

Документ подписан простой электронной подписью
Информация о владельце:
ФИО: Порохня Андрей Алексеевич
Должность: И.о. директора института перспективной инженерии
Дата подписания: 22.10.2026 13:25:38
Уникальный программный ключ:
990bea3aecc48c23bd8699e48288f8d1960c600

MINISTRY OF SCIENCE AND HIGHER EDUCATION OF THE RUSSIAN FEDERATION
Federal State Autonomous Educational Institution
higher education
NORTH CAUCASIAN FEDERAL UNIVERSITY

I APPROVED BY

Acting director of the institute
advanced engineering
Ph.D. tech. Sciences , Associate Professor
A.A. Porokhnya

WORKING PROGRAM OF THE DISCIPLINE (MODULE)
Experimental Physics II/College Physics Experiment II

Direction of training	11.03.02 Infocommunication technologies and communication systems
Profile	Intelligent Data Processing in Infocommunication Systems and Networks
Year of commencement of studies	2026
Form of study	full-time
Implemented in a semester	3

Developed by

Professor of the Department of Digital,
robotic systems and electronics
Institute of Advanced Engineering
Doctor of Technical Sciences, professor
V.P. Mochalov

Stavropol 2026

1. The purpose and objectives of mastering the discipline (module)

The purpose of mastering the discipline : to develop students' general professional competencies in the direction of scientific thinking and research activities.

Objectives of mastering the discipline :

1) Systematization of fundamental knowledge in the field of physics and mathematics, their use to solve practical problems in the formalization and analysis of the physical essence of processes associated with the receipt, transmission, processing and storage of information in information and telecommunication systems.

2) Practical training in conducting experimental research by modeling physical phenomena and processes arising in information and telecommunications systems, as well as in using basic techniques for processing and presenting the obtained data.

2. The place of the discipline (module) in the structure of the educational program

The course "Experimental Physics II/College Physics Experiment II" is one of the disciplines of the compulsory part of Block 1 of the Course (modules).

3. List of planned learning outcomes for the discipline (module), correlated with the planned learning outcomes for the educational program

Code, formulation of competence	Code, indicator formulation	Planned learning outcomes for the discipline (module), characterizing the stages of formation of competencies, indicators
OPK-1. Capable of using the principles, laws, and methods of natural science and mathematics to solve engineering problems.	ID-1 _{OPK-1} understands the fundamental laws of nature and the basic physical mathematical laws and methods of accumulation, transmission and processing of information.	Understands the fundamental laws of nature, physical phenomena, and processes that occur in telecommunications systems; the basic physical methods and mathematical techniques used in telecommunications for storing, transmitting, and processing information.
	ID-2 _{OPK-1} applies physical laws and mathematical methods to solve theoretical and applied problems.	Applies physical laws and methods to formalize the representation of physical phenomena and processes occurring in telecommunications.
	ID-3 _{OPK-1} uses knowledge of physics and mathematics when solving practical problems.	Uses knowledge of physics to solve practical engineering problems in the field of telecommunications.
OPK-2. Capable of independently conducting experimental research and using basic techniques for processing and presenting the obtained data.	ID-3 _{OPK-2} understands the basic methods and means of conducting experimental research, standardization and certification systems.	Understands the basic methods and means of conducting experimental research using computer technology.
	ID-4 _{OPK-2} selects measurement methods and tools and conducts experimental research.	Selects the necessary methods and means of measurement, conducts experimental research.
	ID-5 _{OPK-2} has methods for processing and presenting the obtained data and assessing the error of the measurement results.	Proficient in methods of processing and presenting obtained laboratory data and assessing the error of measurement results.

