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**Federal State Autonomous Educational Institution
Higher Education "Peoples' Friendship University of Russia"**

Agrarian-Technological Institute

(name of the main training unit (PMO)-developer of the EP HE)

WORK PROGRAM OF THE DISCIPLINE

INSTRUMENTAL RESEARCH METHODS

(name of discipline/module)

Recommended by ISSS for the direction of training/specialty:

35.04.04. Agronomy

(code and name of the direction of training/specialty)

The development of the discipline is carried out within the framework of the implementation of the main professional educational program of higher education (OP HE):

Integrated Plant Protection

(name (profile/specialization) ep he)

1. THE PURPOSE OF MASTERING THE DISCIPLINE

The purpose of mastering the discipline "Instrumental Methods of Research" is the formation of a highly qualified specialist with theoretical knowledge and practical skills on modern innovative technologies in agricultural production.

2. REQUIREMENTS FOR THE RESULTS OF MASTERING THE DISCIPLINE

Mastering the discipline "Instrumental Research Methods" is aimed at forming the following competencies among students:

Table 2.1. List of competencies formed in students during the development of the discipline (results of mastering the discipline)

Code	Competence	Competency Achievement Indicators (within the framework of this discipline)
UK-1	Able to carry out search, critical analysis of problem situations on the basis of a systematic approach, to develop an action strategy	UK-1.2 Uses a systematic approach to solve the tasks
OPK-1	Able to solve the problems of development of the field of professional activity and (or) organization on the basis of analysis of the achievements of science and production	OPK-1.1. Demonstrates knowledge of the main methods of analysis of the achievements of science and production in agronomy
OPK-3	Able to use modern methods of problem solving in the development of new technologies in professional activities	OPK-3.1. Analyzes methods and methods of solving problems for the development of new technologies in agronomy
OPK-4	Able to conduct research, analyze results and prepare reporting documents	OPK-4. 1. Analyzes methods and methods of solving research problems
OPK-7	Able to own the tools for working with large arrays of structured and unstructured information, use modern digital methods of processing, analysis, interpretation and visualization of data in order to solve the tasks of professional and research activities in the field of agronomy	OPK-7.2. Uses modern digital methods of data processing, analysis, interpretation and visualization in order to solve the tasks
PK-2	Able to develop methods of conducting experiments, master new research methods	PK-2. 2. Applies modern types and methods of observations and accounting in field experiments

3. MESTO DISCIPLINE IN THE STRUCTURE OF THE OP VO

The discipline "Instrumental methods of research" refers to *theoretical* part of block B1 of the EP HE (B1.O.02.01)

Within the framework of the EP HE, students also master other disciplines and / or practices that contribute to the achievement of the planned results of mastering the discipline "**Instrumental Research Methods**".

Table 3.1. List of components of the EP HE that contribute to the achievement of the planned results of the discipline

Code	Competence	Other disciplines/modules*	Subsequent disciplines/modules*
UK-1	Able to carry out search, critical analysis of problem situations on the basis of a systematic approach, to develop an action strategy	History and methodology of scientific agronomy Information Technologies Work with scientific literature	Organization of integrated plant protection systems Prognosis of pests and diseases Phytosanitary risk analysis Plant immunity Biotechnology in plant protection Research work Pre-diploma practice
OPK-1	Able to solve the problems of development of the field of professional activity and (or) organization on the basis of analysis of the achievements of science and production	Information Technologies Phytosanitary risk analysis	Mathematical Modeling and Design Plant immunity Organization of integrated plant protection systems Biological method of plant protection Virology Bacterial diseases Biology of weedy vegetation Plant protection in organic farming Molecular methods for diagnosing phytopathogens Nematode diseases Prognosis of pests and diseases Biotechnology in plant protection Plant quarantine Research work Pre-diploma practice
OPK-3	Able to use modern methods of problem solving in the development of new technologies in professional activities	Information Technologies Phytosanitary risk analysis	Molecular methods for diagnosing phytopathogens Nematode diseases Prognosis of pests and diseases Biotechnology in plant protection Plant quarantine Research work Pre-diploma practice

