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Federal State Autonomous Educational Institution of Higher Education
PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA
NAMED AFTER PATRICE LUMUMBA
RUDN University

Agrarian-Technological Institute

educational division (faculty/institute/academy) as higher education programme developer

COURSE SYLLABUS

Molecular methods for diagnosing phytopathogens

course title

Recommended by the Didactic Council for the Education Field of:

35.04.04. Agronomy

field of studies / speciality code and title

The course instruction is implemented within the professional education programme of higher education:

Integrated Plant Protection

higher education programme profile/specialisation title

1. THE PURPOSE OF MASTERING THE DISCIPLINE

The purpose of mastering the discipline "Molecular methods for diagnosing phytopathogens" is to obtain basic knowledge about the methods and ways of spreading a viral infection, measures to prevent plant infection and methods of localization of lesions, familiarization with modern methods of identification and diagnosis of viruses.

2. REQUIREMENTS FOR THE RESULTS OF MASTERING THE DISCIPLINE

Mastering the discipline "Molecular methods for diagnosing phytopathogens" is aimed at the formation of the following competencies in students: OPK-1.2; OPK-4.2; OPK-4.3; PC-4.5; PC-4.6; PC-7.1; PC-7.2

OPK-1.1; OPK-1.2; OPK-4.2; OPK-4.3; PC-2.1; PC-5.1; PC-7.1; PC-7.2

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)
OPK-1.1	Demonstrates knowledge of the main methods of analysis of the achievements of science and production in agronomy	OPK-1.1.1 Able to apply in practice knowledge about the scheme of identification of phytopathogen by molecular methods
OPK – 1.2	Uses methods of solving problems in the development of agronomy based on the search and analysis of modern achievements of science and production	OPK-1.2.1 Uses in professional activities ideas about the basics of the molecular structure of DNA and RNA molecules, their biological and physicochemical properties OPK-1.2.2 Uses in professional activities methods for diagnosing phytopathogens, including the ELISA method and PCR modifications
OPK – 4.2	Uses information resources, scientific, experimental and instrumental base for research in agronomy	OPK-4.2.1 Uses modern equipment in the laboratory for conducting tests by PFR and ELISA methods OPK-4.2.2 Uses skills in working with analytical samples of the material for the isolation of DNA / RNA, its amplification and detection of phytopathogens
OPK – 4.3	Formulates the results obtained in the course of solving research problems	OPK-4.3.1 Able to interpret the results of modern molecular genetic diagnostic methods, including bioinformatic analysis of nucleotide sequences
PC-2.1	Develops methods of conducting experiments	PC – 2.1.1 Participates in the development of regulatory documents for the diagnosis of pests PC – 2.1.2 Participates in the testing and development of new tests for species

		diagnostics of pathogens
PC-5.1	Draws up a research program to study the effectiveness of agricultural techniques	PP-5.1.1 Introduces rapid diagnostic methods in the process of establishing the phytosanitary state of fields and gardens to develop a program to combat identified phytopathogens
PC – 7.1	Recognizes quarantine objects and identifies quarantine pests and pathogens	PC – 7.1.1 Owns methods of species identification of fungi, bacteria, nematodes, viruses, viroids and phytoplasmas related to quarantine and closely related
PC – 7.2	Conducts examination of crops and crop products for the presence of quarantine facilities	SC – 7.2.1 Owns methods and techniques for conducting phytosanitary studies of plant material to search for quarantine phytopathogen species, including sampling and preparation of analytical samples.

3. MESTO DISCIPLINE IN THE STRUCTURE OF THE OP VO

The discipline "**Molecular methods for the diagnosis of phytopathogens**" refers to *the elective* part of the block B1.B.DV.03.01 OP VO.

Within the framework of the OP HE, students also master other disciplines and / or practices that contribute to the achievement of the planned results of mastering the discipline "**Molecular methods for diagnosing phytopathogens**".

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

Code	Competence	Previous disciplines/modules, practices*	Subsequent disciplines/modules, practices*
OPK-1.1	Demonstrates knowledge of the main methods of analysis of the achievements of science and production in agronomy	Phytopathology Biological method of plant protection Work with scientific literature Fundamentals of Scientific Communication Plant protection in organic farming Prognosis of pests and diseases Phytosanitary risk analysis	Instrumental research methods Instrumental research methods Plant quarantine Biotechnology in plant protection
OPK – 1.2	Uses methods of solving problems in the development of agronomy based on the search and analysis of modern achievements of science and production	Phytopathology Biological method of plant protection Work with scientific literature Fundamentals of Scientific Communication Plant protection in organic farming	Instrumental research methods Instrumental research methods Plant quarantine Biotechnology in plant protection

		Prognosis of pests and diseases Phytopathology risk analysis	
OPK – 4.2	Uses information resources, scientific, experimental and instrumental base for research in agronomy	Phytopathology Biological method of plant protection Work with scientific literature Fundamentals of Scientific Communication Plant protection in organic farming Prognosis of pests and diseases Phytopathology risk analysis	Instrumental research methods Instrumental research methods Plant quarantine Biotechnology in plant protection
OPK – 4.3	Formulates the results obtained in the course of solving research problems	Phytopathology Biological method of plant protection Work with scientific literature Fundamentals of Scientific Communication Plant protection in organic farming Prognosis of pests and diseases Phytopathology risk analysis	Instrumental research methods Instrumental research methods Plant quarantine Biotechnology in plant protection
PC-2.1	Develops methods of conducting experiments	Phytopathology Biological method of plant protection Work with scientific literature Fundamentals of Scientific Communication Plant protection in organic farming Prognosis of pests and diseases Phytopathology risk analysis	Instrumental research methods Instrumental research methods Plant quarantine Biotechnology in plant protection
PC-5.1	Draws up a research program to study the effectiveness of agricultural techniques	Phytopathology Biological method of plant protection Work with scientific literature Fundamentals of Scientific Communication Plant protection in organic farming	Instrumental research methods Instrumental research methods Plant quarantine Biotechnology in plant protection

