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

Mathematical Modeling and Design

course title

Recommended by the Didactic Council for the Education Field of:

35.0 4.04 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

2023

1. THE PURPOSE OF MASTERING THE DISCIPLINE

The purpose of mastering the discipline "Mathematical Modeling and Design" is to form basic ideas about obtaining and processing information for its analysis by a person and making decisions on its basis to perform management tasks related to production activities in the field of agriculture.

REQUIREMENTS FOR THE RESULTS OF MASTERING THE DISCIPLINE

Mastering the discipline "Mathematical Modeling and Design" is aimed at forming the following competencies (part of the competencies) among students:

Table 1 - The list of competencies formed by students during the development of the discipline (the results of mastering the discipline)

Code	Competence	Competency Achievement Indicators
UK-7.	Able to search for the necessary sources of information and data, perceive, analyze, memorize and transmit information using digital means, as well as with the help of algorithms when working with data received from various sources in order to effectively use the information received to solve problems, to evaluate information, its reliability, to build logical conclusions on the basis of incoming information and data	UK-7.1 Evaluates information, its reliability, builds logical conclusions on the basis of incoming information and data
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 analyzing the achievements of science and production 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
PK-3	Able to organize, conduct and analyze the results of experiments (field experiments)	PK-3.1 Owns modern methods of processing research results using methods of mathematical statistics
PK-4	Able to create models of crop cultivation technologies, plant protection systems, varieties	PP-4.1 Knows the biological and economic features of agricultural and newly domesticated plants as the basis for the development of technologies for their cultivation
PK-5	Able to prepare scientific and technical reports, reviews and scientific publications based on the results of the research performed	PP-5.2 Uses methods of mathematical statistics in data processing and report preparation

2. THE PLACE OF DISCIPLINE IN THE STRUCTURE OF THE EP HE

The discipline "Mathematical Modeling and Design" refers to the mandatory part of the block *B1.O.01.06.*

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 "Mathematical Modeling and Design".

Table 2 – List of components of the EP HE that contribute to the achievement of the planned results of the discipline

Code	Competence	Previous disciplines/modules, practices	Subsequent disciplines/modules, practices
UK-7.	Able to search for the necessary sources of information and data, perceive, analyze, memorize and transmit information using digital means, as well as with the help of algorithms when working with data received from various sources in order to effectively use the information received to solve problems, to evaluate information, its reliability, to build logical conclusions on the basis of incoming information and data		
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-4	Able to conduct research, analyze results and prepare reporting documents		
PK-3	Able to organize, conduct and analyze the results of experiments (field experiments)		
PK-4	Able to create models of crop cultivation technologies, plant protection systems, varieties		
PK-5	Able to prepare scientific and technical reports, reviews and scientific publications based on the results of the research performed		

3. THE SCOPE OF DISCIPLINE AND TYPES OF EDUCATIONAL WORK

The total labor intensity of the discipline "Information Technology" is 3 credits.

Table 3 – Types of educational work by periods of mastery of OP HE for full-time education

Type of educational work	Total, aca. hrs.	Semester 3
Contact work	34	34
including:		

Lectures (LC)		–	–
Laboratory works (LR)		–	–
Practical/Seminar Classes (FPs)		34	34
Independent work of students		59	59
Control (exam/test with grade)		15	15
Overall labor intensity of the discipline	108	108	108
	3	3	3

4. CONTENTS

Table 6 – Content of the discipline (module) by types of educational work

Name of the discipline section	Contents	Type of educational work
Section 1. Methodological and theoretical foundations of modeling and design.	Topic 1.1. The concept of models and modeling. The importance of modeling in agricultural research. Structure and functions of the model. Ways to build a model. Classification of mathematical models and their characteristics: descriptive (empirical) and explanatory (theoretical), optimization and simulation, statistical and dynamic, deterministic and stochastic.	NW
	Topic 1.2. Model properties. Principles of modeling. Modeling stages: selection of the model type and substantiation of the degree of its complexity, development of the model content, formalization of the model, determination of the type of functions and parameters of the model, assessment of the adequacy of the model, analysis of the sensitivity of the model, use of the model.	NW
Section 2. Storage Structures and Access Methods	Topic 2.1. Data processing systems (ODS). File data processing systems and trends in their development.	NW
	Topic 2.2. Data structures for FSOD and access methods. A simple sequential file model. The index organization of the file. Index search methods.	NW
Section 3. Modeling of highly productive agricultural systems	Topic 3.1. Modeling in crop selection. Requirement for the model of the variety. Modeling in crop yield planning. Optimization of the crop planting model for different regional conditions. Model of agrophytocenosis.	NW

	Topic 3.2. Models of fertilizer and plant protection systems, soil treatment. The use of modeling in the practice of regulating the weedy component of agrophytocenoses. Modeling of the relationship between contamination and productivity. Use of models in the development of projects of technologies for the production of plant products.	NW
	Topic 3.3. The main technological blocks of control of the production process of plants. Basic model of crop production technologies. Adaptors to basic technologies.	NW
Section 4. Baz sof data.	Topic 4.1. Database concepts. Database properties. Requirements for the organization of the database. Data bank. Information store components. Information store administrator. Database management system (DBMS).	NW
	Topic 4.2. Data presentation layers. Database life cycle. Database design process. The principle of top-down design with successive iterations. Design expertise. Requirements analysis.	NW

5. MATERIAL AND TECHNICAL SUPPORT OF DISCIPLINE

Table 7 – Discipline Logistics

Audience type	Equipping the classroom	Specialized educational/laboratory equipment, software and materials for mastering the discipline
Seminary	An auditorium for seminar-type classes, group and individual consultations, current control and intermediate certification, equipped with a set of specialized furniture and technical means of multimedia presentations.	
Computer Lab	Computer class for classes, group and individual consultations, current control and intermediate certification, equipped with personal computers (in the amount of _____pieces), a whiteboard (screen) and technical means of multimedia presentations.	