OPK-4	Able to conduct research, analyze results and prepare reporting documents	Mathematical Modeling and Design Biological method of plant protection Virology Bacterial diseases Work with scientific literature Fundamentals of Scientific Communication Biology of weedy vegetation Plant protection in organic farming Molecular methods for diagnosing phytopathogens Nematode diseases Prognosis of pests and diseases Phytosanitary risk analysis	Organization of integrated plant protection systems Plant immunity Biotechnology in plant protection Plant quarantine Research work
OPK-7	Able to own the tools for working with large arrays of structured and unstructured information, use modern digital methods of processing, analysis, interpretation and visualization of data in order to solve the tasks of professional and research activities in the field of agronomy	Mathematical Modeling and Design Biological method of plant protection Virology	Biotechnology in plant protection Plant quarantine Research work
PK-2	Able to develop methods of conducting experiments, master new research methods	Biological method of plant protection Plant protection in organic farming Biological method of plant protection Molecular methods for diagnosing phytopathogens	Organization of integrated plant protection systems Plant immunity Biotechnology in plant protection Plant quarantine Research work

* - is filled in accordance with the competence matrix and the SPMS OP VO

4. SCOPE OF DISCIPLINE AND TYPES OF EDUCATIONAL WORK

The total labor intensity of the discipline "**Instrumental Research Methods**" is **2** credits.

Table 4.1. Types of educational work by periods of mastering the EP HE for **full-time** education

Type of educational work	TOTAL, aca.hrs.	Semester(s)			
					2

<i>Contact work, ac.ch.</i>		33				33
Including:						
Lectures (LC)		11				11
Laboratory works (LR)						
Practical/seminar sessions (PE)		22				22
<i>Independent work of students, ac.ch.</i>		33				33
<i>Control (exam /test with grade), ac.ch.</i>		6				6
Overall labor intensity of the discipline	aca.hrs.	72				72
	Hrs.ed.	3				3

5. CONTENT OF THE DISCIPLINE

Table 5.1. The content of the discipline (module) by types of educational work

Name of the discipline section	Contents	Type of educational work*
Section 1 General	Classification of instrumental methods of environmental research, sampling, sample preparation, separation and concentration, measurement (definition), data processing, conclusions and report, representation of chemometrics	LC, PE
Section 2 Atomic absorption spectrometry	Theoretical foundations of the method of atomic emission spectrometry, radiation sources used in atomic emission spectrometry, spectrometers for atomic emission spectrometry, possibilities of the method of atomic emission spectrometry for the analysis of environmental objects, theoretical foundations of the method of atomic absorption spectrometry, the device of atomic absorption spectrometers, the possibilities of the method of atomic absorption spectrometry, the analysis of water by the method of atomic absorption spectrometry, air analysis by atomic absorption spectrometry, atomic absorption method for the determination of lead in the air in accordance with the international standard ISO 9855, the determination of heavy metals in the soil in accordance with the international standard ISO 11047, food analysis, analysis of biological samples.	LC, PE
Section 3 Spectral methods of analysis	Infrared spectroscopy, ultraviolet spectroscopy, nuclear magnetic resonance spectroscopy, gas-liquid chromatography, high-performance liquid chromatography, mass spectrometry, chromatography-mass spectrometry	LC, PE
Section 4 Electrochemical methods of analysis	Theoretical foundations of electrochemical methods of analysis, potentiometry, voltammetry, the possibilities of electrochemical methods for the analysis of environmental objects, the determination of the mass fraction of nitrate ions in products of plant origin, products of fruit and vegetable processing, feed, mixed fodder and feed raw materials by the potentiometric method, the determination of the mass	LC, PE

	concentration of vitamin C in fruits and berries by the voltamperometric method, the determination of iodine in food products and food raw materials by voltamperometric method.	
Section 5 Chromatography	Theoretical foundations of chromatography as a method of separation and determination of chemicals, gas-liquid chromatography, high-performance liquid chromatography, ionic chromatography, mass spectrometry, chromatography-mass spectrometry, determination of the content of essential oils, determination of anions.	LC, PE

* - is filled in only on **full-time** forms of training: LC - lectures; PZ – practical exercises.