4. Volume of the academic discipline (module) and forms of control

Amount of classes: total: <u>3</u> credits, 108_academician	OFO, in academic hours
Contact work:	24
Lectures/including practical training	0 / -
Laboratory work /including practical training	0 / -
Practical classes /including practical training	24 / -
Independent work	48
Forms of control	
Exam	36
Credit	-
Credit with grade	-
Calculation and graphic works	-
Coursework	-
Tests	-

5. The content of the discipline (module), structured by topics (sections) indicating the number of hours and types of classes

No.	Section (topic) of the discipline and brief content	Developed competencies, indicators	full-time education				Current Progress Monitoring Form
			Contact work of students with a teacher/of which in the form of practical training, hours			Independent work, hours	
			Lectures	Practical classes	Laboratory work		
3rd semester							
1	Information and telecommunication infrastructure as a complex physical system. The physical level of infocommunication systems and the fundamentals of information transmission. Physical principles of interaction between infocommunication systems and external physical fields. Representation of information at the physical level. Characteristics of physical fields as information carriers. Physical transmission media. Modeling and research of simple analog and digital signals. Modeling and research of the process of propagation of simple signals in a physical environment Practical work No. 1 SIMULATION AND RESEARCH OF SIMPLE ANALOG AND DIGITAL SIGNALS	OPK-1 ID-1 OPK-1 ID-2 OPK-1 ID-3 OPK-1 OPK-2 ID-3 OPK-2 ID-4 OPK-2 ID-5 OPK-2		2		4	Interview

2	Elements of field theory, fundamentals of vector analysis. Scalar and vector description of fields. Vector multiplication. Integral characteristics of vector fields: flow and circulation. Gradient. Hamiltonian (Nabla) and Laplace operators. Differential vector operators: divergence and curl. Fundamental theorems of field theory. Modeling and research of characteristics of physical fields and processes of their transformation. Practical work #2 MODELING AND RESEARCH OF THE PROCESS OF PROPAGATION OF SIMPLE SIGNALS IN A PHYSICAL ENVIRONMENT	OPK-1 ID-1_{OPK-1} ID-2_{OPK-1} ID-3_{OPK-1} OPK-2 ID-3_{OPK-2} ID-4_{OPK-2} ID-5_{OPK-2}		2		4	Inter-view
3	Basic electromagnetism. Physical principles of electrical interaction. Types of electric fields and their comparative characteristics. Electrostatic field, its characteristics and properties. Effect of electric field on substances. Electric field in a conductor. Physical principles of magnetic interaction. Magnetic field and its characteristics. Manifestations of magnetic field. Ampere and Lorentz forces. Properties of magnetic field. Properties of magnetic field. Magnetic storage media. Modeling and research of electric fields. Modeling and research of magnetic fields and electromagnetic induction phenomena. Practical work #3 MODELING AND RESEARCH OF CHARACTERISTICS OF PHYSICAL FIELDS, PROCESSES OF THEIR TRANSFORMATION	OPK-1 ID-1_{OPK-1} ID-2_{OPK-1} ID-3_{OPK-1} OPK-2 ID-3_{OPK-2} ID-4_{OPK-2} ID-5_{OPK-2}		2		4	Inter-view
4	Electromagnetic fields. Electromagnetic induction. Eddy electric field, displacement current. Maxwell's equations and their physical meaning. Modeling and research of electromagnetic waves. Practical work #4 MODELING AND RESEARCH	OPK-1 ID-1_{OPK-1} ID-2_{OPK-1} ID-3_{OPK-1} OPK-2 ID-3_{OPK-2} ID-4_{OPK-2} ID-5_{OPK-2}		2		4	Double inter-view

