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

Agrarian -Technological Institute
educational division (faculty/institute/academy) as higher education programme developer

COURSE SYLLABUS

Breeding and Seed Production
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:

General Agriculture
higher education programme profile/specialisation title

2025

1. COURSE GOAL(s)

The discipline "Breeding and Seed Production" is included in the master's degree program "General Agronomy" in the direction of 35.04.04 "Agronomy" and is studied in the 3rd and 4th semesters of the 2nd year. The discipline is implemented by the Agrobiotechnology Department. The discipline consists of 12 sections and 32 topics and is aimed at studying plant breeding and the techniques of the breeding process.

The purpose of mastering the discipline is to gain basic knowledge on plant breeding methods, organization and technique of the breeding process and seed production of agricultural crops.

2. REQUIREMENTS FOR LEARNING OUTCOMES

Mastering the discipline "Breeding and Seed Production" is aimed at the formation of the following competencies (part of the competencies) among students:

Table 2.1. List of competences that students acquire through the course study

Competence code	**Competence descriptor**	**Competence formation indicators** (within this course)
OPK-4	Able to conduct scientific research, analyze the results and prepare accounting documents.	OPK-4.1. Analyzes methods and methods of solving research problems;
		OPK-4.2. Uses information resources, scientific, experimental and instrument base for conducting research in agronomy;
PK-1	Able to organize experiments (field experiments) to evaluate the effectiveness of innovative technologies (technology elements), varieties and hybrids in production conditions.	PK-1.1. Develops a research program to study the effectiveness of innovative technologies (technology elements), varieties and hybrids, develops experimental methods, and develops new research methods;
PK-2	Able to develop and implement environmentally friendly techniques and technologies for the production of high-quality crop production, taking into account the properties of agricultural landscapes and economic efficiency	PK-2.3. Justifies the specializations and types of products grown in an agricultural organization;
PK-3	Able to identify areas for improving and increasing the efficiency of crop production technologies based on scientific achievements and best practices of domestic and foreign producers.	PK-3.1. Defines promising areas for improving the efficiency of crop production;

Competence code	Competence descriptor	Competence formation indicators (within this course)
PK-4	Able to create models of crop cultivation technologies, plant protection systems, and varieties	PK-4.1. Creates models of crop cultivation technologies, plant protection systems, and varieties;

3.COURSE IN HIGHER EDUCATION PROGRAMME STRUCTURE

Mastering the discipline "Breeding and Seed Production" is aimed at forming the following competencies (part of the competencies) among students:

Table 3.1. The list of the higher education programme components/disciplines that contribute to the achievement of the expected learning outcomes as the course study results

Competence code	Competence descriptor	Previous courses/modules*	Subsequent courses/modules*
OPK-4	Able to conduct scientific research, analyze the results and prepare accounting documents.	Scientific research work / Научно-исследовательская работа;	
PK-1	Able to organize experiments (field experiments) to evaluate the effectiveness of innovative technologies (technology elements), varieties and hybrids in production conditions.	Scientific research work / Научно-исследовательская работа; Technological Training; Information Technology; Crop Production; Mechanization of Crop Production; Pests and Diseases; Soil Fertility Management;	
PK-2	Able to develop and implement environmentally friendly techniques and technologies for the production of high-quality crop production, taking into account the properties of agricultural landscapes and economic efficiency	Crop Production; Pests and Diseases; Technological Training; Scientific research work / Научно-исследовательская работа;	
PK-3	Able to identify areas for improving and increasing the efficiency of crop	Scientific research work / Научно-исследовательская работа;	

Competence code	Competence descriptor	Previous courses/modules*	Subsequent courses/modules*
	production technologies based on scientific achievements and best practices of domestic and foreign producers.	Technological Training; Crop Production;	
PK-4	Able to create models of crop cultivation technologies, plant protection systems, and varieties	Crop Production; Scientific research work / Научно-исследовательская работа;	

* To be filled in according to the competence matrix of the higher education programme.

4. COURSE WORKLOAD AND ACADEMIC ACTIVITIES

Possible wording

The total labor intensity of the discipline " Breeding and Seed Production " is 7 credits for full-time education.

