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

Department of Applied Radio Electronics

[RE-40] VIRTUAL DEVICE TECHNOLOGIES

Curriculum of the academic discipline (Syllabus)

Course details

Level of higher education	First (bachelor's)
Field of knowledge	G - Engineering, manufacturing, and construction
Specialty	G5 - Electronics, electronic communications, instrument engineering, and radio engineering
Educational program	All
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 16 hours, Practical classes 30 hours, Laboratory work 30 hours, Independent work 74 hours)
Semester Control/control measures	Credit
Class schedule	https://schedule.kpi.ua
Language of instruction	Ukrainian
Information about the course leader/teachers	Lecturer: V. M. Golovnya, Lab: V. M. Golovnya,
Course location	https://do.ipo.kpi.ua/course/view.php?id=6955

Curriculum

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

The course "Virtual Device Technologies" is devoted to computer technologies for designing virtual devices and conducting simulation experiments. The educational component prepares students for the practical use of computer tools during simulation experiments by visualizing physical phenomena and creating virtual devices.

Upon completion of the course, students will be able to create applications using basic templates and architectures when solving real-world problems. The main emphasis of the course is on typical practical tasks, which allows students to use the acquired competencies in their thesis design and scientific research.

The main objectives of the discipline are:

- Qualified use of personal computers by higher education students as a means of conducting simulation experiments;
- obtaining basic training in the use of the LabVIEW graphical programming environment;
- proficiency in programming and debugging virtual devices.

According to the requirements of the educational and professional program, after mastering the academic discipline, higher education seekers must demonstrate the following learning outcomes:

Know:

- The basic principles of visual graphic programming,
- The G programming language and methods of debugging programs for the LabVIEW environment,
- Features of creating virtual devices,
- Methods of control and measurement in a virtual environment.

Be able to:

- Use LabVIEW to create applications for receiving, processing, and displaying data,
- Use basic templates and architectures,
- Master various editing and debugging techniques,
- Use a computer as a means of collecting, analyzing, and processing data, formalize the task and build an algorithm for its solution,
- Create original data processing and analysis programs in the LabVIEW environment, using both built-in and library virtual instruments.

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

The discipline belongs to the cycle of professional and practical training.

Subject of the discipline: computer technologies for designing virtual instruments in the LabView environment and conducting simulation experiments.

Interdisciplinary connections:

The study of the discipline "Virtual Device Technologies" is based on knowledge from the disciplines of the general training cycle "Introduction to the Specialty," "Computer Science. Part 1. Fundamentals of Programming and Algorithms," "Computer Science. Part 2. Fundamentals of Computing," "Fundamentals of Metrology," "Digital Signal Processing," and the professional training disciplines "Radio Electronics in Intelligent Systems," "End-to-End Development of Intelligent Technology," and "Design of Intelligent Radio-Electronic Equipment."

The knowledge gained in the elective educational component "Virtual Device Technologies" corresponds to the general competencies:

- Ability to apply knowledge in practical situations (GC2),
- Knowledge and understanding of the subject area and understanding of professional activity (GC4),
- Ability to learn and master modern knowledge (GC7),
- Ability to identify, pose, and solve problems

(GC8), and professional competencies:

- Ability to perform computer modeling of devices, systems, and processes using universal application packages (PC4),
- Ability to apply object-oriented programming technology and basic design patterns when creating software with appropriate functionality for radio-technical information systems and implement programs in various programming environments (PC19),
- Ability to select methods and means of information processing using intelligent technologies (PC20),
- Ability to select and critically evaluate and choose technical solutions at all stages of development and design of radio-electronic equipment using intelligent technologies (PC22),
- Ability to select and apply specialized software tools for simulation modeling and design of radio-electronic equipment (PC23),
- Ability to develop algorithms and implement them in software-configurable radio-electronic systems (PC24),
- Ability to reasonably select CAD for analysis, calculation, and optimization of the output characteristics of mathematical and circuit models of analog and digital devices depending on the frequency range with taking into account external factors, use Internet information resources to obtain mathematical and design models radio components from manufacturers based on an assessment of the characteristics of information transmission in radio networks (PC25).