	PROPERTIES AND CHARACTERISTICS OF WAVE PROCESSES						
5	Wave processes. General characteristics of waves. Wave frequency distribution. Harmonic waves and their parameters. The equation of a plane traveling wave. The wave equation. Wave phenomena. Modeling and study of properties and characteristics of wave processes. Practical work #5 MODELING AND RESEARCH OF ELECTRIC FIELDS	OPK-1 ID-1 _{OPK-1} ID-2 _{OPK-1} ID-3 _{OPK-1} OPK-2 ID-3 _{OPK-2} ID-4 _{OPK-2} ID-5 _{OPK-2}		2		4	Double interview
46	Electromagnetic waves. The concept of an electromagnetic wave, its characteristics and properties. Fields of elementary electromagnetic emitters. Near and far zones. Energy transfer by electromagnetic waves. Propagation of radio waves. Registration of electromagnetic waves. Interference of electromagnetic waves. Diffraction of electromagnetic waves. Fresnel zones. Dispersion of electromagnetic waves. Modeling and study of fields of elementary electromagnetic emitters. Modeling and research of the process of registration of electromagnetic fields (waves). Practical work #6 MODELING AND RESEARCH OF MAGNETIC FIELDS AND PHENOMENA OF ELECTROMAGNETIC INDUCTION	OPK-1 ID-1 _{OPK-1} ID-2 _{OPK-1} ID-3 _{OPK-1} OPK-2 ID-3 _{OPK-2} ID-4 _{OPK-2} ID-5 _{OPK-2}		2		4	Interview
7	Physical processes in linear electrical circuits of the first and second order. Concepts of electrical circuits and electronic equipment. Equivalent circuits for physical processes in electrical circuits. Features of alternating current electrical circuits. Electromagnetic processes in first-order circuits. Voltage resonance in a series circuit. Current resonance in a parallel circuit. Modeling and research of alternating current electric circuits. Modeling and research of resonance phenomenon in electrical circuits.	OPK-1 ID-1 _{OPK-1} ID-2 _{OPK-1} ID-3 _{OPK-1} OPK-2 ID-3 _{OPK-2} ID-4 _{OPK-2} ID-5 _{OPK-2}		2		4	Interview

	Practical work #7 MODELING AND RESEARCH OF ELECTROMAGNETIC WAVES						
8	Transient processes in linear electrical circuits. General information about transient processes in electrical circuits. Analysis of transient processes in RL circuits. Analysis of transient processes in RC circuits. Analysis of transient processes in an oscillatory circuit. Modeling and research of transient processes in first and second order electrical circuits. Practical work #8 MODELING AND RESEARCH OF THE PROCESS OF SHIELDING ELECTROMAGNETIC FIELDS	OPK-1 ID-1_{OPK-1} ID-2_{OPK-1} ID-3_{OPK-1} OPK-2 ID-3_{OPK-2} ID-4_{OPK-2} ID-5_{OPK-2}		2		4	Double inter- view
9	Physical processes in distributed circuits (long lines). Basic concepts of long-line theory. Differential (telegraph) equations of a long line. Physical meaning of solutions of telegraph equations. Wave processes in a line with distributed parameters. Long lines as oscillatory systems. Modeling and research of the process of current propagation through electrical circuits with distributed parameters. Practical work #9 MODELING AND RESEARCH OF AC ELECTRIC CIRCUITS	OPK-1 ID-1_{OPK-1} ID-2_{OPK-1} ID-3_{OPK-1} OPK-2 ID-3_{OPK-2} ID-4_{OPK-2} ID-5_{OPK-2}		2		4	Double inter- view
10	Physical foundations of functional processes in radio-electronic means of the physical level. Fundamentals of electromagnetic oscillation generation. Free oscillations in an ideal oscillatory circuit. Conservation of energy in harmonic oscillations. Damping of free oscillations in a real oscillatory circuit. Forced oscillations in an oscillatory circuit. Self-oscillating system. Conditions for generating sinusoidal self-oscillations. Generation of electromagnetic waves. Fundamentals of modulation. Time and frequency representation of signals. Fundamentals of amplitude modulation. Fundamentals of frequency modulation. Fundamentals of demodulation.	OPK-1 ID-1_{OPK-1} ID-2_{OPK-1} ID-3_{OPK-1} OPK-2 ID-3_{OPK-2} ID-4_{OPK-2} ID-5_{OPK-2}		2		4	Double inter- view

