024 dated 06/22/2024)
Approved by the methodological commission of the faculty/research institute (protocol No. 06/2024 dated 28.06.2024)