3. Contents of the academic discipline

Section 1. Virtual platforms for designing intelligent technologies (IT).

Topic 1.1 Introduction. Characteristics of IT. Basic definitions.
Topic 1.2 Real and virtual devices and systems. Description of physical processes in the LabVIEW environment.
Topic 1.3 Programming operations in the LabVIEW environment.

Section 2. Performing virtual experiments.

Topic 2.1 Creating virtual devices in LabVIEW.
Topic 2.2 Using LabVIEW to create applications for receiving, processing, and displaying data.
Topic 2.3 Interaction of LabVIEW with third-party applications.

4. Teaching materials and resources

1. Golovnia, V. M. Creating virtual devices in the LabVIEW environment [Electronic resource]: textbook for bachelor's degree students majoring in 172 Electronic Communications and Radio Engineering educational programs: Intelligent technologies of microsystem engineering, Information and communication radio engineering, Radio engineering computerized systems / V. M. Golovnya; Igor Sikorsky KPI. – Electronic text data (1 file: 4.37 MB). – Kyiv: Igor Sikorsky Kyiv Polytechnic Institute, 2023. – 142 p. – Title from https://ela.kpi.ua/bitstream/123456789/57500/1/Tehnologii_virtual_pryladiv_LabVIEW_lr.pdf
2. Proceedings of the International Conference on Intelligent Communication, Control and Devices [electronic resource]: ICICCD 2016 / edited by Rajesh Singh, Sushabhan Choudhury. // Springer eBooks - Singapore: Springer Singapore: Imprint: Springer, 2017. - XXVIII, 1157 p.743 illus., 551 illus. in color. online resource. - (Advances in Intelligent Systems and Computing, ;ISSN:2194-5357 ; 479)
3. Information assessment of measurement quality and process modeling: [monograph] / V.Yu. Larin [et al.]. - Donetsk: NOULIDZH, 2011.
4. Kiselova O.G. Programming in NI LabVIEW. Technology for developing virtual devices: textbook for students of higher educational institutions studying in the field of

"Computer Science" / O.G. Kiselova, A.V. Solomin; Ministry of Education and Science of Ukraine, NTUU "KPI". - Kyiv: NTUU "KPI", 2014. - 273 p.

5. https://www.ni.com/en-us/support/downloads/software-products/download.labview-student-software- suite.html#352828

Educational content

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

Lecture 1. Introduction to LabVIEW.
Lecture 2. LabVIEW in simulation research of physical processes. Lecture 3. Structure of the LabVIEW language. Programming operations. Lecture 4. Arrays and clusters.
Lecture 5. Decision making in a virtual device.
Lecture 6. Graphical data display. Strings and file input/output.
Lecture 7. Object properties and virtual device settings. Lecture 8. Working with data, application optimization.
Lecture 9. Technologies for LabVIEW interaction with application software.

Laboratory classes:

LP No. 1: Introduction to the LabVIEW interface and creation of a typical virtual device LP No. 2: Modeling physical processes in LabVIEW
Lab session 3: Programming operations and graphical representation of data in LabVIEW Lab session 4: Mathematical calculations in LabVIEW. Working with arrays.
LP No. 5: Data handling functions in LabVIEW. LP No. 6: Tools for working with strings in LabVIEW.
LP No. 7: Working with file input/output functions in the LabVIEW environment. LP No. 8: Modeling the operation of digital devices.
LR No. 9: Remote access and control of LabVIEW virtual devices.

6. Independent work by students

Homework assignments (HZA) are required. The purpose of HZA is to:

- to test the knowledge acquired;
- systematic and comprehensive mastery of the course;
- teaching students to work independently;
- lay the foundations for students to make rational technical decisions.

Homework (10 hours) involves designing virtual devices and planning virtual experiments. Each student receives an individual assignment. The assignment involves developing a virtual experiment based on a virtual device designed in accordance with the assignment option.

The assignment is given in the second week of the academic semester, and week 18 is the last week for defending the homework assignment.

A modular (rated) test (MTR) is provided. Its purpose is to

- reinforce the theoretical provisions of the main topics and sections of the curriculum;
- to check the assimilation of knowledge gained during laboratory work.