	Modeling and research of processes of generation of electrical oscillations, modulation and demodulation. Practical work #10 MODELING AND RESEARCH OF THE RESONANCE PHENOMENON IN ELECTRIC CIRCUITS						
11	Physical principles of electromagnetic compatibility of radio-electronic equipment. Basic concepts of electromagnetic compatibility. Parasitic coupling in electrical circuits of electronic equipment and the causes of its occurrence. Parasitic capacitive coupling. Parasitic inductive coupling. Parasitic galvanic coupling. Grounding. Fundamentals of shielding electromagnetic fields. Shielding of electric fields. Shielding of magnetic fields. Electromagnetic shielding. Fundamentals of selection. Frequency filtering (selection). Fundamentals of spatial selection. Modeling and research of interference arising from external parasitic connections. Modeling and research of the process of shielding electromagnetic fields. Practical work #11 MODELING AND RESEARCH OF INFLUENCE, ARISING DUE TO EXTERNAL PARASITIC CONNECTIONS	OPK-1 ID-1 OPK-1 ID-2 OPK-1 ID-3 OPK-1 OPK-2 ID-3 OPK-2 ID-4 OPK-2 ID-5 OPK-2		2		4	Double interview
12	Physical principles of fiber-optic communication. General information about fiber-optic transmission systems. Structure, types, and operating principles of optical fiber. The effect of intermode dispersion on signal propagation. Chromatic dispersion. Attenuation in optical fiber. Practical work #12 MODELING AND RESEARCH OF TRANSIENTS PROCESSES IN ELECTRIC CIRCUITS OF THE FIRST AND SECOND ORDER	OPK-1 ID-1 OPK-1 ID-2 OPK-1 ID-3 OPK-1 OPK-2 ID-3 OPK-2 ID-4 OPK-2 ID-5 OPK-2		2		4	Interview
	TOTAL for 3rd semester			24.00		48.00	
	Exam					36.00	
	TOTAL			24.00		84.00	

6. Fund of assessment tools for conducting ongoing monitoring of academic performance and midterm assessment of students in a discipline (module)

The Assessment Toolkit (AT) for ongoing monitoring of student performance and midterm assessment in the course (module) " Experimental Physics II/College Physics Experiment II " is based on a list of mastered competencies, indicating the stages of their development during the course (module) mastery. The AT provides objective monitoring of the achievement of planned learning outcomes. The AT includes:

- description of indicators and criteria for assessing competencies at various stages of their formation, description of assessment scales;
- methodological materials defining the procedures for assessing knowledge, skills, abilities and (or) work experience, characterizing the stages of competence development;
- standard test assignments and other materials necessary for assessing knowledge, skills and the level of mastery of the developed competencies in the process of mastering the discipline (module).

FOS is an appendix to this discipline (module) program.

7. Methodological guidelines for students on mastering the discipline

When starting work, each student should take into account the following provisions.

The discipline (module) is structured on a thematic principle, each topic is a logically complete section.

The lecture material is devoted to the examination of key, basic provisions of the discipline and the explanation of educational assignments assigned to students for independent work.

Laboratory work is carried out with the aim of consolidating the acquired information and acquiring skills for its application in solving practical problems in the relevant subject area.

Students' independent work is aimed at independent study of additional material, preparation for laboratory work, and completion of all types of independent work.

To successfully master the course, it is necessary to complete all types of independent work using the recommended sources of information.

8. Educational, methodological and informational support of the discipline

8.1. List of basic and additional literature required for mastering the discipline (module)

8.1.1. List of main literature:

Sagdeev K.M., Goncharov D.G. Physical Foundations of Telecommunications: Textbook / K.M. Sagdeev, D.G. Goncharov. - Stavropol: North Caucasus Federal University, 2022. - 442 p. - The book is in the basic version of the IPRbooks electronic library system.

Goldstein A.E. Physical Foundations of Obtaining Information Electronic resource: Textbook / A.E. Goldstein. - Tomsk: Tomsk Polytechnic University, 2010. - 292 p. - The book is in the premium version of the IPR BOOKS electronic library system. - ISBN 978-5-98298-650-4.

Evstifeev V.V. Physical foundations of electricity and magnetism Electronic resource / Evstifeev V.V.: textbook. - Penza: PSU, 2019. - 416 p.

8.1.2. List of additional literature:

Sagdeev K.M. Physical Foundations of Information Security Electronic resource: textbook / A.F. Chipiga / V.I. Petrenko / K.M. Sagdeev. - Stavropol: North Caucasus Federal University, 2015. - 394 p. - The book is in the basic version of the IPRbooks electronic library system.