6. MATERIAL AND TECHNICAL SUPPORT OF DISCIPLINE

Table 6.1. Logistics of discipline

Audience type	Equipping the classroom	Specialized educational/laboratory equipment, software and materials for mastering the discipline (if necessary)
Lab	And I'm an instructor for laboratory and practical classes during the semesters.	- <i>Laboratory utensils and tools</i> - <i>Laboratory equipment</i> - <i>Reagents</i>
Auditorium for independent work of students	An auditorium for independent work of students, equipped with a complex of specialized furniture and technical means of multimedia presentations.	- <i>Specialized furniture</i> - <i>Computer Lab</i>

7. EDUCATIONAL, METHODOLOGICAL AND INFORMATION SUPPORT OF THE DISCIPLINE

Main literature:

1. Nagorny V.D. Instrumental methods of analysis in agricultural research = Instrumental methods of research in agronomy : education and Methodical Complex / V.D. Nagorny. - Book in English; electronic text data. - M. : PFUR, 2013. - 171 p. - ISBN 978-5-209-05059-9
2. Chekaev, N. P. Instrumental'nye metody issledovaniya : uchebnoe posobie / N. P. Chekaev, V. N. Erkaev. — Penza : PGAU, 2016. — 187 p. — Text : elektronnyi // Lan : elektronno-bibliotchnaya sistema. — URL: <https://e.lanbook.com/book/142073>

Further reading:

1. Educational and methodical manual for laboratory classes in the discipline "Instrumental

methods of research" : educational and methodical manual / compiler N. I. Perfilieva. — Nalchik : Kabardino-Balkarsky GAU, 2015. — 62 p. — Text : electronic // Lan : electronic-bibliotechnaya sistema. — URL: <https://e.lanbook.com/book/146017>

Resources of the information and telecommunication network "Internet":

1. RUDN University EBS and third-party EBS, to which university students have access on the basis of concluded contracts:

- Electronic library system RUDN University – EBS RUDN university
<http://lib.rudn.ru/MegaPro/Web>
- EBS "University Library Online" <http://www.biblioclub.ru>
- EBS Yurayt <http://www.biblio-online.ru>
- EBS "Lan" <http://e.lanbook.com/>

2. Databases and search engines:

- NCBI: <https://p.360pubmed.com/pubmed/>
- RUDN University Bulletin: access mode from the territory of RUDN University and remotely <http://journals.rudn.ru/>
- Scientific Library Elibrary.ru: access by IP-addresses of RUDN University at the address: <http://www.elibrary.ru/defaultx.asp>
- ScienceDirect (ESD), FreedomCollection, Cell Press And Elsevier. There is remote access to the database, access by IP-addresses of RUDN University (or remotely by individual login and password).
- Google Scholar is a free search engine for full texts of scientific publications of all formats and disciplines. Indexes the full texts of scientific publications. Access mode: <https://scholar.google.ru/>
- Scopus is a scientometric database of the publishing house "Elsevier". Access to the platform is carried out by IP-addresses of RUDN University or remotely. <http://www.scopus.com/>
- Database of Botanical and Biological Publications:

Educational and methodical materials for independent work of students when mastering the discipline / module:*

1. Methodical instructions for students on the development of the discipline "**Plant Immunity**"
2. Lecture notes
3. Methodical recommendations on all topics of laboratory work
4. Tasks to perform as part of independent work

* - all educational and methodological materials for independent work of students are placed in accordance with the current procedure on the page of **the discipline in TUIS!**

8. EVALUATION MATERIALS AND POINT-RATING SYSTEM FOR ASSESSING THE LEVEL OF FORMATION OF COMPETENCIES IN THE DISCIPLINE

Assessment materials and a point-rating system* for assessing the level of formation of competencies (part of competencies) based on the results of mastering the discipline "**Instrumental Research Methods**" are presented in the Appendix to this Work Program of the discipline.

* - OM and BRS are formed on the basis of the requirements of the relevant local regulatory act of RUDN University.

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