Table 4.1 – Types of educational work by periods of mastering the OP HE for full-time education

Type of academic activities		Total academic hours	Semesters/training modules			
			1	2	3	4
Contact academic hours		*112*			*68*	*44*
including:						
Lectures (LC)		56			34	22
Lab work (LW)		56			34	22
Seminars (workshops/tutorials) (S)						
Self-studies		*110*			*58*	*52*
Evaluation and assessment (exam/passing/failing grade)		*30*			*18*	*12*
Course workload	academic hours_	**252**			**144**	**108**
	credits	**7**			**4**	**3**

5. COURSE CONTENTS

Table 5.1. Course contents and academic activities types

Course module title	Course module contents (topics)	Academic activities types
Module 1: Breeding as the science of breeding varieties and hybrids	1.1 Breeding as a science and branch of agricultural production. Realization of the advantages of breeding in seed production	LC; LW
	1.2 The economic importance of breeding. The founders of Russian breeding and outstanding breeders	LC; LW
Module 2: The doctrine of the variety	2.1 The concept of a variety and a heterotic hybrid. Morphological and economic-biological signs and properties of the variety. Energy-saving and environmental grade function	LC; LW
	2.2 Varieties of folk breeding. Breeding varieties	LC; LW
	2.3 Variety and agrotechnics: cultivation in various agricultural fields; variety as an effective protection against diseases and	LC; LW

Course module title	Course module contents (topics)	Academic activities types
	pests; the role of the variety in improving the quality of agricultural products	
Module 3: Source material in breeding	3.1 The concept of the source material for breeding. N.I. Vavilov, his role in the teaching of the source material	LC; LW
	3.2 Centers of origin of cultivated plants. Peasant varieties as a source material for breeding	LC; LW
	3.3 The world's VIR collections and their use. Genetic banks	LC; LW
Module 4: Hybridization	4.1 The concept of analytical and synthetic breeding.	LC; LW
	4.2 Intraspecific hybridization. Selection of breeding pairs. Methods and techniques of hybridization.	LC; LW
	4.3 Distant hybridization. The importance and difficulties of remote hybridization. Ways to overcome incompatibility during distant hybridization. Methods of genetic and chromosomal engineering and biotechnology in remote hybridization	LC; LW
Module 5: Mutagenesis in plant breeding	5.1 A brief history of mutational breeding. The role of spontaneous mutations in breeding	LC; LW
	5.2 Physical and chemical mutagens	LC; LW
	5.3 Identification of mutants in self- and cross-pollinating and vegetatively propagating crops. Achievements and problems of mutant breeding	LC; LW
Module 6: Polyploidy and haploidy in plant breeding	6.1 Preparation of autopolyploids for breeding purposes using colchicine and other agents	LC; LW
	6.2 Reduced seed productivity of autopolyploids and methods of its increase	LC; LW
	6.3 Methods for obtaining haploids. The importance of haploidy in remote hybridization. Advantages of haploid breeding	LC; LW
Module 7: Selection methods.	7.1 Main types of selection: Individual selection from homozygous populations in self-pollinators. Individual selection of cross-borderers	LC; LW
	7.2 Mass selection of self-pollinators and cross-pollinators. Selection from cell populations. Selection on selective media	LC; LW
Module 8: Population genetics	8.1 Genetic processes in populations	LC; LW
	8.2 the kinetic foundations of evolution. Population dynamics factors	LC; LW
Module 9: Organization and technique of the breeding process	9.1 Creation of populations; selection of plants; testing of offspring	LC; LW
	9.2 Types of breeding crops. Types of variety testing	LC; LW
	9.3 Typicality, accuracy of experience and the principle of the only difference in the breeding process	LC; LW
	9.4 Field work techniques. Sowing, care, observations, assessments, rejection, and crop accounting	LC; LW
Module 10: Breeding of heterotic hybrids	10.1 A brief history of breeding for heterosis. Types of heterotic hybrids on the example of corn	LC; LW
	10.2 Combinational ability. CMS and its use in the production of hybrid seeds	LC; LW
Module 11: State testing and protection of breeding achievements	11.1 Tasks and organization of the state variety testing. The methodology and technique of its implementation	LC; LW
	11.2 The procedure for including varieties in the state variety testing and zoning of varieties. Criteria for the protection of breeding achievements: novelty, distinctiveness, uniformity, stability. The variety testing network and its work	LC; LW
Module 12: Seed production as a branch of agricultural production	12.1 Organization of seed production in modern conditions. The Law of the Russian Federation "On Breeding achievements" and the Law of the Russian Federation "On Seed Production"	LC; LW
	12.2 Variety change and variety renewal as the most important tasks of seed production	LC; LW
	12.3 Requirements for seed and planting materials. Standards (GOST standards) for seed quality. Documentation of varietal	LC; LW