Physical principles of recording and storing information: teaching aid / compiled by V.I. Drozdova, G.V. Shagrova, M.G. Romanenko; North-Caucasian Federal University. - Stavropol: SKFU, 2014. - 84 p.

Feynman R. Feynman lectures on physics / R. Feynman, R. Leighton, M. Sands; edited by I S. Smorodinsky, Vol. 5, Electricity and magnetism. - M.: URSS, 2013. - 300 p. : ill. - ISBN 978-5-

397-04029-7. - ISBN 978-5-453-00051-7.

Feynman R. The Feynman Lectures on Physics / R. Feynman, R. Leighton, M. Sands; edited by Ya. A. Smorodinsky, Issue 3, Radiation. Waves. Quanta. - 9th ed. - Moscow: URSS, 2014. - 240 p.: ill. - Bibliography in interlinear notes. - ISBN 978-5-453-00059-3. - ISBN 978-5-397-04361-8.

Feynman R. Feynman lectures on physics / R. Feynman, R. Leighton, M. Sands; edited by Ya.A. Smorodinsky, Vol. 6, Electrodynamics. - 7th ed. - M.: URSS, 2014. - 347 p.: ill. - Bibliography sublinearly approx. - ISBN 978-5-453-00058-6. - ISBN 978-5-397-04359-5.

8.2. List of educational and methodological support for independent work of students in a discipline (module)

Guidelines for completing laboratory work in the academic discipline "Experimental Physics II/College Physics Experiment II": Training program "Infocommunication Technologies and Communication Systems": [Electronic resource]. - Stavropol: SKFU, 2026.

Guidelines for independent work on the academic discipline "Experimental Physics II/College Physics Experiment II": Training direction "Infocommunication technologies and communication systems": [Electronic resource]. - Stavropol: SKFU, 2026.

Lecture notes on the academic discipline "Experimental Physics II/College Physics Experiment II": Direction of training "Infocommunication technologies and communication systems": [Electronic resource]. - Stavropol: SKFU, 2026.

8.3. List of resources of the information and telecommunications network "Internet" required for mastering the discipline (module)

Physics website. – Access mode: <http://www.physel.ru>.

www.biblioclub.ru - Electronic library system "University Library Online"

www.eLibrary.ru - Scientific Electronic Library

www.iprbookshop.ru - IPRbooks Electronic Library System

9. List of information technologies used in the implementation of the educational process in the discipline (module), including a list of software and information reference systems

Lectures utilize computer technology to present multimedia presentations. During laboratory work, students conduct research on models of physical processes and the devices that implement them using computer modeling software and industrial laboratory equipment.

Information reference systems:

Information and reference and information and legal systems used in the study of the discipline:

1.	Physics website. – Access mode: http://www.physel.ru .
----	---

Software:

1.	NI LabView Teaching Only.
2.	NI Multisim Education or Electronics Workbench.
3.	PTC Mathcad
4.	Airen Test Control Program

10. Description of the material and technical base necessary for the implementation of the educational process in the discipline (module)

Lecture classes	A classroom for conducting classes, equipped with multimedia equipment and technical teaching aids.
Practical classes	A classroom equipped with equipment and technical teaching aids for presenting educational information:

	- magnetic marker board 1-element 120x240; - Epson short-throw multimedia projector with wall mount; - 15 workstations consisting of: computer - Lenovo Idea Centre all-in-one computer ((i5-3330s-2.7/ RAM 4Gb/HDD 1Tb; video card 615M/DVD/keyboard/mouse. Connection to the Internet, access to the university's corporate network.
Independent work	A room for independent student work equipped with computers and the ability to connect to the Internet and access the university's electronic information and educational environment.
Practical training	It is carried out in the structural divisions of the university and (or) in organizations operating in the profile of the relevant educational program, including its structural division

11. Features of mastering the discipline (module) by persons with disabilities

Students with disabilities are provided with special textbooks, teaching aids and didactic materials, special technical teaching aids for collective and individual use, the services of an assistant (helper) who provides students with the necessary technical assistance, as well as the services of sign language interpreters and tactile sign language interpreters.