Modular assessment tests are conducted during lectures.

Policy and control

7. Policy of the academic discipline (educational component)

The lecture course is taught using computers and multimedia means of presenting information: the course material is provided to higher education students in the form of presentations and visual courses. During the course, work in the LabVIEW software environment is widely practiced, with test tasks for modeling problems being solved in real time in the classroom. The course is supported by a number of electronic manuals, which form the basis for the lecture material. Methodological guidelines on the course topic are provided to higher education students in laboratory work, which describes the course of work and tasks.
Laboratory work is carried out in parallel with attending the lecture course, in accordance with which the topics of the laboratory workshops are set in such a way as to ensure their coordination. The defense of laboratory work requires the preparation of a work report in electronic form with a presentation of the progress and results obtained. The assessment of higher education students' mastery of the educational material is carried out in accordance with the student rating system (SRS), which should be designed in such a way as to encourage higher education students to work continuously throughout the semester.

Rules for attending classes (both lectures and laboratory classes)

Laboratory work is compulsory and must be completed. If these classes are missed, they must be made up during consultations. If lectures are missed, the material must be studied independently before the modular test. Lecture materials and videos are posted on the discipline's Telegram channel.

Defense of laboratory work

Laboratory work is defended on the day of completion. Higher education students are assessed on their activity and initiative during laboratory work, individual study, and their defense and answers to test questions.

Defense of individual assignments

As part of their independent work, higher education students complete laboratory work assignments. Based on the results of the assessment, course participants receive comments from the instructor and a grade. Individual assignments cannot be retaken.

Incentive and penalty points and academic integrity policy

The most active higher education students and higher education students who complete individual assignments in an exemplary manner can receive up to 5 points towards their semester rating.

Penalty points are applied in cases of passing off someone else's work as one's own, with mandatory subsequent reworking.

Deadline and resit policy

If the deadlines for submitting assignments are missed, the maximum score for the assignments is reduced by 10%.

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

A student's grade for a course consists of points awarded for:

1. completing and defending laboratory work;
2. completing a modular control assignment (MCA);
3. completing homework assignments (HA).

Rating (weighted) point system and assessment criteria:

1. Laboratory work.

Weighting score - 8. The maximum number of points for all laboratory work is: 8 points × 9 = 72 points.

Each laboratory work is assessed on the following criteria:

a) preparedness for work:

- fluency in theoretical material, availability of a prepared protocol 0.5 points;
- poor command of theoretical material 0 points;
- unpreparedness for work -1 point;

b) performance of laboratory work:

- report formatting in accordance with requirements 0.5 points;
- work completed with errors or sloppily 0 points;
- work not completed -1 point;

c) defense of the work:

- completion of an individual assignment 3 points;
- complete answer during defense 4 points;
- satisfactory answer during defense 3 points;
- no answer - 0 points.

2. Modular control work (MCW).

Weighted score – 13.

Assessment criteria:

- fully disclosed topic of the task 13 points;
- the topic of the task is fully covered, but technical errors are made 12 points;
- the topic is covered superficially 7 points;
- the topic is not covered, the task is not completed 0 points.

3. Homework assignment (HA).

Weighted score - 15. Assessment criteria:

- neat presentation, correct result, interpretation provided 15 points;
- neat presentation, correct result, no interpretation 12 points;
- acceptable presentation, result close to correct, no interpretation 8 points;
- no answer 0 points.

The final assessment is a test. The test covers the main questions, typical problems, tasks that require creative answers and the ability to synthesize the knowledge gained and apply it in solving practical problems.

Students who have not completed laboratory work, homework assignments, and module tests are not allowed to take the test.

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 on the discipline (educational component)

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

classrooms of the Department of Applied Radio Electronics.

Work program of the academic discipline (syllabus):
Compiled by V. M. Golovnya;
Approved by the Department of Applied Radio Electronics (Minutes No. 06/2025 dated 06/25/2025)
Approved by the methodological commission of the faculty/research institute (protocol No. 06/2025 dated 26.06.2025)