Course module title	Course module contents (topics)	Academic activities types
	crops and seeds. Variety control. Field testing and registration of crops. The peculiarities of the approbation of individual crops. Methods and techniques of approbation	

* - to be filled in only for **full** -time training: *LC - lectures; LW - lab work; S - seminars.*

6. CLASSROOM EQUIPMENT AND TECHNOLOGY SUPPORT REQUIREMENTS

Table 6.1. Classroom equipment and technology support requirements

Type of academic activities	Classroom equipment	Specialised educational / laboratory equipment, software, and materials for course study (if necessary)
Lecture hall	An auditorium for conducting lecture-type classes, equipped with a set of specialized furniture; a blackboard (screen) and multimedia presentation equipment	
Scientific Laboratory	An auditorium for laboratory work, individual consultations, routine monitoring and intermediate certification, equipped with a set of specialized furniture and equipment.	
Self-studies	A classroom for independent work of students (can be used for seminars and consultations), equipped with a set of specialised furniture and computers with access to the electronic information and educational environment.	

* The premises for students' self-studies are subject to **MANDATORY** mention

7. RESOURCES RECOMMENDED FOR COURSE STUDY

Main readings:

1. General plant breeding / Yu.B. Konovalov, V. V. Pylnev, T. I. Khupatsaria, V. S. Rubets. — 5th ed., ster. — Saint Petersburg : Lan, 2023. — 480 p. — ISBN 978-5-507-45737-3. — Text : electronic // Lan : electronic library system. — URL: https://e.lanbook.com/book/282386

2. Pylnev, V. V. Fundamentals of breeding and seed production / V. V. Pylnev, A. N. Berezkin ; Edited by: Pylnev V. V. — 2nd ed., ster. — Saint Petersburg : Lan, 2023. — 216 p. — ISBN 978-5-507-45402-0. — Text : electronic // Lan : electronic library system. — URL: https://e.lanbook.com/book/267383

Additional readings:

1. Practical training on field crop breeding and seed production : a textbook / V. V. Pylnev, Yu.B. Konovalov, T. I. Khupatsaria [et al.]. — St. Petersburg : Lan, 2022. - 448 p. — ISBN 978-5-8114-1567-0. — Text : electronic // Lan : electronic library system. — URL: https://e.lanbook.com/book/211478

2. Tsatsenko, L. V. Innovative technologies in agronomy: breeding and seed production : a textbook / L. V. Tsatsenko. Krasnodar : KubGAU Publ., 2020. 88 p. ISBN

978-5-907294-48-6. Text : electronic // Lan : electronic library system. — URL: https://e.lanbook.com/book/171561

Internet sources

1. Electronic libraries (EL) of RUDN University and other institutions, to which university students have access on the basis of concluded agreements:

- RUDN Electronic Library System (RUDN ELS) http://lib.rudn.ru/MegaPro/Web
- EL "University Library Online" http://www.biblioclub.ru
- EL "Yurayt" http://www.biblio-online.ru
- EL "Student Consultant" www.studentlibrary.ru
- EL "Lan" http://e.lanbook.com/

2.Databases and search engines:

- electronic foundation of legal and normative-technical documentation http://docs.cntd.ru/
- Yandex search engine https:// www .yandex.ru/
- Google search engine https://www.google.ru/
- Scopus abstract database http://www.elsevierscience.ru/products/scopus/

*Training toolkit for self- studies to master the course *:*

The set of lectures on the course « Breeding and Seed Production »

* The training toolkit for self- studies to master the course is placed on the course page in the university telecommunication training and information system under the set procedure.

DEVELOPERS:

position, department	name and surname
position, department	name and surname
position, department	name and surname

HEAD OF EDUCATIONAL DEPARTMENT:

name of department	name and surname

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