		Prognosis of pests and diseases Phytopathology Phytosanitary risk analysis	
PC – 7.1	Recognizes quarantine objects and identifies quarantine pests and pathogens	Phytopathology Biological method of plant protection Work with scientific literature Fundamentals of Scientific Communication Plant protection in organic farming Prognosis of pests and diseases Phytopathology Phytosanitary risk analysis	Instrumental research methods Instrumental research methods Plant quarantine Biotechnology in plant protection
PC – 7.2	Conducts examination of crops and crop products for the presence of quarantine facilities	Phytopathology Biological method of plant protection Work with scientific literature Fundamentals of Scientific Communication Plant protection in organic farming Prognosis of pests and diseases Phytopathology Phytosanitary risk analysis	Instrumental research methods Instrumental research methods Plant quarantine Biotechnology in plant protection

* - 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 "**Molecular methods for diagnosing phytopathogens**" is **4** 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)			
			4	5		
<i>Contact work, ac.ch.</i>		34	34	34		
Including:						
Lectures (LC)						
Laboratory works (LR)		34	14	20		
Practical/Seminar Classes (FPs)						
<i>Independent work of students, ac.ch.</i>		59	30	22		
<i>Control (exam /test with grade), ac.ch.</i>		15	7	8		
Overall labor intensity of the discipline	aca.hrs.	108	51	57		
	Hrs.ed.	3	1	2		

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 Introduction to Molecular Biology	Topic 1.1. The subject and history of molecular biology in the context of diagnostics. The structure of DNA and its properties. ELISA: the principle of the method and comparison with PCR.	LR, WED
Section 2 The main stages and sections of molecular genetic diagnostic methods	Topic 2. 1. Basics of PCR methods. Classical PCR	LR, WED
	Topic 2. 2. Electrophoresis method for visualization of PCR results	LR, WED
	Topic 2. 3. Real-time PCR - qualitative and quantitative analysis	LR, WED
	Topic 2. 4. Modifications of the PCR method. Nested, ISSR, RFPL, LAMP, Drop-digital.	LR, WED
	Topic 2. 5. Interpretation of PCR results. Schemes of analysis. Practical application.	LR, WED
Section 3 Analysis of nucleotide sequences	Topic 3. 1. Sequencing method: Principle, steps.	LR, WED
	Topic 3. 2. Sequencing Method. Interpretation of Results. Bioinformational Analysis and Application in Practice.	LR, WED
	Topic 3. 3. Phylogenetic analysis	LR, WED
Section 4 Genetically engineered organisms.	Topic 4. 1. Fundamentals of Genetic Engineering in Agriculture: The Use of Developments and Their Impact on the Environment	LR, WED
	Topic 4. 2. Methods of detection and diagnosis of genetically modified plants. International legislative practice of GMO control.	LR, WED
Section 5 Cloning method in the diagnosis of phytopathogens.	Topic 5.1. Molecular DNA cloning	LR, WED
	Topic 5.2. Stages of formation of diagnostic protocols for species diagnostics of phytopathogens	LR, WED
	Topic 5.3. Scientific and practical significance of the use of DNA and RNA in the effective diagnosis of phytopathogens and pests of agricultural crops	LR, WED

* - is filled only in **full-time** forms of training: LC - lectures; LR - laboratory work; SZ - seminar classes.

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)
Specialized audience	An auditorium for practical work, individual consultations, current control and intermediate certification, equipped with a set of specialized furniture and equipment. (audiences 310, 238)	Comof specialized furniture Mobile Projector
Educational and	Laboratory of Molecular	Amplifier for classical PCR
Audience type	Equipping the classroom	Specialized educational/laboratory equipment, software and materials for mastering the discipline (if necessary)
Scientific Laboratory	Genetic Diagnostic Methods (235, 439)	Set of dispensers Solid-state thermostat Vortex Centrifuge
For independent work of students	Auditorium for independent work of students (can be used for lectures and consultations), equipped with a set of specialized furniture (room 310)	Set of specialized furniture Mobile Projector

* - the audience for independent work of students is indicated **NECESSARILY!**

7. EDUCATIONAL, METHODOLOGICAL AND INFORMATION SUPPORT OF THE DISCIPLINE

Main literature:

Publications:

1. D.V. Rebrikov. Real-time PCR. Ed. "Laboratory of Knowledge", 2015
2. V.V.Lukashov. Molecular evolution and phylogenetic analysis. Ed. "Binomial", 2009
3. D. V. Rebrikov, V. V. Ilyinsky, D. O. Korostin, E. S. Shubina. NGS High Performance Sequencing

Further reading:

Electronic and printed full-text materials:

1. "Molecular Biology (Structure and Biosynthesis of Nucleic Acids)", "Graduate School", 1990.
2. Lewin B. "Genes", Publishing House "The World", 1987
3. Mamontov S.G., Zakharov V.B. Obschchaya biologiya. M.; Ed. "Higher School", 1996

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>

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>

– Electronic resource: EPPO global database URL <https://gd.eppo.int/>

– Electronic resource: Classical and molecular biology URL <http://molbiol.ru/>

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

1. Methodical instructions for students on mastering the discipline "PCR" of the company "DNA-Technology"

2. Stepik training application for advanced training and independent work of students

* - 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

Evaluation 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 "**Molecular methods for diagnosing phytopathogens**" 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.

DEVELOPERS:

Senior Lecturer at the
Agrobiotechnology Department

Position, BCD

Signature

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Surname F.I.

HEAD OF BCD:

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