The acquisition of a discipline (module) by students with disabilities can be organized jointly with other students, as well as in separate groups.

The acquisition of a discipline (module) by students with disabilities is carried out taking into account the characteristics of psychophysical development, individual capabilities and health status.

In order to ensure accessibility of higher education under the educational program for individuals with disabilities, the following is provided when mastering a discipline (module):

1) for persons with visual impairments:

- the presence of an assistant who provides the student with the necessary technical assistance, taking into account individual characteristics (helps to take up a workstation, move around, read and complete assignments, including taking down dictation),

- written assignments, as well as instructions on how to complete them, are written in large print,

- special textbooks, teaching aids and didactic materials (with large print or audio files),

- individual uniform illumination of at least 300 lux,

- if necessary, the student is provided with a magnifying device to complete the assignment;

2) for persons with hearing impairments:

- the presence of an assistant who provides the student with the necessary technical assistance, taking into account individual characteristics (helps to take up a workstation, move around, read and complete assignments, including taking down dictation),

- the availability of sound amplification equipment for collective use is ensured; if necessary, the student is provided with sound amplification equipment for individual use;

- is provided with appropriate sound means for reproducing information;

3) for persons with disabilities who have musculoskeletal disorders (including severe impairments of the motor functions of the upper limbs or the absence of upper limbs):

- written assignments are completed on a computer with specialized software or dictated to an assistant;

- at the student's request, assignments can be completed orally.

12. Features of the implementation of the discipline using distance learning technologies and e-learning

According to Part 1 of Article 16 of Federal Law No. 273-FZ of December 29, 2012, "On Education in the Russian Federation," *e-learning* is defined as the organization of educational activities using information contained in databases and used in the implementation of educational pro-

grams, as well as information technologies, technical means, and information and telecommunications networks that facilitate the transmission of said information over communication lines, as well as interaction between students and teaching staff. *Distance learning technologies* are educational technologies implemented primarily using information and telecommunications networks through indirect (remote) interaction between students and teaching staff.

The course may be delivered using distance learning technologies and e-learning, in whole or in part. The components of the course's teaching and methodological kit (the course curriculum, assessment and methodological materials, and assessment forms) implemented using distance learning technologies and e-learning contain instructions for their use.

When organizing educational activities using distance learning technologies and e-learning, asynchronous and synchronous methods of interaction between participants in educational relations may be provided through the Internet information and telecommunications network.

When using distance learning technologies and e-learning, the curriculum for the discipline shall indicate: methods of interaction between participants in educational relations via the Internet (videoconferencing, electronic testing); links to the SKFU electronic information and educational environment, to educational platforms and resources of other organizations that are openly accessible via the Internet; for synchronous learning - the time of online classes and teachers; for asynchronous learning - the authors of online courses.

When organizing midterm assessments using distance learning technologies and e-learning, the Methodological Recommendations for the Application of Technical Means Ensuring the Objectivity of Results during Midterm and State Final Assessments for Higher Education Programs—Bachelor's Degree Programs, Specialist Programs, and Master's Degree Programs Using Distance Learning Technologies—are used (Letter of the Ministry of Education and Science of the Russian Federation dated December 7, 2020, No. MN-19/1573-AN "On the Submission of Methodological Recommendations").

The implementation of the course using e-learning and distance learning technologies is carried out using the electronic information and educational environment of SKFU, to which students have access via the information and telecommunications network "Internet", or using the resources of other organizations, including platforms providing services for video conferencing, online meetings and distance learning (MTS-Link), as well as using the capabilities of social networks for communication between students and teachers.

The educational and methodological support for a discipline implemented using e-learning and distance learning technologies includes a work program, educational and methodological manuals or a course of lectures, methodological instructions for the implementation of various types of educational activities of students provided for by the discipline, and other educational and methodological materials posted in the information and educational environment of SKFU, presented in electronic form.