For independent work of students	An auditorium for independent work of students (can be used for seminars and consultations), equipped with a set of specialized furniture and computers with access to EIOS.	

6. EDUCATIONAL, METHODOLOGICAL AND INFORMATION SUPPORT OF THE DISCIPLINE

Main literature:

1. Computer Technologies in Science and Education: A Textbook / L.S. Onokoy, V.M. Titov. - M.: ID FORUM: INFRA-M, 2011. - 224 p. http://znanium.com/bookread.php?book=241862

2. Modern technologies and technical means of informatization: Textbook / O.V. Shishov. - M.: NIC Infra-M, 2012. - 462 p. http://znanium.com/bookread.php?book=263337

3. Computer workshop on the course "Informatics": Textbook / V.T. Bezruchko. - 3rd ed., rev. and add. - M.: ID FORUM: INFRA-M, 2012. - 368 p.: http://znanium. com/bookread. php? book=332293

Further reading:

1. Economic and mathematical methods and models: computer modeling: Textbook / I.V. Orlova, V.A. Polovnikov. - 3rd ed., rev. and add. - M.: Vuzovskii uchebnik: INFRA-M, 2011. - 389 p. http://znanium.com/bookread.php?book=324780
2. Computer technologies of data analysis in econometrics / D.M. Dayitbegov. - 2nd ed., ispr. and add. - M.: Vuzovsky textbook: INFRA-M, 2010. - 578 p.: http://znanium. coiTi/bookread. php? book=251791
3. Distance educational technologies: design and implementation of training courses / Lebedeva M. B., Agaponov S. V., Goryunova M. A., Kostikov A. N., Kostikova N. A.,

Nikitina L. N., Sokolova I. I., Stepanenko E. B., Fradkin V. E., Shilova O. N. / Pod obshch. red. M. B. Lebedevoy. SPb.: BHV-Peterburg, 2010. ? 336 s. http://znanium. coiTi/bookread. php? book=350822

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 Jurait http://www.biblio-online.ru
– EBS "Student Consultant" www.studentlibrary.ru
- EBS "Lan" http://e.lanbook.com/
- EBS "Trinity Bridge"

2. Databases and search engines:
- – electronic fund of legal and normative-technical documentation of the http://docs.cntd.ru/
- – Yandex https://www.yandex.ru/ search engine
- – Google search engine https://www.google.ru/
- – abstract database SCOPUS http://www.elsevierscience.ru/products/scopus/
- http://quakes.globalincidentmap.com/,
- http://www.globalincidentmap.com/, http://earthquake.usgs.gov/earthquakes/recenteqsww/Quakes/quakes_all.php,
- http://www.tesis.lebedev.ru/forecast_activity.html
- University Library Online: http://www.biblioclub.ru

- National digital resource "RUKONT": http://rucont. ru
- IQlib: http://www.iqlib.ru
- ScienceDirect: http://www. sciencedirect. com
- EBSCO: http://search.ebscohost.com
- Sage Publications:http://online.sagepub.com
- Springer/Kluwer:http://www.springerlink.com
- Tailor & Francis: http://www.informaworld.com
- Web of Science: http://www.isiknowledge.com
- University Information System RUSSIA: http://www. cir. ru/index. jsp
- U chebny portal RUDN University: http://web-local.rudn.ru/
- Http://www.studmedlib.ru Student Advisor
- National digital resource "RUKONT": http://rucont. ru
- IQlib: http://www. iqlib. ru

- http://www.rsl.ru - Russian State Library http://www.cnshb.ru/ - Central Scientific Agricultural Library http://www.mcx.ru/ - Ministry of Agriculture of the Russian Federation (MINISTRY of Agriculture of the Russian Federation)http://www.gpntb.ru/ - State Public Scientific and Technical Library of Russia http://www.fao.org/ - FAO databases
- The basic concepts of computer information technologies - http://bip-ip. com/osnovnye-ponyatiya-kompyuternyx-informacionnyx-texnologij/
- Computer technologies in science and education -
- http://www.google.nj/url?sa=t&rct=j&q=%D0%BA%D0%BE%D0%BC%D0%BF%D1%8C%D1%8E%D1%8 New information technologies in science and education - http://www.iis.nsk.su/files/articles/sbor_kas_10.pdf

7. ASSESSMENT 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 (parts of competencies) based on the results of mastering the discipline "Mathematical Modeling and Design" are presented in the Appendix to this Work Program of the discipline.

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